How I came to the United States.

In general it is unusual to come from Europe to the United States by way of Russia and Japan, but in the extraordinary times in which we now live everything is possible. I am often asked, -"How was your trip of nearly ten thousand miles?" and I always answer, "It was wonderful, and of course most interesting."To leave a country in which you were born, which you have loved withyour whole heart, and which you have considered as your eternal homeland, a country which you have served as a soldier, and later as a scientist, is not a simple matter. Of the home-land is like of a sweetheart to say: Whom the heart loves the eye finds beautiful. Bavaria was a beautiful country. I always postponed and postponed the departure, but Germany and also my closer homeland, Bavaria, became at last more and more an enemy country. So, finally, I was really happy when I left that land in the "twelfth hour" with the certainity that I would never see it again.

I am always asked, "Was it difficult for you to get out of Germany?" The war had already started. "No, it was relatively easy for me to get out of Germany". At that time the Nazis wanted to oust as many Jews as possible from Germany. I could receive the immigration visa to the U.S. only after a hernia operation and even this was paid by a public, not a Jewish, organization. The difficulties I was faced with were of political nature and in the beginning my success in coming through was very questionable. At the time when I left - it was in the first days of August 1940 - the Baltic States were taken over by the Soviet Government. I had to ask for the transit visa through two of these states, Lithuania and Latvia, during the last days of July and it was uncertain if I could get these transit visas at the right time. The whole journey was possible only during the short time when Germany and Soviet-Russia were "friends"! Another question was my baggage. I had the permission to take out my scientific books and other things which I thought necessary. In this way I had several wooden boxes. After many difficulties I found my belongings safe in Kobe, Japan, and I have them now in the U.S., but I must confess I would have left Germany even in swimming trunks!

The journey was prepared by the Jewish organizations in Germany,Manchuria and Japan,but I had the permission to use a traveling bureau in Munich which helped me a great deal and made my trip successful.The expenses were paid partly by the first mentioned group and partly by relatives of mine in the U.S.The German authorities, through the office for Foreign affairs had given a letter of recommandation to the Soviet Goverment (they did it for every emigrant usung the Eastern route), and so the way was free for my journey.I had the American immigration visa (dated Stuttgart May 20th 1940,a few days before Italy entered the war),the transit visa through Japan (given by the Japanese Consul in Vienna),and received the visa for Manchuria, Russia,Lithuania and Latvia in Berlin.Then I had the German exit visa which gave me the permit for leaving Germany a single time and which did not allow any return.

When I was released from the Concentration Camp Dachau in December 1938,after a stay though my familiy had its residence in Munich since 1759 I had to sign a paper that I would leave Germany as soon as possible,and from time to time I was called to the Gestapo and asked how far my emigration possibilities would have proceeded.

On July 29,1940 I left Munich.The hardest step for me was the separation from my

How I came to the United states. 2nd part. (17.5.44.)

It was in 1912 in Munich. A Japanese writer, clothed in Samurai robe, ~~spoke~~ was speaking about Japan. I remember 2 phrases of his speech: "I look everyday into the mirror and cannot find that we are so yellow as your emperor told". It was the time when Wilhelm II. spoke the words: "Völker Europa's, wahrt Euere heiligsten Güter und hütet Euch vor der Gelben Gefahr" (Folks of Europe, preserve your holiest goods and be carful before the yellow danger). Another phrase was: " We observe evrything, and what is useful for us we imitate for our own purpose." This was 1912!. During my studies on the Munich University I also attended the lectures of Karl Haushofer, whose later role I did not know. It was long before Hitler came to power. Haushofer gave a report about a talk he had with Yuan-Shi-Kai, the first President of China, who had originally the intention to reestablish a new monarchy with him as Emperor. Haushofer asked Yuan-Shi-Kai; What would happen, if China would be conquered by the Japanese. Yuan-Shi-Kai answered: "Nothing; after 3 or 4 generations the conquerors are Chinese!" He gave as a proof that China was conquered many times by foreign peoples, and all these people are today Chinese, even the Chinese Jews who came to that country about 2000 years ago. Haushofer brought this story to demonstrate ~~how~~ the mentality of the people in the Far East ~~think of time~~.

When I received my transit-visa through Manchu-tikuo in Berlin on ~~XXXX~~ July 16th 1940 I had to go to the Manchurian Legation. There I found a Chinese looking young man who did not understand what for a profession I have, though his German secretary tried to explain it to him. I asked for a description of Manchuria and received a booklet "Manchoukuo gives birth to new culture", Questions and Answers 1940, published by the Manchuria Daily News in Hsinking, the capital of this country. In this book is emphasized Manchuria as an "independent State". Very interesting in this booklet is the following question and answer: "I have been told that Manchoukuo claims to be a State of racial harmony in which are living the different races of Japanese, Manchus, Hans (= Chinese), Koreans, Mongols, and White Russians, forming a perfectly harmonized society. Is this true? - True it is. Manchoukuo is a State in which particular emphasis is put on the creation of a moral society." So is to read in this booklet of 1940. Please, watch the sequence of the different races. The Japanese range before the Manchus in this "indepnndent" Manchu-State. The young man in Berlin was the only Manchurian state-official I saw; in Manchuria itself I saw only Japanese. The "White Russians" are people who were against the Bolshewiks and had left the USSR; the Japanese considered them as "good friends", and used them for their ~~own~~ purpose. I don't know how this situation is today. This as introduction to my travel report.

Manchouli, or Manchurya, is a very lonely and dirty border town. It makes more or less a Russian impression; formerly the whole area, ~~including~~ Harbin, was at once ~~Russian, or at least~~ under Russian influence. The houses have mostly only one or 2 floor; there are wood- and stone houses. The streets were muddy, because the day before was rain. The new railroad building is big and it has (in the entrance hall to the trains) a large map of the Trans-Siberian Railroad and the railroads through Manchoukuo on the wall. Here we could follow the ~~direction~~ way (on the railroad) the of our journey. The Jewish Committee in Charbin had ordered a resident of Manchouli to take care for us. He was an old man, a taylor, who spoke very bad German and, of course, not a single word English. We arrived in the afternoon in Manchouli. Koolies with red caps and white big numbers on their back, took care for our baggages. They were very quick creatures, one looked like the other, and only by their numbers they were to recognize. We were lead to the Hotel Taná in Manchouli and spent the night there. It had European, and Japanese rooms. I had an European one with one of our travellors together. Manchouli was the most critical point in the whole journey. It was possible to pay the journey in RM. only until Manchouli, and the ~~continuation~~ had to be paid in $, by the help of relatives in the U.S. This money should have arrived in Manchouli before the travellor reached that place. In most of the cases it did not, or it was told ~~it~~ that did not arrive. In the inner of Asia and in the situation in which you are, there is no controle possible. We have now to go in communication with the Japanees Tourist Bureau. The man in charge was a White-Russian, a very unfriendly man. He sad in English: "If I have no money you cannot continue the journey; you have to stay here until I have the mony". This brought many of us in a very difficult situation. The visa to the U.S. is valid only during a limited time, then it has to be prolongated. For many of our travellors was the danger that the visa ~~is~~ would expire before they arrive in Japan. We tried to come in communication with the Committee in Harbin, and we received the answer that they

Philosophical Thoughts
of a Natural Scientist.

It is an eternal question this problem of the living .It puzzled the demigod Gilgamesh in the same manner as it had the disciples of Buddha who on questioning their teacher on the matter of death received the reply:"Since we don't know what life is ,we are also unable to say what is death.

Natural science teaches that change of form (growth),change of substance (assimilation and dissimilation),and change of strength (transformation of energy) are the main characteristics of the living or of the life.Thus,it is true,its visible phenomena,have been named but not the forces which cause these things,and above all cause them to be regulated.For,is it not wonderful when from a fertilized egg following a certain plan which is also determined temporally ,an individual develops?Develops in such way that one is able to say in one month the creature coming to existence will be ~~at~~ a certain stage of development and after three months of another certain stage.We do not want to stress the overwhelming thought that lies in this idea that in the animal world absolutely free moving creatures of different sex attract each other like magnets for the purpose of mating.At least in the wild state living, not domesticated animals the mating takes ~~xxxx~~ place only at a time when the best conditions for existence of the issue are provided.(Connected with this is frequently a dwarfing of the germ glands during which time no copulation takes place.).In other cases,the further development of the fertilized egg is left uncompleted until springtime as in the case of the Europaean roe or the bat,for which copulation takes place in September.The young animals then also see the light of day when the "table is abundantly set" for them.We do not at all wish to speak of instincts,for instance in insects forming states,as bees or termites or ants in which everything runs like a clock-work.One need but watch the action of the tropical leaf cutting ants which from leaves and flowers cut out sections and carry them into the nest for their fungus-garden. The same is true of plants. By sweet juices, nectar, being secreted, animal visitors, mostly insects, are instigated to transfer the pollen from flower to flower in order to complete pollination, and thus fertilization. Thereby the "Postillons d' amour" are mostly "flower-constant", that is, they always remain in the same kind of flower. The problem of the galls on plants, caused by insects, was even treated from a philosophical side. (Caused by the sting of ~~a~~ gall-insects the pl nt forms a tissue which gives the larvas of the insects nurriture and protection, often in a very refined manner, and which is absolutely useless for the plant). We cannot explain this, but into our amazement, our reverence toward the magnitude of nature we have forgotten to take stock of ourselves in this, our quickliving, hurrying time which robs man of all repose to concentrate on himself. Here the famous "Ignorabimus" of Dubois-Reymond is still valid. We stand before an eternal miracle and - " the miracle is faith's most favored child" ("Das Wunder ist des Glaubens liebstes Kind"?Faust I.) For many modern thinking natural scientists this miracle is the "divine", the "divine idea" which peeps forth from nature!

We cannot say what the living is, but with regard to other things we fare not better. What may we say about the things surrounding us? Indeed, we know only that which we gather from the reactions on our sense organs, for, only through these are we brought into contact with our surroundings. one may, indeed, say only this is iron because it has this or that collor. (visual sense), or because it (has) this or that weight (sense of touch), or it may feel to the hand more or less cold (sense of temperature), but more then this, we don't ~~t~~ know. This is exactly the same with electricity or with light. We are able to recognize these things only by their reactions on our sense organs. When today physical science says the unit of all matter is "energy" one may use the latter exactly as little as with

Wie der National-Sozialismus die deutsche Wissenschaft beeinflusst!

In Banse's "Handbuch der Geographie" steht auf Seite 474 der 1938 erschienen Auflage:

"... Solange sie ihre Volkssprache beibehalten, bleiben sie Angehörige des Heimat-Volkes; sobald sie sie aber verlieren und damit auch den kulturlichen, sowie ideellen Zusammenhang mit ihrem Volk aufgeben, kann man sie nichtmehr als Glieder ihres Volkes ansehen, denn die blutliche Abstammung allein ist volklich nicht entscheidend. Andererseits darf man Zuwanderer zu einem Volk nicht ohne weiteres als Volksgenossen ansehen, doch können ihre Nachkommen durch Aufnahme des Kultur-, Ideen- und Sprachgutes solche werden, falls ihr Rassenblut dem der Rasse des Volkes entspricht. Wenn schon ein so gut deutsch fühlender und schreibender Mann wie Chamberlain durch die Uebersiedelung nach Deutschland kein wirklicher Deutscher geworden ist (was aber von seinen Nachkommen wegen artgleichen Blutes ohne weiteres zu gelten hätte), so können Juden noch viel weniger durch Wohnen in Deutschland und durch Annahme deutscher Sprache Deutsche werden, und hier bestreiten wir auch ihren sämtlichen Nachkommen wegen ihrer Fremdblütigkeit dieses Anrecht".

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walking on the highway.

8,000 PLANT SPECIMENS

Dr. Maguire Brings Them to the Botanical Garden From West

Eight thousand plant specimens have been brought to the New York Botanical Garden by Dr. Bassett Maguire, of its staff, following the fourteenth annual survey of the region between the Rockies and the Sierra Nevadas, it was announced yesterday. The survey, begun in 1931, will need two more years for completion. It is being sponsored jointly by the New York Botanical Garden and the Utah State Agricultural College.

This summer's expedition included a 10,000-mile automobile and pack train trip through central and southern Nevada.

Among the plants brought back by Dr. Maguire was a bloom identified as a "desert almond," which has a delightful fragrance and a profusion of delicate pink flowers. An effort will be made to induce the flower to grow in climates other than its native mountain and desert land.

[illegible]wn End Within 90 Days, Services in State Department

[illegible] in Europe under the occupation
[illegible] branch [illegible]

POST CARD

PLACE
ONE CENT
STAMP
HERE

MISS HERTHA KRAUS · 233 ROBERTS ROAD · BRYN MAWR, PA.

clipping from NY Times – Aug 27 –

The leaves drop entirely off so the stem trunk looks like made of concrete. The royal palm has is also of import for Cuba (fruits, see fans). The most spectacular exper in Soldier was a fruiting year of

15, 16, 17. . . . ——

On my return to the States I was a few days in Havana. I visited there the . . . .

Here I saw the kenaf experim which the Cuba Govt makes together with the U. S. Dep of Agr.

18. 19

This shows how the plants segregate as all other cultivated plants when raised from seeds. We can observe this also on the potato and see on the Date palm when raised from seeds

A short visit was prepared

(LO 3-9979)

Radiant Manufactg Corp.
2627 W. Roosevelt Road
Chi. 8 Ill.

Ltr. J[illegible] before my botan trip to Cuba ~~[illegible]~~ I brought with bra[illegible] for a [illegible] manufactured by ~~[illegible]~~ your firm. Unfortunately during my work in the field I had difficulties with one leg. After having returned to Phila I gave this part of the leg brace and to the Station to correct after their [illegible] they have sent it back to you. This was done

more than 14 days ago

West where I make a botanical trip for

to a strange fan palm, where the leaves have no petioles which are [illegible] only in Cuba. Copernicia is the name. I returned then to Key West and Miami continuing botany.

[illegible] few, [illegible], is [illegible], the
male finish Our most edible [Our rear
passes a rocky part with tree-like
succulent Euphorbia from Africa and some
cacti 9-10. We reach the oasis here
of the oldest part of the garden it is
11 after 50 years old, and here are
also other interesting plants. Of phan-
erogamic interest are Salvadora
[illegible] 12-13, Acacia Catechu (14) [illegible]
[illegible], Myristica fragrans which is [illegible],
Myroxylon toluiferum, Japanese ~~the~~ camphor-tree)
A few words about the palms. They are
really the kings of the tropics and it
is well to understand when botanists believe
palm-royalty and dedicate their main
interest to these trees. In our hot-house
palms look like birds in a cage. In
Cuba, where I was, the royal palm
--- is the dominant tree (18.-)

please be so kind and return the [illegible] to the
[illegible] immediately after you receive this letter. I use
tele lens and for this purpose I [illegible] the [illegible]
[illegible]. I thank you for your cooperation in [illegible].

Juan Gonzales de Mendoza
Rome 1585.
Historia de las cosas mas notables, ritos y costumbres del gran Reino de la China;
De trigo clamado maíz, veinte millones doscientas cincuenta mil fanegas: which implies that a great quantity of Maize was grown in China as early as 1575, which was the year in which M.'s informants had visited Ch.
In 1601 the cult. of m. was introduced to the Marianas
was not very common in the Philippin (Argent. [illegible]

EL to 2nd St + Market Ferry
Oneway ticket to Tom's River
7.40 Long Branch Train

Academy of Natural Sciences - Torrey Botanical Club
FORKED RIVER, NEW JERSEY
September 15-16, 1945

There will be field trips starting from the Forked River (CRR) station both Saturday and Sunday. Persons from Philadelphia coming via train to Tom's River can reach Forked River by taxi or bus.

SATURDAY

The party from New York is expected to reach Forked River about 9:30 a.m. and will walk down the railroad track from the station, crossing Upper Fork, marsh, cedar swamp, and dry areas. Autos may be parked at the station.

Lunch at Forked River House, leaving there at 2 p.m. to explore bogs and dry barrens at Ostrom and below--Middle Fork.

There probably will be an informal evening meeting at the Forked River House.

Accommodations: Forked River House, 2 in room without bath, $1.50 each; Greyhound Hotel, 2 in room without bath, $1.00 each; a few rooms with bath at $1.50 each. Please make your own reservations.

At Tom's River, about ten miles north, are the Marion Inn, Ocean House, and Riverview Hotel.

SUNDAY

Train from Philadelphia reaches Tom's River at 9:10 a.m. Take taxi or bus to Forked River RR Station where trips start at 10 a.m.

One party will repeat the Saturday tour down the RR track. Second party may visit salt marshes, or another pine barren area.

A bird trip will start from the Forked River House at 7 a.m.

Afternoon trip starts from Forked River House at 2 p.m.

Return train to Philadelphia leaves Tom's River at 6:22 p.m.

Leaders will include Dr. H.K. Svenson and Miss Hester Rusk of the Brooklyn Botanic Garden; Charles E. Mohr of the Academy of Natural Sciences; and Louis E. Hand, Hollis Koster, G.G. Nearing, and A.T. Beals.

Angewandte Botanik (Nutzpflanzen)

Wir hätten die Abteilung auch "Pflanze und Mensch" heissen können,denn die Produkte des Pflanzenreichs sind für den Menschen nicht minder wichtig wie die des Tierreichs.Nahrungs- und Genussmittel,Oele,fette,Riechstoffe,Gummi,Harze Gerb- und Farbstoffe,Faserstoffe,Arzneimittel u.s.w. liefern die Pflanzen dem Menschen.Ja sogar Bausteine,die er zum Bauen seiner Häuser verwendet,sind von Pflanzen geschaffen.

Die Produkte des Pflanzenreichs haben aber auch eine ungeheuere kulturgeschichtliche Bedeutung,auf die einleitend hingewisen sein soll.Der Mensch hat stets mit ihnen Handel - zunächst Tauschhandel - getrieben und er hat die ihm wertvollen Pflanzen,die "Nutz"-Pflanzen verbreitet,sei es auf den Handelswegen, Ihren sei es durch gewollten Anbau,fern der ursprünglichen Heimat.Dafür einige Beispiele.Schon im Altertum kam auf bestimmten Wegen,auf den "Seidenstrassen" die von der Seidenraupe gesponnene Seide aus "Sericum",dem Seidenlande China zu den Römern (Sericum ist identisch mit Sinicum;dieser ist der Name für China, der auf dem Seewege nach Rom gelangt ist).Diese Seidenstrassen gingen durch Zentralasien über Persien nach Byzanz oder Syrien.Ihnen folgte im Laufe der Zeit der Maulbeerbaum,dessen Blätter den Seidenraupen zur Nahrung dienen.Um 120 v. Chr. bringt der chinesische General Tschang Ch'ien,der ursprünglich für China Bundesgenossen gegen die Hunnen suchen sollte (Die Hunnen haben sich zuerst gegen die Chinesen gewandt,ehe sie Europa beunruhigten),~~brachte~~ die Walnuss,den Flachs,die Weintraube,mit dem Pferde die Luzerne und - Nachrichten die bis nach Syrien reichen - ins Reich der Mitte.Die Banane ist mit dem Sklavenhandel von ihrer Heimat Indien bis nach Westafrika gekommen und von hier ist sie durch Spanier und Portugiesen nach der Neuen Welt gelangt.Der amerikanische Mais,in Amerika vor der Entdeckung Kolumbus',das wichtigste Getreide, ist durch ~~die Portugiesen~~ im Handelsverkehr mit China, Japan und auf zu den eingeborenen Völkern Afrikas gebracht worden Der aus Abessinien stammende Kaffee hat ebenfalls grosse Wanderungen gemacht. Es gäbe noch viele solche Beispiele.Die indische Baumwolle ist um ca 600 v.Chr. von dem assyrischen König Senaherib in Assyrien angebaut worden,das erste Beispiel ~~d~~der planmässigen Kultur einer fremden Nutzpflanze.Die Araber haben das aus Indien stammende Zuckerrohr und den gleichfalls in Indien heimischen Reis in den von ihnen bewohnten Gebieten kultiviert.Der Reisbau in Spanien und von hier aus in Italien geht auf diese Zeit zurück.

Aber noch eine andere Bedeutung haben die pflanzlichen Produkte gehabt.Der Handel mit ihnen hat die Leute reich und selbst bewusst gemacht.In den grossen Handelszentren kommt dies in Profan- und Sakralbauten zum Ausdruck.Wir sehen das nicht nur in den grossen,fernen - heute würde man sagen "internationalen" Handelszentren des Altertums und Mittelalters wie Petra (Rekem) in Arabien,wo man riesige Kultstätten aus dem Felsen herausmeisselte und wo sich der Handel von Ostasien,Indien,Arabien mit dem des Abendlandes traf,oder Byzanz oder Venedig.Wir haben auch Beispiele in unserer engeren Heimat.Die stolzen Rathäuser von Augsburg und Nürnberg,die grossen Stadtkirchen in München,Ulm,Landshut Regensburg u.s.w. [illegible] vom Bürgertum gebaut worden.Ja,in Landshut wollten die

Bürger zeigen,dass sie mit dem 110 m hohen Martinsturm so hoch hinaufkommen können,wie der Herzog auf der Trausnitz.

Die deutschen Kaufleute verkauften die Erzeugnisse unseres Vaterlandes in der Fremde im sog."Warenhaus",im Fondaco und erstanden dafür Dinge,die sie in der Heimat absetzen konnten,wie Seide,Gewürze,Drogen,u.s.w.Nur im Fondaco durfte Handelgetrieben werden und im Fondaco dei tedeschi,im "deutschen Warenhaus" zu Venedig ist ein Jakob Fugger ein und aus gegangen und zu seiner Ausschmückung hat Albrecht Dürer das "Rosenkranzfest" gemalt,Albrecht Dürer,der in Venedig die italienische Kunst kennen gelernt hat."Levante-Handel" nennt man diesen Warenaustausch.Ueber die Gotthart- und über die Brennerstrasse sind von Genua und Venedig die Waren über Süddeutschland nach Nordengeagngen.Die Städte Innsbruck Schwaz,Mühldorf bis nach Passau zeigen,wie weit die südliche Bauweise in unser Vaterland hereingedrungen ist.

Am 20.Mai 1498 landete der Portugiese Vasco da Gama zum 1.Male in Südindien,wo er sehr wenig freundlich empfangen wurde.Venedig hat aber sofort erkannt,was diese erste Umseglung Afrikas und die Entdeckung des Seewegs nach Indien für seinen Handel bedeutete.Die Produkte des Fernen Ostens und Indiens sind trotz des Intrigenspiels Venedigs direkt nach Lissabon gelangt und von hier aus sind sie nicht mehr über Süddeutschland gegangen.100 Jahre nach der Landung des kühnen Portugiesen war der Reichtum der süddeutschen Städte im Verblassen begriffe Die Entdeckung des Seewegss nach Indien,um die sich auch unser Landsmann Martin Behaim verdient gemacht hat.- Die Venezianer Polo waren die ersten Europäer, die auf dem Landwege nach dem fernen Osten gekommen sind.Marco Polo,der jüngste von ihnen stand 27 Jahre im Dienste des Grosskhans Kublai.Das war am Ende des 13.Jahrhunderts,zur Zeit von Dante und Walther v.d.Vogelweide.Marco Polo hat von seiner Reise berichtet und sein Buch war wegweisend für spätere Reisen.Columbus glaubte in der Neuen Welt Indien und in Cuba das "Zipangu" (= Japan)des Marco Polo gefunden zu haben.Die grossen Gewinne,die der Levantehandel abwarf und ferner die Tatsache,dass die Zwischenhändler,seien es Perser oder Araber gewesen,oder was es sonst für Völker waren,die Ursprungsländer zu verschleiern oder mit einem geheimnisvollen Nimbus zu umgeben suchten,beides waren die Ursachen für die grossen Entdeckungsreisen zu Ende des Mittelalters. Ja,um die Heimat der Gewürznelken zu finden,hat der Portugiese Magellaes die ganze Welt umsegelt.- Doch genug,wir besprechen jetzt die einzelnen Gruppen und kommen auf das eine oder andere nochmals zurück.

Der Schrank Nr.   enthält die Nahrungsmittel und die Gewürze.(Aus Raumgründen musste der Zucker im Schrank "Genussmittel" untergebracht werden).

<u>Nahrungsmittel</u>.aus Getreide-Früchten.(Uber die Früchte des Getreides siehe Schrank Nr.   "Frucht":Caryopse)Die Gewinnung von Stärkemehl aus Grasfrüchten geht auf die früheste Vorzeit zurück.Der primitive Mensch wird wohl zuerst die Körner von Wildformen gesammelt haben,ehe er sich entschloss,sie anzupflanzen. Der Getreidebau ist bei allen Völkern mit religiösen Vorstellungen verbunden. Das ist der Fall im Abendland wie im Orient und im Fernen Osten.Musste doch der Kaiser von China zu Beginn des Jahres ein Feld bestellen.

Weizen .Der Weizen ist eine der ältesten in Kultur befindlichen Getreidearten. Sein Anbau geht sowohl bei den Babyloniern,Aegyptern,und Griechen als auch bei den Chinesen auf sagenhafte Vorzeit zurück.Es gibt von ihm zahlreiche Unterarten und Rassen,die sich deutlich von einander unterscheiden.Seine ursprüngliche Stammform ist nicht mit Sicherheit festzustellen.Er wird als Winter- und als Sommergetreide gebaut. Kolumbus hat ihn schon auf seiner zweiten Fahrt nach der Neuen Welt gebracht.Im Schrank sind die Aehren verschiedener Weizenarten und - Rassen aufgestellt.Ueber deren Chromosomenverhältnisse siehe Schrank "Polyploidie" am Südfenster in der Mitte .Ausserdem werden noch die Spelzen von "Mumienweizen" und verkohlte Körner von "Pfahlbauweizen" aus Schussenried (Württemberg) gezeigt.Die Pfahlbauer hatten bereits zweierlei Weizen,wahrscheinlich Triticum dicoccum und monococcum (Emmer und Einkorn)in Kultur,wie sie auch schon verschiedene Apfelsorten kannten.Auch der "Mumienweizen" war Emmer,der überhaupt die am frühesten kultivierte Weizenart darstellt.Er stammt von einem Grabfunde bei Abusir aus der Zeit um 2400 v.Chr.Durch Mahlen der Früchte bekommt man das Weizenmehl.Dabei bleibt die Vitaminreiche Kleie zurück.Das Getreidekorn besitzt unterhalb der verwachsenen Frucht-Samenschale eine Zellschicht,die Eiweiss enthält,den Kleber.Dieser ist ein stark quellbaren Colloid,das für die Backfähigkeit den Mehles von grosser Wichtigkeit ist.Er ist in besonderem Masse im Hartweizen,Triticum durum,der in wärmeren Gegenden wächst und bei uns eingeführt werden muss enthalten.Weizenstärke ist Mehl,dem der Kleber entzogen wurde.

Bei den Kulturrassen fallen die Körner frei aus,nur beim Dinkel,Triticum Spelta,bricht die Aehrenspindel in Stücke und die Körner fallen aus.

Gerste.Die Gerste ist ebensolange in Kultur wie der Weizen,wenn sie auch dessen Bedeutung für die menschliche Ernährung nicht erreicht.Babylonier,Aegypter,Griechen und Chinesen haben sie angebaut.Auch von ihr gibt es zahlreiche Rassen,die sich deutlich von einander unterscheiden.Ihre Stammform ist gleichfalls unbekannt.Aufgestellt sind verschiedene Aehren und auch aegyptische Mumiengerste.'Während die Weizenkörner frei von Spelzen sind,haben wir bei der Gerste deren Verwachsung mit der Frucht,eine Erscheinung,der wir später beim Reis wieder begegnen werden.- Beim Weizen ist das wichtigste Produkt das Weizenmehl.Gerstenmehl wird nur wenig verwendet.In Tibet spielt es geröstet als Tsamba die Rolle eines Volksnahrungsmittels.Verwendet wird bei uns geschälte Gerste,sog."Rollgerste".Eine grosse Bedeutung hat hat sie dagegen für die Bereitung von Malz.Hierzu lässt man die Gerste keimen.Es bildet sich im Korn ein Enzym,die Diastase.Diese verzuckert die Gestenstärke und bereitet daraus Malzzucker.Es ist aber so reichlich Diastase vorhanden,dass auch noch andere Stärke verzuckert werden kann.Davon macht man Gebrauch bei der Spiritus-Brennerei,bei der man Kartoffelstärke verwendet.In diesem Falle lässt man Gerste zu "Grünmalz" keimen.Marbeitet hier nur auf Diastase und tötet die Keimpflanzenab,wenn der grüne Spross etwa 3 cm lang ist.Das Grünmalz wird dem Kartoffelbrei,der "Maische" zugesetzt und die Diastase macht dann nach der Verzuckerung der Stärke die Maische gärungsfähig.Für die Bierbereitung lässt man die Gerste nur keimen,dass die Würzelchen herausschauen;dann tötet man sie mit Hitze ab. Farbmalze und Kaffee-Surrogate erhält man dadurch,dass man beim Abtöten der gekeimten Gerste grösser Hitze verwendet.

Mais. Der Mais ist das einzige Getreide, das aus der Neuen Welt stammt. Sein Name ist dem indianischen Worte "mahiz" nachgebildet. (Der lateinische Name "Zea" den Linné verwendete, war bei den Griechen für Dinkel gebräuchlich). Schon lange vor der Ankunft des Kolumbus wurde er in Nord- und Südamerika in zahlreichen Rassen kultiviert; er spielte dort die gleiche Rolle, wie der Weizen in der Alten Welt. Nach dieser gelangte er durch Kolumbus, der ihn schon 1493 auf der Rückkehr von seiner ersten Fahrt mit nahm. In Europa war er zuerst eine Zierpflanze in den spanischen Gärten, ohne dass man wusste, woher er kam. 1525 wurde er in Andalusien zum ersten Male als Feldfrucht angebaut. Durch die Venezianer gealngte er nach dem Orient und von hier durch die Handelsbeziehungen der Europäer weiter nach Osten. Zu Anfang des 17. Jahrhunderts gelangte er nach China. In besonderem Masse hat er bei den Eingeborenen-Völkern Afrikas Eingang gefunden. (Vergl. Einleitung) Die Maiskörner sind durch verschiedene Gestalt ausgezeichent (Pferdezahn-Mais mit einer Einsenkungauf der Oberseite, Spitz-Mais mit spitzigen Körnern ect.) ferner kann man an ihnen einen äusseren hornigen und einen inneren mehligen Teil - beides Endosperm- erkennen. Der erstere zeigt verschiedene Farben, rot, gelb, purpur ect., eine Erscheinung, die auf ineressanten Vererbungs-Vorgängen beruht. (Siehe Schrank "Xenien"). Bei einer Rasse, beim sog. "Zucker-Mais" kommt es in den Körnern nur zur Bildung von Zucker, nicht von Stärke. Die Körner schrumpfen deshalb sehr stark. Dieser Mais wird daher meist nur als Grünfutter angebaut. Aus Mais gewinnt man Griess, der als Brei, Polenta geheiseen, genossen wird, Mehl (amerikanisch "Maizena", englisch "Mondamin") und aus diesem Dextrin. Die Keimlinge liefern ein fettes Oel (Vergl. Schrank Oele ect.) Im Schrank sind verschiedene Kolben aufgestellt. Von Interesse sind die Nicht unter Glas befindlichen; sie stammen von Indianern Perus (Hacienda Huayuri; Tal d. Sta Cruz-Flusses zwischen Ica und Palpa, Süd-Peru, Ernte Jan. Feb. 1932, gestiftet v. Dr. Doering.

Reis. Der Reis ist neben Weizen das wichtigste Getreide, ja er übertrifft diesen noch an Bedeutung, denn er dient 2/3 bis 3/5 der Menschheit als Nahrung. Er wird in Form von Brei genossen und einleitend wurde schon auf das Verhältnis von Brei- zu Brot-Essern hingewiesen. Wie der Weizen ist auch der Reis seit undenklichen Zeiten in Kultur, vor allem in Indien, im indischen Archipel, in China und Japan. Nach Westen kam der Reis von Indien her. Kurz vor dem berühmten Zug Alexanders d. Gr. nach Indien (326 v.Chr.) kam er nach Mesopotamien. Durch den Alexander-Zug haben ihn die Griechen mit vielen anderen tropischen Nutzpflanzen (z.B. Banane) kennen gelernt; auch die Römer wussten von ihm. Nach Europa kam er durch die Araber, die ihn in Spanien anpflanzten und von hier gelangte er durch die militärischen Unternehmungen Karls V. nach Italien, wo der Reis heute noch auf der Po-Ebene sein nördlichstes Anbau-Gebiet hat. 1647 kam der R. nach Virginien und 1694 nach Süd-Carolina (Nord-Amerika), das heute den besten Reis den Carolina-R, liefert. 3/4 der Reisproduktion stammen von brit. Indien, Burma und Java. Der R. wird als Trocken- und als Wasserreis kultiviert. Der letztere erfordert ein umfangreiches Bewässerungssystem, das der Landschaft ein charakteristisches Aussehen verleiht, das aber einen gefährlichen Malariaherd darstellt. Der Trockenreis, der trocken kultiviert wird und auch noch in grösseren Höhen wächst hat keine grosse Bedeutung erlangt. Es gibt sehr viele Rassen vom Wasser-Reis (begrannte und unbegrannte). Die Heimat der mutmasslichen Wildform, die noch brüchige Fruchtstände hat, ist Indien, Ostasien und Australien. Er ist das einzige Gras, das noch 6 Staubblätter hat. Die Spelzen sind mit der Fruchtwand fest vereinigt und ihre Entfernung ist schwierig. Sie wird in Reismühlen, sowohl in asiatischen als auch in europäischen, vorgenommen. Die Frucht-und Samenschale ist das vitaminreiche "Silberhäutchen) Da dieses fetthaltig ist und ranzig wird, muss es durch Polieren entfernt werden. Dadurch wird aber der Reis vitaminarm und sein ausschliesslicher Genuss ruft eine Avitaminose-Krankheit "Beri-beri" geheissen, hervor. Der R. wird dann noch mit Stärke-Sirup "glasiert", um ihn haltbarer zu machen. Die Abfälle bei der Reis-Aufbereitung sind Bruchreis, Reisgries Reis-Mehl und Reis-Futtermehl (Vergl. die aufgestellten Gläser, gestiftet v...) Dinge, die alle Verwendung finden. Ein wichtiges Nebenprodukt bei der Reis-Aufbereitung ist die [illegible] aus dem Bruchreis [illegible] Behandeln mit verdünnter Natronlauge. Wegen ihrer leichten Verkleisterbarkeit dient die Reisstärke (s.Präparat) zum "Stärken" der Wäsche, zum Appretieren des Stoffes, sie wird im Zeugdruck (als Bindemittel) für die Farben. und neben Weizenstärke in der Papierfabrikation verwendet und dann stellt man aus ihr "Reispuder" her, der in der Cosmetik und in der Nahrungsmittelindustrie von grosser Bedeutung ist.

Roggen. Roggen wird als Winter-, seltener als Sommergetreide angebaut. Er ist das am spätesten in Kultur genommene Getreide; Babyloniern, Aegyptern und Chinesen war er unbekannt. Er scheint von den Slaven zu uns gekommen zu sein. (Heimat Südrussland?) Bei uns kommt sein Anbau etwa in der Hallstatt-Zeit auf. Da er in unserem Klima am besten gedeiht, ist er für Deutschland das wichtigste Getreide, "das Korn" schlechthin. Rassen-Unterschiede treten nur wenig hervor. Die reifen Körner fallen leicht aus. Aufgestellt sind ausser den Aehren noch In- und Ausland-Roggen; dieser stammt meist aus Russland. Roggenmehl wird zur Herstellung des Schwarzbrotes verwendet; Roggenkleie dient als Viehfutter.

Hafer[1]. Der hafer ist das einzige einheimeische Rispengetreide. Seine Kultur war bei ~~[illegible]~~ Römern, Babyloniern, Aegyptern, Griechen und Chinesen gleichfalls unbekannt. Die Römer hielten ihn für ein Unkraut. Er scheint, wie der Roggen, in der Hallstattzeit aus dem Osten nach Mitteleuropa gekommen zu sein. Bei Kelten, Germanen Slaven und Basken wird er viel angebaut. Er ist in erster Linie Pferdefutter, doch dient er auch der menschlichen Erbährung. Er wird in verschiedenen Rassen kultiviert. Es sind verschiedene Hafer-Sorten aufgestellt. Die Körner sind von den Spelzen eingehüllt, können aber leicht daraus befreit werden. Gezeigt werden ferner Hafermehl und grob geschroteter Hafer, sog. Quaker-Oats.

Hirse. Es gibt verschiedene Hirse-Arten, die wichtige Getreidepflanzen sind. Im Schrank, oben, befinden sich Panicum miliaceum, die Rispenhirse, Setaria italicum L., die Kolbenhirse und Pennisetum spicatum Negerhirse. Unten rechts (wegen der Höhe des Glases) steht dann noch die "Mohrenhirse" oder Durra, Andropogon sorghum Brot., in Afrika ein sehr wichtiges Getreide. Eine Abart davon Andropogon saccharatus Kunth, f. technicum wird in Südeuropa angepflanzt; das mannshohe Gras liefert das Material für die "Reis-Besen". Die grösste Bedeutung von allen Hirse-Arten hat Panicum miliaceum, die Rispenhirse, erlangt. Auch bei dieser sind die Früchte von den braunen Spelzen eingehüllt (Glas links) und wie beim Reis müssen sie für Nahrungszwecke davon befreit werden. (Glas rechts; geschälte Hirse). Die Hirse ist das älteste in der Alten Welt in Kultur gewesene Inhalt Getreide. Es hat viele Rassen gegeben. Man hat Hirse-Körner im Magen 6000 jähriger ägyptischer Mumien festgestellt, man hat sie in prähistorischen Gräbern in Deutschland gefunden, man hat ihren Anbau in ältesten Zeiten in Zentralasien nachgewiesen. und auch in China und Japan ist sie eine uralte Kulturpflanze. In den letztgenannten Ländern hat sie auch heute noch eine ganz besondere Bedeutung für die minderbemittelte Bevölkerung, der die Reisnahrung zu teuer ist. Die Hirse ist durch die grossfrüchtigen Getreide-Arten, Weizen, Roggen, Reis ect. verdrängt worden. Sie war so zu sagen ihr Vorläufer in der Kultur.

An die Grasfrüchte reihen sich die Früchte und Samen anderderer Pflanzen, diese stehen den ~~[illegible]~~ zuerst beschriebenen an Bedeutung weit nach.

Buchweizen. (Fagopyrum esculentum), eine Chenopodiacee, also verwandt mit dem Spinat. Man sieht die Pflanze, die [illegible] Früchte und [illegible] hergestellten groben und feinen Griess. Buchweizen wird bei uns erst seit dem

13. - 15.Jahrhundert angebaut.Es folgen dann ein~~z~~ige Leguminosen- Samen:Vicia-faba minor,die (kleinfrüchtige) Pferdebohne,Lens esculenta ,die Linse,gleichfalls eine alte Kulturpflanze, und dann die Banane.Es ist dies aber nicht die gewöhnliche Obstbanane Musa sapientum,sondern die nur in den Tropen verwendete Mehl- oder Gemüse-Banane Musa ~~sapientum L~~ paradisiaca L.,die Plante.Die schon einleitend erwähnte Geschichte der Banane werden wir bei Besprechung des Schrankes "Ausländisches Obst" behandeln.Bei der Mehlbanane,die übrigens sehr gross sein kann,wird bei der Fruchtreife die Stärke nicht verzuckert.Sie kann deshalb nur entweder gekocht oder gebraten genossen werden.In den Tropen vermag sie allerdings Kartoffen oder Brot bei den Eingeborenen zu ersetzen ®

Die nachfolgenden Stärkearten stammen von anderen Pflanzenteilen.In erster Linie von unterirdischen Knollen (Spross- oder Wurzelknollen),vergl.Schrank Nr.2 (Spross~~metamorphose~~ Knollen) und Nr.4 (Wurzelknollen).Hier wäre zunächst natürlich die Kartoffel zu nennen.Von ihrer Bedeutung als Nahrungsmittel abgesehen,wird

x Musa paradisiaca L. ssp. sapientum (L.) O. Ktze

xx " " " normalis O. Ktze

auch die Kartoffelstärke vielfach verwendet,z.B.für die Herstellung von Stärkezucker.von Dextrin,ect.Auf die Sp~~r~~iritus-Brennerei wurde schon hingewiesen(Gerste)Die Kartoffel stammt,wie der Mais,aus Amerika.Seine Heimat ist das Hochland der Anden von Chile und Peru.Schon vor der Ankunft des Kolumbus war ihre Kultur in verschiedenen Rassen in Amerika weit verbreitet.In der zweiten Hälfte des 16.Jahrhunderts kamen die ersten Berichte über die Kartoffel nach Europa. zu dieser Zeit sind wohl auch die ersten Knollen auf spanischen Schiffen nach Spanien gelangt und in Gärten angepflanzt worden.Von Spanien ~~kam~~ kamen die K.auch nach Italien und dort erhielten sie den Namen ~~T~~ "Taratoufli",ein Wort,das dem italienischen Wort für Trüffel Tartufoli (Trüffel) nachgebildet ist und wovon sich unser Name K.ableitet.Eine zweite direkte Einfuhr nach England efolgte gleichfalls 16.Jahrhundert wahrscheinlich durch Francis Drake.In Europa hat sich der Kartoffelbau während des 17.und18.Jahrhunderts überallverbreitet.Es sei nochmal bemerkt,die Kartoffel ist eine Spross-Knolle,nicht die Frucht der Pflanze (Siehe diese m Schrank (Beeren)).

Tapioka,Mannick.Die Euphorbiacee Manihot utilissima Pohl liefert eine Stärke, die für die Tropen sehr wichtig ist.Die Heimat ist wahrscheinlich das tropische Brasilien.Durch die Portugiesen kam die Pflanze im 16.Jahrhundert nach Westafrika und ins Kongo-Gebiet und von da ist sie weiter nach Osten gewander t.Die gereinigten Wurzelknollen werden ger spelt unddas giftige Alkaloid wird durch Auswaschen entfernt.Die Indianer bringen den Brei in Gefelchte,wie eines am Fenster links sich befindet,und pressen ihn damit aus (Durch Anziehen an den Enden) Aus dem Waschwasser sitzt dann die Stärke ab.Sie bildet das Manniok- oder Mandioka-Mehl.Verkleistert und gekrümelt heisst sie Tapioka.

Yams Eine Knolle ist rechts unten aufgestellt.Sie stammt von Doiscorea Batatas L Es gibt mehrere Knollen liefernde Dioscorea-Arten,die sowohl in der Alten als auch in der Neuen Welt behimatet sind.Die Frage,ob es sich um Spross- oder Wurzelknollen handelt,ist nicht ohne weiteres zu beantworten,da die Dioscorea-Knol-

® D... Mehlbanane [illegible]

len ~~////////~~ sowohl Spross- als auch Wurzeleigenschaften besitzen. Die Pflanzen besitzen oberirdische windende Sprosse (die auch vielfach Knollen tragen (Luftwurzel-Knollen?)tragen. Die unterirdischen Knollen können sehr gross und schwer werden. Auch der Yams vermag in den Tropen die Kartoffel zu ersetzen. Besonders wichtig ist sie für Kamerun und Togo, unsere früheren Kolonien. Für den Handel kommt nur die Stärke in Betracht.

Pfeilkraut (Arrowroot). Das Rhizom der Marantacee Maranta arundinacea L. liefert die feinste und auch die teuerste Stärke. (Amylum Marantae). Die Enden der der unterirdischen Sprosse sind keulenförmigen Speicherorganen angeschwollen; sie zeigen eine deutliche Gliederung in Knoten und Internodien und sind an ersteren mit Niederblättern besetzt. Es handelt sich also um Sprossknollen. Die Pflanze ist in Südamerika beheimatet. Die Portugiesen brachten sie nach Westafrika und wahrscheinlich auch nach Ostindien. Die meiste Stärke kommt von St. Vincent, das zu den Antillen gehört.

(Kleinen)
Es sind nun noch einige Proben von Stärken, die nur eng begrenzte Bedeutung haben, aufgestellt. z.B. von Nelumbium, von der Pflanze, die im Wasserpflanzenhaus zu sehen ist.

Gewürze. Dei Gewürze sind Zusatzmittel zur menschlichen Nahrung, die selbst keinen Nährwert besitzen. Sie verleihen durch ihren Duft und Geschmack der Nahrung Wohlgeschmack und regen dadurch die Sekretion der Verdauungssäfte an. Nur Zucker (und Salz) nimmt zwischen Nahrungsmitteln und Gewürzen eine Zwischenstellung ein. Der Bedarf an Gewürzen war früher viel grösser wie heute; man ass die Speisen viel schärfer gewürzt ~~///////~~. Auch Getränke, besonders Wein, wurden mit Gewürzen versehen. Dies war um so mehr nötig, als Wein damals in Gegenden gebaut wurde, in denen heute nichts mehr davon zu sehen ist. So wurde in München bei Giesing und Feldmoching (dort auf Feldern) Weingezogen, ein Wein, der wohl recht sauer war. Der Name Weinzierl, der bei uns nicht selten ist, erinnert noch ~~an die~~se Zeit.-Die meisten Gewürze stammen aus den Tropen, besonders aus den Tropen der Alten Welt.. Der wite Weg und die vielen Hände, durch die sie gingen, verursachte in früheren Zeiten ihren hohen Preis. Bei grossen Festlichkeiten unter Sixtus IV in Rom im 15. Jahrhundert (das war zur Zeit, als unsere Frauenkirche erbaut wurde) ~~/////////~~ brauchte man grosse Gewürzmengen, um seine Wohlhabenheit zu ~~//////~~ beweisen, ja man vergoldete sogar die Speisen und würzte sie mit - Kampfer. Auf die kulturgeschichtliche Bedeutung der Gewürze wurde in der Einleitung schon hingewiesen.

Im Schrank können nicht alle Gewürze gezeigt werden. Ihre Aufstellung geschieht nach morphologischen Grundsätzen und so beginnen wir mit den

a) Gewürzen aus Rhizomen.

Es werden hier Ingwer, Galgant und Zittwer gezeigt. Diese gehören alle zur Familie der Zingiberaceen (S. Schrank Nr.   Syst. Abtlg.). Die Rhizome (Vergl. Schrank Nr.2) sind verzweigt; man kann an ihnen die Knoten und auch die Nieder Blätter (Schrank Nr.   ) erkennen.

Ingwer ist das getrocknete oder vor dem Trocknen auch geschälte Rhizom von Zingiber officinale Roscoe. Der Ingwer war eines der am meisten verwendeten Gewürze. Er diente zum Würzen von Fleisch- und Fischspeisen und wurde auch, dem Weine zugesetzt. Bereits schon im Mittelalter stellten die Inder eine Zucker-Confitüre, die auch nach dem Abendland kam, her. Marco Polo berichtet von verschiedentlich von der Pflanze. Sie ist in Ostindien zuhause, wird aber auch in China, Cochichina und anderen Tropenländern angebaut. Aufgestellt sind Proben von Ingwer aus Ostindien, Cochinchina, Afrika und Jamaika.

Galgant oder Galanga stammt von Alpinia officinalis Hance (Der Name stammt von dem Italiener Alpini (gest.1617);Galanga kommt vom Arab. Khalandjan).Die Heimat ist die Insel Hainan und Südchina,sowie Indien,wo auch Marco Polo die Pflanze angetroffen hat.In Deutschland ist er zum ersten Male Mitte des 9. Jahrhunderts bekannt geworden.

Gelbwurzel Curcuma longa ist nur für die indische und chinesische Heimat als Zusatz zum Reis (Curry) wichtig

Zittwer (vom arab.Zedwar)stammt von Curcuma Zedoaria Roscoe,einer in Indien, Java und Madagaskar heimischen Pflanze.Das Gewürz wurde Speisen und Getränken zugesetzt,sonst wurde und wird die Pflanze nur in der Apotheke verwendet.

Gewürze aus Rinden.Es kommt hier nur der Zimt in Betracht.Es sind verschiedene Zimtsorten aufgestellt.Das erste Glas links enthält den feinsten -Ceylon-Zimt von Cinnamomum zeylanica Breynè,im nächsten Glas ist Cassia-Zimt,eine mindere Sorte,die von verschiedenen Cinnamomum-Arten,die dem C.zeylanicum sehr nahe stehen,stammen.Diese Cassia-Zimt-Arten sind in Hinterindien und Süd-China, wo Zimt schon seit grauer Vorzeit produziert wird,zuhause.Das Gewürz wird in folgender Weise gewonnen.Stock-Auschläge,also Schösslinge werden geschält und die Rinden-Stücke werden ineinander gesteckt und einer Art Gärungsprozess unterworfen.Nur die innere Rinde,die Bastschicht liefert das Arom.Deshalb wird nach der Gärung die äussere Schicht,die Borke,abgeschabt.Beim Trocknen rollen sich dann die Stücke ein.Der Zimt kommt auch gepulvert in den Handel.Er ist schon im 14.Jahrhundert v.Chr.nach Aegypten gekommen;ein Beweis für die uralten Handelsbeziehungen des nahen Orients mit Indien.

Bis zur Landung Vasco da Gamas in Indien (2o.V.1498) kam der Zimt auf dem Seewege nach Europa:Indischer Ozean,Rotes Meer,Nil zum Hauptstapelplatz Alexandria und von dort auf dem Mittelmeer nach Venedig und Genua.Später haben aber dann Portugiesen,Holländer und zuletzt die Engländer unter Benützung des direkten Seeweges ~~aus dem Zimthandel grosse Gewinne gehabt,denn der Bedarf an Zimt war sehr gross~~ da bei der Bereitung von Speisen aller Art und besonders zum Würzen des Weines stets gestossener Zimt verwendet wurde.

Nelkenzimt von der Lauracee Dicypellium caryophyllatum ,einer brasilianischen Pflanze stammend,wird für Liköre verwendet.

Gewürze aus Blättern.Hierher gehören zunächst die Lorbeer-Blätter von Laurus nobilis L.,einer Mittelmer-Pflanze, und dann die Blätter und meist auch das Kraut verschiedener,gleichfalls in Mittelmeergegenden beheimateten Lippenblütler,die reich sind an aetherischen Oelen.(Vergl.Schrank "Riechstoffe Nr.) Es sind als Beispiel die zerriebenen Blätter vom "Bohnenkraut" Satureja hortensis L.,vom Thymean (Thymus vulgaris L.) und von dem in Altbayern besonders beliebtem "Leberknödelgewürz" Majoran (Origanum majorana L.),aufgestellt.Alle diese Pflanzen sind mit Ausnahme des Lorbeers,für den unser Klima zu kalt ist schon seit dem Mittelalter bei uns in Kultur.

Gewürze aus Blüten. Von Blütenknospen stammen die Kapern und die Gewürznelken. Die Kapern sind die in Essig und Salzwasser eingemachten,etwa 1ccm grossen Blüten-knospen von Capparis spinosa L.Die Heimat ist das Mediteeran-Gebiet. Es sind in 2 Gläsern Zweige aufgestellt,die von Pflanzen aus den Gewächshäusern undvon Pflanzen aus Gardone am Gardasee stammen.Man beachte den Unterschied in der Wuchsform.Die Blüten knospen in dem kleinen Glas stammen aus Südfrankreich (La Casiere). [illegible]

[illegible]

Gewürznelken. Diese gehören zu den Gewürzen, die eine grosse Bedeutung gehabt haben. Die Gewürznelken, keine Nelken, sondern die Blütenknospen des Myrtengewächs Jambosa caryophyllus Ndz., bestehen aus einem stielartigen Teil, der den Fruchtknoten enthält und einem Knöpfchen, das von der Blumenkrone, die Staubblätter und Griffel einhüllen, gebildet wird. DER STielartige TEIL, der Gewürznelke, der mit 4 Kelchblättern endigt, ist eine Verdickung und Verlängerung der Blütenachse nach unten; sie wird bei der Fruchtreife von der Frucht ganz ausgefüllt. Beim Aufblühen wird die Blumenkrone als Ganzes wie eine Kappe abgeworfen und die zahlreichen Staubblätter richten sich auf Die Gewürznelken stammen von einem stattlichen Baum (Blüten und Früchte siehe Schrank Nr.46). Sie enthalten einätherisches Oel, das Nelkenöl, das am reichsten in den Blütenknospen enthalten ist. Sobald diese sich zu röten beginnen, werden sie geerntet und dann im Schatten getrocknet, wobei sie braun werden. Sehr interessant ist die Geschichte (vergl. Einleitung. Schon im 3. Jahrhunder v. Chr. waren die Gewürznelken den Chinesen bekant. Im abendländischen Kulturkreis werden sie erst nach Chr. erwähnt. Zur Merowinger-Zeit (   ) finden wir sie schon an der Rhonemündung und durch das ganze Mittelalter hindurch war der Bedarf sehr gross, da man sie zum Würzen von Speisen und Weinen brauchte. Die Heimat bleib langezeit unbekannt. Die Einfuhr nach Europa erfolgte auf dem Seewege das ganze Mittelalter hindurch unter Vermittlung arabischer Kaufleute über Alexandrien und Venedig. Die Preise waren immer hoch, da die Gewürznelken durch viele Hände and Länder, wo überall Zoll erhoben wurde, gingen, bis sie zum Verbraucher kamen. Der Handel mit den Gewürznelken war sehr ertragreich. Die Landung des Portugiesen Vasco da Gama in Südindien erfolgte, wie schon erwähnt, am 20. Mai 1498. Der erste Europäer, der zu den "Gewürzinseln", den Molukken, kam, wat der Portugiese Serrano; dieser war 1511. auf der Insel Ternate. Als 1521 die unter spanischer Flagge segelnde, von dem Portugisen Magellaen geführte Expedition (vergl. Einleitung) die Molukken gleichfalls erreichte, waren die Portugiesen schon dort. Es entspann sich zwischen Spanien und Portugal ein Streit. Durch den Schiedspruch des Papstes erhielt dann Portugal die Inseln und es übte ein Handelsmonopol über den Gewürznelken-Handel aus. Bereits im zu Anfang des 17. Jahrhunderts rissen aber die Holländer die Gewürzinseln an sich und übernahmen so auch den Handel. Sie konnten aber trotz der strengsten Ueberwachung und sogar Ausrottung vieler Bäume nicht verhindern, dass die Pflanzen nach andern Tropengegenden heimlich verschleppt wurden. So gelangten sie nach Zansibar und Westindien (Réunion), wovon heute die meisten Gewürznelken kommen.

Safran. Der Name kommt vom Arabischen. Die getrockneten Blüten-Narben der im Herbst blühenden Iridacee Crocus sativus L. bilden den Safran des Handels. Sie stellen einzeln oder noch zu dreien mit dem Griffel zusammenhängende am Ende trichterförmig erweiterte rotbraune Fäden dar, die einen charakteristischen Geruch aufweisen. Die Heimat des Safrans ist wohl der Orient. Seine Bedeutung hat er fas ganz eingebüsst; u.a. wird er zum Färben von Butter und Konditorwaren noch verwendet, dagegen brauchte man ihn in früheren Zeiten in der Küche als Gewürz, zum Malen als Farbstoff, als Parfum und als Arzneimittel. Seine Verwendung ist ja uralt; schon bei den alten Aegyptern und in der Bibel wird er erwähnt. Der Safran ist sehr teuer; vielleicht das teuerste Gewürz; da das Gewicht der Narben sehr gering ist. Er kommt heute meistens aus Spanien.

Gewürze aus Früchten. Pfeffer.: Peffer stammt von der Piperacee Piper nigrum L. einem kletternden Strauch. Die Früchte sind einsamige Steinfrüchte (Vergl. Schrank Nr.   ) Man verwendet "schwarzen" und "weissen" Pfeffer. Beim ersteren werden die

Früchte unreif von der Pflanze genommen und getrocknet. Dabei runzeln Exo- und Mesokarp ein und werden schwarz. Bei der Gewinnung von "weissem" Pfeffer werden die roten, reifen Früchte von derselben Pflanze geerntet und nach einem kurzen Gärungsprozess werden Exo- und Mesokarp mechanisch entfernt; alsdann werden die Früchte in der Sonne getrocknet. Die Hauptmasse des Samens besteht aus stärkereichem Perisperm (Fussnote!). Endosperm und Keimling nehmen nur einen kleinen Raum ein. Geruch und Geschmack kommen von einem im aetherischen Pefferöl gelösten Harz und ebenfalls darin gelösten Piperin. Nun zur Geschichte. Der Pfeffer ist wie früher auch heute noch das wichtigste Gewürz, wenn auch gegenüber dem Mittelalter sein Preis auf den 5. Teil gesunken ist. Seine Heimat, die ostindische Malabar-Küste, das "Pfeeferland", war schon frühzeitig bekannt. In früheren Zeiten scheint nur schwarzer, wenig weisser Pfeffer ins Abendland gekommen zu sein. Der letztere ist hauptsächlich im fernen Osten konsumiert worden. Die erste Bekanntschaft mit dem Pfeffer machten die Abendländer auf dem berühm- Zug Alexanders d. Gr. nach Indien 327 v. Chr., wo sie auch zum ersten Male den festen Zucker und die Banane kennen lernten. Theophrast wusste schon 286 v. Chr., dass es einen schwarzen und einen weissen Pfeffer gibt. Etwa um Christi Geburt ist der Pfeffer auf dem Handelswege in Europa erschienen. Im Mittelalter hat ihn Marco Polo in Indien wachsen sehen. Der meiste Pfeffer ging damals nach China, traf doch auf 100 Schiffe, die von Indien nach dem Reiche der Mitte fuhren, nur eines, das nach Westen segelte. Alle Handelsstrassen, zu Wasser und Land, die Indien mit dem Abendlande verbanden, dienten der Verbreitung des Pfeffers. Besonders wichtig war als Durchgangsland Aegypten und Alexandrien war ein bedeutender Stapelplatz. In Europa spielte damals die Hauptrolle Venedig. Der Pfeffer hatte für diese beiden Städte die gleiche Bedeutung wie heute der Rohrzucker für Cuba. Anders wurde das nach der Landung Vasco da Gamas in Indien. Der Pfeffer spielte im Mittelalter eine ungeheuere Rolle. Es gab keine Handelsstadt, die sich nicht damit befasste, es gab keinen reisenden Kaufmann, der nicht Pfeffer bei sich hatte; damals ist für die das Wort "Pfeffersäcke" aufgekommen. Wie weit verbreitet und welch hohen Wert der Pfeffer hatte, geht daraus hervor, dass man von Bürgern, Bauern, Klosterleuten Steuern in Form von Pfeffer erhob und Pfeffer-Strafen statt Geldstrafen diktierte. Da man im Mittelalter scharfe, den Durst erregende Speisen liebte, so musste auch der Pfeffer ein Lieblingsgewürz gewesen sein. Bei der starken Nachfrage nach dem Gewürz war der Pfeeferhandel sehr gewinnbringend. Auf seiner ersten Fahrt konnte Vasco da Gama von Calicut in Südindien nur wenig Pfeffer nach Lissabon bringen. Der Empfang in Indien war ja auch sehr unfreundlich. (Vergl. Einleitung). Zu Anfang des 16. Jahrhundert setzten sich die Portugiesen in Indien fest, um den Pfefferhandel direkt nach Europa zu übernehmen und Araber und Venezianer auszuschalten. Bei Beginn des 17. Jahrhunderts wurden sie aber durch die Holländer verdrängt und etwa wieder 100 Jahre später nahmen die Engländer deren Platz im Pfefferhandel ein; die Holländer wurden von den Briten vertrieben. Zum Schluss noch eine kleine Episode aus der Gegenwart, aus dem Jahre 1935. Je nach der Nachfrage nach weissem oder schwarzem Pfeffer lässt man die Früchte ausreifen oder erntet sie unreif. Ein Spekulant wollte in London, dem heutigen Haupthandelsplatz für Pfeffer, allen schwarzen Pfeffer aufkaufen, ihn zurückhalten und dann den Preis diktieren. Die Nachfrage stieg und damit auch der Preis. Das hatte zur Folge, dass statt weissem immer mehr schwarzer Pfeffer erzeugt wurde, Dass schwarzer und weisser Pfeffer von einer Pflanze stammen, war dem Spekulanten unbekannt. Das Ende war ein ~~wurden~~. Dies ein Zeichen, dass auch der Pfeffer heute noch Bedeutung hat.

Riesen-Zusammenbruch der Spekulation und der damit verbundenen Kreise.

viel verwendetes
Cubeben-Pfeffer von Piper Cubeba L.fil. war früher ein ~~weitverbreitetes~~ Gewürz.
Marco Polo erwähnt es öfters; heute wird es als solches nichtmehr gebraucht.
in einem Wirtel befindl
Sternanis stammt von der Magnoliacee Illicium verum Hook f. Die von den apocarpen Gynaeceen gebildeten, mehrere Samen enthaltenden Balgfrüchte liefern ein in ~~......~~ verwendetes Gewürz. In Europa wird es wie Anis, der später besprochen wird, gebraucht (auch zum Likör "Anisette"). Die Pflanze ist in Südchina zuhause. - Es folgen nun mehrere Umbellifernen- d.s. Doldenblütler-Früchte: Kümmel, Mutterkümmel, Anis, Fenchel, Koriander. Die Früchte zerfallen bei der Reife in 2 einsamige Teilfrüchte, die meist an der Spitze an einem häufig ~~.......~~ gabelförmig gespaltenen, fadenförmigen Träger hängen. Die Fruchtwände besitzen sog. "Oelstriemen", die ein aetherisches Oel enthalten, das die Veranlassung zu ihrer Verwendung als Gewürz bildet. Diese Umbelliferengewürze sind nicht ~~...~~ in
heimisch
den Tropen sondern ~~..........~~ sie kommen auch in unserer Heimat wild vor.
Kümmel stammt von Carum Carvi L.. Er wächst wild auf unseren Wiesen. Der Kümmel ist das älteste in Europa verwendete Gewürz; auch im Orient wird er schon im Altertum gebraucht. Man verwendet ihn zum Würzen des Brotes und auch einen Likör gleichen Namens stellt man ~~......~~ her. Mutterkümmel oder "römischer Kümmel" von Cuminum Cyminum L. hat einen kampferähnlichen Geruch. Er stammt aus dem Orient und wird bei der Herstellung "magenstärkender" Liköre verwendet. Anis, ~~...~~. von Pimpinella Anisum L. stammt wohl auch aus dem Orient. Er war schon den alten Griechen und Römern bekannt und die letzteren haben ihn wohl nach Mitteleuropa gebracht. Heute wächst er in allen gemässigten Gegenden. Er ist ein Küchengewürz das auch zu Likörfabrikation wie der Sternanis ~~........~~ Anwendung findet.
Fenchel von Foeniculum vulgare Mill. stammt ebenfalls aus dem Orient. Er wird heute in allen gemässigten Gegenden kultiviert und dient als Küchengewürz.
Coriander von Coriandrum sativum L. ist auch im Orient zuhause und wird ebenfalls bei uns gepflanzt. Die Spaltfrüchte sind kugelig; er dient als ~~........~~ Gewürz von Gurken und Saucen.
Spanischer Pfeffer, Paprika, stammt von dem im tropischen Amerika beheimateten Nachtschattengewächs Capsicum anuum L. Bei den Indianern wurde die Pflanze als Gewürz verwendet wie bei uns der Pfeffer. Die Bezeichnung "spanisch" hat hier
in der Alten Welt
dieselbe Bedeutung wie bei dem aus Ostindien stammenden "spanischen" Rohr, d.h. es wurde von den Spaniern nach Europa gebracht. Der spanische Pfeffer wird am meisten in Form von Pulver verwendet. Die Früchte werden gemahlen. Heute wird er
Europa in
in Ungarn, Südfrankreich, Spanien und Italien angebaut. Dort wird auch eine ~~.....~~ bei der Reife grünbleibende Sorte (Doe reifen Paprika-Früchte sind rot), die fast keine Schärfe besitzt, als Gemüse gegessen.- Cardamomen, die Früchte der Zingiberacee Elettaria cardamomum um W.et M. ~~..............~~ enthalten Samen die von einem Samenmantel, einem Arillus eingehüllt sind. Dieser Arillus liefert das als Gewürz verwendete aetherische Oel. Marco Polo erwähnt Cardamomen des öfteren.- Vanille. Der aus dem Spanischen kommende Name bedeutet "Schötchen" Vanille ist das feinste Gewürz. Es wird von der in Zentralamerika heimischen Orchidee Vanillia planifolia Andrews geliefert. Es ist dies die einzige Orchidee, die eine Nutzpflanze darstellt. Sie ist eine kletternde Erd-Orchidee, kein Epiphyt. Sie rankt mit Rankenwurzeln empor (Siehe Schrank "Kletterpflanzen") Die Spanier lernten die Vanille mit der ~~......~~ Kakao-Kultur in Mexiko kennen. 1510 wurde sie zum ersten Male nach Europa gebracht. Die Blüten sind gelblichweiss. Die nach der in der ...

künstlichen Bestäubung sich entwickelnden Früchte müssen einen "Gärungsprozess" durchmachen. Dabei werden sie dunkelbraun. Sie werden erst erhitzt und dann an der Sonne getrocknet. Dann kristallisiert das Vanillin in feinen Nadeln aus. Die kleinen, schwarzen Körnchen, die man zuweilen in der "Vanille-Sauce" findet, sind die kleinen Samen der Pflanze. Die Orchideen-Samen sind ja sehr klein (Vergl. Schrank) Heute kommt die meiste Vanille von der Insel Réunion. Das Aroma wird auch künstlich hergestellt; u.a aus dem Kambium-Saft der Nadelhölzer, aus dem sog. Coniferyl-Alkohol, und ausserdem aus Gewürznelken-Oel (Eugenol) auf chemischem Wege.

2) Gewürze aus Samen. Hieher gehör~~t~~en einzig und allein die Muscat-Nuss und die "Muscat-Blüte, die Macis.. Sie stammen von der Myristicacee Myristica fragrans Hout. die im gleichen Gebiete zuhause ~~ist~~ sind wie die Gewürznelke und die auch fast die gleiche Geschichte haben wie diese. Gehört doch die Muscat-Nuss mit Pfeffer, Zimt und Gewürznelken zu den wichtigsten, aus den Tropen stammenden Gewürzen. Ein Küchenbuch aus dem 14. Jahrhundert ~~[illegible]~~ sagt; Zu einer guten "Fülle" gehören "Muskatblumen, Galgan, Pfeffer, Ingeber, Kümmel und Negelin". Die Pflanzen sind zweihäusig. Man kann aber auch männliche Zweige auf weibliche Pflanzen pfrpfen. Es sind immergrüne, grosse Bäume. Die Früchte sind Beeren (Vergl. Schrank). Die Samen besitzen einen ästig verzweigten Samenmantel, einen Arillus von roter Farbe, der durch Volumenzunahme als Schwellkörper wirkt und die Frucht in 2 Klappen sprengt. Eine ähnliche Einrichtung haben wir auch bei unserem Pfaffenkäppchen. Der Arillus lockt auch Tauben, die die Samen fressen und so die Pflanzen verbreiten, an. Er kommt getrocknet als "Muskatblüte" oder Macis in den Handel. Er enthält ein aetherisches Oel. Die Samen, die Muskat-Nüsse, besitzen unter der holzigen Samenschale ein reichzerklüftetes Nährgewebe (~~Endosperm~~) ein sog. "ruminiertes" Endosperm, das ebenso wie der Keimling ölhaltig ist. Wenn man die Nüsse im Querschnitt betrachtet sieht man das [illegible] gefärbter Vorsprünge die das ätherische, Oel enthalten, das dem Gewürz den Gewchmack ~~[illegible]~~ bzw. Geruch verleiht. Ob diese Vorsprünge bei der Entwässerung des Samen zur Zeit der Reife eine Rolle spielen, ist nicht festgestellt. Zum Schutz gegen Insektenfrass werden die Nüsse gekalkt. Die Araber haben das Muskatgewürz schon früh von Indien her bekommen, aber nicht gewuss, wo sie wachsen. Nach Europa kamen sie im Mittelalter vorwiegend auf dem Landwege. Bagdad, Täbris und Samarkand waren wichtige Stapelplätze. Was die Kenntnis vom der Heimat anbetrifft, so galten Während der Portugiesenherrschaft in Indien die Banda-Inseln als das Ursprungsland. Die Holländer haben später auf allen übrigen Inseln die Bäume vernichtet. Trotzdem konnte nicht verhindert werden, dass die Pflanzen heimlich nach anderen Tropengegenden verschleppt wurden, wie es auch bei den Gewürznelken der Fall war

S c h r a n k Nr.

"Genussmittel"

Zucker.

An interesting Orchid.

In the left side of the big conservatories,in House Nr. 13,,of the New York Botanical Garden,there is an interesting orchid,the flowers of which are to be seen fr[illegible] time to time.The Latin name of this plant is E p i d e n d r u m cochleatum. It is at home in Central America and in the West Indies, Ill. # 1. and # 2.

Toexplain the nature of this bloom,we have to say something about the orchid-flower.which is rather difficult to understand.The Orchid-family with its approxemately 20 000 species,belongs,like the Composites,to those families in the plant kingdom which are most rich in species.The Orchids belong to the Monocotules.By examples which are familiar to everybody we shall try to explain the organisation of the flowers.

The monocotyle-flower is built following the " three-number".This means that the leaf-organs which are arranged verticillately,have in each whorl three leaves. We start from the

Tulip,and begin with the exteriorially attractive apparatus,with the cup-like perianth,in Monocotyles,with the "Perigon",because we have no division into calix and corolla.This perigon consisits of twice three colored leaves (2 x 3) which have nearly the same shape and size.Then follow the sex-organs of the flower:the 6 stamina and the ovary,the unit of the 3 fruit-leaves.which are fertile almost to the top.This is the reason that we miss in tulip a pistil,the sterile end of the fruit-leaves.The ovary ends directly with the stigma.The 6 stamina which produce the pollen,also are arranged in two circles,every one with three stamina. - The next example of which we intend to speak is

Iris.In Iris the 6 leaves of the perigon are not equal;the leaves of the outer circle have another shape than the leaves of the inner circle.It may be mentioned that in the Iris-flower are only 3 stamina,a reduction of the number of stamina in the flower.We shall se a similar fact in the Orchids.

The flowers of Tulip and Iris are equilateral in plan,they are "radiate",the short axis of the flower (this is the shortened part of the sprout which bears the leaf-organs in the flower,perianth,stamina and fruitleaves)has a verical orientation.This is another in

Gladiolus,a plant,seen so often in flower shops.Here the flower-axis is situated horizontally and even in the Gladiolus-flower,we may observe that it is no longer radiate; we may distinguish between an upper- and a lower side and so we call this flower "dorsiventral".The Gladiolus-flower is also influenced by the gravitation of the Earth,this means that the flowers on the inflorescence show a certain orientation.

All these features we have in the orchid-flower,and especially in our Epidendrum. Here also the floweraxis is situated horizontally and the flower is influenced very strongly by the gravitation,a matter which is important for our Epidendrum.In the orchid-flower the 3 perigon-leaves of the outer and from the inner circle are very different from each other.In Lady-Slipper one leaf of the inner circle is the "Slipper",whilst in the other orchids the same leaf forms the "lip",the "labellum". Following the fact that the orchid-flower is influenced by the gravitation,this "labeelum is directed mostly towards the Earth;it is on the lowerside of the perigon. It is the "landing-place" for the visiting (and pollinating)insects.This takes place by a turning of the flower,called "resupination". It is caused by the turning of the inferior ovary.After fertilisation this turning-process reverses in the most cases.In our Epidendrum we have no resupination and so the brown labellum is on the upperside of the flower and directed vertically. Ill.# 1 and # 2.Ill # 3 shows Dendrobium nobile with flowers as they are mostly to be found in the orchid-family:The labellum is below.Perhaps only the Botanist may be interested to know that,probably,it is the "Gynostegium",the unit of pistil and stamen.of the only present stamen,which is sensitive to gravitation.For the Botanist's benetif,it may be mentiones that,as in Iris,where there are only 3 stamina,the number of stamina is in Lady-Slipper reduced to 2 of the inner- and,in the other orchids,to 1 of the outer circle.

Theodor Philippe Haas. Ph.D.

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Dr.Theodor Philipp Haas,
Botanist

1904 13th Street N.
Philadelphia, Pa., March 1942.

"The American
Philosophical Society",
Independence Hall,
Philadelphia, Pa.

Application for a grant of
$ 1200.-
for research work in the
Mangrove-Formation of Florida, during
one year.

Gentlemen:

I would like to do research work on the Western Mangrove-Formation which occurs in Florida.

The problems which I want to study are the following:

1. The life conditions in the Western Mangrove-Formation,

2. The pollination of the Mangrove-Plants,

3. The vivipary,

4. The root-problem.
   Is the theory of W.Troll right which states that the negative geotropic aerial roots (in the Western Mangrove-Formation e.g. in Avicennia nitida) bring the extremely branched nourrishing roots into a favorable position in the soil that is ever increasing in depth? How is this on the positive geotropic aerial roots of Rhizophora Mangle?
   How are the roots of Rhizophora Mangle branched on their ends?
   In the growth points of the positive geotropical aerial roots of Rhizophora Mangle does there live a beetle which destroys these and increases the branching of these roots as in the case in Rhizophora mucronata or Ceriops Candolleana in the Eastern Mangrove-Formation of the Indian Ocean?

5. Are the aerial roots of the Western Mangrove-Formation also permanently associated with small red-algae like those of the plants in the Eastern Mangrove-Formation?
   Are these epiphytic red-algae identified?

Other problems may arise during the research work.

5

Aristolochia silvicola Stan.

Contribution from the
Arnold Arbor. of Harvard 1933
The Flora of. Barro Colorado Island. Panama

The Alpha Sigma Society

of the

Philadelphia College of Pharmacy and Science

This is to Certify *that* Dr. Theodore P. Haas *has been duly elected an* **Active** *Member of the aforesaid Society this* twenty-fourth *day of* September 1943.

In Testimony Whereof *are hereunto affixed the names of the proper officers and the seal of the Society.*

President, Walt. A. Moyer, Jr.

Secretary, Richard S. Cook

Aus der Geschichte des Papiers.

(Eine kulturgeschichtliche Betrachtung)

Kaum ein Ding des täglichen Gebrauchs hat eine so reiche Geschichte wie das Papier, dessen Geduld wir preisen und das doch in der Welt so viel Unheil anzurichten vermag. Ist es doch der Träger der Schrift und damit Uebermittler unserer Gedanken und Worte und so gilt auch vom Papier das arabische Sprichwort: "Messerwunde heilt, Zungenwunde heilt nicht."

So alt wie die Schrift ist auch das Verlangen nach einem Untergrund, auf den man schreiben kann. Man hat die Schriftzeichen in Stein gemeisselt und in Felswände gehauen und so Geschichts-Denkmäler von unvergänglichem Werte geschaffen. Es sei hier nur an den "Darius-Stein" in Persien, der die Entzifferung der Keilschrift ermöglichte, an den "Drei-Sprachen-Stein", den man in Aegypten gefunden hat und der den Schlüssel zum Lesen der Hieroglyphen, der aegyptischen Bilderschrift, gab, erinnert, es sei auf die nestorianischen und alttürkischen Inschriften in Zentralasien **hingewiesen.**

Aber auch für den täglichen Gebrauch benötigte man einen Schreibgrund. Da im Altertum nur wenig Leute lesen und schreiben konnten, so war der Bedarf leicht zu decken, nur musste der Schreibgrund einfach herzustellen sein. So verwendeten die Babylonier weichen Ton, in den sie ihre Keilschriftzeichen eindrückten und den sie dann brannten. Die Aegypter stellten aus dem Mark eines grossen Riedgrases, aus Cyperus papyrus L., wie der wissenschaftliche Name lautet, einen Schreibgrund her, der grosse kulturgeschichtliche Bedeutung erlangt hat. Das Mark wurde kreuzweise übereinander gelegt, gepresst und verklebt. Die einzelnen Stücke wurden aneinander geleimt und dann wurde das Ganze über einen Stab aufgerollt. So entstand die Papyrus-Rolle. Seitdem man unter Berücksichtigung der Faserung die zerfallenen aegyptischen Papyri in mühevoller Arbeit wieder zusammensetzen kann, ist es auch möglich, die alten Beschriftungen zu lesen und man bekam so Einblick in das kulturelle Leben im alten Aegypten.

In Pergamon in Kleinasien, einem der bedeutendsten Kulturzentren des Altertums, schrieb man auf geschabte Kalbs-, Schafs- und Ziegenhäute, die man an der Luft trocknete. Hier stand die Papyrus-Pflanze nicht zur Verfügung. So entstand das Pergament.

Papyrus und Pergament waren bis weit ins Mittelalter der Schreibgrund in Europa. Des ersteren bediente sich noch bis ins zehnte Jahrhundert die römische Kurie und das letztere war der Schreibgrund für die wertvollen Handschriften der Klöster mit ihren wunderbaren Initial-Malereien, bei denen Eiweiss als Bindemittel für die Farben verwendet wurde.Es sei hier nur kurz darauf hingewiesen,dass die Buchmalerei,insbesondere die byzantinische ungeheueren Einfluss auf die Malerei des Mittelalters in Europa gehabt hat.

Für den täglichen Gebrauch verwendete man im Altertum und Mittelalter mit Wachs überzogene Metall- und Holztafeln,auf die man mit einem spitzigen Instrument,einem Stichel,die Schriftzeichen einritzte.Man hat die Holzta_ feln einseitig zusammen gebunden und daraus ist die Form unsere Buches entstanden.

Papyrus,Pergament und Wachstafeln,sie alle sind verdrängt worden durch das P a p i e r .Seine Wiege steht weit,weit weg,in - China.Dort wurde es, man weiss das ganz genau aus den chinesischen Berichten, 105 n. Chr. von dem chinesischen Hof- oder Staatsbeamten Tsai-Lun erfunden.Darüber hat 1890 Friedrich **Hirth** unter Verwendung chinesischer Quellen berichtet.(Friedrich Hirth:Die Erfindung des Papiers in China).Da diese Arbeit wenig zugängig ist,sei einiges daraus wiedergegeben.Die Chinesen haben in früher Zeit auf schmale Holzbrettchen ~~und~~ geschrieben das war wohl die Veranlassung zu ihrer Vertical-Schrift. Die Brettchen wurden durch 2 quergezogene Stricke oben und unten zusammen gehalten;das war die Form des Buches bei den Chinesen.Auf Holz werden auch die Lehren des Kung-tse oder Kung-fu-tse,den die Jesuiten Confuzius nannten und der ein Zeitgenosse von Sokrates war,geschrieben gewesen sein.- Etwa um 126 v. Chr. wird als weiterer Schreibgrund Seidenstoff verwendet. Die Seide stammt ja auch aus China,Sie ist schon zur Zeit der Römer nach Europa gekommen und diese nannten das ferne Land im Osten das "Seideland" Für Schreibzwecke stellte man eigene Seidenstoffe her.~~Für Schreibzwecke~~ Man verwendete dazu ganz minderwertiges Material,Abfälle u. dergl.Diese wurden festgestampft.Man spricht damals bereits von einem "Lumpenpapier". Dieses hatte gegenüber den Holzbrettchen den Vorteil der Biegsamkeit und des geringeren Gewichtes,es war aber zu teuer.Da setzt nun die Erfindung des Tsai-Lun ein:Er nahm statt tierischer Fasern,die auch die Seide bilden, Pflanzenfasern.Tsai-Lun verwendete,wie es heisst,alte Fischernetze und Hadern..Sie waren aus Ramiefasern,Hanf und Flachs.Die Ramiepflanze ist eine Brennessel-Art,die den wissenschaftlichen Namen Boehmeria nivea L. führt. Sie ist in China zuhause und heisst auch "Chinagras",Die Fasern werden wie bei unserem Flachs durch "Rösten",d,i, ein Fäulnis-Prozess,bei dem die weicheren Sprossteile verfaulen und die festeren Fasern zurückbleiben,gewonnen Bei uns macht man aus Ramiefasern u.a. die Gasglühstrümpfe,Ursprünglich fremd sind in China Hanf und Flachs.Der erstere wird wohl mit den uralten Handelsbeziehungen mit Indien ins Reich der Mitte gelangt sein.Der Flachs soll,wie Friedrich Hirth angibt,durch den chinesischen General ~~Tschang K'ie~~

Tschang K'ien im 2.Jahrhundert v. Chr. aus Ferghana in Persien nach China gebracht worden sein.Dieser General war von seinem kaiserlichen Herrn ~~Wu~~ Wu - ti aus der Han-Dynastie nach Westen ausgeschickt worden,um Verbündete gegen die Hunnen,gegen die "Hiung - nu",wie die Chinesen sagen,zu suchen. Diese haben mit den Chinesen immer Krieg geführt und gegen sie war die Grosse Mauer ,zuerst als blosser Wall.errichtet worden.Ein Teilstamm dieses unruhigen zentralasiatischen Reitervolkes ist später nach Europa gelangt.
etwa bis Ostturkestan.
Tschang K'ien kam bis nach Zentralasien.Er kam zu einem höchst merkwürdigen Volke,das eine Sprache redete,die mit den europäischen Sprachen Verwandtschaft zeigt,dessen Angehörige,wie spätere Bilderfunde zeigen blauäugig und blond waren,ein Volk,das die Wissenschaft "Tocharer" nennt und das die Römer für die "Serer",für die Leute hielten,von denen die Seide kommt.Bei seiner Rückkehr von diesem seltsamen Volke nach China 126 v.Chr. brachte der General neben dem Pferd,das in China (wie übrigens auch im
Reiche
alten Aegypten) unbekannt war,die Luzerne (Medicago sativa L.)als Pferdefutter,noch viele in China unbekannte ~~Pflanzen~~ Nutzpflanzen mit:Die Weintraube,die Walnuss und auch den Flachs.Ausserdem brachte er noch Nachrichten,die bis nach Syrien und ans Mittelmeer reichen,mit.Es war wohl die kulturgeschichtlich bedeutsamste Reise,die je ein Militär ausgeführt hat. Die geographischen Kenntnisse der Chinesen reichten sehr weit nach Westen. Die Syrier nannten sie,nach Hirth, "Tat - sin",Die Städte Antiochia und Ktesiphon "~~Ant~~ "An-tu" und"Si-pon".

Ausser Ramie und Flachs ist von altersher auch die Rinde des Papier-Maulbeerbaumes Brousonetia papyrifera L. zur Papierbreitung verwendet worden.Hirth führt auf diese Tatsache das Wort "kaghid" zurück.Dieses Wort ist die Bezeichnung für Papier im Arabischen,im Uigurischen,einer alttürkischen Sprache in Zentralasien (Turkestan)und im Osmanischen,dem modernen Türkischen,das mit dem letzteren grosse Aehnlichkeit hat.Nach Hirth lässt sich "kaghid",das aus dem Persichen stammt,,vom Chinesichen,wo es auch Rindenpapier bedeutet,ableiten.

Das chinesische Pflanzenfasern-Papier verbreitete sich im ganzen chinesichen Kulturkreis.Sven Hedin,Aurel Stein,A.v.Leqoq und andere Forscher haben Papierfunde in Zentralasien gemacht.Sie tragen Schriftzeichen,die man entziffern konnte und die uns Kunde geben von dem Kulturgeschehen in diesem Erdenraume von 150 bis 800 n.Chr.Wir erfahren durch sie von den

Nestorianern,den ersten Christen,die nach Osten gewandert sind.(Reste von diesen sind die sog. "Assyrer",die heute noch im Irak leben und dem Völkerbund manch Kopfzerbrechen verursachen).Wir lernen die Manichäer kennen, die Anhänger der Religion des Mani,eines im Gegensatz zu Zarathustra befindlichen Persers,der eine Religion begründete,die im Mittelalter ausserordentlich weit verbreitet war und die heute ganz verschwunden ist.Die Papierfunde geben uns ferner einen Einblick in die kulturellen Beziehungen zwischen Ost und West,zwischen Persien,Indien und China,Beziehungen,die sehr innige waren. - Das Rindenpapier fand Verwendung als - Papiergeld , gleichfalls eine Erfindung der Chinesen.Es sollte ursprünglich als leicht. transportable Quittungen für einbezahlte Kupfermünzen - China hatte Kupfer Währung - diese ersetzen.Das geschah etwa im 10.Jahrhundert;später hat man die Papierscheine allein als Geld benützt und das hat zu einer Inflation geführt.Marco Polo hat sie uns ausserordentlich interessant zu schildern gewusst.Man könnte glauben,die Worte wären 1923 geschrieben worden und nicht zur Zeit von Dante und Walther v.d. Vogelweide zu Ende des dreizehnten Jahrhunderts.In der deutschen Uebersetzung der Reisen Marco Polos v. August Bürck (Leipzig 1855)findet sich von Karl Friedrich Neumann,dem bedeutenden Sinologen,folgende Anmerkung,datiert vom Oktober 1844:"Das chinesiche Wort "Tschao" ,welches Papiergeld bezeichnet,wird mit einem Charakter geschrieben,der sprechend genug aus "wenig" und "Metall" zusammengesetzt ist und ursprünglich "wegnehmen","confiscieren" bedeutet.Wer hätte wohl dem steifen Schranzenwesen der Chinesen so viel Ironie zugetraut?" Diese Anmerkung ist,wie gesagt 1844 geschrieben worden!

Bis zum Jahre 751 n.Chr. konnten die Chinesen die sich rasch ausbreitende Papiermach-Kunst geheim halten;sie ist bis zu diesem Zeitpunkte nicht über den chinesischen Kulturkreis hinaus gekommen.Durch einen Krieg mit den Mohammedanern 751 bei Samarkand gelangte das Pflanzenfasern-Papier in die arabische Welt.Zuerst mussten in Samarkand chinesische Kriegsgefangene ,die des Papiermachens kundig waren,das Papier herstellen,wenn es auch dort die Rohstoffe Chinas nicht gab.Man verwendete nun in erster Linie und ausschliesslich Leinenhadern.Im arabisch-islamischen Kulturkreis hat sich das Papier sehr schnell verbreitet.794/795,zur Zeit von Harun al Raschid,dem Zeitgenossen Karls d. Grossen,befand sich in Bagdad bereits eine grosse Papierfabrik.

Wie die Araber die Herstellung des Zuckers aus dem aus Indien stammenden Rohr durch Erfindung der Raffinade verbessert haben,so wurde auch das

Papier in ihren Händen ein wertvollerer Stoff.Sie führten die Füllung und Leimung des ausschliesslich aus Leinenfasern gemachten Papiers ein (durch Zugabe von Weizenstärke und Weizenkleister).und auch die technischen Einrichtungen der Papierfabriken wurden vervollkommnet.Auf dem geleimten Papiere konnte man viel besser schreiben.Es wurden jetzt bereits farbige Papiere hergestellt und durch Zusatz von Coloquintensaft machte man es gegen Teirfrass widerstandsfähig.Das Papier wurde nun auch ein wichtiger Gegenstand des Levantehandels im Mittelalter,der so viel zum Wohlstande der deutschen,besonders der süddeutschen Städte beigetragen hat,was dort in den grossen Bauten zum Ausdruck kommt.

Das chinesisch-arabische Papier hat das Papyrus- Material schon zu Beginn des 10.Jahrhunderts ganz verdrängt und seine Herstellung zum Erliegen gebracht.Ende des 14.Jahrhunderts kommt es nach Nürnberg und Köln.Es ist die Zeit,wo es Gutenberg gelingt,die Fabrikation der Buchdrucker-Lettern zu vereinfachen.(Chinesen kannten auch die Buchdruckerei lange vor den Europäern;die Papiergeld-Scheine zur Zeit Marco Polos waren bereits mit den Unterschriften der Minister abgestempelt).Ende des 14.Jahrhunderts sind die ersten Papierbücher,die "Incunabeln" gedruckt worden.An diesen ist auffällig die bis zum heutigen Tage fast weisse Farbe des P[illegible] das geringe Gewicht selbst von dicken Bänden.Man vergleiche damit e[illegible] das Adressbuch einer modernen Grossstadt!

Soweit die Geschichte des Papiers.Sie bis in die Gegenwart zu verfolgen ist nicht der Zweck dieser Zeilen.Nicht nur die Glocke begleitet uns während unseres ganzen Lebens,auch das Papier,das so wertlos erscheinende Papier kann ein ganzes Schicksal bedeuten und zwischen Geburts - und Sterbeschein bewegt sich unser ganzes Dasein.Die zwei Blätter Papier begrenzen unsere Wallfahrt auf Erden.

Dr. Theodor Philipp Haas

Beobachtungen an Mimosa pudica (10.8.1943)

Ueber Mimosa pudica gibt es sehr viel Literatur.Goebel gibt im 1. Ergänzungsband zur "Organographie","Entfaltungsbewegungen",Jena 1924,einen Ueberblick,über das,was er finden konnte.Ich habe die Pflanzen immer nur als Gewächshaus-Kulturen gesehen (München,Frankfurt,New York Philadelphia etc.);man findet sie wohl in jedem botanischen Garten.Ich war daher sehr überrascht,sie zum ersten Male als Freiland Pflanze beobachten und ihr Leben studieren zu können.Darüber will ich nachfolgend berichten.

Im Sommer 1942 brachte ich einige Topfpflanzen aus den Gewächshäusern des "Macfarlane Institutes" der University of Pennsylvania in Philadelphia in den kleinen "Kilmer Botanischen Garten" des "Philadelphia College for Pharmacy and Science" in West-Philadelphia. Die Pflanzen,die in den Töpfen blieben,gediehen besser wie die ausgetopften.Die ersteren wurden in den Boden (bigger) eingegraben,die letzteren frei ausgepflanzt.Offenbar ist Mimosa pudica (der Name kommt - nach Goebel - von mimosa,spanisch, = zart und pudica = schamhaft) sehr (sensitive) empfindlich gegen eine (damage) Beschädigung des Wurzelsystems und diese ist ja beim Herausnehmen ([illegible]) der Pflanze aus dem Topf nicht zu vermeiden.Die Pflanzen - Topfpflanzen wie ausgetopfte - blühten 1942 reichlich und setzten auch Früchte mit keimfähigen Samen in grosser Zahl an. Die Früchte sind stachelige,(articulate) gegliederte (craspedium) Rahmenhülsen,deren einzelne (joint) Glieder,die den Samen enthalten,bei der Reife sich ablösen,sodass nur mehr der stachelige Rahmen an der Pflanze zurück bleibt.Mit dem Eintritt der kalten Witterung gingen die tropischen Pflanzen natürlich zugrunde,aber auch die Topfpflanzen,die ins Laboratorium genommen wurden,gingen sehr bald ein.1942 konnte ich daher die Frage,ob Mimosa pudica ein- oder mehrjährig,oder besser hapaxanthisch oder (perennial) perennierend ist,nicht beantworten.Goebel schneidet diese Frage an und bemerkt dazu,dass er,obwohl er merhmals in den Tropen war,diese Frage nicht beantworten könne.Mr.Lambert vom Macfarlane-Institute,der mehmfach in den Tropen war,versicherte mir, dass er bestimmt mehrjährige Pflanzen gesehen hat.

Ich war sehr überrascht,anfangs Juni 1943 im genannten "Kilmer Botanischen Garten", wo im Jahre vorher die ausgetopften Pflanzen waren,etwa 8 Keimpflanzen zu sehen:Die Samen der tropischen Pflanze (die Heimat ist Brasilien) waren (winter hard) winterhart in Philadelphia!Dies war völlig neu für mich und auch für die Botaniker in Philadelphia!Ich vermute,dass die Samen wasserarm,sind wie alle Leguminosen Samen und daher unter der Kälte nicht wesentlich [lei]den.

(7)

Die Keimpflanzen haben sich inzwischen zu stattlichen Pflanzen entwickelt. Ich musste mich am 20. August 1943, um sie photographieren zu können 2,5 m von den Pflanzen entfernen, weil sie sonst nicht ganz ins Sehfeld (optic field) gegeangen wären! Sie werden in ihrer Entwicklung nicht gestört und 4 - 5 mal in der Woche reichlich gegossen. Die 3 stattlichsten Pflanzen werden als Versuchspflanzen behandelt und beobachtet; ich habe sie als "a", "b" und "c" bezeichnet Es sind aber noch weiter Pflanzen im Beet, sodass man Vergleiche anstellen kann. Es treten auch noch neue Keimpflanzen auf, so eine anfangs August. ~~Am 18.8. habe ich 16 Samen, die ich Pflanzen der Gewächshäuser der Universität entnahm in einen Topf ausgepflanzt, den Topf n unweit des Standortes der Versuchspflanzen eingegraben und will sehen, ob eine längere Samenruhe nötig ist.~~ Der Standort (location) hat den Tag über Sonnenschein. Jetzt, Mitte August, verschwindet die Sonne etwa um 4^h 45' P.M., E.W.T. hinter dem Schulgebäude. Am 5. August haben die Pflanzen zum ersten Male geblüht und am 19.8. wurden die ersten Früchte festgestellt, Es blühten am 5.8. insgesamt 5 Blüten köpfchen, die alle Früchte angesetzt haben. Sie waren am 23.9.43. reif. Am 5. August sind auch die ersten 3 Photographien aufgenommen worden (# 1 um 2^h 15' E.W.T. bei grellem Sonnenschein an einen klaren Tage, # 2 & # 3 nachmittags etwa um 5^h E.W.T., also im Schatten bei Streulicht. Die Entfernung betrug 90 cm und die Camera wurde nicht aus ihrer Lage gebracht) Die Pflanzen blühen in gewissen Rhytmen; so zeigten sie am 10.8. ca. 21 Blütenköpfchen, am 19.8. sogar ca. 100 und dazwischen kommen immer wieder Tage, an denen keines der violetten Köpfchen in Blüte zu sehen ist.

Die Cotyledonen der Keimpflanzen sind rundlich (round leaves); die Keimung erfolgt epigaeisch. Die Keimpflanzen haben zuerst ein einziges Laubblatt (foliage leaf) mit schräg gestelltem Blattstiel (petiole) und horizontal orientierter Spreite. Die ersten Blätter (protophyll) sind einfacher gestaltet: sie besitzen nur 2 Fiederblatt-Achsen (pinna) im Gegensatz zu den Folgeblättern (metaphyll), die deren 4 aufweisen. Nach etwa 5 - 6 Primär-Blättern treten dann plötzlich die Blätter der Folgeform auf; es gibt keine Uebergänge zwischen beiden. Gegenüber Topfpflanzen in den Gewächshäusern zeigen die Freiland-Pflanzen einen viel kräftigeren Wuchs. Die Pflanzen scheinen ein sehr starkes Lichtbedürfnis zu haben, denn einige von ihnen, die von einem Rhamnus Purshiana im Garten beschattet werden, sind nicht so kräftig entwickelt wie a, b, c. Das Glas der Gewächshäuser nimmt auch viel Licht weg; sogar bei Sonnenschein! Schon sehr frühzeitig treten unmittelbar über dem Erdboden - ~~vielleicht subcotyledonar~~ - Seitenzweige auf, die in ihrem Wuchs stärker gefördert sind wie der Hauptspross und auch, wie Messungen (measurement) am 20.8.43. ergaben, auch

Zu Seite 2 :

.....es gibt keine Uebergänge zwischen beiden. Bei Mimosa Speggazini Pirotta bleibt diese Jugendform der Blätter dauernd erhalten; nur die Rhachys der Fiederblatter ist länger wie
juvenile form
bei der Jugendform von Mimosa pudica. Die Blattstellung bei der letzteren ist zweizeilig. Das beweist die Seiten-Nutation, die Haupt- und Seitensprosse deutlich zeigen. (Vergl. Photo mit nahezu reifen Früchten vom Hauptspross von "b", aufgenommen am 31.8.43. aus 20 cm Abstand)
two-ranked leaf arrangement
Diese Seiten-Nutation ist ja für die zweizeilige Blattstellung characteristisch. Ohne Rücksicht auf die Orientierung des Sprosses sind die Blattspreiten immer horizontal eingestellt, auch bei den flach am Boden hinstreichenden Zweigen. Dadurch kommt ein dichtes Blatt-Mosaik zustande, das den Boden bedeckt und ihn längere Zeit vor dem Austrocknen bewahrt. Dazu kommt folgendes. Die Verzweigung ist an der Basis der Pflanzen besonders stark gefördert. Am 31.8.43. beobachtete ich die folgenden Verzweigungsverhältnisse:

"a"	hatte	an	den	ersten	6	Nodien	Seitenzweige,	die	folgenden	10 (12)	Nodien	hatten keine;
"b"	"	"	"	"	10	"	"	"	"	23	"	" "
"c"	"											

9, 11, 12, 15

Bei "c" hat der Hauptspross einen sehr starken Seitenzweig, der wie dieser schräg nach oben wächst im Gegensatz zu den übrigen Seitenzweigen, die flach am Boden hinstreichen. Diese Seitenzweige haben nur an den ersten Nodien Auszweigungen; später nicht mehr. Die Seitenzweige entspringen wohl der Achsel eines Laubblattes - man findet zuweilen auch 2
leaf axil
Seitenzweige in einer Blattachsel - sie bleiben aber nicht in der Ebene des Blattstieles; sie sind nach rechts oder links davon gerichtet.

Zu Seite 3.

.....Seitenspross dagegen 20,22 und 20 cm. Am 30.8. war die Wachstumszunahme in 10 Tagen beim längsten Hauptspross 14,16, und 15 cm, beim Seitenspross dagegen 13,13 und 16 cm, sodass in der
growth-promotion
2. Beobachtungsperiode eine Wachstumsförderung der Seitensprosse gegenüber dem Hauptspross nicht mehr zu beobachten war. Es wird noch eine 3. Beobachtungsperiode eingeschaltet. Sie mag zeigen, wie die Verkürzung der Tage das Wachstum beeinflusst.

"a"	hatte	an	den	ersten	13	Nodien	Seitenzweige,	die	folgenden	12	Nodien	hatten keine (1.9.
"b"	"	"	"	"	12	"	"	"	"	15	"	" "
"c"	"	"	"	"	18	"	"	"	"	12	"	" "

Der Gabel-Ast entspringt am 12 Nodium

weiter gefördert bleiben. Es ergaben sich folgende Masse:

Pflanze:		Länge d. Hauptsprosses				Länge d. längsten Seitensprosses						Zahl der basalen Seitensprosse:
Datum:		10.8.	20.8.	30.8.	9.9.	10.8.	20.8.	30.8.	9.9.	19.9.		
a	90 cm	44 cm	59 cm	73 cm	85 cm	52 cm	72 cm	85 cm	104 cm	112 cm	11?	~~6~~ 6
b	109 cm	55 "	69 "	85 "	100 "	60 "	82 "	95 "	113 "	118 cm	120	~~6~~ 5
c	114 cm	62 "	75 "	90 "	110 "	74 "	94 "	110 "	128 "	133 cm	143	6 7

length-increment

Die Längenzunahme betrug beim Hauptspross in den 10 Tagen vom 10. bis 20. August, in denen sich, da das Wetter sehr günstig war, die Pflanzen sehr gut entwickeln konnten, beim Hauptspross 15,14 und 13 cm, beim lägsten Seitenspross dagegen 20,22 und 20 cm. Die verholzten Teile der Sprosse sind rotbraun, glänzend und mit Borsten (bristle) und Stacheln besetzt, letztere befinden sich in der Nähe der Blattbasen.

Die Pflanzen zeigen einen sehr starken plagiotropen Wuchs, wie man das bei Topfpflanzen niemals zu sehen bekommt. Die Pflanzen erinnern in ihrer Wuchsform sehr stark an Calluna vulgaris, wie sie Troll in seiner "Vergleichenden Morphologie der höheren Pflanzen" beschrieben hat. Sie bilden niederliegende (decumbent) Sträucher; auch der Hauptspross wächst schräg, nicht senkrecht! Die basalen Seitenzweige liegen dem Erdboden dicht auf, bringen aber niemals
wie das - nach Troll - für plagiotrope Sprosse characteristisch ist.
Adventivwurzeln hervor. Da Goebel einen ähnlichen Versuch im Gewächshaus beschreibt, habe ich am 10.8. eine kleinere Pflanze, die bereits Folgeblätter hatte und vollkommen entwickelt war, eingetopft und - auch im Freien - unter Wasser gestzt. Am 16.8., also nach 6 Tagen hat sich reichlich Aerenchym am Spross unter Wasser entwickelt (das weissliche Aerenchym erinnert stark an das Aerenchym von Lythrum salicaria) und ~~[illegible]~~ ausserdem wurden an der Spross-Basis 4 weisse Adventivwurzeln festgestellt. Dieses Aerenchym muss von einer tiefer liegenden teilungsfähigen Zellschicht, vielleicht vom Phellocambium gebildet werden; die rotbraune Aussenhaut bekommt Längsrisse und lässt das weisse Aerenchym erkennen. Ich habe dann noch eine weitere Pflanze und eine Keimpflanze in zeitweise überschwemmtem (flooded) Boden gepflanzt; zu einer Aerenchym-Bildung ist es aber hier nicht gekommen. Alle diese Pflanzen in dem feuchten Boden oder im Wasser sind frisch, sie entwickeln sich aber bedeutend langsamer wie normal gezogenen Pflanzen. Sie scheinen sich nicht recht wohl zu fühlen!

Das grösste Interesse an Mimosa pudica haben die Reizbewegungen der Blätter hervorgerufen. "Sinnes-Pflanze", "sensitive plant" wird sie daher genannt! Man kann 2 Arten von Blattbewegungen an der Pflanze beobachten: Die seismonastischen und die Nyctinastischen, die Erschütterungs- und die Schlaf-Bewgungen. Die Blätter zeigen noch eine dritte Art von Bewegungen, eine photonastische im grellen Sonnenlicht. Ich habe versucht, alle 3 Bewegungen zu photographieren. Bei grellem, intensiven Sonnenschein, also tagsüber, sind die Blattspreiten mehr oder weniger Die Blattflächen wird der Sonne gehalten ... zur Sonne zu

ten horizontal eingestellt.Die Fiedeblättchen drehen sich und stellen sich schräg nach (Phot. 29.43)
aufwärts,sodass sie der direkten Sonnenbestrahlung bis zu einem gewissen Grade entgehen.
Nur bei Streulicht,also bei trüben Wetter oder im Schatten sind die Fiederblättchen
parallel zur Ebene der 4 Fiederblattachsen orientiert (Vergl.Photo)Goebel zeigt auf
Seite 475 in Fig.247 ein Bild von Mimosa invisa wo die Blättchen partiell beschattet
waren und wo sich diese im direkten Sonnenlicht befinden,haben sie sich gehoben.Ein Zusammenschlagen der Blattfiedern,wie sie etwa bei Erschütterung eintritt oder bei der
Schlafstellung - Goebel erwähnt dies S.475 - habe ich nie gesehen und dabei ist die
Sonneneinstrahlung in Philadelphia,das am 40.Breitegrad liegt,recht stark.Auch die
"Wasserpflanzen"machen die photonastische Bewegung der Fiederblättchen mit.So weit die
photonastische Bewegung!Ueber die seismonastsche Bewegung,die ja der Pflanze ihren Namen
gegeben hat,ist sehr viel geschrieben worden,sodass ich mich hier kurz fassen kann.Sie
tritt ein bei Berührung.Wenn man die Spitze eines Fiederblattes mit einem brennenden
Zündholz reizt,so schlagen die Fiederblättchen zusammen.Der Reiz pflanzt sich fort und
zwar bei dem gereizten Fiederblatt in der Richtung zu dessen Basis,also von der Spitze
weg.Nach einer kurzen Pause schlagen auch die Fiedern der restlichen 3 Fiederblätter
zusammen,doch erfolgt hier die Fortpflanzung in der entgegengesetzten Richtung,also spitzenwärts.Zum Schluss senkt sich der Blattstiel mit dem ganzen Blatt.Manchmal senkt sich auch
das ganze Blatt schon,wenn die Reizbewegung des gereizten Fiederblattes dessen Basis erreicht
hat.Bei Sonnenschein geht das Blatt etwa nach 30' wieder in die ursprüngliche Normalstellung über.Beim Erschüttern der ganzen Pflanze oder bloss eines Zweiges,nehmen die Blätter
die Reizstellung ein.Die Blattstiele sind nach unten gesenkt und die Fiederblättchen nach
oben geschlagen;ihre Achsen bleiben aber gespreizt.Ich erwähne das wegen der später zu
erörternden Schlafstellung.Auch die 4 Fiederblatt-Achsen sind nach untengerichtet (Photo)
Bei Sonnenschein gehen die Blätter sehr schnell wieder in die Normalstellung zurück und
ich musste mich beim Photographieren sehr beeilen.Bei Wind oder wenn sich ein Insekt auf
ein Blatt setzt,tritt lokal mehr oder weniger stark die Reizstellung auf.Ich habe am 26.8
Den Hauptspross von Pflanze "a" mit 2 weiblichen chinesischen Mantis aus 50 cm photographiert,um dies zeigen zu können.Auch beim Giessen,selbst,wenn man die Pflanzen nur benebelt,tritt Reizstellung ein (Photo),wohl als eine Folge des Luftzuges.Am 27.8. konnte ich
zum ersten Male die Wirkung des Regens beobachten,denn der ganze Monat war regenlos.

Vom Regen beeinflusst werden nur die Blattspreiten, nicht die Blattstiele. Die ersteren sind unbenetzbar; das Wasser perlt ab. Bei schwachem Regen nehmen die Blattspreiten etwa die Stellung ein wie im grellen Sonnenschein, d,h, die Fiedern sind gedreht und schräg nach oben gehoben. Bei s~~t~~arkem Regen - wie er in den Tropen die Regel ist - tritt in erster Linie der seismonastische Reiz auf. Die Blättchen, die von einem grossen Tropfen getroffen werden, schlagen nach oben, während die andern ausgebreitet bleiben; dadurch bekommen die Fiederblätter ein uneinheitliches Aussehen. Es ist daher zu verstehen, dass bei einem Regen die Blättchen ständig in Bewegung sind. Die "Wasserpflanzen" zeigen die gleiche Erscheinung. Die Frage, ob hierbei Ermüdungs-Erscheinungen auftreten, konnte ich nicht beobachten. Nach etwa 2 Stunden Regen war noch nichts davon zu bemerken und einen Dauerregen (permanenten), sagen wir von etwa einem Tage, hatten wir bis jetzt nicht. In wie weit hygronastische Bewegungen an den BlattBewegungen beteiligt sind, kann ich bis jetzt noch nicht sagen. ~~Ich will an einem trockenen Tage die Pflanzen bewässern, ohne die Blätter zu benetzen.~~ Es ist über den Zweck der Blattbewegungen von Mimosa pudica viel dispu~~t~~iert worden. Ich erwähnte bereits, dass die Blätter der Pflanze den Boden als dichtes Mosaik bedecken.

Bei starkem Platzregen sind alle Fiedern zusammengeschlagen und die Erde ist frei. Die Blattstiele sind stark gesenkt. [illegible]

Bei Regen, wenn ein grosser Teil der Fieder-Blättchen nach oben geschlagen ist, wird der Boden von der Laubbedeckung frei und für das Eindringen des Wassers leicht zugänglich. Es wäre daher möglich, dass die Wasserausnützung an dem sonnigen Standort, an dem Mimosa pudica wächst, eine Bessere ist. Wenn es regnet wird der Erdboden für die Bewässerung frei und nachher schützen die ausgebreiteten Blätter diesen vor dem Austrocknen! Dasselbe ist auch zu sagen von der nächtlichen Schlafbewegung, bei der auch die Blattfiedern zusammen geschlagen sind und den Boden für Taubenetzung frei geben. Die Schlafbewegung -die nyctinastische Bewegung - verleiht der Pflanze ein ganz verändertes Aussehen. Beobachtungen am 15. 8. zeigten, dass sie bereits um 6^h 15' - 6^h 30' (E.W.T.) einzutreten beginnt. Es dauert dann etwa 1 Stunde, bis sich alle Pflanzen - einschliesslich "Wasserpflanzen" - in Schlafstellung befinden. Um 7^h 45' ist diese vollkommen; es ist zu dieser Zeit noch farbenhell. Der Eintritt der Dunkelheit erfolgte etwa um 8^h 15'. Was veranlasst den Eintritt der Schlafstellung lange bevor es dunkel wird? Die Schlafstellung unterscheidet sich von der Reizstellung in mancher Hinsicht. Die Schlafstellung der Blätter gleicht der Knospenstellung der Blätter. Die Blattstiele sind nicht so tief gesenkt wie bei der letzteren. Die Blattfiedern sind nach oben zusammengeschlagen, aber die 4 Achsen sind ~~viel~~ ganz näher beisammen. Die Blattspreiten sind in einem stumpfen Winkel schräg nach oben gerichtet.

[1]

A Botanical Museum.

In this country there are many beautiful botanical gardens which are often connected with "Botanical Museums". When speaking of a "Botanical Museum", we mostly think of a herbarium in which the plants are conserved in pressed form. Such a collection is absolutely necessary to be able to identify the plants, and the more specimens a botanical museum possesses, the better it is. The Botanical Museum of the New York Botanical Garden on December 1940 celebrated the incorporation of the 2 000 000th specimen.

In this article we mean something else by a "Botanical Museum". We think of a museum with an exhibition of plants, not pressed, or at least, most of them not pressed, in their natural shape.

Botany should not be studied exclusively from books; it must be learned on the living plant. Since this is not always possible, a botanical museum (in our sense) may take nature's place. For this purpose artificial models and dioramas are used in this country, as I have seen them in the Field Museum in Chicago. The American Museum of Natural History in New York shows in its zoological dioramas the plants, belonging to them, in models so much conforming to nature that it is possible to identify them. The best that I saw, a thing which is really unique in the world, is the collection of the "Blaschka-Glass-Flower-Models" in the University-Museum of the Harvard University in Cambridge, Mass. Because of these, the Museum is called simply "Glass-Flower-Museum". These models are not only wonderful works of art, they are also marvelous from the botanical standpoint. The Direction of the Museum published a little pamphlet, telling the history of that collection. It is true that such models are not made any more. The artists died and their technique is no more in use.

One of the best botanical museums of the world is - or perhaps "was" - in M u n i c h - N y m p h e n b u r g, connected with the Botanical Garden there, founded by G o e b e l. As a pupil of this man I have had the great good fortune of being active there for more than 7 years, during which time I rearranged the entire museum. Due to the great pedagogical value of that museum, and because there exists no literature, I will give a description of a botanical museum, following my own experience. It is possible to show to the scientist, the student and the layman the whole plant kingdom; at first naturally what the visitor may see with naked eye. In Munich we started from the original plant, collected, [redacted], in its natural habitat or in the Botanical Garden.

One use dry and wet specimens, dry preparations in which plants, e.g. algae or dry fruits, are bound up on cardboard, wet preparations where the plants are conserved in square glasses in alcohol or formalin-water, or in both together. Here they are bound up on a white or black glass plate in the square glass. Wet preparations have always a better effect than dry specimens. At the end of this article I shall give details.

The specimens are supposed to be labeled according to the following rule:

Scientific Name (Latin)
Common Name, according to the country.
Family   area of distribution,

Explanatory text.

Place and date of discovery.   Name of collector.

First a few technical things about the museum. Where shall the plants be collected? A botanical museum's exhibition should always be connected with a large botanical garden. It shall indeed supplement this and show things which for the time being, at least, may not be shown there. Indeed a great advantage of a museum, in contrast to a botanical garden, is that things may be viewed constantly independent of the season or the nature stage of the plant. Whereever possible, the plants should be obtained from their natural location, for, in cultivation they frequently change their appearance. In most instances one will be obliged to use the material of a botanical garden, unless original material in alcohol is available from travels. Matters of this kind are ever of particular value for a botanical museum.

does not turn yellow.This has the advantage that the text can be finished at the same time as the specimen.If the text is printed,much necessary time is lost and,if the descriptive matter is lagging,it is difficult to catch up with matters neglected.It would be most advantageous if the text could be glued to the show-glass ,even if it were done only with the "art-corner",used in photographic albums.All my efforts to fasten durably paper on glass were invain. After a longer or shorter time it became loose again.If the text is placed directly in front of the specimen,the danger exists,that it may get lost or be changed by mistake.

Other objects of demonstration which should not be absent from a botanical museum's exhibition,are window-diapositives (these may be illuminated artificially),or photographic pictures of plants which have been taken on the spot in the natural surroundings.Thus pictures of Cacti and succulent Euphorbiaceae which exist half buried in sand,should be shown.One may present pictures of epiphytes which are taken in the primeval forests.The different museums of natural science possess such pictures also in colors.In addition stereoscopic pictures of characteristic landscapes are important,like steppes,savannahs, primeval forests,mountain ranges,especially codachromes of this country.There are stereoscopic machines which the visitor may operate himself,without being in the position to touch the picture itself.Microscopes also may be set up,safe against vandals,to show interesting microspecimen by means of revolving object tables.I saw this very well in the Newark Museum in Newark,N.J.In plant physiology and in genetics it may be difficult to manage without reproductions from books.Also demonstrating apparatus should be necessary.As I mentioned for artists would be a field of action;e.g. a model of the method to receive polyploids by using colchicine,after Blakeslee,would be very interesting.

The wet and dry preparations must be kept in show cases.These cases should be preferably of metal and must be shut dust tight.They should not be too high, so that specimens,standing high up,may be studied also.Large and heavy objects are,of course,placed in the lowest compartment of the case.For shelves in the case we had cut glass plates which were reinforced by iron rails (angle iron).

Every case should be arranged according to a certain fundamental principle. Thus for instance, I had arranged the case of Parasite-Plants according to the basic principle of depth of penetration into the host. I have started with exmatrically root semi-parasites, e.g. Euphrasia officinalis or Alectorolophus minor and concluded with inmatrically shoot-parasites, with Pilostyles. In the case "Mangrove" I have shown that in the first place the root-system and the arrangements for propagation must be suited to the saturated soil, poor in oxygen. Objects which, due to their height, cannot be placed in cases are best put on special stands alongside of them.

How shall the botanical museum be divided? In answering this question I would like to confine myself to conditions in Munich-Nymphenburg, my former sphere of action. This arrangement was very practical. I will demonstrate it in the following lines:

I. Systematic Division.

Here representatives from all plant families are shown as far as they are visible with the naked eye. The start is made with algae, fungi, liver worts (hepaticae), mosses (musci), passes over to vascular cryptogames (pteridophytes), to gymnosperms and concludes with the dicots and monocots. Flowers, leaves, branches and fruits and seeds are to be seen here.

II. Morphological Division.

1. Shoot:

a) structure of shoot (nodes and internodes, long- and short branches, symmetry, polarity ect. adventitious shoots)

b) metamorphosis of shoot (cladodes, phylloclades, stem-succulents, stolones, rhizomes, aerial and subterranean tubers, bulbs, shoot-thorns, shoot-tendrils)

c) wood, lianes and used woods

2. Root:

a) transition from shoot to root (horse-radish)

b) rootlike prehensile organs, holdfast organs of Laminaria-species.

c) root systems

d) metamorphosis of root (anchoring roots, prop roots, respiratory roots,

d) metamorphosis of root (continuation), contractile roots, root tubers, root tendrils (e.g. Vanilla)

e) rhizophores in Selaginella.

3. Leaf:

a) segmentation of the leaf (leaf blade, leaf stalk, leaf base, stipules)

b) buds and vernation

c) phyllodes

d) metamorphosis of leaf (leaf succulents, bracteal leaves, scale leaves, leaf thorns, stipule thorns, leaf tendrils, stipule tendrils)

e) sleep- (= night-) and frost-position of leaves.

4. Flower:

a) "flowers" of Equisetum and Selaginella

b) " of Gymnospermae (Cycadaceae, Ginkgo, Conifers and Gnetaceae)

c) " of Angiospermae (particularly intersting flowers)

d) protogyny, protandry, sexual dimorphism, cauliflory

e) hydrogamous, anemogamous and zoogamous (insects, birds, mammals) flowers. (chasmogamous flowers)

f) cleistogamous flowers (e.g. Euryale ferox)

g) inflorescences (racemose, cymose), pseudanths (= flowerlike inflorescences e.g. Dogwood, Euphorbia fulgens, Pedilanthus)

h) double flowers, double blooms, e.g. Begonia, Dahlia, Chrysanthemum chinensis

5. Fruit:

a) monocarp, apocarp and syncarp fruits, parthenocarpous fruits

b) forms of real fruits (indehiscent fruits: nut, caryopsis, achene, schizocarp, springfruit; dehiscent fruits: follicle, legumes, capsule, pyxidium, loculicidal fruit, carcule, biloment, drupe, berry); spurious fruits, heterocarpy.

c) gymnosperm seeds (e.g. Ginkgo seeds, analog of a stone fruit of a cherry)

d) distribution of fruits and seeds (dissemination)
aa) autochory: sling fruit, e.g. Impatiens, Ecballium, Hura crepitans; Geocarpy.
bb) allochory: distribution by wind (airborne fruits and seeds), (anemochory)
" " water (including ocean-water) (hydrochory)
" " animals (zoochory)
(exo-, endo- and synecic distribution, myrmecochory, the distribution by ants)

6. Germination:

a) germination of Cycas and Gynkgo

b) " " Conifers (polyembryony)

6. Germination (continuation):

c) germination of dicots and monocots
epigeal and hypogeal germination, especially interesting cases of germination, e.g. vivipary, germination of Bertholetia excelsa.

7. Asexual Reproduction:

a) brood buds, bulbils etc.

b) grafting, chimaeres.

III. Ecological Division.

1. Hygrophytes:

a) marsh plants and transitions to the

b) water plants (= hydrophytes), emerged and submerged.

2. Xerophytes:

a) reduction of the transpiring surface, facility of inrolling, thorns, prickles

b) sclerophyllous plants, resin coating of the stem (Sarcocaulon)

c) covering with tomentose hairs

d) succulent plants (stem- and leaf-succulents, fleshy subterranean organs, (rhizomes, bulbs, root-tubers, storing water))
e) cushion plants (in derserts and mountains and polar-zones)

f) halophytes.

3. Twining and climbing plants:

a) to the right- and to the left twining plants (= clockwise and counterclockwise twining plants)
b) scrambling plants, climbing plants with climbing organs (shoot-, leaf-, stipule- and root-tendrils)

4. Epiphytes:

a) hemi-epiphytes (plants which are still in connection with the soil)

b) holo- " (" " " not " " " " ")

c) epiphytism in waterplants, especially in marine algae (red-algae)

5. Saprophytes and Parasites.

a) hemi-saprophytes

b) holo- " (e.g. Neottia Nidus avis)

c) hemi-root-parasites (e.g. Euphrasia, Alectorolophus)

d) holo- " " exmatrical (e.g. Lathraea)
immatrical (" Rafflesia)

5. Saprophytes and Parasites (Continuation):

e) hemi-shoot-parasites exmatrical (e.g. several tropic Loranthaceae)
immatrical (" Viscum)
f) holo- " " exmatrical (" Cuscuta)
immatrical (" Pilostyles)

6. Insectivorous Plants:

a) sticky perch catchers:
aa) without moving emergences and without digesting enzymes (e.g.Roridula)
ab) " " " " with " " (" Pinguecula)
bb) with " " " " " " (" Drosera)

b) pitfall catchers:
aa) without digesting enzymes (e.g.Sarracenia,Cephalotus)
bb) with " " (" Nepenthes)

c) valve-trap catchers: (e.g. Aldrovanda,Dionea)

d) mouse-trap catcher:
aa) without movement of the catching organ (e.g. Genlisea)
bb) with " " " " (" Utricularia)

7. Mangrove~~s~~

a) roots:
aa) positive geotropic aerial roots (e.g. Rhizophora)
bb) negative " " " (" Sonneratia,Avicennia)
cc) root-knees (" Bruguiera)
b) equipment for reproduction (vivipary)

8. Symbiosis:

a) Symbiosis between plants:
aa) lichen~~e~~s,as an example for symbiosis between Algae and Fung~~us~~
bb) roots of Cycadaceae and Gunnera chilensis,containing the blue-alga Anabaena,as an example of symbiosis between higher plants and algae.
cc) Symbiosis between higher plants and nitrogenous bacteria~~s~~:
cc') in roots,(root tubercles as in Leguminosae)
cc'')" leaves(Pavetta,Psychotria,Ardisia)

b) Symbiosis between plant and animal:
(ant-plants,fungi breeding insects (fungus garden of termites and leaf cutting ants),wood inhabiting insects,Yucca-Moth.

IV.Palaeobotanical Division.

Representatives of the plantworld of previous terrestrial periods,arranged according to families.

In addition:Calcareous formations by plants (lime precipitation by the activity of assimilation of carbonic acid by algae,living in the water.

V. Physiological Division.

1. Respiration and Assimilation.

Circulation of carbon and nitrogen in nature, nitrogen linkage, fertilizers, chemical composition of the most important plant seeds and plant foods.

2. Gravitation, Tropism, Movements due to stimulations, growth hormones etc.

3. Rising of Sap.

(All to be demonstrated partly by plantspecimens, but also by illustrations, models and compositions of apparatus).

VI. Genetic Division.

1. Heredity laws (intermediate and dominant heredity, e.g. Anthirrhinum maius)

2. Hybridisation (Bastards), natural and artificial, grafting, chimaeres.

3. Xenia (demonstrated on Indian Corn)

4. Polyploidy (natural and artificial, e.g. X-rays, Colchicin-Method)

VII. Division: Economic Plants.

1. Food:
originating from:
a) fruits and seeds ,(cereals, legumes, buckwheat etc.

b) shoots (Sago, tubers, potatoes, tapioca etc,)

c) roots (Arrow-Root, Sweet Potatoe)

d) sugar (sugar cane, sugar beet, sugar maple (maple-sugar), sugar palm)

2. Spices:
originating from:

a) flowers (clove, safran)

b) fruits and seeds (umbelifer-fruits like caravey, anisum etc.) Cardammon)

c) leaves (leaves from Labiates, like Majoran)

d) shoots (Cinnamon)

e) rhizomes and roots (ginger)

3. Tropical Fruits.

4. Delicacies:

(Coffe, Tea. Cocoa, Cola, Tabacco, Opium, Haschisch, Mate, Kawa, Betel, Areca etc.)

5. Oils and Fats

a) fat oils
aa) drying fat oils (Chinese Woodoil, linseed-oil)
bb) not drying fat oils (Olive-Oil, Sesam Oil)
cc) fast fat oil (Cocos-Fat, Oilpalm-Fat) fast-making of liquid fat oils

5. Oils and Fats (continuation):

b) aetheric oils (parfums)

c) wax.

6. Rubber.

(Cautchouc,Guttaperche,Balata,Quajale etc.)

7. Resins.

8. Tanning- and Dye-Stuffs:

a) Tanningstuffs,originating: from:
- aa) leaves
- bb) barks
- cc) woods
- dd) fruits
- ee) galls

b) Dyestuffs,originating from:
- aa) lichenes (e.g. lackmus,originating from the Roccela-Lichens)
- bb) herbc and leaves
- cc) barks
- dd) woods and roots
- ee) flowers.

9. Fibers, originating from:

a) fruits and seeds (e.g, cotton,capock)

b) shoots (e.g. flax,hemp,ramie)

c) leaves (e.g. Agave-,Palm- leaves,Piassave etc.)

d) paper.

10. Cork,hard Palm Fruits:

Cork for bottles,isolating stones and linoleum

Seeds from palms with hard endosperm,e.g. Phytelephas,for making of beads. buttons

VIII. Pharmaceutical Division.

1. Allopathy:
All officinally drugs and other important medicals and their raw products

2. Homoeopathy:
All important preparations and medicals.

IX. Others.

Plant diseases,deformationsgalls (including animal galls).

I believe that in these 8 divisions a total view may be had of the entire plant kingdom. Here is also the opportunity to show the products of this country and its interesting plants.

It cannot be avoided that the one or other specimen must be shown twice, e.g. cactus plants in "metamorphosis of shoot" and in "xerophytes".

Besides the ~~called~~ noted literature (Engler-Prantl: "Die natürlichen Pflanzenfamilien" 1st and 2nd edition, Index Kewensis and Londonensis), for the systematic division, I used especially for the "economic plants" the following books: "Handwörterbuch der Naturwissenschaften", 2nd edition (1935) Elisabeth Schiemann "Die Entstehung der Kulturpflanzen" (Handbuch der Vererbungswissenschaften, Vol3 (1933), L. Reinhardt "Geschichte der Kulturpflanzen", Wilhelm Heydt "Die Geschichte des Levantehandels im Mittelalter" (Stuttgart 1879), Ost-Rassow: "Lehrbuch der chemischen Technologie" Berlin 1938, and many periodicals which I found. I considered the books of Goebel and Troll-Halle and also many American und English and French books and periodicals

In "economic Botany" matters of History of Culture or of Chemical Technology should alsobe used. I would show this by three examples: In the texts of rubber and of coffee and tea.

"Rubber" is made from raw cautchouc (cautchouc is an Indian word), mixed with the organic substances Balata and Factis (= oxydated linseed-oil or linoxyn) and the inorganic materials as soot or Antimonpentasulfid, or Zincum-oxyd, Baryte etc., and sulphur powder. The raw cautchouc is first cleaned and softened by rolling with hot cylindrical wheels. Afterwards it is mixed with the other substances and thoroughly kneaded. Then objects are molded from this mixture and heated in boilers at a temperature of 140° C, for several hours. Thereby vulcanisation - an invention of Goodyear-New Haven, Conn, about 80 years ago - takes place: The rubber becomes elastic. For making tires, the rubber mixture is poured over a cotton-tissue. The best raw cautchouc originates from the Euphorbiaceae Hevea brasiliensis L. and is imported from Brasil or from the Duch East-Indian Islands (cautchouc plantations). The raw cautchouc is obtained by slashing the trees and coagulating the gathered milky juice. This coagulation is caused either by smoke (in this case the raw cautchouc becomes brown), or by chemicals (here it becomes white). The finished rubber is colored red by its content of Antimonpentasulfid, white by Zincum-oxyd, or black by soot. Besides the natural c cautchouc, synthetic cautchouc also is used."

<u>Der Botanische Garten in München.</u>

Zum 80. Geburtstage Karl v. Goebels.

Am 8.März 1935 hätte einer der bedeutendsten Botaniker der Welt, Karl v. G o e b e l ,seinen 80.Geburtstag feiern können.Sein Lebenswerk, an dem er bis zu seinem am 9.Oktober erfolgten Tode gehangen hatte,war der Botanische Garten in München-Nymphenburg,den er zu einem der schönsten Gärten Europas gemacht hat und der weit mehr ist als eine lokale Sehenswürdigkeit der bayerischen Hauptstadt.

An Hand von Bildern sei im folgenden dieser herrliche Garten geschildert. Wir wollen zuerst die <u>Gewächshäuser</u>,die sich gleich links vom Eingang befinden,besuchen.Zu ihrer Anlage ist der Frankfurter Palmengarten Pate gestanden.Von einer breiten Mittelanlage gliedern sich die Seitenhäuser ab. Nicht alle sind dem Publikum zugängig,da mehrere Häuser der Vermehrung und Aufzucht der Pflanzen dienen.Man betritt zuerst die Mittelhalle und sieht ~~einige~~ grosse Blatt-Pflanzen,die nur ~~auf~~ in trockenen Gegenden, wo es wenig regnet,gedeihen.Diese Gewächse,die teilweise in der Alten [Welt], teilweise in der Neuen zuhause sind,aber unter gleichen Bedingungen leben sehen sich sehr ähnlich,obgleich sie ganz verschiedenen Familien angehören.Es sind Liliaceen,zu denen z.B.die Aloe gehört und Amaryllidaceen, zu welchen die Agaven zählen.Diese stammen aus Amerika,sind aber in den Mittelmeerländern verwildert;sie wachsen auch in Bozen und Meran im Freien.Die Pflanzen besitzen vielfach fleischige Blätter,sie sind "Blattsukkulente".(Abb.

Im ersten und zweiten Seitenhause-rechts-befinden sich die epiphytischen Orchideen, an denen der Münchener Garten besonders reich ist.Welche Formen-Mannigfaltigkeit hier herrscht,mögen die beifolgenden Photographien zeigen:

Wie schade,dass man nicht die wundervollen Farben - und auch Düfte wiedergeben kann!Wir sagten vorhin "epiphytische"Orchideen.Während unsere einheimischen Knabenkräuter auf dem Erdboden wachsen,leben die meisten tropischen als "Aufsitzer" auf Aesten und Stämmen von Bäumen.Nur dort können sie im Urwald genügend Licht bekommen.Kurz sei darauf hingewiesen,dass diese Tropengewächse,wie alle Epiphyten,Einrichtungen besitzen,die das Niederschlags-Wasser festhalten,seien es Spross-Anschwellungen oder Ueberzüge über Luftwurzeln,die sich wie ein Schwamm mit dem lebensspendenden

Nass vollsaugen.Es gäbe ja hier so viel zu erzählen von Wuchsform,Blütenbau und besonders von der interessanten Aufzucht.Die ~~sehr~~ winzig kleinen Samen werden auf Traubenzucker-Agar ausgesät und steril aufgezogen,Möglichkeiten,die nur ein grosser Garten zu bieten vermag.Man kreuzt auch verschiedene Sorten und bekommt dadurch neue ~~Blütenformen und~~ Blütenfarben und - Formen,wenn man auch oft über 5 Jahre auf das Ergebnis seiner Versuche warten muss.-Zwischen den beiden Orchideen-Häusern ist ein kleiner Pavillon,der neben vielen andern Gewächsen die Nepenthes-Pflanzen birgt. (Abb.).Diese decken ihren Stickstoff-Bedarf durch insektenfang;sie sind "fleischfresseende"Pflanzen.Die Blätter sind zu krugartigen Gebilden umgewandelt.Der Rand sondert süss schmeckende Stoffe,die die Insekten anlocken,ab.Beim Herumkriechen gleiten dann die Tiere aus und fallen in die Kanne hinein;sie enthält eine wässrige Lösung von salzsauerem Pepsin,wie unser Magensaft,und die Tiere ertrinken und werden verdaut .-

Zurück zur Mittelhalle und wir betreten nach Passieren einen Glastüre das Palmenhaus.Hier bfinden sich hochwüchsige Pflanzen,natürlich Fächer- und Fiederpalmen.Freilich,mit den riesigen Exemplaren des Frankfurter Palmen-Gartens können sich diese nicht messen,trotzdem gibt es aber hier sehr schöne "Motive",die uns in Gedanken in die Tropen versetzen können.(Abb.).Es ist wohl eine grosse Dattelpalme,die Goebel vor ca. 25 Jahren von Bordighera mitgebracht hat,vorhanden,aber ihre Jahre sind gezählt,denn sie stösst schon seit einiger Zeit am Dache an.Goebel wollte keine allzugrossen Palmen.Er sagte sich,an einer kleineren sieht man genau so viel wie an einer grossen,aber die erhöhten Heizungskosten für ein umfangreicheres sind nicht zu verantworten.Im Palmenhaus sind noch verschiedene Pflanzen untergebracht.Z.B.Pandanus mit riesigen Stelzwurzeln (Abb.),Bananen ect.Eine Lieblingspflanze Goebels war Brownea grandiceps. Sie ist durch die eigenartige Entfaltung ihrer grossen Fiederblätter interessant.Die jeweiligen Spross-Zuwächse stecken als Ganzes zuerst in einer grossen braunen Knospe.Diese wird gesprengt und das junge Zweig-Stück hängt mit seinen braun gesprenkelten Blättern schlaff herunter.Erst nach einiger Zeit richtet es sich auf und die Blätter werden rein grün.Diesen Vorgang bezeichnet man als "Laubausschüttung".Er kommt übrigens in sehr verlangsamter Form auch bei unserer Rotbuche im Frühling vor.-

Im dritten Seitenhause werden,so weit es die Temperatur gestattet,(T

(Tee muss in einem kälteren Hause kultiviert werden),die tropischen Nutzpflanzen vorgeführt.Es wachsen hier Gummi,Faserstoffe,Arzneipflanzen,Kaffee,Zuckerrohr,Erdnuss,Gewürze ect.,ect.und was hier reif wird,mögen 2 Bilder zeigen:Bananen und Kakao.Wie viel wäre hier über die tropischen Nutzpflanzen und ihre kulturgeschichtliche Bedeutung zu erzählen! Vom welchen Pflanzenteilen die Faserstoffe stammen,von der Baumwolle wäre zu erzählen,dass eine Art auch in der Neuen Welt heimisch ist (Gossypium barbadense)und ferner,dass der König Senaherib v.Assyrien die indische Baumwolle bereits in seinem Lande zu pflanzen versucht hat (700 v.Chr.).Es wäre zu berichten vom Zucker,der aus Indien stammt(auch das Wort selbst ist indischen Ursprungs)und den die Araber in der Alten,die Spanier und Portugiesen in der Neuen Welt verbreiteten.Die Araber haben auf ihrer medizinisch-chemischen Hochschule bei Bagdad um 1000 n.Chr. die Raffinerie ausgearbeitet,ein erstes Zusammenhelfen von Wissenschaft und Technik,und kurz vor der Ankunft des Marco Polo in China(z.Z.v.Walther v.d.Vogelweide oder Dante)ist diese Kunst nach dem Reiche der Mitte gekommen.Nebenbei sei bemerkt,dass die Beziehungen zwischen China und dem europäisch-orientalischen Kulturkreise sehr alt sind.Die Römer besassen die chinesische Seide und umgekehrt bezogen die Chinesen Arzeimittel aus orientalischen Ländern;auch wussten sie,dass dort Pinien und Cypressen wachsen.Eine Vermittlerrolle spielten dabei die Perser.Es gäbe hier so unendlich viel zu erzählen,doch der Raum gestattet es nicht.Es sei nur kurz darauf hingewiesen,dass der Reichtum Frankfurts zu Beginn der Neuzeit auf dem Levantehandel beruht, insbesondere nach der Entdeckung des Seewegs nach Indien durch Vasco da Gama (1498).Sehr interessant ist die Geschichte der Banane und die Organanisation ihres Handels,bei dem im Grossen lebende Pflanzenteile aus den Tropen in gemässigtere Gebiete gebracht werden. Aber wir müssen unseren Rundgang fortsetzen und können und solche Abschweifungen nicht gestatten.An das Nutzpflanzenhaus reiht sich das "Victoria-Haus",in dem die grossblättrigen Seerosen Victoria regia,cruziana und Euryale ferox, sowie viele andere herrlich blühende Kletterpflanzen gezogen werden;im Winter werden hier die während des Sommers im Freien befindlichen Pflanzen Neuseelands,wie Akazien,die man auch "Mimosen"nennt,Myrten,zu denen der Eukalyptus gehört,ect.untergebracht.

Dazu kommen auch Vertreter der Mittelmeer-Flora,wie Erica arborea,die das Holz für die Bruyère-Pfeifen liefert und zu deren Füssen nach der Legende von Isis und Osisris der tote Osisris gefunden worden ~~sein~~ soll:Auch wenn es draussen im ~~Freien~~ Freien stürmt und schneit,gibt es hier herrliche Blumen:Farbenprächtige Chrysanthemen im Spätherbst,Azaleen im Winter zeigen von der Kunst der Gärtner undim März verkündet künstlich angetriebener Flieder,der aber ganz schwach duftet,das Herannahen des Frühlings.-

Die letzte Abteilung der Mittelhalle ist für Trockenheits-Pflanzen,für Xerophyten bereit gestellt.Hier wachsen dickfleischig e,vielfach blattlose Wolfsmilcharten und Kakteen.Auch sie erreichen das Glasdach und müssen von Zeit zu Zeit abgeschnitten werden.Doch zuerst noch einige Worte über das 5.Seitenhaus,in dem sich die Wasserpflanzen befinden.Hier sind Aquarien vorhanden,deren Glaswände auch eine Betrachtung der unter Wasser befindlichen Pflanzenteile gestatten.So kann man an der freischwimmenden Wasser-Hyacinthe Eichhornia azurea,die in den grossen Strömen Südamerikas schwimmende Inseln bildet,das Wurzelsystem sehen.In einem Mittelbecken wachsen Nelumbium-Arten,indische Lotos-Blumen,mit wachsbereiften,unbenetzbaren schildförmigen Blättern,deren stärkereichen Wurzelstöcke in Ostasien als Gemüse verwendet werden.In einem kleinen Bassin wird der tropische Sumpf gezeigt.Am wichtigsten sind hier der Reis,der von seiner indischen Heimat durch die Araber bis nach Spanien kam und von dort nach Italien gelangte und die Papyrus-Pflanze.Nicht nur,dass dieses schöne Gewächs als Säulen-Motiv von Bedeutung war,ihr kreuzweise übereinander gelegtes und gepresstes Mark diente langezeit als Schreibgrund;es war das Papier des Altertums und seitdem man unter Berücksichtigung der Faserung die zerfallenen Stückchen in mühevoller Arbeit wieder zusammen setzen kann,ist man auch in der Lage,die Beschriftung zu lesen.Hier sei nur angedeutet,dass unser heutiges Papier vielleicht die interessanteste Geschichte hinter sich hat,bis es 1391 nach Deutschland gekommen ist.Aus einer praktischen Notwendigkeit heraus wurde es 105 n.Chr.von dem chinesischen Landwirtschaftsminister Tsai-Lun aus Ramie-Fasern und Rinden von bestimmten Bäumen hergestellt.Im Anschluss an einen Krieg gelangte die Papiermach-Kunst nach Samarkand,wo zum ersten Male Leinen-Hadern verwendet wurden,da es dort die erstgenannten Rohstoffe nicht gab.Zur Zeit Karls d.Gr,wurde die Technik bereits in Bagdad vervollkommnet und um das Jahr 1000 n.Chr.kannte man schon verschiedene Papiersorten,sogar das Einwickelpapier.Ueber Kairo-Italien und Fez-

Spanien-Frankreich kam es dann zur Zeit Gutenbergs in unser Vaterland.-
Nach dieser Abschweifung zurück zu unserem Rundgang! Im Wasserpflanzenhaus ist noch eine "Mangrove-Abteilung" eingerichtet. Mangrove ist die von Pflanzen verschiedener Familien gebildete Sumpfwald-Formation, die den im Gezeitenbereiche gelegenen Schlammboden tropischen Flach-Küsten und Flussufer bedeckt. Die Mangrove, die schon den Griechen auf dem berühmten ~~Zu~~ Indien-Zuge Alexanders d.Gr. (ca.327 v.Chr.) aufgefallen ist, stellt eine der interessantesten Lebensgemeinschaften dar. Die Pflanzen leben auf einem sauerstoffarmen, zähen und salzhaltigen ~~Schlamm~~ Schlick und so zeigen ihre Wurzeln und Fortpflanzungseinrichtungen weitgehende Anpassungen, auf die hier leider nicht eingegangen werden kann. In diesem Winter hat hier eine Mangrove-Pflanze ~~...~~ Bruguiera eriopetala sogar geblüht (Abb.
Sie kommt an den Ufern des Indischen Ozeans und in Ostaustralien vor. Vor ein paar Jahren hat auch das Luftschiff "Graf Zeppelin" aus Brasilien lebende Mangrove-Pflanzen mitgebracht. Es war das der erste Luft-Transport von Pflanzen aus den Tropen.-Die nächsten Seitenhäuser bergen wie die Mittelhalle in ihrem letzten Teile Stamm- und einige Blattsukkulente. Richard ~~und Fritz~~ v. Wettstein, die berühmten Botaniker, haben sie von ihren Südafrikas Heimatländern, nach denen sie 1929/30 eine Reise unternahmen, mitgebracht. Leider kann man diese Gewächse nicht so wie sie dort ~~...~~ leben, kultivieren d.h. zum grossen Teil im Sand vergraben. Es sind Vertreter aus verschiedenen Familien, die aber wie Kakteen, die nur in der ~~Neuen~~ Neuen Welt zuhause sind, aussehen. Pflanzen, die unter ähnlichen Bedingungen wachsen, haben häufig die gleiche Gestalt. Man nennt das Konvergenz. Darauf wurde schon auf S.... hingewiesen. Hier einige Bilder:
Die Seitenhäuser der Nordseite bekommen noch reichlich Sonnenlicht.
Das erste, in dem die Hymenophylleen, sehr zartblättrige Farne, untergebracht sind, ist der Oeffentlichkeit nicht zugängig. Seinem Eingange gegenüber steht eine grosse Peireskia (Abb.) d.i. ein Kaktus, der noch normal beblättert ist, allerdings auch schon Dornen besitzt. Man hält ihn für die Urform der Kakteen. Man kann ihn auch als Unterlage für Kakteen-Pfropfungen verwenden.-
Die nächsten 2 Seitenhäuser gehen wieder von der grossen Mittelhalle, in der die Palmen stehen, ab. Im ersten werden Vertreter des tropischen Regenwaldes, riesige Aronstab-Gewächse, gezeigt. Die Blätter zeigen häufig Anpassung an die starken Regengüsse. Sie sind vielfach senkrecht gestellt

In diesem Hause befindet sich ~~auch~~ eine grosse Sammlung von Bromeliaceen. Zu dieser interessanten Familie gehört auch die Ananas. Die Sammlung besteht im wesentlichen aus epiphytischen Bromeliaceen, die wie die schon geschilderten Orchideen das Wasser festhalten, sich dabei aber eines anderen Prinzips bedienen. Die Blatt-Basen bilden einen Becher, in dem sich das Wasser ansammelt. In den Tropen können ~~sich~~ hier auch Malaria-Erreger ~~halten~~ leben. Manche Arten besitzen Rollblätter, die das Wasser kapillar festhalten. Eine solche ist Tillandsia usneoides. Sie vermag sogar auf - Telegraphendrähten zu gedeihen. Diese Pflanzen ~~vermögen~~ können auch mit ihren Blättern gelöste Salze aufnehmen. Noch andere Schätze birgt das Haus so eine Passionsblume Passiflora quadrangularis (Abb. 12). Eine interessante Pflanze ist ~~Passi~~ Marggrafia umbellata, die an die Bestäubung durch Kolibris angepasst ist.- (Abb 13)

Gärtnerisch am schönsten ist das ~~B~~ Farnhaus. Zuhause sind diese zierlichen Baumfarne in der Nebelwald-Region tropischer Gebirge. Sie gedeihen meist in einer Höhe von 1 - 2000 m. (Abb. 14, 15) Im Farnhause wachsen auch die als Zimmerpflanzen beliebten "Araucarien". Araucaria excelsa, wie ihr wissenschaftlicher Name lautet, stammt von den Norfolk-Inseln (Südamerika). Mit ihr hat Goebel einen Versuch gemacht, der kurz beschrieben sei. ~~Sie hat einen~~ Die Araucarie hat einen sehr klaren Aufbau. Der kerzengerade Stamm entsendet in Etagen strahlenförmig nach allen Richtungen jeweils 5 - 6 Seitenaeste, die ihrerseits wieder zweizeilig angeordnete Zweige besitzen. Diese Verästelung ist fixiert. Es ist bekannt, dass wenn bei unserer Fichte oder Tanne der Gipfel abbricht, sich einer der obersten Seitenäste aufrichtet und einen neuen Gipfel bildet. Wird aber bei der Araucarie der Gipfel entfernt, so werden dadurch die obersten Aeste in ihrem Richtungswachtum nicht beeinflusst und es werden an der Schitt- oder Bruchstelle mehrere neue gebildet (Abb. 16); der kräftigste ~~Ast~~ führt dann den Stamm fort. Im Gegen satz dazu hat Goebel 1906 einen Seitenzweig als Steckling eingepflanzt und dieser hat seine Zweiggestalt bis zum heutigen Tage beibehalten. (Abb 17

Es folgen nun noch 3 Seitenhäuser. Im ersten befinden sich die Cycadeen. Diese stehen am Anfange der Reihe der Blütenpflanzen. Ihre Schönheit sollen 2 Bilder zeigen. (Abb 18 - 20). Die letzten 2 Häuser sind Kalthäuser. Hier wächst der chinesische Tee, dessen Genuss - nebenbei bemerkt - Marco Polo nicht beobachtet hat. Im Winter sind hier Vertreter der australisch-südafrikanischen Flora, Proteaceen, Mimosen ect. im Sommer geben verschiedene Begonien-Arten ein farbenprächtiges Bild. Auch das letzte Haus ist zum grossen Teile der gärtnenrischen Kunst zur Verfügung gestellt. Man sieht hier Gloxinien,Cyclamen,Pantoffelblumen ect.ect.Zwi~~s~~schen den beiden Häusern ist noch ein ~~Pavillon~~ warm-temperierter Pavillon,der in den Tropen heimische epiphytische Farne,deren Blätter vielfach wie Hirschgeweihe, aussehen,enthält.Diese Pflanzen leben an Baumstämmen und auf Aesten.Sie besitzen neben normalen rasch verholzende Blätter,die Humus auffangen können und so machen sich diese Gewächse (Drynarien und Platycerien) ihren "Blumentopf" selbst,denn in den Humus wachsen dann die Wurzeln hinein.

Schon zu lange haben wir in den Gewächshäusern geweilt.Sie sind ja nur ein Teil des Botanischen Gartens.Die Freiland-Anlagen sind sehr,sehr umfangreich.Da gibt es neben Aufzucht-Beeten eine systematische Abteilung,in der die Pflanzen nach Familien zusammen gestellt sind,eine Abteilung für Nutz- und Arzneipflanzen,die auch die Futter- und Gemüsepflanzen enthält,eine biologische Abteilung,in der u.a.Anpassungs-,Schutzeinrichtungen der Pflanzen,Bestäubungs-Verhältnisse,Verbreitungsarten sowie die Vererbungs-Erscheinungen gezeigt werden..Hier stehen auch in erhöhten Becken die Wasser- und Sumpfpflanzen.- Eine besondere Anziehungskraft besitzt der"Schmuckhof" und damit kommen wir zur landschaftlichen Schönheit ~~xxxxxxxxxxxxxxxxxxxx~~ die Goebels Lebenswerk auszeichnet.Es ist unmöglich auf die botanischen Einzelheiten einzugehen."Los" ist ja auch im Freien immer etwas,selbst im Winter:Die Aufnahmen Nr.   zeigen die Blattstellung des Rhododendrons im Winter;sie sind bei -16 Grd.aufgenommen worden.Die Blätter nehmen die Froststellung ein,die sofort wieder verschwindet,wenn sich die Temperatur dem 0-Punkt nähert.Der Schmuckhof,der etwas tiefer liegt,zeigt die Leistungen der Blumen-Züchtungskunst.Auch Firmen stellen hier aus.Es werden hier, je nach der Jahreszeit,Blumen aller Art gezeigt,von den früh blühenden Tulpen bis zu den Dahlien und Astern im Herbst.-An einem Hohlwege in altem Baumbestande,die "Farnschlucht",durch die ein Bächlein rieselt,wachsen Farne und andere Schattenpflanzen(Abb.   )Unweit davon befindet sich als Unterholz eine grosse Rhododendron-Pflanzung,deren Blütenpracht im Juni nicht zu beschreiben ist~~von Leuchtenden~~.Vom leuchtendsten Rot und Orange bis ins satte Violett prangt die Landschaft.Durch die Farnschlucht gelangt man an einen Teich,in dem sich das Alpinum spiegelt(Abb.   )Wie oft ist Goebel diesen Weg gewandelt!Von dem Weiher,in dem sich auch Seerosen befinden,wird der ganze Garten bewässert.Hier wird auch die im Alpenvorlande so häufige Seen-Verlandung vorgeführt.und unweit davon die Pflanzengesellschaften von Moor und Heide sowie der Düne.Das Alpinum selbst ist eines der grössten Deutschlands.Mit ihm verbunden ist ein Alpengarten auf dem Schachen (bei Garmisch-Partenkirchen)in ca 1900 m Höhe (Abb.   )

auch er ist von Goebel geschaffen worden.

Zur Ergänzung all der Schätze des Botanischen Gartens dient noch eine Schausammlung. Auch sie ist eingeteilt in eine allgemein-botanische-oekologische, in eine systematische und in eine Abteilung für angewandte Botanik einschliesslich einer Zusammenstellung von Arzneipflanzen.

(Abb.)Sie ist untergebracht im Institutsgebäude, mit dessen Abbildung ( )diese Schilderung abgeschlossen sei.

Goebel hat mit dem Botanischen Garten in München-Nymphenburg ein wundervolles Instrument der Wissenschaft geschaffen und sich selbst ein unvergängliches Denkmal gesetzt.

The Cultural-Historical Significance of the Silkworm

~~The Silkworm and its culture-historical Significance.~~

Is a silkworm an animal

Among the domesticated animals a tiny insect has fulfilled the most important action in the history of ~~action~~ culture. This is the silkworm ~~has been fulfilled by a little insect:the silkworm~~! It connected for the first time in history the Far East with the Occident, and furthermore ~~last~~ it was one of ~~and it was the cause of~~ the main contributing causes leading to the discovery of America! The product of the silkworm is silk, the most precious fiber we know. The first relations between China and Rome were bound together with a thread of silk!

The Chinese have had the silkworm as a domesticated animal since immemorial times. It is, together with the honey bee, the only domesticated and cultivated ~~animal among the~~ insects. The silk worm is adapted to the domestication that the silk moth which developed from the silkworm has lost the ability to fly. The silkworm is completely dependent upon man. The only food it takes is the leaves of the Mulberry tree, Morus alba L., there fore its scientific name is Bombyx mori L. ~~With the silkworm the Mulberry tree, which is native in China, traveled to the West. Also~~ The digesting apparatus of the caterpillar is adapted to the exclusive food of Mulberry leaves. The eggs of the moth are kept cool to prevent the development of the silkworm. The latter may finally creep out when fresh Mulberry leaves are available. The technique of raising the silkworm, to obtain the silk later on, has been used by the Chinese since the earliest times. It is told that in 199 A.D. a Chinese Prince was reported to have brought the silkworm to Japan. In other wise the Chinese tried to keep secret the producing of the silk; they only exported the latter.

I asked a Chinese friend what silk is called in his country, and he told me a word which sounds like "szl" or "szil". Indeed our word "silk" originates from a Chinese word. The Romans already knew of the Chinese silk. We will discuss this fact later ~~have to talk about this fact afterwards~~ and ~~They~~ called the silk growing peoples "Serers" and their country "Sericum". The Mongolian word for silk is "serke" and from this word probably originates the term "Sericum". Another fact is interesting. In the antiquity the "silk-country" was named "Sericum", but this country which was known to be situated very far to the East, had still another name: "Sinicum". It was used late ~~deep~~ into the Middle Ages until the Occident learned that "Sericum" and "Sinicum" are identical

The knowledge of the existence of this land, situated far away, came ~~by~~ from the sea ~~route~~ -India, Red Sea, Egypt - and ~~following the way~~ to them by land - through Central Asia, Persia Byzantium or Syria - to the Romans. "Sinicum" was the name which reached Rome by the first route, "Sericum" by the latter one. The word from which "China" originates is a Malayan word; Marco Polo called that country "Kathai", deriving the name from a Mongolian folk "Khitan". The Chinese - as my friend told me - name themselves "Chung Kuo", "State or Folk of the Mid", "Middle Kingdom", because they thought at one time their land would be the center of the world. They were (at once) the only civilized people in a waste area. "Kuo" means "folk", or "State". "Chi-Pen-Kuo" is "Land of the ~~Raising~~ Rising Sun". Marco Polo wrote it in Italian manner: "Zipangu" and from this word our word Japan is derived. "Manchu-Kuo", or more correct "Manchu-ti-Kuo" is the Manchu State, and - "Asia" means the same. It is a Semitic, perhaps an Assyrian word "Acu", ~~means~~ meaning "east", "morning land" - "Land of the ~~Raising~~ Rising Sun". In contrast to it is "ereb", the "evening land" - "Europe"!

The origin of the word for the "silk land" has taken us away from our subject. I intend, however, to go down such "side roads" at other opportunities.

The silk, not the silk worm, ~~came~~ was brought to Europe ~~very~~ at an early date by ~~the way of~~ traders, but the European people had no correct knowledge of where this precious fiber came from. Silk was mentioned in the "Revelation of St. John". In Chapter XVIII, 11. and 12. ~~is to read~~:

"11 And the merchants of the earth shall weep and mourn over her, for no man buyeth their merchandise anymore.
12 The merchandise of gold, and silver, and precious stones, and of pearls, and fine linen and purple, and s i l k ... "

It is supposed that the silk did not reach Rome before 115 B.C. This was the time when the famous General Chang- Ch'ien made his trip to the West. We have to go down a "side road" again. I mentioned that the Chinese thought their land ~~were~~ was the center of the world and they were the single civilized people in it. On their Western boundary were living nomadic tribes who always invaded China. ~~This~~ These were the - Huns, the "Hiung-nu", as they are named by the Chinese. These "Hiung-nu" were the same people who later invaded Europe, or rather, it was a tribe of them who reached Europe under Attila. Against the invasions of the Huns, the Chinese built the Great Wall. The latter was known in the Occident under the name of "Gog and Magog.

The Culture-Historical Significance of the Silkworm.

Among the domesticated animals a tiny insect has fulfilled the most important action in the history of culture. This insect is the silkworm! It connected for the first time in history the Far East with the Occident, and furthermore it was one of the main contributing causes leading to the discovery of America! The product of the silkworm is silk, the most precious fiber we know. The first relations between China and Rome were bound together with a thread of silk!

The Chinese have had the silkworm as a domesticated animal since immemorial times. It is, together with the honey bee, the only domesticated and cultivated insect. The silkworm is adapted to the domestication that the silkmoth which develops from the silk worm, has lost the ability to fly. The silkworm is completely dependent upon man. The only food it takes is the leave of the mulberry tree <u>Morus alba L.</u>; therefore its scientific name is <u>Bombyx mori L.</u> With the silkworm the mulberry tree, both native in China, traveled to the West. The digesting apparatus of Bombyx mori - of ccurse of the caterpillar, this is the silkworm - is adapted to the exclusive food of mulberry leaves. The silk moth does not take solid food. during its short life time. The eggs of the moth are kept cool to prevent the development of the silkworm. The latter may finally creep out when fresh mulberry leaves are available. The technique of raising the silkworm to obtain the silk later on, has been used by the Chinese since the earliest times. It is told that in 199 A.D. a Chinese prince was reported to have brought the silkworm to Japan. This was an exception; the Chinese tried to keep secret the pro-cing of the silk; they only exported the latter.

I asked a Chinese friend what silk is called in his country, and he told me a word which sounds like "szl" or "szil". Indeed our word "silk" originates from a Chinese word.

The Romans already knew of the Chinese silk. We have to talk about this fact later. They called the silk growing peoples "Serers", and their country "Sericum". The Mongolian word for silk is, after Friedrich Hirth, "serke", and from this word probably originates the term "Sericum". Another fact is interesting. In the antiquity the "silk-country" was named "Sericum", but this country which was known to be situated very far to the East, had still another name: "Sinicum". It was used late into the Middle Age until the Occident learned that "Sericum" and "Sinicum" are identical. The knowledge of the existence of this land, situated far away, came by the sea route - through India, Red Sea and Egypt - and following the way by land - through Central Asia, Persia and Soghdiana (Buchara with Samarkand of today) Byzantium or Syria - to the Romans. "Sinicum" was the name which reached Rome by the first route, "Sericum" by the latter one. The word from which "China" originates is a Malayan word; Marco Polo called that country "Cathai", deriving from the name of a Mongolian folk " Chitan". The Chinese - as my friend told me - name themselves "Chung Kuo" = "State or Folk of the Mid", at once "Middle Kingdom" because they thought at one time their land would be the center of the world Indeed, about three thousand years ago - at the time of the New Egyptian Kingdom - they were the only civilized people in a waste area. "Kuo" means "folk", or "State" "Chi-Pen-Kuo" is "Land of the Rising Sun". Marco Polo wrote it in Italian manner "Zipangu", and from this word our word "Japan" is derived. "Manch-Kuo", or more correct "Manchu-ti-Kuo" is the Manchu-State, and - "Asia" means the same!. It is a Semitic, perhaps Assyrian word, deriving from "Açu", meaning "east", "morning land" "Land of the Rising Sun". In contrast to it is "ereb", the "evening land" - Europe!

The origin of the word for the "silk land" has taken us away from our subject. I intend, however, to go down such "side roads" at other opportunities!

The silk, not the silkworm, came to Europe at a very early date by the way of trade, but the European people had no correct knowledge of where this preciuos fiber came from. Silk was mentioned in the "Revelation of St. John". In Chapter XVIII, 11. and 12. is to read:

> 11. And the merchants of the earth shall weep and mourn over her, for no man buyeth their merchandise anymore
> 12. The merchandise of gold, and silver, and precious stones, and of pearls, and fine linen and purple, and s i l k ...

It is supposed that silk did not reach Rome before 115 B.C. This was the time when the famous General Chang-Ch'ien made his trip to the West. We have to go down a "side road" again. I mentioned that the Chinese thought their land was the center of the world.On their Western boundary were living nomadic tribes who frequently invaded China.These were the - Huns,the "Hiung-nu",as they are named by the Chinese.These "Hiung-nu" were the same people who later invaded Europe, or rather,it was a tribe of them who reached Europe under Attila.Against the invasions of the Huns,the Chinese built the Great Wall.The latter was known in the Occident under the name "Gog and Magog Wall".

The ruling Emperor was at the time of 120 B.C.:Wu-ti of the Han Dynasty. This Emperor wanted to have allies against the Huns and sent out the general Chang-Ch'ien.After an absence of more than 10 years the general returned to China with knowledge about Syria.At that occasion he brought to China the grape (which retains still the Chinese name "po-tau",derived from the Greek word "botrys"), and the "blood sweating horse" with its food,the alfalfa,Medicago sativa.At that time the silk must have found first its way to the West.We have Chinese Jews still in China today.They look completely like the Chinese,and they have preserved only a little of their religion.It is supposed that these Jews came from the West to China with the silk trade during the Han period.

The silk,in the form of woven goods,came on certain roads,the "silk-roads", leading through Central Asia to Syria to the cities Tyrus and Sidon in the former Phenicia.These silk roads were again of interest in our times when Sven Hedin was requested by the present Chinese Government to find out if they could be used for modern autos and trucks.(1935).The silk stuffs were separated into silk threads and dyed again.The knowledge of dyeing was highly developed in Syria at that time.The newly dyed silk threads were now sold to Rome.That the silk trade between Rome and the Far East was important is proven by the fact that in Central Asia,Roman coins were found from the period of 25 - 200 A.D.The silk was tremendously expensive in Rome.It is reported that at the time of Emperor Marcus Aurelius (275 A.D.) 1 kg Silk costed 5,157 gold francs and under Justinian (550 AD) even 17,190 gold francs.We know that Emperor Augustus had already used silk.The large amount of money,expended for silk,was one of the causes of the decadence of the Roman Empire.

Of greatest importance were the investigations of the Macedonian silk trader Maes Titianus concerning the land route to China in about 100 A.D. Titianus went perhaps as far in Central Asia as the land of the "Serers" who were a Scythian folk and who today are known as "Tocharers"; they were the Chinese "Yue-tschi" of the time of Emperor Wu-ti and Chang-Ch'ien in 120 B.C. The Tocharers whom Wu-ti wanted as allies against the Huns, were an Indo-Germanic folk, speaking a language related to the European Indo-Germanic languages. The Romans believed that the "Serers" were blond and had ~~would have~~ blue eyes, a proof that the Chinese themselves were unknown to the Romans. These Tocharers, further the Persians and other people, living in the area of the Inner-Asiatic silk trade, such as the inhabitants of Soghdiana (today the Russian Buchara with Samarkand and Tashkend), were the middle men of the silktrade between China itself and the Occident. In about 800 A.D. the Tocharers were still settled ~~stated~~ in East-Turkestan (Chinese Sinkinag of today) It is also possible that Titianus collected travel reports from Chinese. silk traders. Perhaps he had in his possession a Chinese "travelbook" through East-Turkestan as they are mentioned in chapter 96 of the Han-Annales. ~~The traveling~~ in this tremendous Chinese Empire was well organized at that time. The Chinese traveler Kan-Ying (98 A.D.) reports:

> "Along the most important roads, bungalows and mail stations were built at certain distances in order to change the horses. The couriers of urgent messages and the traveling interpreters are able to do their job at any season of the year".

This meant very much in Central-Asia! It was the time of the Han Emperor Ho-ti (88-105 A.D.). It seems that at that time foreigners were already in that country and were perhaps occupied with the silk trade. It is also possible that Titianus was a silk worker in Tyrus, itself. In any ~~every~~ case the famous geographer Marinus of Tyrus, a contemporary of Titianus, was informed of the experiences of the latter. May be he also had the information of other travelers in Central-Asia or the Far East. I may mention here that from the time of Chang-Ch'ien, the Chinese were much better informed about the West, than the Western people of the East. They knew even the most important cities by name, like Ktesiphon, the capital of the Sassanidian Persian Kingdom which they called "Sepon", or Antiochia, the capital of Seleucidian receipts of a certain sum of money ~~on~~ in the place of money itself. This was the first paper money. Later on such receipts were used without the backing of real money. In this way the inflation started with all the results we know in our time.

With From the invention of paper started also the invention of the playing card. This came ~~over~~ from India to Europe and there developed the "visiting card". A play card was used first to invite someone to a game and later on it was used to announce ones self as a visitor. This is our "side road" digression concerning paper.

The discovery of America and our silk. Yes, they cling together. Two books influenced Columbus so much that he developed the idea of the "Enterprise of the Indies" and developed the initiative and courage for sailing to the West in order to find the residence of the Great Khan in China. These books were: the book of Ptolemy of Alexandria and the travel report of Marco Polo. Ptolemy had more knowledge of the sea route to Asia whilst the knowledges of the Chinese concerned the land route I have mentioned that they were informed of cities like Samarkand (Kank-ku) Merw Mu-Lu) in Persia, Ktesiphon (Ssdpon), Rekem-Petra (Li-kan) in Arabia,, Antiochia (An-tu); they knew countries like India (Tien-chu), Persia (An-hsi), Mesopotamia (Tiao-chi), or Syria (Ta-t'sin). On the other side Ptolemy knew the Peninsula Malacca (Golden Chersonnes) Singapoor (Zabae), Java (Jabadiu, the Greek word of the Sanskrit "Javadvipa" (= Millet-Island in the "Ramayana"). The "Maniola-Islands" are probably the Philippines. Luzon had the Malayan name "Manila" (= getting green), of which "Maniola is the Greek form. Columbus ~~had not~~ did not have a clear picture of East India and China. I have already spoken of the fact that the knowledge of Marinus of Tyrus was taken over by Ptolemy. Also the great error of exaggerating the extent of the Eurasian continent, made by the Syrian geographer was accepted. In this way Columbus supposed the Atlantic Ocean far smaller than it indeed is, and risked crossing it. In this way the discovery of America goes back to the silk trade in the antiquity because Marinus of Tyrus got his knowledge by the way of the silk trade! Columbus sailed to the West in 1492. When he returned in 1493 he believed he had found a new way to the Indies and to China. It was an Italian historian, living in Spain, Peter Martyr of Anghiera, who on November 1st 1493 wrote to the ~~Spanish Bishop~~ Cardinal Ascanio Sforza that he did not believe that Columbus was in the Indies or in China. He thought that Columbus has discovered a "New World"

This is the origin of that name for the Western hemisphere. It was again an Italian who brought the knowledge of the existence of America to China and ~~payed~~ paid back our debt to this country *and high stand of civilization*. The wonders of China which ~~described~~ found Marco Polo so interesting gave Columbus the intuition to ~~to find~~ to try to find his way to the Great Khan.

The Italian Jesuit Matteo Ricci landed ~~in~~ 1582 in Canton. His arrival is mentioned in chapter 326 of the Ming Annales (1573 - 1620 A.D.). Following Berthold Laufer, it reads as follows: "I-ta-li-ya is a country, situated in the great Western Ocean. A man of this country arrived at the capital and displayed a map of the 10,000 countries, explaining that there are in the world 5 great continents. The first of these is called Asia with more than a hundred countries, of which China is the first. The second is Ou-lo-pa (= Europe. the Chinese cannot pronounce our "r"), the third is Li-wei-ya (= Lybia, the old name for Africa, a name, originating from the North-African folk,
and used from the Portuguese during their discovery journeys along the coasts of the
"the Afri"). The fourth is A-mo-li-kia (= America), wast in extend, and divided into a *Latin*
or Africans, known to the Romans.
northern and a southern continent, which, however, are connected with each other"!

These are the last results of the work of a small, ugly looking white caterpillar. It uses his thread to hide himself from the world. The same silk thread opened to man the connection between the Occident and the Far East with their different types of culture and at last the way to a new continent, the way to the New World!

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and other sources.

Curriculum Vitae
of the Botanist
Theodor Philipp Haas, Ph.D.

Born: April 7th 1892 in Munich (Germany-Bavaria)
In U.S.A.: Since September 21st 1940 (Arrival in San Francisco, Cal.)
"First Papers" I have since June 17th 1941.
From July 2nd 1941 until September 2nd 1941 I was a member of the "American Seminar" in Holderness School, Plymouth, N.H., and from October 8th 1941 until March 1st 1942 I was a member of the "Cooperative College Workshop" in Haverford, Pa.
Education: 4 years Public School
6 " High Commerce School in Munich
22 " Munich University
(From 1911 until 1929 I worked in my father's factory, but during this time, I always attended the University's lectures)
Branches of studies at the University:
Botany; as a student of Goebel: Plant Morphology.
Besides: Zoology, Geology, Chemistry, Chemical Technology, History of Culture, History of Art.
Examinations: Examination of High Intelligence (= "Begabten-Prüfung") 1929 (at the Bayer. Ministerium für Unterricht und Kultus in Munich)
Took the degree as a Ph.D. on the Munich University under Prof. Frits v. Wettstein on December 21st 1932.
Thesis: "Untersuchungen an der Gattung Acer" (Research work on the Genus Acer Maple-Family)
Minor fields: Zoology and Geology (for the degree)
Employment: Botanical Museum in Munich-Nymphenburg, October 1st 192? - February 15th 1937.
Kind of work: Museum work in the exhibitions of the Botanical Museum
(Collecting of plants, making of preparations of them for the Museum, giving the scientific explanations.
Rearranging of the entire Museum exhibition, according to modern principles of a museum.)
Besides: Establishing a collection of botanic and pharmaceutic specimens for the University's lectures.
Scientific guidances through the Botanical Garden and through the Botanical Museum in Munich-Nymphenburg for the "Volkshochschule" (popular Universi ?)
In U.S.A.: In New York: Doing independent research work in the Library of the N.Y. Botan. Gard. giving scientific advise to artists of the "WPA", working in the Botanical Museum there, Identifying of plants (from models) in the American Museum of Natural History, Africa-Hall, Roosevelt Memorial Building.
In Philadelphia: Doing taxonomic work as a voluntary helper in the Herbarium of the Academy of Natural Sciences.
Publications: In Germany: Thesis, "Seltsame Pflanzen", "Ahornblüte", "Aristolochia Goldieana", "Buchenjahr 1938", "Cephalotus follicularis", "Beobachtungen an der Zirmertanne", "Die weisse Pestwurz und ihr Schmarotzer, die gelbe Sommerwurz" and other shorter articles. (I had to spend most of the time to museum work).
In U.S.A.: "The Dogwood's curious Floral Bracts" Journal of the New York Botanical Garden, May 1941, "Rhododendron in winter", Frontiers February 1942, "Bananas" March 1942 in Frontiers. Other articles are ready for publication.
("A Botanical Museum", "Hoya Darwinii Loher", From which parts of plants does vegetable fibers originate? "How does the plants in winter-cold regions pass the unfavorable season?").
References: Professor E.D. Merrill, Director of the Arnold Arboretum, Jamaica Plains, Mass.
" W.H. Robbins, " " " New York Botanical Garden
" Francis E. Lloyd, McGill-University, Carmel, Cal. Box 842.
Dr. Henry Hopp, U.S. Dept. of Agriculture, Soil Conservation, Washington DC.
" W. Porterfield " " " " " " Room 641 Washington St.
New York City, Federal-Building.

(17)

32 06 Biologist, Botanist

9 3 Have "First Papers"

7 Born: 4/7/1892

14 University of Munich; Ph.D.

17 Take part on lectures in Botany at the University of Pennsylvania (Prof. Seifriz and Prof. Stockbeck)

18 Helper in the Kilmer Botanical Garden of the Philadelphia College for Pharmacy and Science in Philadelphia.

20 Keep garden in good condition, collect plants and identify plants

21 Drug plants (for scientific purpose)

23 Philadelphia College for Pharmacy and Science, Philadelphia, Pa.

24 Assistant Curator on a botanic museum

25 7 years an 4 months (Okt. 1st 1929 until Feb. 15th 1937 at the Botanical Museum in Munich-Nymphenburg)

26 No

27 Collecting of plants, making preparations, giving scientific explorations, arranging museum exhibitions, making scientific tours and excoursions, doing, taxonomic work. Plant photography.

28 doing research work in plant morphology, taxonomic work or teaching plant photography.

29 7 years and 4 months

To # U 650 Theodor Philipp H a a s , Botanist, Ph.D.

Cycadaceen

In den Tropen der Alten und der Neuen Welt leben die Vertreter einer Pflanzenfamilie, die durch die Schönheit ihrer grossen Blätter auffallen. Sie erinnern in ihrem Aussehen sehr an Palmen, ohne mit diesen etwas gemeinsam zu haben. Sie gehören zu den Nacktsamigen, den Gymnospermen, zu Pflanzen, bei denen die Samenanlagen nicht von einem Fruchtblatt umhüllt sind, sie stehen also den Coniferen nahe. Diese Gewächse gehören zur Familie der Cycadaceen, einer Pflanzenfamilie, die zufolge ihrer primitiven Blüten und besonders wegen ihrer Bestäubungsverhältnisse an den Anfang der Reihe der Blütenpflanzen gestellt wird. Die Cycadaceen sind Schopfbäume, d.h. sie haben einen unverzweigten Stamm, der an seinem oberen Ende mehr oder weniger waagrecht gestellte grosse Blätter trägt. (Abb. 1.) Die Cycadaceen sind zweihäusig, d.h. es gibt Pflanzen, die nur Blütenstaub hervorbringen, d.s. die männlichen, und solche, die die Samenanlagen besitzen, das sind die weiblichen. Während die männlichen Blüten durchwegs Zapfen darstellen - oft von sehr grossen Dimensionen - , lässt sich an den weiblichen Blüten eine fortlaufende Entwicklungsreihe beobachten. Deshalb interessieren uns hier nur diese. Dabei ist die unentschiedene Frage, ob es sich um Blüten oder Blütenstände handelt, offen gelassen.

Die einfachsten Verhältnisse finden wir bei der Gattung Cycas, die mit ihren 15 Arten in den Tropen der Alten Welt lebt. Die ersten Abbildungen zeigen Cycas revoluta ~~Thunberg.~~ Die Pflanze ist im südlichen China, in Japan und den vorgelagerten Inseln, wie Formosa, beheimatet. In den gemässigten Breiten muss sie in Gewächshäusern gezogen werden, während sie im mittleren Japan noch häufig im Freien zu sehen ist. So ist Cycas revoluta in Kobe in Japan eine beliebte Garten Pflanze und im Botanischen Garten in Kyoto steht ein sehr schönes Exemplar vor dem Gewächshause. (Abb. 1,2,3.). Die Pflanze wird auch als Zwergbäumchen in künstlerischen Gefässen in Wohnungen gehalten. Cycas revoluta besitzt dunkelgrüne, steife Blätter, die bis zu 2 m lang werden können und die einen beliebten Kranzschmuck darstellen. Wenn die Pflanze sich in Ruhe befindet, so sieht man an ihrem Sprossende eine grosse, mit braunen Niederblättern bedeckte Knospe. Von Zeit zu Zeit, in unregelmässigen Abschnitten nach einer mehr oder weniger langen Ruhepause wächst der Stamm weiter, und dann bringt die Pflanze eine grosse Zahl ihrer schönen Blätter hervor. (Abb. 4,5,6.). Diese durchbrechen die Knospenhülle, die Rhachis ist anfangs senkrecht gestellt und die Seitenfiedern sind nach innen gerollt. Später entfalten sie sich und das Blatt nimmt allmählich eine schräge bis waagrechte Lage ein. Zuerst ist es noch ganz weich und hellgrün; es dunkelt aber alsbald nach und wird steif. In Japan werden die alten Blätter abgeschnitten; die Garten-Kultur ist ja in diesem Lande sehr hoch; so werden auch an den Nadelbäumen in den Parks die alten Nadeln jeweils entfernt. Wenn Cycas revoluta Blätter gebildet hat, tritt wieder eine Ruhepause ein und eine neue braune Knospe wird sichtbar, aus der dann nach einiger Zeit wieder neue Blätter hervorbrechen. Nicht immer läuft der Vorgang in der geschilderten Weise ab. Wenn die Pflanze zur Blütenbildung übergeht, erscheinen statt der grünen, sterilen Laubblätter fertile Blätter. Sie sind mit einem braunen Haarfilz bedeckt. Die Rhachis ist ca. 20 cm lang. An Stelle der unteren Fiedern befinden sich etwa

6 - 8 Samenanlagen, der obere Teil der Rhachis ist etwas verbreitert, ist aber noch deutlich gefiedert. (Abb. "~~8~~ 7.). Das Primitive bei Cycas revolta ist, dass sich die fertilen Blätter in ihrer Gestalt nicht grundsätzlich von den sterilen unterscheiden; auch sie haben noch eine gefiederte Blattspreite. (Abb. 7.) Die Blüte besteht aus einem Schopf dieser fertilen Blätter (Abb. 8 und 9.) (Abb. 8 zeigt die Blüte am Anfang der Anthesis, Abb. 9. in einem späteren Stadium). Wie eingangs gesagt, wollen wir uns in der unentschiedenen Frage, ob es sich um eine Blüte oder einen Blütenstand handelt (auch bei den Coniferen sind hier die Botaniker noch zu keiner Einigung gelangt), nicht festlegen; wir sprechen aber immer von der weiblichen Blüte. Spross-Achse und Blütenachse sind hier identisch; es ist also, wenn die Pflanze blüht, der oberste Teil des Stammes zugleich die Blütenachse. Nach einiger Zeit wächst er weiter, bildet eine neue, von Niederblättern bedeckte Laubblattknospe, aus der dann unter zur Seitedrängung der fertilen Blätter wieder sterile Blätter hervorbrechen. Es wird also die Blüte regelmässig durchwachsen. Die Blütenachse (gleich zu setzen mit Spross-Achse, Hauptspross oder Stamm) zeigt also noch kein begrenztes Wachstum, wie es für die Blüten der höheren Pflanzen charakteristisch ist. Bei Cycas revoluta verläuft das Wachstum in einem ständigen Wechsel zwischen sterilen und fertilen Perioden. In Kobe und Kyoto, wo viele Cycas revoluta-Bäume im Freien stehen, fällt die fertile Periode weg. Es ist dort für die Blütenbildung zu kalt; man sieht sie viel weiter südlich. Aehnliche Verhältnisse wie bei Cycas revoluta haben wir bei einem anderen Vertreter der Gattung Cycas, bei Cycas circinalis L., einer in Südindien, Ceylon und im Indischen Archipel beheimateten Pflanze, die man auch in den Gewächshäusern in den gemässigten Breiten sieht. Auch hier ~~ist ein ständiger~~ entwickeln sich die sterilen Blätter wie bei Cycas revoluta (Abb. 10.), indem sich die Seitenfiedern entrollen und auch hier ist ein ständiger Wechsel zwischen sterilen und fertilen Perioden vorhanden. Auch hier sind ~~ein~~ die jungen Laubblätter sehr steil gestellt und hellgrün und auch hier dunkeln sie nach. Die Blüten sind aber nicht so locker wie bei Cycas revoluta. (Abb. 11. und 12.) und dann ist bei den fertilen Blättern ein Fortschritt festzustellen Die Rhachis ist auch verbreitert wie bei den fertilen Blättern von Cycas revoluta, aber statt der vielen Fiedern sind nur mehr zahlreiche Zähne festzustellen (Abb. 12.). Der sterile Teil der fertilen Blätter ist also nichtmehr gefiedert sondern nur mehr gezähnt. Auch die Zahl der Samenanlagen ist reduziert; die Samen werden dafür sehr gross. (Abb. 13.)

Bei den beiden genannten Cycadaceen war der Hauptspross zugleich die Blütenachse und wenn auch immer ein Wechsel zwischen sterilen und fertilen Perioden stattfand, so wuchs doch die Hauptachse einheitlich weiter. Bei diesen beiden Pflanzen ist also der Spross ein Monopodium. Anders ist das bei denjenigen Cycadaceen, denen wir uns jetzt zuwenden wollen. Bei Dioon edule ~~Lindl.~~, die in der Neuen Welt, in Mexico, zuhause ~~ist~~, ist ein weiterer, grosser Schritt zu sehen erkennen: Man sieht den ersten Zapfen. Der Stamm dieser Pflanze wird bis zu 3 m hoch und ist mit den Basalresten der abgestorbenen Laubblätter gepanzert. Diese werden etwa 1 - 1½ m lang. Sie sehen aus, wie wenn sie aus Blech gestanzt wären. (Abb. 14.) Die jungen Blätter sind auch hier am Anfang sehr weich; sie werden aber dann ganz hart und steif. Wir sagten, dass hier die ersten Zapfen auftreten. Diese Zapfen sind noch ganz locker; sie sind etwa 20 - 30 cm lang und 15 - 20 cm dick. (Abb. 15 16 u. 17.). Abb. 17. zeigt den Zapfen längsgeschnitten. Die einzelnen fertilen Blätter sind gestielt und filzig behaart. Sie haben noch eine deutlich entwickelte Blattspreite (Abb. 18.) von der Gestalt eines spitzigen Dreiecks und nur an dessen Basis sieht man 2 kurze Zipfel, die als die Ueberbleibsel der Zähne, wie wir sie bei Cycas antrafen, gedeutet werden. Gegenüber Cycas circinalis zeigen also die Blätter von Dioon edule eine weitere Vereinfachung. Sie haben nur mehr 2 Samenanlagen und so bleibt es in der ganzen Familie in derselben Weise wie bei den Coniferen. Dazu kommt noch etwas weiteres. Die fertilen Blätter sitzen an ~~der~~ einer Zapfenspindel. Diese beendigt das Wachstum des Hauptsprosses und eine Seitenknospe am Gipfel führt diesen unter zur Seite Drängung des Zapfen fort. Der Stamm von Dioon edule besteht also im Gegensatz zu Cycas revoluta und circinalis aus einer Verkettung vieler einzelner Wachstums-Perioden, er ist kein Monopodium sondern ein Sympodium. Bei Ceratozamia mexicana, einer in Mexico ~~wachsenden~~ heimischen Pflanze, endlich fehlt an den fertilen Blättern auch noch die Blattspreite; es sind nur mehr die 2 als Hörner erscheinenden "Zähne", von denen auch die Pflanze ihren lateinischen Namen hat, vorhanden (Abb. 19.) und das letzte Glied in unserer Entwicklungsreihe ist, dass das fertile Blatt nur mehr aus einer gestielten Scheibe mit 2 Samenanlagen besteht und dass diese zu einem ganz dichten Zapfen vereinigt sind. Die letzten Bilder von Zamia Skinneri sollen das zeigen. (Abb..

Es sollte hier in der Familie der Cycadaceen eine fortlaufende Entwicklungsreihe gezeigt werden. Zum Schluss sei noch bemerkt, dass manche dieser schönen Pflanzen in ihrem Stamme Stärke anhäufen und so als lokale Nutzpflanzen nicht ohne Bedeutung sind; insbesondere ist das der Fall bei Cycas revoluta, deren Stärke in Formosa verwendet wird. Man nennt sie daher auch "falsche Sagopalme", obwohl diese Pflanze, wie gezeigt wurde, mit den Palmen, den zu den "Monocotyledonen" gehörigen Blütenpflanzen nichts zu tun haben.

F. R. P. Haas

[illegible] B.5.7
[illegible] Dezember 1939

Das Meer.

Das Meer bedeckt als Weltmeer, Ozean (bedeutet nach der babylonischen Vorstellung von der Gestalt der Erde "Ringfluss"), den weitaus grössten Teil der irdischen Hydrosphäre (Wasser-Oberfläche), 71 % der Erdoberfläche. Seine grösste bis jetzt festgestellte Tiefe beträgt 10,8 km, so dass also, bei einem durchschnittlichen Erdradius von 6370 km, das Meer, ähnlich der Atmosphäre, nur eine verhältnismässig dünne Schicht auf dem Erdball darstellt.

Das Weltmeer weist eine reiche Gliederung auf ; die waagrechte Gliederung ist die Verteilung von Wasser und Land, die senkrechte bezieht sich auf die Tiefen und auf die Bodengestalt des Meeres. (s.a. "Erde"!). Die waagrechte Gliederung wird im grossen bedingt durch die Kontinente, die Festländer oder Erdteile, riesige Inseln im alles umspannenden Weltmeer. Im kleinen findet die Gliederung statt durch ~~Insel~~ Inselreihen oder untermeerische Höhenzüge, oder man führt künstliche Grenzen ein. So unterscheidet man 3 Ozeane: Den Atlantischen zwischen Europa-Afrika und Amerika, den Indischen Ozean zwischen Südasien-Ostafrika und Australien, den Stillen Ozean zwischen Ostasien, Australien und Amerika, drei Ozeane, die alle im Süden zusammenhängen und bei denen die von den Südspitzen der Kontinente zum Südpol-Festland hinziehenden Meridiane die Zwischengrenzen bilden. Die von

Polarkreisen umspannten Teile des Weltmeeres werden als Polarmeere bezeichnet. Vom offenen Meere ,vom Weltmeere, werden die Nebenmeeres, kleinere,in die Festlandsockel eingesenkte Meeresteile abgetrennt und diese Nebenmeeres werden wieder in Randmeere und Mittelmeere eingeteilt. Die ersteren sind den Kontinenten eingelagert,z.B. die Nordsee,die letzteren in diese eingebettet (vielfach Einbruchsbecken,durch Einsinken von Schollen der Erdrinde). Sie werden dann zu Einbruchsmeeren,wie z.B. das Rote und das Aegäische Meer. Mittelmeere sind das Europäische,das Merikanische und das Autral-asiatische oder Indonesische Mittelmeer. Ein Binnenmeer ist nur durch schmale Wasserverbindungen mit dem Weltmeere in Zusammenhang,so die Ostsee durch den Oeresund ,das Europäische Mittelmeer durch die Strasse von Gibraltar und das Schwarze Meer,der Pontus (Pontos) durch Bosporus und Dardanellen,in diesem Falle sogar einstige Flussläufe . Im Stillen Ozean trennen Inselketten Binnenmeere ab,z.B. das Japanische Meer. Schmale Meeresarme werden als Meerengen oder Meeresstrassen oder in Nordeuropa als Sunde bezeichnet,z.B. der schon genannte Oeresund,die gleichfalls erwähnte Strasse von Gibraltar, ebenso die Strasse von Malakka u.a.. Schmale Landverbindungen,Landbrücken,die Meere oder Meeresteile trennen,werden als Landengen oder Isthmen bezeichnet,z.B. die Landengen von Panama oder der Isthmus von Korinth. Zur Abkürzung der Seewege sind sie vielfach künstlich von Kanälen, Seekanälen durchstochen, z.B. Kanal von Korinth, Suezkanal, Panamakanal. Die Binnenmeere zeigen vielfach Ausgliederungen, die nach ihrer Gestalt auch mit Lokalnamen bezeichnet werden. Man spricht von Meerbusen, z.B. ~~der~~ Finnische Meerbusen, ~~der~~ Jadebusen, von Golfen (lat. sinus), z.B. Golf von Genua. Als "Wehle" wird eine Bucht benannt, die durch grosse Fluten entstand. Ein Haff bedeutet eine nur durch mehr oder weniger schmale Warrerrinnen mit dem Meere verbundene Bucht (Ostsee-Haffe). Die Nebenmeere machen insgesamt nur 7,2% des Weltmeeres aus; sie sind also scheinbar nur unbedeutende Anhängsel desselben, trotzdem aber bewahren die Nebenmeere, dem Ozean gegenüber, gerade durch die oft schmalen Verbindungen eine grosse Selbständigkeit. Diese kann sich in der Temperatur, im Salzgehalt des Wassers, im Ausbleiben von Ebbe und Flut u.s.w. äussern. So ist das Wasser der Ostsee salzärmer, das des Europäischen Mittelmeeres salzreicher wie das Wasser des Atlantik im Durchschnitt. Geologisch sind sie auch vielfach jünger als das Weltmeer, denn zweifellos haben mindestens Teile des letzteren, bes. im Stillen Ozean, schon zu Zeiten früherer Erdperioden bestanden (Permanenz der Ozeane!). Die Nebenmeere haben auch den Hauptanteil an den völkerverbindenden Eigenschaften des Meeres. Die alten Seevölker, z.B. Phönizier haben sich wohl noch nicht auf das freie offene Meer, auf die hohe See oder Hochsee gewagt. Ihre Schiffahrt bewegte sich längs der Küsten ; immerhin kamen sie sehr weit. Es sei nur an die von Herodot erzählte Reise der Phönizier um Afrika und dem ägyptischen König Necho (c. ~~702-~~ 596-594 v. Chr.) erinnert. Auch heute noch beanspruchen die ~~Länder~~ Staaten ~~Länder~~ einen Meeresstreifen von bestimmter Breite als ihr Hoheitsgebiet (Küstenmeer, Küstengewässer, Territorialgewässer) und beispielsweise für viele Städte ist ihre Entfernung vom Meere (Meerferne) von grösster Bedeutung.

Was die Verteilung von Wasser und Land auf der Erdoberfläche anbetrifft, so wird die Nordhalbkugel von 61% , die Südhemisphäre von 81% Wasser bedeckt. Der Südpol befindet sich auf dem vereisten Südpolar-Kontinent, während der Nordpol vom Meere bedeckt. Die Verteilung von Wasser und Land auf der Erde und bes. das Fehlen des letzteren in weiten Gebieten der Südhalbkugel ist u.a. von grösster Bedeutung für die später zu besprechenden Wasserbewegungen des Ozeans. Die senkrechte Gliederung des Weltmeeres hat die Tiefenverhältnisse zum Gegenstand, doch sind die Ränder von Meer und Land nichts absolut Feststehendes(es sei nur an die Wegener'sche Kontinentalverschiebungs-Theorie erinnert). Es gibt Hebungen und Senkungen des Landes, verschiedener Art, die sich in negativen und positiven Niveauschwankungen äussern. Die Meeresoberfläche kann durch Stürme gehoben werden (Windstau) und ins Land einbrechen. Das vermag schwere Katastrophen zu verursachen; so ist durch eine Sturmflut die Zuidersee in Holland entstanden, die noch z.Z. der Römer ein abgeschlossener See war, so wurde 1362 die bedeutende Hafenstadt Rungholt zerstört. Das Vordringen des Meeres ins Land (Ingressionsmeer, s.a. "Küste") wird als Transgression, sein Rückzug als Regression bezeichnet. Die letztere kann man an Strandterrassen-Bildung oder auch an mit Muscheln besetzten antiken Bauwerken erkennen, so etwa an den Tempelruinen Pozuoli bei Neapel. Die Niveauschwankungen, die also eine Änderung der relativen Lage des Meeresspiegels bedeuten, können sich auf grosse Gebiete ausdehnen. Es gibt plötzliche Niveauschwankungen (instants), etwa nach Erdbeben oder Vulkanausbrüchen (wie in Neuseeland), allmähliche Niveauschwankungen, die sich in langen Zeiträumen abspielen (z.B. in Skandinavien), man nennt sie säkulare Niveauschwankungen. Eustatische Niveauschwankungen sind fortgesetzte Transgressionen durch Meereseinbrüche. Ein Zurückweichen des Landes kann auch durch die Brandung, eine später zu besprechende Form der Meereswellen zustande kommen. Durch ständige Ablagerung von Sinkstoffen (Verschlickung) oder durch Anschwemmung wird andererseits eine Anlandung (Aufschlickung, Anschlick) möglich und damit eine Regression des Meeres. Vielfach wird der Schlick in Gräben, Grüppen genannt, gesammelt und bei der Eindeichung verwendet. Als Abrâsion bezeichnet man die Zerstörung der Küsten durch den Anprall der Meereswogen ; sie ist besonders stark an Steilküsten.

Die Ufer des Meeres ,die Küsten(s.a. "Küstë) können mehr oder weniger senkrecht einfallende Wände bilden,oder sich allmählich zum Meeresspiegel senken. Im ersten Falle spricht man von Steil-,im letzten Falle von Flachküsten mit breiter Strandentwicklung. Während jene mit ihren Kliffs häufig~~s~~ der Abrasion stark ausgesetzt sind,findet bei den letzteren vielfach thalassogen eine Anschwemmung und Ablagerung von Sedimenten statt. Bei Flussmündungen kommt es häufig zu sog. Barren ; schuld an dieser Barrenbildung ist gerade in den Tropen die Ausfällung koloidaler Stoffe bei Vermischung des süssen Flusswassers mit dem salzigen Meerwasser /.Es gibt hier Bänke,Sandbänke,Sände oder auch Sande,Platen,Watten geheissen,seichte,vielfach nicht,oder nur bei Ebbe über die Meeresfläche aufragende Untiefen, (plattdeutsch Uver) ,die für die Schiffahrt sehr gefährlich sind. Für die Mächtigkeit,das Ausmass der genannten Ablagerungen werden auch die Meeresbewegungen, bes. die später zu besprechenden Gezeiten, von grosser Bedeutung ; durch letztere können sie auch ihren Standort ändern. Vertiefungen zwischen den Bänken werden als Rinne, Priel, Rille, oder Ley bezeichnet. Verfestigen sich die Sedimente, so kann es zur Bildung von Sandbänken und Sandriffen, oder wenn sie mit Schalenresten von Muscheln und Schnecken bedeckt sind, von Muschelbänken kommen. An den Küsten selbst ist ein mehr oder weniger breiter Streifen Landes vorhanden, der bei Flut mit Wasser bedeckt, bei Ebbe von diesem frei ist. Dieser Streifen wird besonders breit an der deutschen Nordseeküste ; in seinem Bereiche liegt das Wattenmeer. An den Flachüsten finden sich vielfach vom Meere stammende, grosse Sandmassen, das sog. Dünengebiet. Für das dahinter liegende, fruchtbare Kulturland bedeuten die Dünen eine Gefahr und man ist bemüht, durch Anpflanzung von Gewächsen mit reich entwickeltem Wurzelsystem ihr Wandern zu unterbinden. Auf Strecken, welche infolge der Senkung des Landes tiefer liegen als der Meeresspiegel, wird die Küste durch Deiche (Wälle) vor der Uberflutung und den bei Deichbrüchen durch sie erzeugte Ausspülungen (Bracks) geschützt. Das sich hinter diesen Deichen in Gräben ansammelnde Wasser wird als Binnenfleet oder Binnentief bezeichnet; Fleet (Aussenfleet) wurde da-

neben auch zum Namen für meernahe Kleinschiffahrts-Kanäle.
Die tropischen Flachküsten tragen vielfach einen Sumpfwald, die Mangrove. Die Mangrovepflanzen ertragen den Salzgehalt des Bodens und besitzen häufig in Bezug auf Wurzelverankerung und Fortpflanzung sehr interessante Anpassungs-Einrichtungen (z.B. Viviparie).

Die Meeresufer, die Küste ~~oder~~ bezw. der Strand hat seine Fortsetzung im Meeresboden. Seine Erkundung, wie überhaupt die Erforschung der Meere, geschah und geschieht durch Forschungsfahrten mit bes. Schiffen und nach diesen werden dann meistens die Expeditionen selbst benannt. Schon von altersher hat man auf Seereisen Beobachtungen gemacht. (Es sei nur an die Thulefahrt des Pytheas von Massilia, zwischen 350-320 v.Chr., erinnert, wo bereits Beobachtungen u.a. über Ebbe und Flut gemacht wurden.) Auch heute noch werden ständig von den gewöhnlichen Schiffen Aufzeichnungen über Meeresströmungen u.s.w. vorgenommen. Kann auch als eine Art Vorläufer die Resolution-Expedition (1772-75) gelten, so werden doch systematische Untersuchungen durch besondere Fahrten wesentlich erst seit dem 19. Jahrhundert durchgeführt. Sie sind von vielen seefahrenden Nationen in allen Meeren unternommen worden. Einige Namen mögen folgen. Schon die Challenger-Expedition (1872-76) brachte so reiches Material, dass es in einem eigens hiefür eingerichteten

"Challenger-Office" in Edinburgh aufgearbeitet werden musste. Die Meereskunde, die Meeresforschung oder Ozeanographie (Thalassographie oder Thalassiologie) ist heute eine wichtige Wissenschaft. Besondere ozeanographische Verdienste erwarb sich einst Georg von Boguslawski (Lehrbuch d. Ozeanographie 1884) ,in Ost- und Nordsee Bruno Schulz, ,neuerdings Otto Krümmel und der Ozeanograph und Geograph Gerhard Schott. Es gibt Institute für Meereskunde, Museen für Meereskunde und beispielsweise auch eine Internationale Kommission für die Erforschung der nordeuropäischen Meere u.s.w.; durch ihre Mitarbeit werden vielfach die maritim-wissenschaftlichen Expeditionen ausgerüstet . Diese haben die Aufgabe alle Meeresfragen zu bearbeiten : Untersuchungen des Meeresbodens, Feststellung der Tiefe, Gestalt, Boden-Ablagerungen ,das Meerwasser, sein Salzgehalt, seine Temperatur und seine Bewegungen, ferner die Gross- und Kleinlebewelt, die Grundlagen für Fisch- und Walfang u.s.w.. Hierfür hat man eine Reihe von Instrumenten geschaffen ; man ist aber noch weit davon entfernt, sie als vollkommen bezeichnen zu können, wie es überhaupt in der Ozeanographie noch sehr viele ungelöste Probleme gibt. Zur Bestimmung der Meerestiefe bedient man sich als Ablotungsinstrumenten verschiedener Tiefenlote als Bathometer (Bathymeter), so der

sten Expeditionen. Weiter zurück liegen /die"Germania-Hansa-Expedition" (gleich 2. Deutsche Nordpolar-Expedition) 1869-70, "Gazelle" nach dem Südatlantik,dem Indischen und Stillen Ozean 1874-76, 1889 war die "Deutsche-Plankton-Expedition" mit der National, 1898/99 die "Deutsche Tiefsee-Expedition"mit der Valdivia unterwegs.
1901-1903 fand die bekannte"Gauss-Expedition"unter von Drygalski nach der Antarktis statt ; 1906/07 fuhr die "Planetexpedition" nach Westafrika und Madagaskar (Planet auch in den Insischen Ozean!). 1911 umschiffte die Möve Afrika, 1911/12 war die "Deutschland-Expedition" nach der Antarktis unter Wilh. Filchner und nach dem Kriege befand sich der Meteor auf Kundfahrten. Von anderen Ländern sind folgende Expeditionen besonders zu nennen: Osterreich, Novara-Expedition 1857/59 durchs Mittelmeer nach dem Südatlantik,dem Indischen und Stillen Ozean, "Pola-Expedition" 1891-93 nach dem östl. Mittelmeer. England entsandte ausser der schon genannten,berühmten Challanger-Expedition 1872-76,die durch alle Weltmeere fuhr, 1868 die"Lightning-Expedition" unter Wywille Thomson in den Nordatlantik, 1902-04 die "Scotia-Expedition" unter William Bruce nach der Antarktis, 1903-05 fuhr zum ersten Male die "Discovery" unter Scott gleichfalls dorthin. Holland rüstete 1899/1900 die "Siboga-Expedition" aus, Schweden 1878 die "Vega-Expedition"

elektrisch betriebenen "Lukas-Lotmaschine", die mit einer Klaviersaite arbeitet oder des Echolotes (Schallvermessung!), von dem es, ausser dem von Behm erfundenen noch verschiedene Systeme gibt (z.B. Atlaslot). Bei diesen Echoloten wird ein Schall zum Meeresgrund gesendet, dort reflektiert und von einem Mikrophon am Schiffskörper wieder empfangen. Durch ~~Berechn~~ Berechnungen lässt sich dann die Entfernung des Meeresgrundes feststellen und mit Hilfe zahlreicher Echolotungen die Gestalt des Meeresbodens aufnehmen. Um die Temperaturen in den verschiedenen Tiefen untersuchen zu können bedient man sich der Tiefenthermometer, z.B. des Miller-Casella-Extremthermometers, meist einer Art Kippthermometer ähnlich den Fieberthermometern, die gleichfalls den Quecksilberfaden konstant halten. Für die verschiedenen Wasserschichten hat man Wasserschöpfer, die verschliessbar sind und die man gleichfalls umkippt, in Serien angeordnet und hat hiefür dann die "Umkipp-Wasser-Serienschöpfer" oder "Serienmaschinen" geschaffen. Für die Feststellung der Wasserbewegungen in der Tiefe verwendet man vom verankerten Schiff aus die von Ekman angegebenen Repetierstrommesser. Einen Ehrenplatz unter den Ländern, welche Forschungsschiffe aussandten, nimmt Deutschland ein, sind doch u.a. die Fahrten des Vermessungsschiffes Meteor zur Untersuchung des Atlantischen Ozeans (1925-27) und (1937-38) mit die erfolgreichunter Nordenskjöld, dem zum ersten Male die "Nordost-Passage" um Europa-Asien gelang, 1876/78 war die norwegische "Vöringen-Expedition" nach dem Nordatlantik unterwegs, 1903-06 durchfuhr Amundsen auf der "Gojöa" die "Nordwest-Passage" und 1910 ~~11~~ betrieb die "Michael-Sars-Expedition" wesentlich Plankton-Untersuchungen. Dänemark stellte 1895/96 die "Ingolf-Expedition" nach Island und Grönland und 1902-04 war es die "Thor-Expedition", die das "Aalproblem" (Herkunft der Aale aus den Tiefen der Sargassosee!) klärte. Frankreich entsandte unter dem Ozeanographen Charcot Expeditionen mit den Schiffen "Français" und "Pourquoi pas?", wobei das letztere 1936 in nordischen Gewässern unterging. Von U.S.A. wurden 1873/-78 die "Tuscarora-Expedition" nach dem nördlichen Stillen Ozean und "Albatross-Fahrten" 1883-1925, später Albatross II. ausgeschickt. Belgien liess die "Belgica" 1897-99 nach der West-Antarktis in See gehen. Dies nur einige Namen aus der Geschichte der Meereskunde. Nicht ohne Bedeutung war auch die Legung der Uberseekabel für die Erkundung des Meeresbodens selbst.

Bei der Betrachtung dieses Meeresbodens muss man zwischen Gross- und Kleinformen unterscheiden. Zu den ersten gehört vor allem der Schelf. Das Land senkt sich nämlich am Saum der grossen Festländer nicht sofort in sehr grosse Meerestiefen hinab, sondern man findet zunächst einen, von einem verhältnismässig seichten Meere, der Flachsee, bedeckten, mehr oder weniger breiten Kontinentalsockel, den man eben Schelf nennt. Dieser findet für gewöhnlich sein Ende in einer Tiefe von circa 200 m, wo er knickmähnlich am steil zur Tiefsee absinkenden Kontinentalabhang beginnt. Der Schelf wird auf den Tiefenkarten der Atlanten durch eine helle Farbe angedeutet ; er ist besonders breit in Europa (die Nordsee z.B. ist eine Flachsee oder ein Schelfmeer), in Nord- und Ostasien, zwischen Hinter-Indien und Australien. Andere Grossformen, verhältnismässig flacher Natur - der Meeresboden ist wahrscheinlich überhaupt ebener als die Festlands-Oberflächen - sind in der Tiefsee zwischen 2440 und 5750 m zu finden. (Der Tiefseeboden umfasst 295 ~~000~~ Mill. qkm, das ist über die Hälfte der Erdoberfläche.) Die Vertiefungen ,die Tiefseegesenke, nennt man Tief, Becken, Mulden, Furchen, Gräben oder Rinnen, z.B. den Philippinen-Graben, in dem eine Tiefe von 10800 m, die grösste bisher gefundene, festgestellt wurde. Erhebungen unter Wasser (submarin) werden Plateaus(Tiefseetafeln), Schwellen oder Rücken geheissen, z.B. der Wyville-Thomson-Rücken zwischen Island und Schottland oder die sich durch den ganzen Atlantischen Ozean hinziehende Mittelatlantische Schwelle. Die Erhebungen im Ozean können auch Hochgebirgs-Charakter haben, so hat man auf der Meteorreise 1937 einen untermeerischen, submarinen Vulkan von 4840 m relativer Höhe ,nördlich von Madaira entdeckt, der aus einer Tiefe von 5000 m bis 160 m unter dem Meeresspiegel aufragt. Weitere, zu dem Kleinformen zu zählende, mit den Grossformen in Verbindung stehende Senkungen oder Erhebungen sind Kessel und Furchen ; als Kuppen werden steilere meist vulkanische Erhebungen bezeichnet, die sich in Tiefen von über 200 m befinden, während die bereits genannten Untiefen, Bänke etc. häufig bis 10 m unter den Meeresspiegel aufsteigen, somit der Schiffahrt ähnlich den Riffen sehr gefährlich werden können.

Der von den Nebenmeeren bedeckte, also noch zu den Festländern gehörige Meeresgrund, steht zu diesen in viel engeren Beziehungen als der Boden des offenen Meeres. Dies gilt besonders von den im allgemeinen weichen Ablagerungen des Meeresgrundes ; felsige Meeresböden sind verhältnismässig selten, so dass es mit den bereits erwähnten Instrumenten nicht allzu schwierig ist, Proben selbst vom Tiefseeboden zu bekommen. Man ist stellenweise in diesen bis zu zwei Meter Tiefe eingedrungen, u.a. mit Hilfe einer Art Bohrgeschütz. Es gelang Ch. S. Piggot kürzlich lückenlose Bohrproben von 3 m Länge aus Tiefen bis 1200 m in ungestörter Lagerung heraufzuholen. Bücklin berichtet darüber, dass durch Kartuschen-Explosion ein 3 m langes Stahlrohr von 7 cm Durchmesser, dem wieder eine herausnehmbare , dünnwandige Messingröhre einliegt, senkin den weichen Meeresgrund hineingetrieben wird. Da die Meeresboden-Absätze in grösseren Kontinentalfernen sehr langsam vonstatten gehen, gibt eine 3 m lange Bohrprobe über beträchtliche Bildungszeiträume Zeugnis. An den Ablagerungen, die den gesamten Meeresboden bedecken, sind in reichstem Masse die Reste von Lebewesen beteiligt, welche auch in der Tiefsee in einem ständigen Regen zu Boden sinken, deshalb muss auch auf die Lebewelt im Meere eingegangen werden. Mit ihr befasst sich die Thalassobiologie. Die Lebewelt besteht aus Gross- und Kleinformen, so des Pflanzen-, wie des Tierreichs. Wie im Meere die grössten Säugetiere vorkommen, so leben daselbst auch die grössten Algenformen, welche zu den umfänglichsten Vertreter des Pflanzenreichs überhaupt gehören. So gibt Wettstein für die Braunalge Macrocystis eine Länge von bis zu 200 m an. Diese grossen Pflanzen sind im Boden verankert. Sie können nur bis zu der Tiefe ,wohin das Sonnenlicht noch eindringt, leben ; sie kommen daher nur in küstennahen Gebieten vor. Im Gegensatz zu den Landgewächsen treten hier die höheren Pflanzen ganz zurück. Von letzteren sind zu erwähnen Seegras (Zostera marina) und der interessante, in den Gewässern der asiatischen Tropen vorkommende Enhalus acoroides ,welcher in Bezug auf das Blühen an die Gezeiten angepasst erscheint. Hauptsächlich Algen, Grünalgen, Braunalgen und Rotalgen, und zwar bes. deren Grossformen, bilden die untermeerischen Seewiesen oder

Tangwiesen. Die Braunalgen bevorzugen die kälteren Meere, während die oft eine äussert zierliche Gestalt besitzenden Rotalgen an die grösseren Meerestiefen mit geringerer Lichtintensität angepasst sind. Von den in Ostasien gedeihenden Rotalgen wird der in der Bakteriologie verwendete Agar-Agar gewonnen, während die an unseren Küsten wachsenden Braunalgen als Jodquelle wichtig sind. Von den Stürmen losgerissene Algenstücke bleiben oft recht lange lebensfähig. Das zeigt sich in dem schon dem Kolumbus bekannten Sargassomeer, wie die daselbst
genannt ~~nach der~~ häufigen Braunalge Sargassum natans. Von der Zentralamerikanischen Küste losgerissene Algenteile sammeln sich in einem ruhigen Gebiete des tropischen Atlantischen Ozeans, östlich von Florida und nordöstlich der Bahamainseln. Die festgewachsenen, oder an den Meeresboden gebundenen Lebewesen, Pflanzen und Tiere, werden zu dem Begriffe "Benthos oder Benthal" zusammengefasst. Die Küstenfauna nennt man Litoral, sie reicht bis zur Lichtgrenze, etwa bis zu 400 m Tiefe. Den im Benthos vereinigten Grossformen stehen die Kleinformen des Planktons, Pflanzen und Tiere (Phyto- und Zooplankton) gegenüber. Unter Plankton versteht man Lebewesen, die wohl durch mehr oder weniger lange Körperfortsätze schwebefähig sind, aber im Gegensatz zu den zum Nekton gehörigen Pflanzen und Tieren keine Eigenbewegung besitzen. Die kleinsten Formen rechnet man zum Nannoplankton

oder Zwergplankton. Es handelt sich ausschliesslich um einzellige Organismen, z.B. Kieselalgen (Diatomeen) oder die zu den Flagellaten gehörigen Coccolithophorideen, deren Zellmembranen Kalkplättchen (Coccolithen) eingelagert enthalten, welche zuweilen 3/4 des Globigerinenschlammes ausmachen. Zum Zoonannoplankton gehören die Radiolarien, Ptotozoen mit Kieselsäure-Stützgerüst, die Foraminiferen mit Kalkgehäusen, welche unge~~heuer~~mein häufig in Tiefseeablagerungen vorkommen(z.B. Globigerine bulloides). In Bezug auf die Ortlichkeit des Vorkommens steht dem Litoral das Pelagial gegenüber, letzteres die Gesamtheit der pelagischen oder Hochseefauna enthaltend, deren Hauptregionen die zirkumpolare Warmwasserregion sowie die zirkumpolar arktischen und antarktischen Regionen sind. Die Tiefseefauna wird als Abyssal bezeichnet ; zu ihr gehören Tiere, die mit Leuchtorganen, hervorstehenden Augen u.s.w. sog. Teleskopaugen, ausgestattet erscheinen, welche aber in der Lage sind, den ungeheueren Wasserdruck der Tiefe von mehreren hundert Kilogramm pro qcm auszuhalten. Selbst in 5000 m fristen noch etwa 150 Tierarten am Meeresboden ihr Dasein, abyssales Benthos. Das in den Tropen verbreitete Plankton nennt man Desmoplankton, das der Gemässigten Zone Styliplankton und das der arktischen Gewässer Trichoplankton. Für das Vorkommen der Kleinlebewelt ,von der wieder die grösseren und grössten Organismen leben, ist massgebend die Temperatur des Wassers und sein Gehalt an Phosphaten und Nitraten, die meist aus tieferen und kälteren Schichten stammen; auch darüber haben die Fahrten des Meteor 1925/27 und 1937 aufklärende Resultate gebracht. Das Plankton ist seinerseits wieder die Grundlage des Fischreichtums, so auch für das Vorkommen der grossen Seesäugetiere, der Wale. Der erstere findet sich vorwiegend im Bereiche der kalten Meere, die Wale werden fast ausschliesslich in den Polargebieten gejagt. Dass das Leben überhaupt im Meere entstanden ist, darüber besteht kaum ein Zweifel, aber die gallertige Masse, die man im Atlantischen Ozean in einer Tiefe von 4000-8000 m festgestellt hat und der man den Namen Bathybius Haeckelii gab ist nur eine anorganische kolloidale Ausfällung von Kalziumsulfat.

Die Ablagerungen, welche die Meeresböden bedecken, die sog. Limonage, werden nach Krümmel und Philippi nach der Ortlichkeit ihres Vorkommens eingeteilt in : 1) Litorale, landnahe Ablagerungen, 2) Hemipelagische Ablagerungen, die den Boden der Flachmeere (einschliesslich Kontinentalsockel) bedecken und 3) Eupelagische Sedimente, die sich auf dem Meeresboden der Tiefsee befinden. Die ersteren enthalten sehr viel terrigene Bestandteile ; diese stammen teils von Flüssen, die dem Meere ständig Material von den Festländern zuführen, teils von den Küsten, von denen sie durch die Tätigkeit des Meeres abgelöst werden. Die Bänke und Barren bestehen aus litoralen Ablagerungen; sie enthalten auch organische Stoffe und sind daher vielfach von dunkler Farbe. Sie bergen nicht selten angeschwemmtes Treibholz, Korallenriff-Sande u.s.w.. Am weitesten ins Meer hinausgetragen wird der feinste Schlamm, während die gröberen Bestandteile in der Nähe des Strandes liegen bleiben. Durch Verkittung von Muschel- und Schneckenschalen, und Karallenresten entsteht der sog. "jüngste Meerkalk". In der Mangrove bilden die litoralen Ablagerungen eine graubraune, zähe, infolge der vielen, verwesenden organischen Stoffe überriechende Masse. Die hemipelagischen Sedimente, die den Boden der Schelfmeere und des Kontinentalabhanges als Flachseeablagerungen in grösserer Küstenferne bedecken, leiten vom Kontinentalschlamm zu den Tiefseeablagerungen über. Sie bestehen vielfach aus sandigem Schlamm und nach ihrer Farbe werden sie als blauer, roter (Rotschlamm) oder grüner Schlick bezeichnet. Sie weisen bereits die Schalen von kleinen Organismen z.B. von Foraminiferen auf. Die Ablagerungen der Tiefsee enthalten in der Regel keine Bestandteile mehr, die von den Kontinenten stammen ; nur das von den äquatorwärts ziehenden Eisbergen mitgeführte Material macht eine Ausnahme. Die Eisberge schmelzen in den wärmeren Zonen ab und die in ihnen enthaltenen Gesteinstrümmer sinken zu Boden. Vielleicht haben sie Anteil am Aufbau der Neufundlandbank, weil dort besonders viele Eisberge landen. Auch die eupelagischen Ablagerungen bilden eine weiche Schlammasse. Sie sind teils biogenen, teils abiogenen Ursprungs. Die ersteren bestehen aus Kieselschlick, wenn sie von Kieselalgen, von Diatomeen oder von Radiolarien stammen oder aus kohlensaurem Kalk (Kalkschlick), wenn sie sich von Coccolithophorideen oder Foraminiferen, deren wichtigste Vertreter die Globigerinen sind, ableiten. Man spricht dann von Diatomeen- oder Radiolarienschlamm, bezw. von Cocolithen- oder Globigerinenschlamm oder Globigerinenschlick. Gerade dieser bildet einen Hauptbestandteil der eupelagischen Ablagerungen. Der Globigerinenschlamm bedeckt fast ein Drittel des gesamten Meeresbodens ; man findet ihn bis zu 2500 m Tiefe. In etwa 2700 m lagert der Pteropodenschlamm, der von mit den Globigerinen verwandten Protozoen stammt. Die tiefsten Stellen des Tiefseebodens, die Tiefseegesenke, sind mit rotem Tiefseeton, der weder pflanzlichen noch tierischen Ursprungs ist, bedeckt. Die Tiefseefacies ist nach den Ergebnissen der Tiefseeforschung sehr einförmig ; ihre Bildung geht ausserordentlich langsam vonstatten.

Das Meerwasser stellt eine sehr verschieden mächtige, flüssige Schicht auf unserer Erde dar. Es ist im Gegensatz zum Seewaser (Binnenwasser) ,das auch die grossen Binnen-

seen erfüllt,eine Salzlösung; in diesem Salzwasser wurden bisher mehr als 32 Elemente festgestellt. Unter Salzgehalt versteht man die Menge fester Stoffe,die in einem Kilogramm Meerwasser sich gelöst befinden ; der Salzgehalt bestimmt auch das spezifische Gewicht , Magnesiumverbindungen bedingen seinen bitteren Geschmack. Als Normalsalzgehalt gelten 35 % . In Gegenden mit ausreichender ~~Sonnenwärme~~ Besonnung wird aus dem Meerwasser,in den sog. Salzgärten,durch Ableitung und Eindampfung durch die Sonnenwärme Speisesalz gewonnen.
Der Salzgehalt des Meerwassers ist nicht gleichmässig. Er steigt am höchsten im Persischen Golf mit 41% und sinkt im Finnischen Meerbusen bis auf 2-3 % . Auch der Salzgehalt des Wassers im offenen Ozean erscheint ungleichmässig. Er ist in den Äquatorialgegenden in den oberen Schichten am höchsten,nimmt dann nach der Tiefe zu ab und steigt dann wieder in etwa 1000-2000 m über dem Tiefseeboden. Wo in Form von Eis (in den Polargegenden) oder durch grössere Flüsse viel Süsswasser ins Meer gelangt,ist der Salzgehalt naturgemäss geringer,wo viel Wasser durch die Sonnenwärme verdunstet,ist er höher,bes. wenn noch wenig Zuflüsse vorhanden sind,wie im Europäischen Mittelmeer. Die Linien, welche die Stellen mit gleichem Salzgehalt des Wassers verbinden,werden als Isohalinen bezeichnet. Der Ausdruck "katohalin" bedeutet,dass tiefere Wasserschichten salzreicher

sind als höhere. Auch die Verteilung der einzelnen Bestandteile des im Meerwasser gelösten Salzes ist nicht gleichmässig, so schwankt beispielsweise der Nitrat- und ~~Phosphatge~~ Phosphatgehalt innerhalb der Wasserschichten; hievon war ja schon andeutungsweise bei Besprechung des Planktons die Rede. Für dieses, wie überhaupt für die Lebewesen im Meere ist der Gasgehalt, besonders natürlich der ~~die bewegte,~~ Sauerstoffgehalt von grosser Bedeutung. Die Meeresoberfläche, besonders die bewegte, nimmt Luft auf und zwar mehr Sauerstoff als Stickstoff, vor allem, wenn das Wasser kalt und salzarm ist. Das ~~Stick-Sto~~- Stickstoff-Sauerstoff-Verhältnis ist im Meere 63% : 34% , in der Atmosphäre bekanntlich 78% : 21% . Infolge des Sauerstoffreichtums sind neben dem schon erwähnten Nährstoff- und Plankton-Gehalt die kalten Meeresgegenden (Polargebiete, Kalte Meeresströmungen) die Hauptfanggründe für die Hochseefischerei. Im allgemeinen enthält 1 Liter Meerwasser 3-8 ccm Sauerstoff. Dieser gelangt auch in die grössten Tiefen und ermöglicht auch dort noch ein reiches Tierleben. Auch Kohlensäure befindet sich im Meerwasser, in den tiefen Wasserschichten Schwefelwasserstoff, dort ist naturgemäss ein Leben unmöglich (Schwarzes Meer).

Der Salzgehalt und der Reichtum an festen Bestandteilen, also auch an Plankton ist massgebend für die Durchsichtigkeit des Meerwassers und die ~~Färbung~~ Farbe. Es war schon einmal die Rede davon, dass das Salz des Meerwassers colloidale Bestandteile des Süsswassers auszuflocken vermag; ebenso ist bekannt, dass ein an Plankton reiches Meerwasser einen anderen Farbton aufweist, als ein an Kleinlebewesen armes. Durchsichtigkeit des Wassers und Farbe des Meeres stehen in engstem Zusammenhang. Allgemein gilt, je wärmer und salzreicher das Meerwasser ist, desto klarer erscheint es und ein um so intensiveres Blau zeigt das Meer. In der Äquatorialzone, etwa zwischen dem 40. nördlichen und südlichen Breitegrad, ist das Meer blau, während es nach den höheren Breiten zu allmählich eine grünliche Färbung annimmt, infolge seines hohen Gehaltes an Plankton. Durch von grossen Flüssen eingebrachte Erdbestandteile kann es auch einen anderen Farbton erhalten. Das Gelbe Meer hat seinen Namen von den durch den Huang-ho, den "Gelben Fluss", ins Meer verfrachteten Lössteilchen. Der Name des "Roten Meeres" kommt wahrscheinlich von der in Massen auftretenden, einen rötlichen Farbstoff enthaltenden Alge Trichodesmium erythreum. Am klarsten ist das Meer in der Sargassosee; dort hat man eine Durchsichtigkeit von bis zu 66 m festgestellt. Mit Hilfe einer photographischen Platte hat man als äusserste Lichtgrenze 1700 m gefunden.

Die Temperatur des Meeres spielt für den Wärmehaushalt der Erde eine ausserordentlich wichtige Rolle. Als Wärmequelle kommt wesentlich nur die Sonnen-Einstrahlung in Betracht. In den Polargegenden mit ihrer Eisbildung ist die Wärme am geringsten. Ausser dem Inlandeis bilden sich auch schwimmende Eisdecken. Das Meerwasser selbst gefriert gleichfalls in den Polargebieten. Sein Gefrierpunkt liegt, weil der einer Salzlösung, bei -1,9° C . Bei der Eisbildung wird das gelöste Salz als sog. Rassol in Form von Kristallen auf dem Eise ausgeschieden, oder es wird ins noch nicht erstarrte Meerwasser abgegeben. Das Eis schützt als schlechter Wärmeleiter das darunter befindliche salzreiche Wasser vor dem Einfrieren. Das Meereis kann zusammenhängende Eisfelder bilden, oder als Treibeis, Trifteis, Scholleneis, Tellereis oder Pfannenkucheneis (wenn Eisplatten durch Drehung sich abrunden), mehr oder weniger grosse auf dem Meere schwimmende Stücke bilden, die von Wasser und Wind bewegt werden. Durch letzteren zusammengetriebene, aufgetürmte Eismassen werden als Packeis oder als Presseis bezeichnet ; Eispressungen sind für die Schiffahrt sehr gefährlich. In der Antarktis liegen durch den Südpolar-Kontinent und durch das Fehlen von grösseren Landmassen nördlich von diesem die Verhältnisse anders als in der Arktis. Dort kommt es zur Bildung von Schelfeis, d.i. Eis, das auf seichtem Meeresgrund, dem Schelf des Südpolar-Kontinents aufsitzt und zur Entstehung des schwimmenden Barriere-Eises oder der Eisbarriere.

Der helle Schein, den die Eisfläche durch Reflexion des Sonn- oder Tageslichts am Horizont verursacht wird im Gegensatz zum Seeblink als Eisblink bezeichnet.

Die stärkste Wärme-Einstrahlung findet in den äquatorialen Zonen statt. Hier kann sich das Meerwasser, wenigstens in den oberen Schichten bis auf 35,6° C, die man im Persischen Golf gemessen hat, erwärmen. Im Europäischen Mittelmeer hat man nach Obst-Supan bei Neapel in einer Tiefe von 3000 m noch eine Temperatur von + 13,27° C festgestellt, während das Weltmeer aus später zu besprechenden Gründen nur ~~////////////////~~ + 1 - 2 ° C bei 5000 m aufweist. Natürlich ist die Temperatur des Meeres an der Oberfläche höher als in der Tiefe. Sie ist auch ~~immer~~ meist um einige Grade höher als die umgebende Luft. Der Ozean bedeutet einen riesigen Wärmespeicher ; er wirkt ausgleichend auf Temperaturgegensätze, indem er Wärme abgibt. In unseren Breiten verhindert die ozeanische Luftzufuhr allzu strenge Winterkälte. Andererseits sind z.B. in Irland, das ja das Meeresklima am ausgeprägtesten in Europa zeigt, hohe Sommertemperaturen unbekannt und trotzdem können an der Westküste Palmen im Freien überwintern. Während die Linien gleicher Temperatur im Meeresspiegel bekanntlich, wie auf dem Lande, Isothermen, besser hier Meeres-Isothermen, heissen und diejenigen gleicher Tiefe Isobathen, so versteht man unter Isothermobathen

Linien gleicher Temperatur in bestimmten Tiefen. Normaler Weise müssten in den Aquatorialbreiten hohe, in den Polargebieten niedrige Meerestemperaturen vorhanden sein. Jene Verhältnisse werden aber gestört durch die Meeresströmungen. Durch diese gelangt warmes Wasser bis weit in Polarregionen, wie z.B. durch den Golfstrom, dessen Ausläufer noch in Spitzbergen und Nowaje-Semlja nachzuweisen sind. Der Golfstrom ist bekanntlich die Ursache für das im Vergleich zu Nordamerika viel günstigere Klima Europas, woselbst im nördlichen Norwegen noch Getreide und Obst, begünstigt durch die lange Sonnenscheindauer zur Reife gelangt ; an der Ostküste Nordamerikas dagegen zieht der kalte Labradorstrom entlang und trägt die Eisberge bis weit hinein in niedrige Breiten, bis zum 40. Grad. Die niedrigen Temperaturen, die in den grossen Tiefen des Weltmeeres herrschen, beruhen auf dem Einströmen kalten Polarwassers; wir werden darauf noch zu sprechen kommen. Als katotherm bezeichnet man die Erscheinung dass eine Schicht wärmeren Wassers sich unter einer solchen kälteren befindet.

Da die Hydrosphäre eine Flüssigkeitsschicht darstellt, kann sie beweglich auf äussere Einflüsse antworten. Die in Ruhe befindlich gedachte Meeresfläche, auch Meeresspiegel oder Meeresniveau, wird als der Nullpunkt für die Höhenbestimmung des Festlandes und seiner Erhebungen angenommen und man spricht dann von so und so vielen Metern Meereshöhe, bezw. ü.d.M. oder u.d.M.. Da nicht alle Meere absolut das gleiche Niveau besitzen, z.B. ist der Spiegel des Europäischen Mittelmeeres etwas niedriger wie der des Atlantischen Ozeans, so ergeben sich im Nullpunkt der einzelnen Länder kleine Differenzen ; Deutschland richtet sich nach der Nordsee. Das Meer ist in Wirklichkeit fast niemals in Ruhe. Seine Bewegungen sind dreifacher Art, die aber in Zusammenhang mit einander stehen. Es gibt zeitweilige, periodische und dauernde Wasserbewegungen. Die ersten sind die Wellen, meist Windwellen, die zweiten die Erscheinungen von Ebbe und Flut oder die Gezeiten und die dritten sind die Meeresströmungen, von denen schon mehrfach die Rede war.

Die häufigste Ursache für die Wellenbewegung des Wassers ist der Wind. Sie wurde eingehend untersucht von Graft Larisch-Moennich. Durch ~~diese~~ Reibung der bewegten Luft an der Wasseroberfläche wird auf dieser ein Bewegungszustand verursacht, den man als Seegang bezeichnet(Windsee). Ernst Rottok ist bekannt durch seine Versuche mittelst ausgegossenen Öls den Seegang zu beruhigen. Es sind anfänglich kleine Kräuselwellen und aus diesen gehen letzten Endes die hohen Meereswogen hervor. Glaubte man in früheren Jahrhunderten ~~zehnten~~ an phantastische, über haushohe Wellen, so war es in den letzten Jahrzehnten üblich geworden, die Existenz solcher

Riesenwogen völlig zu bezweifeln. Jüngste genaue, stereophotogrammetrische Messungen Weinblums im Nordatlantik 1936 haben dagegen Sturmwellen-Höhen von durchschnittlich 14 bis äusserst 16 m und Wellenlängen (von Kamm zu Kamm gemessen) von 200-300 m ergeben. Weinblum glaubt nun, dass im Nordatlantik, geschweige denn in Südmeeren, noch grössere Wellenausmasse möglich sind, er glaubt an Maxima von über 20 m Höhe. Am furchtbarsten äussert sich die durch den Wind bewegte See im Bereiche der Wirbelstürme mit ihren Wasser- oder Meerhosen, bes. bekannt sind die ostasiatischen Taifune. Die Meereswellen lassen Wellenberg und Wellental erkennen, wobei die einzelnen Wasserteilchen geschlossene Kurven in der Vertikalen, Orbitalbahnen geheissen, beschreiben (Orbitalbewegung) ; sie kehren also wieder in ihre Ausgangsstellung zurück und es pflanzt sich nur die Bewegung fort. Die Fortpflanzungsgeschwindigkeit ist stets geringer wie die des Windes ; die Meereswogen können sich riesig weit fortsetzen in Gebiete wo längst kein Wind mehr weht. Man bezeichnet diese Erscheinung als Dünung (hohle See). Der stärkste Wellengang tritt wahrscheinlich im Gebiet der landarmen Südsee, am Südende von Südamerika ,in der Gegend von Kap Horn auf.

Eine Veränderung erleiden die Wellen, wenn das Meer an Tiefe verliert, bes. in der Nähe der Küsten. Es treten dann Erscheinungen auf, die man als Brandung bezeichnet.

Durch Berührung der Wellen mit dem Meeresgrund kommt es zu Veränderungen der Orbitalbahnen. Die Wellen türmen sich hoch auf, überstürzen sich und brausen mit weissen Schaumkronen an das Land heran. Sie bilden die sog. Sturzsee oder Grundsee und die Brandungswogen werden als Roller, Brecher, Sturzwellen bezeichnet. An der Flachküste Westafrikas, an der Guineaküste, rollt die Brandung in Form bis zu 350 m langen und 200 m in die Tiefe reichenden Sturzwellen an den Strand heran und erschwert das landen. Diese Strandbrandung führt den Namen Calema ; sie wird auf Dünung im Atlantischen Ozean zurückgeführt, da Wind hiebei meinst fehlt. Am eindrucksvollsten ist die Brandung an Steilküsten, dort arbeitet die Abrasion zerstörend auf eine Zurückverlegung der Steilküste hin ; die Felswände werden dabei gerne in einer Hohlkehle oder Brandungskehle (vergleiche Küste!) unterspühlt und die Bruchstücke nach dem Einsturz durch die Wogen landeinwärts getragen. Es bleibt dann eine flache, nur wenig unter dem Meeresspiegel befindliche Brandungsplatte übrig. Der Anprall der Brandung ist so stark, dass er sich mit Hilfe der hochempfindlichen Seismographen weit im Binnenlande noch nachweisen lässt. Die zwischen den einzelnen Brandungswellen stattfindende, rückläufige Wasserbewegung wird als Soog (Nachstrom) bezeichnet, da sie eine gewisse Saugkraft besitzt. Die Reflexion (Reflux) der Wellen am Kliff wird als Widersee bezeichnet. Unterstützt der Sturm die Brandung, bes. während der Flut, so kommt es zu Stauerscheinungen, zur Sturmflut, die am Lande furchtbare Verheerungen anzurichten vermag. Heftige Wellen, die seismischen oder Stosswellen der Erdfeste werden durch Seebeben, durch unterseeische (untermeerische) Vorgänge hervorgerufen. Das furchtbarste Seebeben, das man kennt, war verursacht durch den Einsturz des Vulkanes Krakatao 1883. Damals hat eine ungeheure seismisch bedingte Flutwelle, die man sogar noch in Irland hat nachweisen können, in einem weiten Umkreis der Ausgangsstelle alles Leben zerstört. In abgeschlossenen Wasserbecken können, durch Windstösse verursacht, stationäre, stehende Wellen, Schaukelwellen auftreten. Von der Ostsee sind solche bekannt unter dem Namen Seebär (Bare) ,von brasilianischen und nordspanischen Küsten als Resaca, der Italiener nennt ~~sie~~ solche dem Seebär ähnelnde Erscheinungen Marrobbio, der Japaner Yota.

Periodisch verlaufende Wasserbewegungen, Heben und Senken des Meeresspiegels, gewissermassen dem Atmen vergleichbar, sind die Gezeiten, die sich an den Küsten als ein sich in bestimmten Zeitabschnitten immer wiederholendes Vordringen und Zurückziehen des Meeres äussern, die Erscheinung von Flut und Ebbe (Tiden). Es handelt sich also tatsächlich um eine Vertikalbewegung ,die sich nur an den Küsten als Horizontalbewegung, Gezeitenbewegung(man nennt sie Gezeitenstrom) äussert. Die vorgedrungene See heisst bekanntlich/ Flut, Meeresflut, man spricht von "überfluten", Flutstrom, womit man das Anrücken der Flut meint ; Flutwasser, Flutwelle(Wanderwelle), Sprungwelle sind gebräuchliche Ausdrücke, weil die Flut vielfach in Form einer mehr/ oder weniger lang sich hinziehenden Wassermauer erscheint. Besonders eindrucksvoll ist die Flut an den Trichtermündungen ,den Astuaren (s.a. Küste") grosser Ströme, z.B. im Tsien-Tang-Kiang (Bucht von Hangtschou). Diese Flutwelle, in vielen Fällen eine Flutbrandung, hat verschiedene Namen gefunden. Man heisst sie Stürmer, Mascaret (Seine) ,woselbst die Flutwelle an sich La Barre angesprochen wird, ~~Raz~~ Marée (Raz de Marée) der Gironde-Mündung, Bore der Gangesmündung, Pororoca des Amazonas. Die Flutwelle bewegt sich, durch die Ufer eingeengt, mit grosser Geschwindigkeit stromaufwärts (im Tsien-Tang-Kiang mit 6 m/Sek.) ; wo sie ihr Ende erreicht, ist die eigentliche Grenze des Meeres. (Als Meeresgebiet werden alle Wasserläufe des Binnenlandes zusammengefasst, die ihr Wasser einem bestimmten Meere zuführen ; so gehört zum Meeresgebiet der Nordsee der Rhein mit allen seinen Nebenflüssen). Zur Messung der Flut bedient man sich der Hochseepegel oder sonstiger Flutmesser, darunter ~~die~~ der kompliziert gebauten Limnimeter oder Marimeter (s.a. "Fluss") und man bestimmt damit die Fluthöhe der Gezeitenströmung. Die Zeit während der das Meer sich zurückgezogen hat, nennt man Ebbe ; man spricht auch von "verebben". Ebbe und Flut fasst man bekanntlich in dem Ausdruck Gezeiten oder Tiden zusammen, da sie sich nach bestimmten Zeitabschnitten immer wiederholen. Den höchsten Wasserstand nennt man "Hochwasser" mit Hochflutgrenze, den niedrigsten "Niedrigwasser". Den Unterschied zwischen Hoch- und Niedrigwasser heisst man den Gezeitenhub, Tiden- oder Fluthub (Hub der Flut), den halben Tidenhub "Amplitude". Innerhalb von 24 Stunden 50 Minuten werden beide Grenzwerte zweimal erreicht ; d.s. die halbtägigen Gezeiten(Wiederzeit gleich Wiederkehr der Gezeit). Der Vorgang ist der, dass nach der Ebbe das Wasser allmählich steigt und sich in Form des bereits erwähnten Flutstroms dem Strande nähert. Ist der Höchststand erreicht und eine Periode des Stillstandes "Stillwasser"(Stillwater, Stauwasser) vorüber, so sinkt der Meeresspiegel allmählich, es tritt ein Stromwechsel oder Kentern ein, der Ebbestrom beginnt, das Meer kehrt in seine Ausgangsstellung zurück. ~~Em~~ Besonders an der holländischen Küste kennt man während der Flut zwei Hochwasser ; man nennt diese Erscheinung Agger, in England Leaky geheissen. Auf dem offenen Meere sind die Gezeiten nur wenig spürbar, nur in nicht zu weiter Entfernung von der Küste wird man den Flutwechsel an der Richtungsänderung des Gezeitenstromes bemerken können, dessen Geschwindigkeit 20-30 cm/Sek.

beträgt. Gezeiten-Erosion machte und macht u.a. an der deutschen Nordseeküste sich geltend. Im Wattenmeer bleiben nur die Gezeitenkolk-Rinnen, Vertiefungen in dessen Boden, auch während der Ebbe mit Wasser gefüllt.

Verursacht werden die Gezeiten durch die Anziehungskräfte von Mond und Sonne, wobei die des ersteren, weil näheren, eine Mondflut hervorbringen, die mehr als doppelt so hoch ist, wie die Sonnenflut. Dass innerhalb von 24 St. 50 Min. zweimal Flut und zweimal Ebbe eintritt, hat seine Ursache darin, dass als Folge der Zentrifugelkraft der rotierenden Erde auf der dem Monde bezw. der Sonne abgewandten Erdhälfte eine zweite Flut auftritt, die allerdings um ein Dreiundvierzigstel niedriger ist. Man nennt die durch die Himmelskörper direkt erzeugte Flut Zenith-Flut, die durch die Fliehkraft der Erde hervorgerufene Nadir-Flut (mit diesen Fragen hat sich zuerst Newton beschäftigt und ist dabei von der Annahme ausgegangen, die Erde sei nur von Wasser bedeckt; Newton'sche statische Theorie). Vereinigen sich die Wirkungen von Mond und Sonne, dann ist die Flut am höchsten ; man bezeichnet sie dann als Springflut oder Springtide (mit Spring-Hochwasser oder Spring-Niedrigwasser). Diese tritt ein bei Neumond ; dann wirken Mond und Sonne auf die Zenith-Flut und bei Vollmond ,dann beeinflusst der Mond die NadirFlut und die Sonne die Zenith-Flut. Bei

Halbmond, wenn die Anziehungskräfte von Mond und Sonne senkrecht zu einander stehen, ist die Flut am geringsten. Man nennt sie Nippflut (Nipptide, taube Flut, taube Gezeit). Durch die Trägheit des Wassers, durch die Unebenheiten des Meeresbodens und bes. durch die Festländer und Inseln treten Verzögerungen und Unregelmässigkeiten im Verlauf der Gezeiten ein, sodass Hochwasser bezw. Niedrigwasser nicht sofort mit dem entsprechenden Stand von Mond und Sonne übereinstimmen. Den verspäteten Eintritt der Springflut (das Alter der Tide) bezw. Nippflut, nennt man Spring- oder Nippverspätung, deren Werte mit den Mondphasen wechseln. Die Verzögerungszeit zwischen Neumond bezw. Vollmond und dem Eintritt des Hochwassers wird als "Hafenzeit" (engl. Establisment/, Hafen-Establisment) bezeichnet, die an verschiedenen Orten verschieden ist. Die Linien, die die Orte mit gleichzeitigem Hoch- bezw. Niedrigwasser, also die gleichzeitigen Flutstunden, vereinigen, sind die Flutstundenlinien (Flutlinien) Isorhachien oder engl. Cotidial-lines . Mit Hilfe von mathematischen Berechnungen, der sog. Analyse (Harmonischen Analyse) lässt sich der Eintritt der Gezeiten vorausberechnen. Man hat sogar Gezeitenmaschinen konstruiert (eine solche ist Thomsons und Roberts Tide-Predictor) und alsdann Gezeitentafeln zusammengestellt. Unter den in der Berechnung auftretenden Ungleichheiten seien die parallaktischen Ungleichheiten genannt, bedingt durch die ungleiche Entfernung des Mondes und der Sonne. Aber auch sonst sind auf der Erde Ebbe und Flut in Bezug auf Höhe des Ausmasses und auf die Zeit verschieden. Der Tidenhub kann sehr hoch sein ; das ist bes. da der Fall, wo das Meer durch das Land eingeengt ist ; die Hubhöhe wird dort durch Stauwirkung vergrössert. So beträgt in der Fundy-Bay an der Küste Neuschottlands während der Springzeit die Fluthöhe 16 m. Auf die Flutbrandung in den Flüssen wurde schon hingewiesen. Es gibt aber auch im Meere Stellen, die vollkommen gezeitenlos sind ; das sind die Amphidromien. Eine solche befindet sich z.B. im Kanal zwischen der engl. Küste von Yarmouth und der holländischen Küste in der Breite der Zuidersee , eine andere nordwestlich von Jütland. Die Fluthöhe nimmt nach der Amphidromie zu ab und ist an dieser Stelle Null. Man hat diese Erscheinung auch als "Drehstrom" bezeichnet, weil sich um die gezeitenlose Stelle die Eintrittszeit der Flut entgegengesetzt der Urzeigerrichtung wie im Kreise dreht. Man hat auch die Gezeiten als eine Wellenbewegung aufgefasst und die Amphidromien , die auch anderorts vorkommen, für eine Interferenzerscheinung gehalten. Es gibt auch als Folge der Gezeiten wirkliche regelmässige Strudel in der Nähe von Fjorden und engen Meeresstrassen. So in Norwegen, wo sie als Malströmmen (Malstrom), Masköströmmen oder Saltströmnen bezeichnet werden. Die ersteren beobachtet man bei den Inseln Voeröy , Maskensö der Lofoten, die letzteren an der Salten-Fjord-Mündung. Hierher gehören auch die seit Homer bekannten Strudel von Scylla und Charybdis an der Strasse von Messina im Europäischen Mittelmeer. Es gibt auch Gegenden, wo nur einmal im Tage Flut und einmal Ebbe auftreten ; solche Eintagstiden kennt man vorwiegend in Mittelmeeren, z.B. im Golf von Tonking und im Golf von Mexiko. Sehr starken Einfluss auf die Gezeiten ,insbes. auf die Fluthöhe hat der Wind. Wenn er das Wasser gegen das Land treibt, kann er durch Windstau die Fluthöhe steigern oder den Rücklauf verzögern ; auch auf die Eintritts~~-Zeit~~ von Hoch- und Niedrigwasser kann er einwirken (meteorologische Tiden). Man hat auch versucht, die Wasserhöhen-Differenz zwischen Hoch- und Niedrigwasser zu Kraftwerken auszunützen und Gezeitenkraftwerke gebaut. Man hält in Staubecken, bes. an Flussmündungen, das Hochwasser zurück und verwendet dann das Gefälle des Wassers ; bisher waren aber diese Werke nicht sehr lohnend. Über die Entstehung der Gezeiten gibt es sehr viele Theorien, am bekanntesten ist die von dem Engländer G.B. Airy aufgestellte Kanaltheorie. Die Kanaltheorie berücksichtigt zwar auch die Reibung ,denkt aber an eine Fortpflanzung ~~den Einfluss der Reibung auf die Gezeiten.~~ durch den kanalähnlichen Atlantik hindurch ; während die sog. "Flutreibungs-Theorie" eine bremsende Wirkung des

Gezeiten

Flutberges auf die Erdrotation annimmt.

Waren die Gezeiten periodische Vertikalbewegungen des Wassers, so sind die Meeresströmungen dauernde horizontale Wasserbewegungen und Wasserverschiebungen. Diese sind Erscheinungen grössten Ausmasses, welche vorwiegend oberflächennahe Schichten des Weltmeeres umfassen. Wie die Gezeiten können sie auf offener See (open Sea) schwer bemerkt werden, da Vergleichsmasse fehlen ; nur bei Schiffen, die draussen verankert sind, kann man die Strömungen mit Hilfe von Strommessern feststellen. Die Strombewegungen sind aber stark genug, dass feste Körper, Treibholz, grosse Schwimmfrüchte von den Tropen bis in die Polarzonen gelangen können. So gibt es in jenen eine etwa einen Meter lange, holzige Hülsenfrucht, Entada scandens, deren schwimmfähige Teilstücke öfters durch den Golfstrom nach dem hohen Norden Europas verfrachtet werden. Umgekehrt führt der Labradorstrom, wie bereits erwähnt, Eismassen als Eisberge von den Polargebieten nach wärmeren Gegenden. Die Meeresströmungen sind für die Schiffahrt sehr wichtig, denn durch sie werden die Fahrzeuge von ihrem Kurs abgelenkt. Man nennt diese Abtrift Schiffsversetzung. Unter "Besteck" versteht die Nautik die Bestimmung des Schiffsstandortes nach Länge und Breite auf hoher See. Wegen der ständigen Ablenkung der Schiffe vom Kurs durch die Meeresströmungen muss das Besteck immer erneut bestimmt werden. Geschieht dies durch astronomische Beobachtungen, so spricht man von astronomischem oder observiertem Besteck, wird es nur aus Kurs und Fahrtgeschwindigkeit berechnet, von gegisstem Besteck. Die Differenz beider heisst kurz "Besteckdifferenz". Die Angaben, welche die Schiffe über die Schiffsversetzungen machen, sind wichtig für die Feststellung des Verlaufs der Meeresströmungen. Dazu kommen noch die Ergebnisse, die von aufgefischten Flaschenposten stammen ; das sind Flaschen, die Zettel mit Angaben über Ort und Zeit der Aussetzung enthalten und die oft lange Zeit unterwegs sind, bis sie gefunden werden. Ferner wird der Verlauf der Meeresströmungen indirekt verfolgt durch Untersuchungen von Temperaturen, Salzgehalten ~~usw~~ u.s.w., da die Wassermassen diese beiden Werte lange Zeit festhalten ; auch der Planktonreichtum gibt Aufschluss. Wird in hohen Breiten eine verhältnismässig hohe Wassertemperatur gefunden, so kann man annehmen, dass das Wasser aus den wärmeren Äquatorialgebieten stammt, wie z.B. das warme Wasser des Golfstroms. Stellen auch die im gewöhnlichen Dienst des Seeverkehrs befindlighen Schiffe den oberflächlichen Verlauf der Meeresströmungen fest, so sind doch für die Untersuchung der Strömungen in tieferen Schichten des Weltmeeres (Tiefsee) Forschungsfahrten nötig, wie sie einst John Bachanan auf der Challenger-Expedition vorgenommen hat, man denke an die Deutsche Tiefsee-Expedition mit der Valdivia und besonders an die schon mehrfach erwähnten Meteorfahrten.

Es gibt innerhalb der ozeanischen Zirkulation zwei Arten von Meeresströmungen, die ganz verschiedene Ursachen haben. Die ersteren sind die Wind- oder Triftströmungen (Driftströmungen, Windtrift), welche durch die auf der Erde herrschenden hauptsächlichsten Luftbewegungen, die Passate und Monsune, sowie die in der Zone zwischen 60° und 35° südl. Breite wehenden Westwinde hervorgerufen werden und deren Wirkungsbereich nicht tiefer als 200 m sich geltend macht ; die andern sind die permanenten Gefällsströmungen, verursacht durch Druckunterschiede (verschiedenes spec. Gewicht, Salzgehalt, Temperatur u.s.w.), die in den grösseren und grössten Meerestiefen verlaufen. Wie die Atmosphäre hat man auch die Hydrosphäre in eine die oberen Schichten umfassende Tropossphäre und in eine Stratossphäre eingeteilt, die zur Unterscheidung von den gleichnamigen atmosphärischen Zonen als "marine" zubenannt werden. Die Triftströmungen bewegen sich in der Troposphäre, die Gefällsströmungen in der Stratossphäre. Beide Strömungsarten stehen in Zusammenhang mit einander ; wir werden Fälle kennen lernen, dass Tiefenwasser nach oben steigt und dann einen Oberflächenstrom bildet und umgekehrt, dass auch Oberflächenwasser in die Tiefe sinkt. Die Trift- und die Gefällsströmungen werden abgelenkt durch die Festländer (die letzteren auch infolge der Erhebungen auf dem Meeresboden) und durch die Rotation der Erde. Wenn man bei windstillem Wetter auf hoher See die glatte Wasserfläche von einem seltsamen Fleck abgelöst findet, und ~~so kann es~~ kein Wind diesen zu erklären vermag, so kann es sich bei einer solchen Kräuselung des Wasserspiegels um die Erscheinung der Kabbel, Kabbelung oder Stromkabellung handeln. Sie wird verursacht durch den Zusammenstoss verschiedener, gegensätzlich gerichteter Meeresströmungen; während man unter Mallungen die unstete, wechselnden schwachen Winde, Windgewell erzeugend, versteht. Für die Oberflächenströmungen gilt, dass durch die nach der Tiefe zunehmende Reibung der bewegten Wasserteilchen an den nicht bewegten sich der Strom allmählich aufzehrt. Seine Tiefengrenze bezeichnet man nach Ekman als "Reibungstiefe." Die Triftströmungen rufen eine Reihe weiterer Strömungen hervor, welche das durch die Bewegung weggeführte Wasser wieder ersetzen ; das sind die Ersatz-, Ausgleichs- oder Kompensationsströmungen, die in einem Winkel zu den erstgenannten stehen, oder diesen sogar entgegengesetzt gerichtet sein können. In Buchten treten sie häufig küstennah als Küstenströmungen auch kreisförmig auf und heissen Neere oder Neerströmungen , Reaktionsströme ; sie können aber auch aus der Tiefe als Auftriebswasser, das durch den Wind weggeführte Oberflächen-Wasser ersetzen. Das ist der Fall an der Westküste von Kalifornien, westlich der Kanaren und ähnlich in Südwestafrika und an der südamerikanischen Westküste. Dort bläst der Passatwind vom Festlande her, er ist ablandig und treibt das Oberflächen-Wasser vom Lande weg ; von unten her strömt dann kaltes Wasser nach. Zu den Kompensations-Strömungen gehören auch die Konvektions-Strömungen (Wärme-Ausgleichs-Strömungen) ; in ihrem Verlaufe kann warmes, leichteres Wasser unter spezifisch schwereres gelangen. Sie werden ausgelöst durch Druckdifferenzen in der marinen Stratosphäre, wobei auch Sommer und Winter eine Rolle spielen. Zu den Konvektions-Strömungen rechnet man u.a. die polaren Tiefenströmungen, deren ~~Temperatur~~ Verlauf, gestützt auf die wiederholt erwähnte Tatsache, dass die Wassermassen ihren Salzgehalt und ihre Temperatur sehr lange beibehalten, mit Hilfe der Isohalinen und Isothermobathen festgestellt wird. Man fand, dass auch in den Subtropen und Tropen in einer Tiefe von 700 m abwärts niedrige Temperaturen herrschen, wie sie in den hohen Breiten zu finden sind. (Defant nimmt deshalb an, dass die ozeanische Troposphäre einen beiderseits vom Äquator bis etwa zu den Subpolarzonen reichenden, einige hundert Meter mächtigen Gürtel bildet. In den hohen Breiten fehlt die Troposphäre und die Stratosphäre reicht bis zur Meeresoberfläche). Die Stratosphäre ist aus verschiedenen Schichten von Wasserkörpern aufgebaut, die sich durch Salzgehalt und Temperatur von einander unterscheiden, deren wagrechte Grenzen nicht an die Grenzen der beiden Hemisphären gebunden sind und die sich sowohl von Norden weit nach Süden als auch umgekehrt bewegen. Die Tiefenwasser der Stratosphäre stammen ausnahmslos aus hohen Breiten und behalten auch die dort herrschenden Temperaturen bei. Dadurch erklärt sich auch die Tatsache, dass selbst in den Tropen in der Stratosphäre die Meerestemperatur nur wenige Grade über Null beträgt, während z.B. im Europäischen Mittelmeer, wohin die kalten Strömungen nicht gelangen können, in 3000 m Tiefe noch, wie erwähnt, + 13,7° C gemessen werden. Zu solchen kalten Strömungen gehört im Atlantischen Ozean das salzärmere, aus den niederschlagsreichen Gebieten um den 50° C kommende, sog. subantarktische Zwischenwasser, zwischen 700 und 1000 m Tiefe, welches sich nordwärts bis etwa zum Wendekreis des Krebses bewegt. In Tiefen von 1200-3500 m zieht der nordatlantische Tiefenstrom von der Arktis nach Süden und in noch grösseren Tiefen bewegt sich der antarktische Bodenstrom mit seinem kalten, aber salzreichen, daher schweren Wasser weit nach Norden hinauf. Dazu schreibt Obst-Supan :" Es wird von Jahr zu Jahr deutlicher, dass die gewaltige Auskühlung der Tiefwasser-Schichten der Ozeane überhaupt zum ganz überwiegenden Teil letzten Endes das Werk der antarktischen Breiten und zwar rund um die Erde ist." Diese Erscheinung ist eine Folge der Landarmut in hohen südlichen Breiten. Ähnlich liegen die Verhältnisse in den anderen Ozeanen, soweit man sie bis jetzt kennt.

Im Bereich der Sargassosee gelangt warmes, salzreiches Wasser aus der Troposphäre in das kalte Wasser der Stratosphäre. Untersuchungen am Golfstrom haben gezeigt, dass Meeresströmungen, die man bisher nur als "oberflächlich" angenommen hat, noch in grössere Tiefen reichen und gerade auf diese Tatsache wird der ausserordentlich starke Einfluss dieser Meeresströmung auf das Klima Europas zurückgeführt. Der Golfstrom besitzt ja eine Länge von 1200 km . Er besteht aus verschiedenen Teilen : Der Floridastrom bewegt sich vom Golf von Mexiko bis Kap Hatteras ; hier, eingeengt durch Inseln entwickelt er in der Enge von Bimini eine Geschwindigkeit von bis zu 200-250 m/Sek. (das bedeutet, dass ein Schiff ohne Eigenkraft innerhalb 24 Stunden 200 km bewegt werden würde). Der zweite Teil des Golfstroms geht mit viel langsamerer Strombewegung über den Ozean zu den Azoren. Der dritte Teil zieht als Irischer Strom bis zur ~~Faröer~~ Fär-Öer-Shetland-Schwelle und der letzte Teil streicht als Atlantischer Strom längs der norwegischen Küste und reicht bis Spitzbergen und Nowaja-Semlja. Durch die Arbeiten von

Wüst ist so der Golfstrom eine der bestbekannten Meeresströme und deshalb, sowie wegen seiner grossen Bedeutung für Nordeuropa ist er hier etwas ausführlicher besprochen worden.

Der Verlauf der Meeresströmungen wird in den Atlanten gern mit roter und blauer Farbe wiedergegeben. Die rote Farbe deutet an, dass es sich um eine warme, also aus den Äquatorialgegenden stammendes Wasser führende Strömung, die blaue Farbe, dass es sich um eine kalte Strömung mit Polarwasser handelt. Die ~~Betrachten~~ wichtigsten warmen Strömungen sind die beiden, durch die Passatwinde erzeugten Äquatorial-Strömungen, die nördliche und die südliche, beide ostwest gerichtet. Im Atlantischen Ozean gehört der Karibenstrom, der Vorläufer des Golfstroms, zu ihnen, dessen Wasser sich wahrscheinlich im Golf von Mexiko stauen (Staustrom) und mit eine Veranlassung sind zu den grossen Geschwindigkeiten des Floridastromes. Im Stillen Ozean mit seiner grossen Breite erreichen sie ihr grösstes Ausmass. Zwischen ihnen bewegt sich als Kompensationsstrom, entgegengesetzt westost gerichtet (Gegenstrom) der Äquatoriale Gegenstrom. Die Äquatorialströme werden durch die Festländer abgelenkt und sie verlaufen dann meist längs ihrer Ostküsten und ziehen in hohe Breiten. Dem Golfstrom des Atlantik entspricht im Pazifik der Kuroschio-Strom (auch Kuroschiwo genannt).

Auf der südlichen Halbkugel ~~längs~~ bewegt sich längs der ostafrikanischen Küste der Moçambique- und Agulhasstrom, längs der Ostküste von Südamerika der Brasilstrom und bei Australien und Neuseeland verlaufen ähnliche Strömungen. In Ostindien wechselt mit den Sommer- und Wintermonsunen die Richtung der warmen Monsunströme. Das wurde von der mittelalterlichen Schiffahrt der Araber und Chinesen ausgenützt, indem sie die eine Stromrichtung zur Ausreise, die andere zur Rückkehr verwendeten. Dieser Richtungswechsel des Monsunstromes, entsprechend dem Richtungswechsel des Monsunwindes, ist ein Beweis für die Windherkunft der Triftströme. Den warmen von Ost nach West gerichteten Aquatorial-Strömungen entsprechen in den Subpolargebieten die kalten subpolaren und polaren Westströme oder Westwind-Triften, verursacht durch die dauernd wehenden, "braven Westwinde". Sie erreichen in der landarmen Antarktis ein weit grösseres Ausmass als in der Arktis. Auf der südlichen Halbkugel zieht ein Ast der Westwind-Trift an Südamerikas Westküste nordwärts als Peru- oder Humboldt-Strom. Am Kap Horn entsendet der Kap-Horn-Strom einen Zweig, den Falkland-Strom an Argentiniens Küsten entlang, dem an Afrikas Südwestküste der Benguella-Strom entspricht. Auf der Nordhalbkugel sind die kalten Grönland- und Labrador- und Oyaschio-Ströme zu nennen. Die genannten kalten Strömungen stehen alle mit den Polarzonen in Verbindung ; anders steht es um den Kalifornien-Strom (Californien-Strom) und den Kanaren-Strom ;sie werden als Kompensations-Strömungen von kaltem aufsteigendem Tiefenwasser gespeist.

Die weithin wirksamen Meeresströmungen ~~bes. Auf~~, welche oftmals nährstoffreicheres Tiefenwasser in die stärker belichteten Oberflächen-Zonen schaffen, werden neuerdings, bes. von französischen Forschern, im biologischen Sinne mit einer Aufpflügung der Ozeane verglichen ; deutsche Biologen sprechen sogar von einer Art frisch gedüngter Wiese.

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6) O. Krümmel :"Handbuch der Ozeanographie." Stuttgart 1911.
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~~11~~ 13) A. Schuhmacher:" Ozeanographie "Handw...VII.
~~12~~ 10) G. Schott: "Geographie des Atlantischen Ozeans"
11) " : "Das Meer" in Obst-Supan, Grundzüge der Phys. Erdk. 8.Aufl. Berlin 1934.
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Der grosse Schachtelhalm.

(Equisetum maximum Lam.)

Nicht nur an tropischen Gewächsen,auch an der ~~heimischen~~ der gemäßigten Zonen Pflanzenwelt kann man interessante Studien machen.([redacted]).An Hand der beigefügten Photographien,die im freien Gelände aufgenommen wurden,sei einiges über den "grossen Schachtelhalm" berichtet.

Diese schöne,stattliche Pflanze wächst an feuchten Stellen;man findet sie in Europa im Alpenvorlande verhältnismässig häufig.(Die Aufnahmen stammen ~~von~~ aus dem Isartale südlich von München;aus der Gegend vom "Bruckenfischer") Etwa im ~~März~~ e April kommen aus dem Boden die Sporen liefernden Sprosse,die "fertilen",die "fruchtbaren"(im Gegensatz zu den später erscheinenden "sterilen","unfruchtbaren"),hervor.(Abb.1.).Die Schachtelhalmgewächse gehören zu den "blütenlosen" Pflanzen;sie bringen daher auch keine Samen hervor. Mit dem Worte "Samen" wird im Pflanzen- und im Tierreich etwas Grundverschiedenes bezeichnet.Während man hier unter "Samen" die männlichen Geschlechtszellen versteht,sind dort die "Samen" - Pflanzenkinder,d.h. es sind fertig entwickelte Pflänzchen,die eine kleine Hauptwurzel,sowie die ersten Blättchen besitzen und ausserdem mit Nährstoffen ausgerüstet sind, da sie sich selbständig noch nicht ernähren können.Diese Pflanzenkinder sind durch eine mehr oder weniger dicke Samenschale vor Schädigungen geschützt.So etwas gibt es bei den Schachtelhalmen und den übrigen "blütenlosen" Pflanzen nicht.

Der Lebenslauf einer Schachtelhalm-Pflanze ist folgender:Er beginnt mit einer grünen Kugel,einer "Spore".Die "blütenlosen" Pflanzen vermehren sich durch Sporen;d.s. einzellige,kugelige Gebilde mit einer derben Aussenhaut.Das Wort "Spore" ~~bedeutet~~ stammt aus dem Griechischen und bedeutet eigentlich "Saat".Wir haben hier den Fall,dass sich die Bedeutung eines Wortes geändert hat.Das kommt öfters vor.So ~~war~~ z.B. "Divan" ursprünglich eine arabische Schreibstube,dann bezeichnete man damit eine gepolsterte Sitzgelegenheit und zuletzt wurde eine - Gedichtsammlung daraus.Goethe hat uns den "west-östlichen Divan" geschenkt.

Aus der Spore entwickelt sich ein winzig kleiner,unauffälliger grüner Pflanzenkörper,der männliche und weibliche Geschlechtszellen hervorbringt. Wenn nun die letztgenannten durch die ersteren befruchtet werden,so entstehen die Schachtelhalm-Pflanzen.Diese besitzen ein weitverzweigtes,ausdauerndes unterirdisches Sprosssystem,das sich ziemlich tief im Boden befindet.Von diesem Sprosssystem gelangen alljährlich Triebe über die Erdoberfläche,die "Schachtelhalme",wie sie unsere Abbildungen zeigen.

Die Schachtelhalme sind wie die Farne und die Bärlappgewächse altertümliche Pflanzen.Sie erreichten in der Steinkohlenzeit ihre bedeutendste Grösse. ~~In~~ Im tropischen Nordamerika gibt es heute noch eine Form,Equisetum giganteum L. die bis zu 5 m hohe und etwa 3 - 5 cm dicke Halme hervorbringt,aber ~~bei uns~~ in Europa ist der "grosse Schachtelhalm" der grösste Vertreter dieser Gewächse.

Abbildungen 1 - 5 sind Nahaufnahmen.Sie geben ein ganz gutes Bild,wie so ein Steinkohlenwald ausgesehen haben mag.Der Name "Schachtelhalm" kommt vom Aufbau der Sprosse aus einzelnen Gliedern.Die oberirdischen Triebe sterben nach einer gewissen Zeit wieder ab.Es werden zweierlei hervorgebracht:fertile gleich zu Beginn der jährlichen Vegetationsperiode und sterile etwas später.Abb. 1. zeigt fertile Sprosse.Sie erscheinen,wie bereits erwähnt,etwa im März über dem Boden.Freilich,unterirdisch angelegt sind sie schon viel früher.Im Sommer des vorher gehenden Jahres findet die Bildung statt und bis Mitte September sind fertile und sterile Triebe schon ganz fertig.Das ist auch bei den Blütenpflanzen der Fall.Man hat in der Regel keine Ahnung wie frühzeitig die Anlage der Blüten erfolgt.Einige Wochen nach dem Blühen bilden sich bei den meisten unserer Bäume und Sträucher die ersten Stadien der nächstjährigen Blüten;bis Mitte September sind sie dann fertig.Nur dadurch ist es möglich,dass wir uns der Blütenpracht des Frühlings erfreuen können.Die Entwicklung der Blüten findet in vielen Fällen gleichzeitig mit der Fruchtreife statt;man sieht,was unsere Bäume und Sträucher im Sommer zu leisten haben.

Die fertilen Sprosse des grossen Schachtelhalms sind unverzweigt;sie besitzen an den Basen der Glieder zahlreiche,in Wirteln angeordnete Blätter, die bis auf ein kleines braunes Spitzchen mit einander zu einer Manchette verwachsen sind.Die des Blattgrüns völlig entbehrenden fertilen Sprosse werden etwa 8 - 15 cm hoch,Sie bestehen aus einem Stamm,der in einem keulenförmig verdickten Stand von Sporenblättern endigt.Abb.1.zeigt die wirtelige Anordnung der letzteren.Man sieht ihre sechseckige Oberfläche; Die nach der Achse des Sporenblattstandes gerichteten Unterseiten tragen die in dünnwandigen Behältern befindlichen grünen Sporen.

Bei der Reife streckt sich die Achse des Sporenblatt-Standes in die Länge;dadurch rücken die einzelnen Blattwirtel auseinander.Gleichzeitig findet auch eine Entwässerung des ganzen Gebildes statt.Das Wasser sammelt sich im ganzen Spross unterhalb des Sporenblatt-Standes an,während diser verhältnismässig trocken erscheint.Jener ist völlig durchnässt.Durch diese Wasseransammlung wird das Gewebe weich und der Spross sinkt zuletzt um (Abb.2.)Wenn man ihn abreisst, trieft das Wasser heraus und es besteht kein Zweifel,dass das Wasser aus dem Sporenblätterstand stammt,da dieser vor der Reife nicht durch Trockenheit auffällt. Solche Entwässerungsvorgänge kommen auch bei den Blütenpflanzen häufig vor.Sie finden besonders bei der Fruchtreife statt. So wandert beim Getreide das Wasser ab;die Körner sind ziemlich wasserarm.Interessant sind die Entwässerungsvorgänge bei der Haselnuss,einer Nussfrucht und bei der Walnuss,einer Steinfrucht.(Bei einer Nussfrucht ist die ganze Fruchtwand verholzt,bei einer Steinfrucht nur die innere Schicht,während die äussere fleischig sein kann.Steinfrüchte sind Kirsche,Zwetschge ect.)In beiden Fällen ist an der Innenseite der Hartschicht ein Gewebe vorhanden,in dem sich das aus dem Keimling und seinem Nährgewebe stammende Wasser wie in einem Schwamme ansammelt und durch die Hartschicht hindurch allmählich nach aussen abgegeben wird.Dies nebenbei.

Die Sporenblätter entlassen nach Aufreissen der Sporenbehälter die grünen Sporen nach aussen,die Sporen,von denen,wie bereits eingangs erwähnt, die Schachtelhalm-Pflanze ihren Ausgang nimmt.Diese Sporen haben noch eine eigenartige Einrichtung,die ihrer Verbreitung durch den Wind dient. Sie sind mit 2 gekreuzten,am Ende etwas verdickten Bändern,den sog.Elateren,spiralig umwickelt.Diese Bänder strecken sich bei Feuchtigkeit gerade.Wenn man die mit diesen Bändern versehenen Sporen anhaucht,so führen sie eine hüpfende Bewegung aus,was man schon bei schwacher Vergrösserung sehen kann.Die fertilen Sprosse gehen etwa im ~~April~~ Mai zugrunde (Abb.2.); natürlich nicht alle gleichzeitig, denn manche Sprosse kommen früher,andere später aus dem Boden heraus.

Wenn die fertilen Triebe absterben,kommen allmählich neue Sprosse,die sterilen,die den ganzen Sommer über aushalten,zum Vorschein.Abb.3.Sie durchbohren als spitzkegelförmige Gebilde den Boden.Dann werden sie immer grösser und bis Mitte Juni erreichen sie ihre endgültige Grösse von etwa 1 m Höhe.Die Aufnahmen 4 und 5 sind Mitte Mai 1936 gemacht worden.Es handelt sich jetzt um die sterilen Sprosse.Diese sind viel kräftiger und grösser wie die im April erscheinenden .(Bei Abb.5.befindet sich in der Mitte im Vordergrund ein fertiler Spross)Der Stamm ist gleichfalls wie dieser beblättert.An den Basen der Blätter-Manchetten treten aber bald grüne Seitenäste etagenweise hervor.Diese Seitenäste werden sehr lang.Sie bestehen wie der Hauptstamm aus einzelnen Gliedern mit ganz verkümmerten Blättchen an den Gliederbasen.Diese grünen Zweige assimilieren die Kohlensäure der Luft.Hier übernimmt also den Spross die Aufgabe,die sonst den Blättern zukommt.Dies kommt auch bei den Blütenpflanzen verschiedentlich vor;es sei nur an die Kakteen erinnert.

Beim grossen Schachtelhalm findet zwischen den"fruchtbaren" und "unfruchtbaren" Sprossen eine Arbeitsteilung statt:Die ersteren dienen der Vermehrung,die letzteren dem Aufbau der organischen Substanz durch die Assimilation. Beim Waldschachtelhalm tragen die grünen Sprosse auch Sporen. [illegible]

Die Schachtelhalme sind reich an Kieselsäure.Sie bekommen dadurch ihre Steifheit.Eine Art,die besonders an trockenen Stellen,z.B.an Bahndämmen, wächst,der Ackerschachtelhalm (Equisetum arvense L.),der sich ganz so wie der grosse Schachtelhalm verhält,wird wegen seines Gehaltes an Kieselsäure zum Reinigen von Metall-geräten als "Zinnkraut" verwendet.

Abbildungen:

Nr. 1.Fertile Sprosse in verschiedenen Reifestadien.
" 2. " " Zwei sind bereits umgesunken.
" 3.Junge sterile Sprosse Mitte April
" 4.Sterile Sprosse Mitte Mai.Man sieht die Entwicklung der Seitenäste. Der linke Spross im Vordergrund hat noch keine.Die Aufnahme ist aus einer Entfernung von 30 cm gemacht;ebenso die Aufnahmen 1,2.3.
" 5.Schachtelhalme aus 1 m Entfernung.Im Vordergrund in der Mitte ein fertiler Spross.
" 6. Sprosse vom Waltschachtelhalm.

Dr. Theodor Philipp Haas.

(5.27.50.)

Observations on Dionaea muscipula Ellis in its natural habitat around Wilmington,N.C.

Dionaea muscipula is noted in Engler-Prantl "Die natürlichen Pflanzenfamilien" vol. 17 b,second edititlon 1936,p. 774/75,written by Diels.After this author the name derives from Dionaia,the Greek godess of love-attraction "des Liebreizes".As Dionaia attracts every-one ,in the same way the Dionaea catches with her leaves everything which comes close to her. There is only one species: Dionaea muscipula Ellis,in Sphagnum moores and moist savannahs, only in the coastal Carölinas.Flowering time in May and June.Then Diels continues to write:The unique plant,with which (in 1796) the insectivory was discovered,is in danger in its natural habitat,and needs protection.I repeat this - on account of the importance - in the original German language:"Die einzigartige Pflanze,bei der (1769) zuerst die Insec-tivorie entdeckt wurde,ist an ihrem natürlichen Standort bedroht und bedarf des Natur-schutzes."Ill. # 479 on page 775 shows a photograph of flowering plants,taken in Wilmington by Uphof.So far this German source.More about the history can be found in the book of Dr. Francis E. Lloyd "The Carnivorous Plants",Waltham,Mass. 1942,Chapter XII,p. 177/194.

The problems with which I wanted to deal were the followinge ones:The life cycle of Dio-naea in its natural habitat,how is Dionaea adapted to its envirement.How lives it in such a limited area?Connected with this was the question:"How lives Dionaea outdoors in a simi-lar habitat in the latitude of Philadelphia,resp. New Jersey,and could it become estab-lished there.

The reseach work on Dionaea is mainly done with greenhouse plants,and here the plant is cultivated everywhere.For instance in the Munich Botanical Garden,before World War II, the plant was and raised very successfully cultivated from own seeds.In April 1950 I have sent a fresh collected specimen by air mail to Munich,and received report that the plant is doing there very well.

In the natural habitat very little,or I must say nothing was done in this direction.To do work there is by far not an easy job.Living in Philadelphia,about 18 bus hours away,and being a trained plant morphologist I felt the obligation to visit Wilmington at different times of the year,but without the unlimited help of two residents of Wilmington,Mrs. Cecil

What I have observed until now (end of February):

The subterranean part is a bulb-rhizome,as it is only known of monocots.To say that the leaves are staying in a rosette is somewhat incorrect.They do not stay on the uppermost part of a vertically oriented tap root,originating of its soot part.The leaves MMM,or better the epiterrestrial parts of the leaves stay close together but originate from a more or less horizontal growing short rhizome.How grows this rhizome?Is it a monopodium or a sympodium?From the base of the inflorescence stalk starts the rhizome to grow diagonal (when ?) downwardand brings in this way the terminal bud into a deeper level. During the flowering and fruiting time the rhizome seems to stay on a higher level in the ground.This going downward of the rhizome causes the fennel like orientatation of the leaves in winter It is a prtective adaptation against drying out.The terminale bud is upward directed (February) in December I have this not observed.The rhizome movement has to be studied in April when I am going again to Wilmington,further during summer and in fall agin. The iniciation of the inflorescence I have not stated yet.It must take place in the previous year,because the inflorescences appear in early february,and the flowers are to recognize. I saw the vegetation point of a not flowering specimen.The cone is much elongated and the leaves show a very long hypophyll;the epiphyll is not developed.So,the hypophyll,growing on its base is accellerated,the epiphyll ovious delayed in its growth.The young end of the rhizome shows leaves with a very long (subterranean) base and an undeveloped epiphyll.Does this develop to petiole and blade? Yes - In the greenhouse plant during the whole year young leaves develop.The center has somewhat moved of its original place,because the rhizome is growing on its tip and the old end dies off.First die off the epiterrestrial part of the leaves and the subterreanean parts,the food storing leaf basis ,persist for a while.In the natural habitat the dying of the epiterrestrial parts goes further and faster as in the greenhouse plants. What causes the variability of the winged petiole?Are the petioles longer and less winged when the plants start blooming?Labor-Division in the leaf.The leaf base is elongated;it stays subterranean and remains without chlorophyll.It is fleshy and in the center it reaches it greatest thickness.A corss section looks like a flat triangle.I planted some of the february plants too high,so the greatest part of the bulb is exposed to light.The petiole which apperas normally above the ground is much ahead with the development.The first petiol

These fleshy leaf basis correspond with the fleshy/ scales in the bulbs which are nothing else as the tremendous developed hypophyll.In Dionaea the leafbasis are somwhat slymy and contain a great amount of starch.The leaf basis stay very dense together.The diameter of the bulb rhizome on a adult specimen is about 3 cm.When with the first fe r ezing in Winter the big leaves/ die,this concerns only their epiterrestrial part.The leaf basis remain alive They serve as starch reservoir.They become exhausted and die much later with the dieing of the rhizome on old end.The entire bulbrhizome dies on the backward end and continued to grow on the tip.This the subterranean organ has in common with the rhizome.The stoage of the food in the large leafbasis the subterranean organ has in common with the bulb; therfore we consider it as a bulbrhizome.The shootpart grows in general horizontaly. I also find a case where it grew curved in its horizontal direction.The older part of the bulb rhizome persists mostly 2 vegetation periods.The older part is distinctly to recognize from the younger one.The terminale end seems to be formed by the inflorescence stalk,and on theapicale side of the base a new bud is to recognize already in February.When the ini- ciation for the next flowering period takes place I don't know yet.The rhizome is there fore to consider as a sympodium.This was already stated in the article of Marshall C. Smith. The young bud is,as told on the base of the inflorescence stalk.Yet the rhizome possesses an ability of intercalary growth.By this the bud may move away from the inlorescence stalkb base.But much more important is the intercalarous growth for the retaining of the correct level of the bulb-rhizome in the ground.The latter is about 3 - 5 cm in the ground.In Feb- ruary I planted some bulb-rhizomes too high.The result was that younger part of the rhizome grew downward,and the young leaves appeared nearly in the normal position.The too high plan- ted leaf basis did not become green though they were exposed to light.They remiand white and died off.

In the terminal bud of the bulb-rhizome the hypophyll is much ahead in its development.The epiphyll from which petiole and blade take their origin is still very minute.When the tip has reachd the surface,then petiole and blade start to grow in the described way.

What is so interesting on Dionaea is the vitality with which it grows in its natural habitat. Finally some notes:On my Window in Philadelphia twice leaves have cought fies.It took exactly 14 day to digest them in both cases.The leaves also regenerate from the base.

I was in Oceanville,N.J. again July 24,1949.The leaves show no difference towards the plants in Wilmington,yet the flowering is delayed for about 4 to 6 weeks.I found a specimen which had still two flowers in bloom,the other flowers were allready closed.The summer is long enough for the ripening of the seeds.Plants which I had at home during July,produced fipe seeds.The fruits ripen in Oceanville.What the desemination is concerned,the dead dry placentar tissue may form a certain pressure upon the seeds,because,when the latter are touched they jump away.The upper part of the ovary which covers the seeds like a cup,disappears before,so the seeds,black and shiny are open visible.The intercalarous growth of the rhizome which moves the terminal bus away from the flower stalk takes place during June and July,during the ripening of the fruits.Since this new part carries leaves,and possesses the leafbasis,so the new part of the bulb rhizome is formed at that time,while the older part with the inflorescence,resp. infrutenscence stalk is still alive.The dieing of the lattter part takes place later.It is like the situation in many orchids,where the old,the previos year subterranean organ provides the food for leaves and inflorescence etc.,and a new tuber is formed at the same time.Her,as repeatedly mentioned,we have not tuber,but a bulb rhizome.

To my visit in Wilmington,Sept.3 - 6.In his article "Ecological Problems of the South-Eastern United States Coastal Plains (Botanical Review 1942)B.W.Wells writes on page 534 "Winter and spring fires are as much to be expected as summer rains" and on page 545 "The highly combustable nature of the vegetation increases fire incidence so that these grass-sedge bog or savannah areas commonly burn every year".Then there is the problem of the salt spray.

(April 23,1951)

Observations on Dionaea muscipula Ellis in its natural habitat around Wilmington,N.C..

Dionaea muscipula is noted in Engler-Prantl "Die natürlichen Pflanzenfamilien" vol. 17 b ,second edition 1936 , p, 774/75, written by Diels.After this author the name derives from Dionaia,the Greek godess of love-attraction, "des Liebreizes".As Dionaia attracts evryone,in the same way the Dionaea muscipula catches with its leaves everything which comes close to the plant.There is only one species:Dionaea muscipula Ellis,in Spag-num moores and moist savannahs,only in the coastal Carolinas.Flowering time in May and June.Then Diels continues to write:The unique plant,with which (in 1769) the insecti-vory was discovered,is in danger in its natural habitat and needs protection.I re-peat this - on account of its importance - in the original German language:"Die ein-zigartige Pflanze,bei der (1769) zuerst die Insektivorie entdeckt wurde,ist an ihrem na-türlichen Standort bedroht und bedarf des Naturschutzes."This remark in a German written book,and published in Germany in 1936,is valid still today.I have to talk later about this problem.The illustration # 479 in the book shows a photograph of flowering plants taken in Wilmington by Uphof.So far the German source. - More about the history cann be found in the book of Francis E. Lloyd "The Carnivorous Plants",Waltham ,Mass. 1942,chap-ter XII, p. 177/194.

The problems with which I wanted to deal were the following:The life cycle of Dionaea in its natural habitat;how is Dionaea adapted tp its envirement?How lives it in such a limited area?Connected with this was the question:"How lives Dionaea outdoors in a simi-lar habitat in the latitude of Philadelphia,res. New Jersey,and could it become estab-lished there?

Research work on Dionaea is mainly done with greenhouse plants,and here the plant is cultivated everywhere.For instance in the Botanical Garden Munich-Nymphenburg,before World War II,and now again,the plant was and is cultivated and raised from seeds very successfully.In April 1950 I have sent a fresh collected specimen by air mail to Munich and have received report that the plant is doing very well.

In the natural habitat very little,or,I must say nothing was done in this direction. To do work there is by far not an easy job.Living in Philadelphia,about 20 bus hours away and being a trained plant morphologist,I felt the obligation to visit Wilmington at different times of the year,but without the unlimited help of two residents of Wilmington, Mrs. Cecil Appleberry and Mr. Claude McAllister jr. who were kind enough to drive me with their cars to the localities where Dionaea can be found,this work would never have been done.I want to express here my deepest thanks for their great kindness!

For the first time in the area I was in Warsaw,N.C. in July 7,1948 where I saw the plant for the first time,and In July 8,1948 I was for the first time in Wilmington,N.C. It was then fruiting time.I was then in Wilmington again in December 27,1948,in April 15,1949 - Easter time - in June 6,1949 - it was flowering time - September 3 - 6,1949 April 7 1950,June 3,1950 (again flowering time),and July 15,1950, when I returned from my journey to Miami-Key West,and I have report from Mrs. Appleberry
July 2,1951 I was again in W. on my return from Cuba.It was very dry
about the situation in fall 1950.In February 1949 I received living material;in July 12, 1948 I took some plants back to Philadelphia and planted them on that day in Oceanville,
Since that time I have planted there about 20 plants.
N.J.,near Atlantic City,N.J..The habitat thereis very similar to that of Wilmington,N.C. In fall 1950 I found them all alive.The only difficulty I have,is that the people discover the unusual looking plantsand take them away.

I will now describe the plants how they look in Wilmington at the different times of the year.Codachromes were taken from different distances.I used mainly a Kine Exakta II with the close up equipment.In general the plants grow in grass land,in the so-called grass savannah,together with the Lablally pine (Pinus),with Sarracenia flava ,and Drosera intermedia and rotundifolia and also with Utricularia subulata-cleistogama to name a few other carnivorous plants.The soil consists of a mixture of peat,humus and fine quartz sand and looks grayish black.The humidity of this soil changes very much throughout the year.in winter and spring it is very wet like a sponge.During the summer it dryes more or less out.In September 1949 when I was there the soil was ver dry and no Dionaea was to discoverbut in 1950 when the soil contained more water, Dionaea stood alive until late fall.The Dionaea grows also along road- or highway sides,in ditches,where the moisture of the soil remains nearly the same throughout the year prey insects.There is also in the natural habitat a great variability in the red coloration of the traps,but it seems to me that the coloration increases with the age of the leaf.There is also a variability in the length of the inflorescence stalk,On sunny localities it is shorter and stiffer as on shadowed places and especially in greenhouses.So far the observations in Wilmington. [illegible]

On my different trips I took plants home to Philadelphia,and kept them either in the greenhouse at the Philadelphia College of Pharmacy & Scinece,and also at home.In both cases they grew very well,at least for a certain length of time.One plant I have since July 48.In the greenhouse,and on June 15,1949 it is still in good shape. [illegible] This plant differs from the wild plants by the fact that it was not exposed in winter freezing conditions.The plant is watered with destilled water and the leaves are never fed.The leaves have a relatively long life time; they persist for several months.The inerior of the traps shows some signs of coloration,but they do no get so red as the "wild plants".During the second week of February ,the first signs of flowering were observed.On that time the petioles were very wide winged and relatively short,and formed a deep fennel. Older leaves of last year have died. The plant produced 2 inflorescences (the second appeared much later).The blooming time was about late March-April,of course much earlier than outdoors There are always several flowers blooming at the same time;This is in contrast to the flowering of Drosera where always only one flower is in anthesis.Also in June I oberved in Wilmington that many flowers on an inflorescence bloom at the same time.The 5 petals are white and the diameter of the flower is about 3 cm.The stamens are numerous.The pollen forms tetrades; I never saw such beautiful tetrade pollen as in Dionaea.The ovary contains many ovules which sit upon a flat central placenta.The fruitwall coversthem - we hav a paracarpous gynaeceum in the sense of Goebel (Organography ,fig. 1992,p. 1913),and style and stigma form a tube. We have therefore "Rohrennarbe",a tube stigma similar to the same formation in Viola,but different by the fact that the flower is actinomorphous.Goebel considers such a stigma as a result of a reduction of the tipsof the carpels.The flowers are protandric.The first two days the flowers are male,the [illegible] style and stigma look - seen from the side -like a little rod upon a wide and flat ovary.Then the tip turns out fossy structures,like the arms of a sea anemone.These then catch the pollen.How the fertilization takes place.i could whole year.Here the plants are -alsoø in Wilmington - espacially in danger to become digged out by the residents and to be sold to dealers!The Dionaea does not grow in water; they always prefer a somewhat elevated level.May I compare the situation with the - date palm,of which it is said they like their feet in the water,their head in the sun!I never saw it growing together with Sphagnum.

Now let us start with the situation,as it is in April,and as I saw it in 1949 and 1950 In winter - as mentioned I was there in December 27,1948 - there is very little to be seen.The soil is very wet;the plants look dead;we see the dead leaves and in the center a tiny green spot,which indicates that the plants are alive.To go in April to Wilmington is really an experience!I observed in 1949 and 1950 that when in Philadelphia the poplar s start blooming,in Baltimore the male katkins have already dropped off,in Washington there is cherry blossom time more or less arrived,and in Wilmington Dog Wood (Cornus florida), or Buck Eye (Aesculus pavia) are in full bloom.It is very interesting to see how spring moves northward!The summer is in Wilmington about ten weeks longer as in the latitudes of Philadelphia.This problem is important for the Dionaeas which I have planted in Oceanville,N.J..The summer is yet still long enough to ripen the seeds.

The country in Wilmington looks very pretty at this time of the year.The different oakes,for instance the Life Oak,Quercus virgniana,are in bloom.Many carry the hemi-stem parasite Phorodendron flavescens,or mistle toe.The Azalias are in their most beautiful color.But when we come to forest - and Savannah grass land,we see all over the fresh signs of previous forest- and grass fires.B.W.Wells writes in his article "Ecological Problems of the South-Eastern United States Coastal Plains"(Botanical Review 1942): "Winter- and Spring fires are as much to be expected as summer rains" (p. 534) and on page 545:"The highly compistable nature of the vegetation increases fire incidence so that these grass-sedge bog or savannah areas commonly burn every year".The people there like these fires,because they kill the vermin.Mr. J.B. Newton who owns the place where I found most of the Dionaeas,told me in April 1950,the previous fire had to him a value of about $ 200.- The Dionaeas do not suffer by these fires. On the pine trees,especially on the older ones,the older needles burn away,and the new needles come out from the buds.This is very good to be seen on the Pinus palustris,the long leaves pine which grows there abubdantly.The bark of the pine trees is black,but

terranean. I have her also to refer to page 2 & 3 . Wehavementioned there the labor divisioon in the leaf. The development of the blade which in comparison with other parts of the leaf is dalayed. The blad develops following the pleuroplastic principle (Prantl). The midrib is much ahead in it develpment. It is bent downward in a very sharp angle to the petiole. During the development of the side parts of the blad (which become later the two halves of the valve trap), the midrib moves away from the petiole. These two side parts stay in a very narrow angle to each other, so in a transversal section of the two halves appear nearly parallel to each other. The edges with the bristles are rolled in. The midrib contains 2 vascular bundles; each of them sends a branch into the two halves. These halves show then an intensive intercalarous growth. When the midrib has reached nearly the same direction as the petiole, the blade looks like a closed book. The bristles are short and still bent inward. They overlap each other. Now finally the bristles com out, still look like bent, yet the two valves touch each other. Finally the angle between the two halves becomes wider, and the bristles strech out themselves, [illegible]
for the catching of prey. The trigger hairs and the digesting glands, both multicellulare structures, are developed very early, long before the completion of the trap.

The petiole is, as mentioned assimilating organ. It is green and winged. The primary leaves which appear at the beginning of the vegetation period, in February or March, are relatively short and the petioleshave very large wings. Later in the season the petioles become much longer and the wings are much reduced. It has also the task to bring the blade = valve trap, in a favorable situation for catching prey. Of course the blade, especially the outside of the trap (= identical with the lowerside of the leaf blade) takes part on the assimilation. [illegible]

The subterranean part of Dionaea is also rather interesting. It is a bulb-rhizome, a structure which is - after Troll - only known of monocots, where we have mainly bulbs. The shoot part of this bulb-rhizome is a tyny structure of about 3 - 5 cm in length and about 1 qmm in the cross section. The vertical diameter is a little bit longer than the horizontal diameter. This shoot is covered by numerous very succulent structures, the basis of the leaves. Some of these leaf basis are thicker than the shoot from which they take their origin. This is the case especially about 3 mm away from the poit where they are attached to the shoot

On June 22,1949 I was again in Oceanville,N.J..Unfortunately I had to state that about 14 days ago the greatest number of the Dionaea brought from North Carolina there,was stolen,so that from this locality not much information may become obtained.The few plants left were just starting to bloom.The flowers wer still closed and the flower stalks still short,while the inflorescence stalk was relatively long.In other wisw the plants X looked like those of Wilmington which I have visited on June 6 th .This visit showed that the shortness of the summer,not the temperature is dicisive.The plants in New Jersey were about 4 to 6 weekes behind the Wilmington plants.We have the same situation also in other tropical and subtropical plants.The limitation of their survival is mostly determined by the length of the summer.On June 25,the first flower of Oceanville which I took home ,started to bloom.Also Drosera filiforme has pollen tetrades,tetrade pollen.

He saw such a delicate plant in a ravine on his return to Tegucigalpa. The writer became very much excited, when Dr. Standley told him, that in this area they have a Rafflesiaceae. The members of this family are holo-parasites. Very famous is Rafflesia Arnoldi, a root-holo-parasite in Sumatra with the largest flower in the world, with a diameter of 3 - 4 feet. The Rafflesiaceae which the author saw, was very minute, but not less interesting as the plant in Sumatra. As under brush in the pine woods in this area of Honduras grows a small woody legume, about 1 - 1,5 m tall with red inflorescences. It belongs to the mimosous plants among the legumes (Mimosoideae). It has very long red stamen-filaments. <u>Calliandra Hustoni</u> is its name. On some plants, on the woody part,, one can see dark, warts like structures. These are the flowers of <u>Pilostyles mexicana</u>, having the size aproximately of a pin head. This strange plant is a endo - holo-parasite. We have in the Philadelphia area also a holo-parasite, the Dodder, a member of the Morning Glory family, but the yellow stems of these plants remain outside of the host plant: it is a "ecto-holo-parasite". With Pilostyles mexicana the stems are dissolved to cell threads, similar to the hyphies of fungy, and these cell threads live between the cells of the host plant underneeth the bark. There is very little known about the plant. One can see how the parasite grows in the host-plant. As every woody plant, the stem of Calliandra Hustoni shows the different increases, their beginning marked by the scars of the scales of the terminal bud. In the moderate zones where the growth is unterrupted by the winter, these increases go conform with the years, By counting backward (the youngest is the latest) we can state the age of a twig. In the tropics where there is no changing of the seasons, the increases start at any time of the year; there are also no annual rings for this reason. Pilostyles mexicana requires at least three increases of the host plant for its growth. Into the youngest increase, perhaps when this is still not woodified, penetrate the threads of the parasite. The next increase showa the flower buds -of course still closed - underneeth the bark, and the third increase shows then the flowers coming through the bark of the hostplants and in anthesis. What happens with the parasite in older parts of Calliandra Hustoni, the writer does not know. The time was too short for more investigations.

The author had to return to the U.S.. On account of the weather condition he flew directly to Miami, and paid from there a short visit to Havana again. Finally he returned to Philadelphia passing Wilmington, N.C. and Washington and botanizing there too. The writer would not like to close this report without saying a few words again about Kenaf. In his article in the June issue of the American Journal of Pharmacy he mentioned the two leaf varieties which he saw in Havana in cultivation at the Estacion Agronomica Experimental in Santiago de las Vegas. He saw the fields again on his trip in 1952. In September 1952 he visited the ......

of Rutgers University in New Brunswick, N.J, This is the northern most locality where Kenaf can be grown outdoors, but there the fruits become not ripe anymore. Also in New Brunswick the author saw the two leaf varieties, the names of which are <u>vulgaris</u> with devided, hemp like leaves of which the plant has its specific name, and <u>viridis</u> with entire, three lobed maple like leaves. The flowers of both varieties are completely identical. In Santiago de las Vegas both varietes were intermixed and also in New Brunswick. Only on the latter place was a plot where there was a pure stand of var. vulgaris. The plants there [illegible]ered very much in the length of their stems. In July 1951 and 1952 the writer saw in [illegible]avana plants blooming. This is contrary to the fact that Kenaf is considered a "short day plant". Blooming at that time was in 1951 only var. viridis (unfortunately [illegible]52 the author did not watch closed). In September 1952 in New Bruns[illegible] only var. vulgaris was blooming. The author could only state these facts; more [illegible] not available, but he thought that this interesting plant should again be [illegible]oned, closing herewith the report of his trip to the tropics.

[1a]

I was in Wilmington from 3–6 of September and in Cornelia on Sept 8. The situation in the bulb stage it is the same as it is during winter. That means that the parts before ~~the inflorescence axis of last~~ the part of the bulb stage in which around the inflorescence axis is dead and dried up. The base of the inflorescence axis of 1948 is covered by the leafbases whose ~~upper~~ lower parts are also gone. There are now a great # of leaves but the 1948 flower stalk is not in the center the stage has moved forward. In

(Stage 1) May 15. 1949. I was in Cornelia in Sept 8. 1949 and can state that all plants are in excellent shape and do not differ from Wilmington plants. Even plants which in June were erroneously taken away and brought back, or plants which I have kept for a while at home, and later planted back, are in perfect shape. The plants have produced seeds and disseminated them.

(Stage 2) I was in September 4 again on Weston place, but the picture has changed. It was still very wet, the grass had so much increased, that it was very difficult to find D. ~~This~~ Many plants had no red leaves anymore, other were probably dying, at least their epidermis at parts. It may be that the substance

grass alone also, Sonnaia, and the plants appear and may
live as long as they are not suppressed by the grass, which
which Draca cannot compete. Dr Wells referred me to his
the — in which he emphasizes the importance of local
fires. He wrote —

Sonnaia is not hurt by a fire, in contrary it is a fire
follower and the localities on which I previously
saw the plant had a fire one or two years before
in the ~~same~~ burned of the — — sites it was
able to observe there was a fire. The fact
that D. is a 'fire follower' makes it also important the
establish a certain area as a 'Sonnaia reservation'.

Probably the plant is not abundant on a certain ~~area~~ locality
and is in the endemic area permanently — not.
Wells and other visitors assured me that there is no
danger of extinct.

The Distribution of Fruits and Seeds.

~~In the June issue of "Frontiers" J e w e l l C a s e y exhibits 4 photographs with the text below "How seeds travel". These words are incorrect. Not everyone of these pictures demonstrates "how seeds travel"! Some photos show the distribution of fruits, others of seeds.~~ Let us not forget the fact that a fruit originates from a modified leaf, a fruit leaf, while a seed from an ovule!

The distribution of fruits and seeds is one of the most amazing chapters of botany. It has ~~only~~ its parallel only in ~~the~~ pollination, the process which precedes the development of fruits and seeds, because - as a rule - without pollination the growth of the fruits and seeds is impossible.

As regards ~~Considering~~ the traveling of fruits and seeds, they are very similar to each other; They may also look somewhat alike, as, for instance, the fruits of Heaven Tree (Ailanthus) and the seeds of the Indian Bean ~~[illegible]~~ (Catalpa), both very abundant around Philadelphia. But

~~In the following lines I wish~~ to describe how both fruits and seeds are distributed by plants. ~~Herewith we don't distinguish between fruits and seeds. How are fruits and seeds distributed by the plants?~~ We shall ~~have to~~ speak only of flowering plants. The others, like ferns, clubmosses, horsetails, or even mosses, mushrooms and algae have no fruits and seeds. They produce onecelled forms, called "spores", a Greek word which means "sowing", and which is used now in this sense.

In the distribution of fruits and seeds there are two possibilities: The first one is that the mother plant itself possesses means to distribute them. In this case we speak of "autochory", of "self-distribution". Second, the plant uses foreign means, such as ~~like~~ the wind, water, or animals, for this purpose. Then we call this "Allochory" or "foreign-distribution".

Let us first consider "[illegible]" self distri- "~~autochory~~". The simplest way is that the fruits and seeds have a certain weight and simply drop off the tree. The great fruits of the Ossage Orange (Maclura) or the seeds of the Horsechestnut are well known examples. A very peculiar instance of this simple fall movement is in the mangrove plants as we have them ~~already~~ in Florida. The mangrove is one of the most interesting plants

(17)

societies.It is a tropical swamp forest,growing in ~~the~~ saltwater regions ~~area of the saltwater~~ (including the mouth of rivers)on the ocean shores in the tide area ~~region~~ where the breakers are not too strong.This forest is composed of a certain group of shrubs and trees (including palms),belonging to different plant families.This swampforest occurs as well in the tropics of the Old as of the New World.* ~~In Florida among others grow Rhizophora Mangle and Avicennia nitida and these are only a few names~~.The conditions of the soil make it necessary that the root system and the propagation possess certain adaptations.The soil mostly is a very tough,grayish, ,bad smelling clay,very poor in oxygen.So it is helpful for the plant if the germination of the seed already takes place in the fruit and is transferred to the mother plant.This is termed "vivipary" and is demonstrated in this country by our native Rhizophora Mangle**.In this plant the tap root of the germplant reaches a length of about 10 cm and the point of gravity lies very close to the root tip. In this way the young germplant falls like an airplane bomb in the soil.It produces very soon sideroots and thus the young plant is anchored and protected against the ocean waves. - Other means of selfsowing ~~autochory~~ are growth movements and one of the most fascinating examples is the peanut (Arachis hypogaea).The plant is native in Brazil but it is cultivated today in all warmer countries of the world.It belongs to the legumes. The peanut has little orange flowers and the peduncles of these flowers grow toward the light as every flower stalk does.But after fertilisation they turn away from the light and grow (positively geotropic) ~~into the ground~~.At the beginning of this process ~~event~~ the young fruits are ~~remain~~ very small and so it is relatively easy for them to penetrate into the soil.When they are at a certain depth they begin to grow and reach their normal size.It is supposed that the fruitwall is able to take up food from the soil because the fruits which have not reached the soil remain small and undeveloped. ~~We call this "geocarpy".This means that the plant itself puts its seeds into the soil. The peanut is its own planter!~~

*Concerning the different plants,composing the mangrove,we distingush between an "Eastern" mangrove,growing in Asia,North-East Australia and East Africa and a "Western" mangrove on the West coast of Africa and on the shores of the both Americas.
** Rhizophara means "bearer of roots;the top roots of the young germplants on the shrubs.

long hair, containing air (therefore cotton is white) we have a kind of "ballon" because between the hairs there is also much air and so the seeds are very light. We have a "parachutist" in the fruits of our, or better, of the European dandelion, because this plant is native "abroad". These "parachutes" are very peculiar. The haircrown (this is the calyx) is only spread out ~~when~~ in dry wheather. On the base of each hair are hygroscopic articulations, and on a rainy day the hairs are turned upright and the "parachute" does not work! ~~In thistles the fruits drop off very easily from the parachute, so the travel is stopped~~ We have "propellers" in the maple fruits or in the fruit ~~for them~~ of the ash tree. In the linden tree whole clusters of fruits are distributed by propeller movement. ~~In the first case the wing is an outgrowth of the fruit, in the linden tree it is a leaf organ, a "pre-leaf" which acts as propeller.~~ To this group the fruits of our beautiful tulip tree also belongs. ~~We also have "gliders".~~ The fruits of the Heaven Tree and the seeds of the ~~Trumpet Tree~~ Indian Bean, the Catalpa, are "gliders". The most beautiful example we have in the tropics by a ~~member~~ member of the Cucumber family: Macrozanonia macrocarpa. The seeds, resp. fruits have wings on both sides. In Macrozanonia the expanse of the wings (from one end to the other) are about 10 cm while the flat seed has only a breadth of about 1 cm. All these adaptations have the function to delay the rapidity of the fall and to give the moved air the opportunity to carry the fruits and seeds away. It was found out that on the fruits of the Heaven Tree the delay of the fall caused by the presence of wings was 5,66 times. ~~This means that the fruit with wings needs for its falling down 5,66 times more time than the fruit would use after removing the wings.~~ - The fruits, or whole clusters of them, may also be rolled on the ground by the wind. These are the so-called "tumble weeds". They are very abundant in the region of deserts and of sand dunes, but also around Philadelphia. For instance, there is a grass, the ~~name is indeed "The~~ "Tumble Weed Grass" (Panicum capillare L.) which during the time when the fruits are ripe, has a very brittle stem. This breaks off and by the wind it is rolled with fruits on the ground. Very interesting is one of the introduced Hortensias (H. arborea) which we have in our gardens. These shrubs - blooming at the beginning of August - have large white sterile flowers* (they have to attract the pollinating insects)

*There is a similarity with Snowball (Viburnum), but Hydrangea belongs to the Saxifragaceae, Snowball to the Caprifoliaceae; the white optical apparatus is in the case of the Snowball the corolla, in that of Hydrangea the calyx! Some of our garden varieties of both plants (Hydrangea and Snowball) possess only sterile flowers.

and smaller ones which possess stamens and pistils which ~~therewith~~ are fertile. In fall the whole closter of fruits and the sterile flowers dry out; the stalk of it is also brittle and breaks off very easily and the entire formation is rolled on the ground by the wind; the sterile flowers act as a sail. You may find these fruit-flower closters very abundant around Philadelphia on the floor between shrubs. A very fascinating shrub is the "wig shrub" (Cotinus cogyria), sometimes to be seen in our gardens. There are only a few ripe fruits, but the stalks of undeveloped fruits continue to grow and get hairy. Like in Hydrangea, everything dries out and pieces of these hairy "wigs" break off and are rolled on the ground; ~~it is always the same principle in "tumble weeds"!~~ - So far the "anemochory"!

The distribution of fruits and seeds by the moving water, the "hydrochory" is still more effective when we think of the possibilities in the oceans. But let us talk first of the importance of the fresh water including rain. The latter is very important. The small seeds of some parasitic living flowering plants of the family Orobanchaceae, sitting on the root of the host plant, are brought there in many cases by the rain water These seeds are so small that they penetrate between the particles of earth. From the root of the host plant seems to be produced an influence, perhaps a chemical substance or a hormone which causes the germination of the seed of the parasitic plant. In this way we may understand the large appearance of beechdrop plants (Epiphegus virginica on a single beech tree. for instance the beechdrop, and the swamp buttercups ~~We know indeed fruits that open only during wet wheather.~~ Many of the seeds are lighter than water and although they are without peculiar adaptations they are able to swim with the streams. If the water moves as quickly as it ~~does~~ is the case in the European prealpine rivers the seeds may travel about 150 miles a day and this means very much in small Europe. The fruits and seeds of high-alpine plants are transported by the moving water into the valley and may germinate and the plants may grow there. When I lived in Munich, after every flood I always could find upon the gravel- and sandbanks of the Isar ~~(the alpine river on which Munich is situated)~~ high alpine plants, ~~especially Hutchinsia alpina, a little Cruciferae, or Linaria alpina, a Scrophulariaceae~~, living in the lime stone alps in a high altitude. They disappear again with the next flood. -Naturally Water Sailor "hydrochory" is much more important in the oceans. Here the fruits have very useful adaptations. The best known swimming fruit is the cocoa nut,though man is most responsible for its distribution in the entire tropics. ~~In hydrocharic fruits and seeds we have an "inland navigation" - I have spoken of it when I described the wandering of fruits and seeds with the streams - and "seafare" in the oceans.~~ Hydrochoric plants, Like sea worthy ships, ~~they~~ must be fitted for long and far journeys. First of all they ~~have to~~ must possess buoyancy;therefore they have air-containing hollow spaces.. ~~The center of the cocoa nut is such and the fibrous substance outside of the "nut" - it is the fruit meat - also contains air.~~ The second adaptation is that these fruits have to be ~~unmoistabel~~ impermeable because they have to be buoyant for a longer time and the third one is a certain resistance against the ocean waves,especially against the breakers. All these demands are fulfilled in the cocoa nut. This is not a real "nut";it is, like the cherry,a stone fruit,a drupe, and what we see ordinarly corresponds with the pit of the cherry,the stone pit. The whole fruit is much larger. It has outside a greyish-brown smooth skin which makes the fruit ~~unmoistable~~ impermeable,then follows a thick fibrous layer ~~(the fibers are used under the name "coir" for "cocos runner")~~ which contains air and then follows the ~~already~~ above mentioned pit,containing the seed which we eat,or of which we obtain fat.(Dried pieces of the seed are called "copra"). ~~The cocos-nuts are able to float a long time on the surface of the ocean.~~ In the tropics of South-America grows a climbing legume which has pods of about 1 m in length;its name is Entada scandens. The pods are woody, and very hard and have a frame on the edge of nearly a finger thickness. They are articulated and the parts appear more or less swollen and contain a large seed and also air. The entire pods or pieces of them are transported by the ocean currents from the tropics to the polar zones. ~~Naturally the plant cannot grow there,but this is an example of very far journeys of fruits and seeds by the moving water.~~ These are a few cases of "seafare" ~~in plants~~!

Another means for dispersion of fruits and seeds are animals. This also includes man but I will not talk here of this fact; ~~because geography and history of culture would lead us too far away from our subject.~~ How plants travelled with man is a chapter in itself. The scientific name for the distribution of fruits and seeds by animals is "zoochory". This distribution can occur in different ways. The first one is that fruits and seeds are fastened outside of the animal,on its hair- or feather-covering. We call this "epizoic" distribution. Another way is that fruits and seeds are eaten and the seeds leave the body of the animal with the excrements.This distribution inside the animal is called "endozoic".We have even a third form of dispersion which is called "synzoic" and which means that animals gather fruits and seeds.The latter are mostly of larger size.The animals bury them in a store place in the soil for later, and forget the burial place,or they lose them when they carry them away.All these zoochoric fruits have adaptations for these different ways of dispersion.The epizoic fruits are dry and hard and have prickles and spikes on their surface.~~If one walks in late summer or fall through the woods one has a whole collection of fruits and seeds on the clothing and the same happens with the fur of the animals.~~In the sanddunes on our seashores we have,for instance,the "Burgrass" or "Sandbur"(Cenchrus the fruits of which stick to our clothing extremely hard!The spines of epizoic fruits may be so sharp that they penetrate into the flesh of animals.In this way the raising of sheep becames impossible in some parts of Australia.In the deserts there are fruits which are adapted to the feet of mammals.When they trample upon these,the so called "trample burs",they become carried away.~~These fruits look very cruel.~~I have seen one with very large and dangerous hooks (the name was Harpagophytum procumbens). ~~Animals which have such fruits in their feet may starve and die because they are not more able to find thier food.If the fruits and seeds are glued with dirt to the feet of waterbirds and are distributed in this manner,which very often occurs,then it is not so painful for the animals!~~By the help of migrating birds the epizoic (and also endozoic) fruits may travel very far.

Constructed quite differently are the fruits which have to pass the intestinal canal of the animals which are eating them:the "endozoic"distribution.First of all the fruits must have something which attracts the animals and causes them to eat them.They are fleshy and juicy and have a taste which is loved by the animals.They have to possess a spectacular color or smell so that the animals observe them ~~already~~ readily from a distance.Birds take the greatest part in the endozoic dispersion of fruits and seeds They see red color best and in this way we may understand the red color of many of our fruits.~~We may see this in Dogwood or in the Cherry,or in many others.~~ ~~Thereby~~ Thus it is interesting that these fruits accept the ~~visible~~ attractive color only when they are ripe and ~~presented by the plant~~ ready to be eaten.~~Before this their color does not differ from the~~

green ~~of the leaves,and so~~ In this way it is prevented that they are eaten too early. ~~It is to emphasize, that~~ Fruits which are poisonous to man are often harmless to birds.The "Deadly Nightshade",Atropa belladonna,so dangerous for man is dispersed in Europe where it is native,by birds,eating the black berries without injury.The seeds must have a strong resistance against the activity of the digestive juices. ~~In other wise a lot of seeds germinate very good after having passed the digesting canal.Many even germinate better than before.The most amazing example for this fact is our tomato.~~ In the fertilizer,originating of the sewage of great cities are contained many tomato seeds.Where this fertilizer is used,tomatos grow as "wildflowers".The seeds have retained their germination power even after passing the digestion of human eaters and the fermentation in the sewage plant.

In the "synzoic" distribution the relatively large and heavy fruits and seeds which have no other means for their distribution,are carried away by animals.Especially rodents,like our squirrel,gather and store them and therewith they disperse the fruits. ~~Our squirrel carry away the acorns;without them the latter would always remain below the tree from which they originate,or not far from it.I remember in the European Alps a conifer (Pinus cembra) the large and hard seeds of which are distributed only by a certain bird, eating a part of them.Only by this bird the tree spreads out.The seeds are too large and have no wings and they cannot be carried away by wind like other conifer seeds.~~
To the synzoic seeds belong also those which are distributed by ants.The scientific name for the plants which possess such seeds is "myrmecochorous" plants.The seeds show very interesting adaptations.In general they have a size which makes it possible to be carried away by the ants.The seeds have fleshy outgrowths,called "elaiosomes", rich in fat and albumen,a food for the ants.The insects gather the seeds and disperse them as it is characteristic for all synzoic fruits and seeds.In our country we have among other plants the Celandine (Cheledonium maius),the violets and others,but in the tropics where are so many varieties of ants,there are epiphytic living plants, sitting on stems and branches high in the trees where they get much light.These plants are extremely adapted to ant distribution and without this they would never reach those favorable places for their growth.In the tropical forests of Brazil or elsewhere the nests of ants upon trees contain a certain society of ant-plants which

occurs only in these ant-nests,so it is in science already spoken of "ant-gardens".

In this aricle I wished to explain the manner in which fruits and seeds are distributed by the plants.In the described ways the higher plants,the flowering plants overcome the fact that they themselves are not movable from their place like the animals.How this occurs is one of the most amazing chapters of nature.

Dr. Theodor Philipp Haas.

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Dogwood.
(Cornus florida L.)

In Parks und Wäldern in und um New York City sind in der 2.April-hälfte die Blumen von Cornus florida L.vom Dogwood-Strauch,zu sehen. Wir sagen "Blumen",denn es handelt sich hier um die blüten ähnlichen Infloreszenzen .Die eigentlichen Blüten sind klein und unscheinbar; sie haben keinen eigenen Schau-Apparat,der die bestäubenden und so befruchtenden Insekten anlocken würde.Der Schau-Apparat wird vielmehr von 4 weissen,weit ausgebreiteten Hochblättern gebildet,die an ihrem apikalen Ende eine Einkerbung mit vertrocknetem Gewebe aufweisen. Dieser Schau-Apparat ist besonders interessant.

Er besteht aus Blättern,wir wollen gleich sagen,abgewandelten Blättern.Bei einem normalen Laubblatt kann man 3 Teile unterscheiden:den Blattgrund,d.i. derjenige Teil,mit dem das Blatt dem Spross aufsitzt, die grüne Blattspreite,die die Kohlensäure der Luft bei Lichtanwesenheit zu assimilieren hat und dazwischen den Blatt-Stiel,der die Blattspreite in ein günstige Lichtlage bringen soll.Haben Blätter eine andere Funktion wie die Assimilation zu vollführen,so ändert sich auch ihre Gestalt:Wir sprechen von einer "Blatt-Metamorphose".Das ist der Fall z.B. bei den Knospenschuppen,jenen Blattgebilden,die statt zu assimilieren den Schutz der zarten Blätter und Blüten für das kommende Jahr zu übernehmen haben,denn diese sind am Ende des Sommers meist schon fertig gebildet.Diese Knospenschuppen haben die zarten Pflanzenteile vor den Unbilden der ungünstigen Jahreszeit zu schützen,besonders vor dem Erfrieren und noch mehr vor dem Austrocknen.Die Knospenschuppen sind meist nicht mehr grün sondern braun,derbhäutig und vielfach verholzt.Sie stellen den im Wachstum sehr stark geförderten Blattgrund dar,während Stiel und Spreite verkümmert sind.Aehnlich ist es auch bei Hochblättern,Blatt-Organen in oder unweit der Blütenregion.Sie bilden vielfach den Schau-Apparat für die Sie Bestäubung,bzw.Befruchtung vollführenden Blütenbesucher.Sie sollen diese durch auffallende Farben anlocken. Es sei nur an die Poinsettia,die in den Gewächshäusern zu sehen ~~sind~~ ist, erinnert.

Bei Cornus florida haben nun die Hochblätter,zeitlich getrennt,zwei Funktionen zu übernehmen: Im Winter den Knospenschutz der jungen Infloreszenz und im Frühling die Anlockung der Bestäuber,sie werden zum Schau-Apparat!Mit dieser Funktions-Aenderung ist auch eine Aenderung im Aussehen verbunden.Im Winter sieht man an den knopfförmigen Infloreszenzen 4 graue Knospenschuppen in dekussierter Blattstellung,wobei die 2 äusseren besonders verholzt erscheinen.Im Frühjahre,etwa im April,beginnen nun die basalen Teile dieser von den Hochblättern gebildeten Knospenschuppen zu wachsen.Die wachsende Partie ist anfänglich grünlich,wird aber alsbald durch im Gewebe enthaltene Luft,die als Reflektor des Lichtes wirkt,weiss.Dabei breiten sich diese nun zum Schau-Apparat gewordenen Hochblätter flach aus.Der Teil,der im Winter die Knospenhülle gebildet hat,ist nicht mehr wachstumsfähig;er ist abgestorben und bildet die erwähnte Einkerbung mit dem vertrockneten Gewebe.Dass es sich bei diesen Hochblättern um den im Wachstum geförderten Blattgrund handelt ,wird durch die Tatsache bewiesen,dass die Nervatur eine andere ist wie bei den Laubblättern.Der Zuwachs im Frühling übertrifft die Knospenschuppe im Winter an Grösse um ein Vielfaches.

Bei Cornus florida haben wir einen der ganz seltenen Fälle,bei denen an den Blättern,wenn auch zeitlich getrennt,zweimal ein Funktionswechsel vorkommt.An Stelle der Assimilation,eine Aufgabe,die für gewöhnlich den Blättern zukommt,tritt zuerst die Funktion als Knospenschutz ein und dann stehen sie im Dienste der Anlockung der Blütenbesucher und bilden den Schau-Apparat.Entsprechend diesen verschiedenen Aufgaben verändern sie dabei völlig ihr Aussehen.

F l e i s c h f r e s s e n d e   P f l a n z e n .

Es findet sich hierüber eine Unmenge von Literatur.Vielleicht das beste Buch uber diesen Gegenstand ist Francis E. Lloyd,Carnivorous Plants

Im Nachfolgenden will ich mich hauptsächlich an meine Beobachtungen in der Natur " in the field" halten .Ich hatte hier die Gelegenheit die Droseraceen Drosera rotundifolia Drosera intermedia Hayneund Drosera filiformis,Rafsinheimisch in den N.J. Pine Barrens, Dionaea muscipula Ellis,die Venus Fliegenfalle,einheimisch im Gebiete von Wilmington, Nord Carolina,ferner Sarracenia purpurea L. einheimisch von Neu-Fundland bis Florida und die Utricularien U. inflata,U. purpurea und U. subulata - cleistogama zu studieren.Die letzteren wachsen auch im oestlichen Nordamerika;ich habe sie ebenfalls in den N.J. Pine Barrens beobachtet.

Die beiden erstgenannten Sonnentau-Arten, D. rotundifolia und intermedia,sind "circumpolar". Ich habe sie oft auf meinen Ausflügen im bayerischen Alpenvorland gesehen und da besteht absolut kein Unterschied zwischen den bayerischen und nordamerikanischen Pflanzen.Drosera rotundifolia bevorzugt die etwas höher gelegenen Polster des Torfmooses ,Sphagnum,das aber in America wohl aus anderen Arten besteht als in Europa.Drosera intermedia wird sehr häufig zur richtigen Wasserpflanze;ich sah sie in "Sim's Place"(N.J.P.B.) zusammen mit Seerosenblättern auf der Wasseroberfläche schwimmen.In diesem Falle sind die Pflanzen dann meistens zu kleinen Kolonien,kleinen Gruppen,vereinigt.In wie weit die verschiedene Länge des Sommers (in Oberbayern dauert der ~~[illegible]~~ die Vegetations-Periode durchschnittlich von Mai bis September,in den N.J.P.B. von Ende April bis spät in den November hinein;das ist in den verschiedenen Jahren verschieden!) das Wachstum der Pflanzen beinflusst,vermag ich nicht zu sagen.Bei D rotundifolia,bleibt der Spross kurz und die Blätter stehen standig rosettenartig,bei D. intermedia wächst er häufig,besonders später in die Länge und erreicht dabei bis 10 cm und mehr. (Wie überwintern?) Die Blüten sind klein und haben eine weisse Krone;die Blüten- ~~[illegible]~~ stände gehören zu denjenigen,bei denen nur immer eine Blüte jeweils geöffnet ist.Die Blütenstands-Achse ist gebogen und die geöffnete Blüte befindet sich immer an der höchsten Stelle.Die Blütezeit ist 1 Tag.

Drosera filiformis Raf. wächst im östlichen Nordamerika.Sie wird im allgemeinen als Küstennahe Pflanze betrachtet,d.h. sie wächst nicht allzuweit von der Küste des Atlantischen Ozeans inland weg.In den N.J.P.B, habe ich sie in Sim's Place und in Oceanville,N.J. ständig beobachtet. Wie bei D. rotundifolia bleibt be D. filiformis der Spross kurz,sodass der Rosettenwuchs standig beibehalten bleibt.Die Blattspreiten sind lang und schmal und im Gegensatz zu den Blattern der anderen Droseraarten,kann man keinen Blattstielerkennen.Die Blätter gehoren zu denjenigen,die durch ein verhaltnismassig langes Spitzenwachstum ausgezeichnet sind. Diese Spitzen sind - wie bei einem Farnblatt - solange das Blatt nicht ausgewachsen ist, gerollt.Die Pflanzen erinnern in ihrem Aussehen an Drosophyllum luisitanum ,unterscheiden sich aber von diesem durch die Abwesenheit eines Stämmchens.Interessant ist dass in Drosophyllumdie Blattspitze nach aussen,in Drosera filiformis nach innen gerollt ist! Dies beruht darauf,dass im Falle von Drosophyllum die Blatt-Oberseite,im Falle von Drosera filiformis anfanglich die Blatt-Unterseite starker wächst,bis im voll ausgewachsenen Blatt dieser Unterschied ausgeglichen ist.Die Stellung der Blatter ist vertical oder schräg vertical.Sie sind etwa 1 - 2 mm breit und werden ca. 10 cm lang.Wie bei den anderen Drosera-Arten ist die Blatt-Oberseite (~~wie bei D. rotundifolia und D. intermedia nach oben gerichtet ist~~) dicht mit Drüsenhaarenbedeckt.Diese sind reizbar und umschliessen das gefangene Insekt und verdauen es.Gegen das Ende des Sommers wird die Winterknospe gebildet.Die Winterknospen befinden sich dicht am Boden;die Blätter fur das nächste Jahr sind nach innen gerollt und von bis zu 2 cm langen braunen Haaren bedeckt; die alten Blätter sterben ab.Die Blütezeit ist anfangs Juli (in den N.J.P.B.) und dauert bis anfangs August.Die Blüten sind purpurfarbig und verhaltnismässig gross.Auch sie blühen einzeln,sie schliessen sich jedoch um die Mittagszeit.Dies haben sie in Gemeinschaft mit den zahlreichen Seerosen (Nympaea odorata).Drosera filiformis ist keine Wasserpflanze,wie in vielen Fällen D. intermedia,sie bevorzugt aber die tieferen Stellen der Moore,insbesondere solche, wo der feuchte Quarzsand mit einer dunkel-violetten Luftalge Zygogonium ericetórum Ktze., eine Art "Meteorpapier" bedeckt ist.Hier lebt die Pflanze dann oft in Gemeinschaft mit der später zu besprechenden terrestrischen Utricularia cleistogama.Es kommt ja in den Breiten von Philadelphia nicht zu einer Torfbildung,obwohl Sphagnum genug vorhanden ist.Der sehr sauere Boden,der Moore,die wegen des vorherrschenden Baumes Chamaecyparis thysoides

"White Cedar! "White Cedar Swamps" genannt werden,besteht aus einem feinen,nassen Quarzsand.In den "White Cedar Swamps" - Chamaecyparis thysoides ist keine "Zeder"! - gibt es eine ganze Reihe von Blütenpflanzen,einschliesslich einiger sehr interessanter Orchideen.

Dionaea muscipula Ellis,die Venusfliegenfalle ist die interessanteste von allen Drosera-Gewachsen.Sie ist als Endemismus einheimisch im Gebiet von Wilmington ,N.C.,das bedeutet dass sie nur in diesem Gebiet,Ca. 300 km im Umkreis von Wilmington vorkommt.Es ist,selbstverständlich ein Rätsel,wie sich eine so hoch spezialisierte Pflanze auf einem so kleinen, engumgrensten Gebiet entwickeln konnte.Man kann Dionaea auch wo anders anpflanzen und sie wachst an anderen Plätzen,die denjenigen von Wilmington ähnlich sind,sehr gut.Ich brachte 1948 Pflanzen von Wilmington nach einem "White Cedar Swamp" in der Nähe von Atlantic City N.J.Die Pflanzen wachsen 1954 noch sehr schön und vermehren sich auch;freilich war bis jetzt noch kein strenger Winter.Ich komme später nochmals darauf zurück.In Wilmington wächst Dionaea in der Grassavanne,einer art Parklandschaft mit Gras und losesetehenden Kiefern,der Loblally Kiefer Pinus und der Long leaved Pine,Pinus palustris. Es ist kein ausgesprochenes Sumpfland,trotzdem ist im Frühjahr der Boden recht nass. Die Pflanze wächst aber auch in den Seitengräben der Landstrassen.Man sieht daraus,dass die Pflanzen viel Wasser vertragen können.Haufig wachsen sie in grossen Mengen beisammen.Schon in der 2. Auflage von Engler-Prantl "Die natürlichen Pflanzenfamilien" Leipzig 1935 ist erwähnt,dass die Existenz von Dionaea als "Wildpflanze" bedroht sei. Das ist zweifels ohne im Jahre 1954 noch viel mehr der Fall als anno 1935.Die Bevölkerung nimmt immer mehr zu und immer mehr Land wird unter Kultur genommen ;auch die Bautätigkeit nimmt zu und mit all diesen Erscheinungen ist eine Absenkung des Grundwasserspiegels verbunden.Das ist ein Faktor,der ja heute leider auf der ganzen Welt zu beobachten ist.Ein zweiter Faktor ist aber das Verhalten der Eingeborenen.Sie wissen,dass nach diesen sonderbaren Gewächsen eine lebhafte Nachfrage besteht.Sie sammeln daher die Pflanzen und verkaufen sie in solchen Mengen,dass sie wirklich eine weitere Gefahr bedeuten.Es sind wohl Gesetze gegen diesen Vandalismus erlassen,aber es ist niemand da,der sich darum kümmern wurde,dass die Gesetze auch befolgt werden!Zum Schutze des Aussterbens könnte man Dionaea an allen geeigneten Plätzen entlang der Ostkuste der U.S. auspflanzen;das ist [illegible]er bis jetzt noch nicht getan worden.Dionaea kann in Gewächshäusern bis zur Samenreife kultiviert werden.Die europaeischen botanischen Gärten tauschen Samen untereinander aus. Der natürliche Standort ist jedoch küstennahe.Wilmington selbst ist ein wichtiger Hafen am Atlantischen Ozean.Um die Pflanze in ihrer natürlichen Umgebung zu studieren,war ich 1948,1949,1950 und später zu verschiedenen Jahreszeiten in Wilmington und im folgenden will ich meine Beobachtungen beschreiben .Im Winter ist nicht viel von der Pflanze zu sehen. Ich war am 28.Dezember 1948 im Gelände;wenn auch kein Schnee auf dem Boden war,so war dieser doch sehr nass.Ich war dann im April - etwa zur Osterzeit - in Wilmington.Die Fahrt dorthin ist um diese Jahreszeit besonders interessant,da man da ununterbrochene Fortschreiten des Frühlings an der Vegetation beobachten kann.In Europa ist das nicht möglich.Hier streichen die Gebirgszüge (Alpen,Pyrenean) von ost nach west,während in der Neuen Welt die Gebirge eine nord-sudliche Richtung aufweisen.Die östlichen,küstennahen Gebiete von Nordamerika haben annähernd dieselbe Höhenlage,und da - wie gesagt - keine wesentlichen Bodenerhebungen vorhanden sind,kann der Frühling ungestört nordwärts und - selbstverstandlich - der Herbst sudwärts fortschreiten.Die Länge des Winters nimmt ja immer mehr ab,je weiter wir nach Süden gehen und in Miami und besonders in Key West,dem südlichsten Punkt der U.S., ist davon überhaupt nichts mehr zu bemerken.In Wilmington dauert der Winter höchstens 2 - 3 Monate,Ende Dezember bis Anfangs März und dieser Winter ist im allgemeinen sehr mild!

Die Lebenstätigkeit von Dionaea erwacht etwa Ende März.Mitte April - der Boden ist sehr nass - sieht man im Gebiet überall die Blattrosetten mit den Primärblattern.Ueber die Frage ob es sich wirklich um Rosetten handelt,werden wir später noch zu sprechen haben.Die Primärblätter unterscheiden sich von den Folgeblättern dadurch,dass sie dem Boden dicht aufliegen,dass sie verhältnismassig kurz sind und dass die Blattstiele breite Flugel besitzen Diese Flugel sind bereits voll entwickelt,wenn sich die Spreite - die Falle - noch in einem sehr frühen Stadium befindet.Es sieht so aus,als ob die Pflanze zuerst den Assimilationsapparat entwickeln wurde,bevor sie zum Tierfang ubergeht! Die Folgeblätter sind viel länger,die Flugel der Stiele sind zu einem Minimum reduziert und die Blatter sind schräg nach oben oder senkrecht orientiert,Doch zurück zur situation im April.Im Zentrum der Blattrossette kann man bei später blühenden Pflanzen schonden jungen Blütenstand erkennen.
Ich möchte hier ein Paar Worte uber die allgemeine Situation um diese Jahreszeit sagen.
Was einem hier auffällt sind die Spuren von Wiesen- und Waldfeuer.Diese Feuer spielen eine

wichtige Rolle im Leben von Dionaea. Die Feuer ereignen sich meistens bevore die ersten Blätter aus dem Boden kommen. Durch das Abbrennen des Grases verbessern sich die Lebensbedingungen wesentlich für Dionaea. Der hohe Wassergehalt der Blatter bedingt, dass die Feuer die Pflanzen nicht wesentlich schadigen. Der Boden ist ein Gemisch von feinem Quarzsand mit Humus und er reagiert sehr sauer. Er ist bis anfangs Juli meistens sehr feucht, da aber im Sommer oft wenig Regenfall stattfindet, ist er im August und September - bis es wieder regnet - sehr trocken. Die Länge der Trockenperiode wechselt mit den Jahren. Diesen Verhältnissen ist Dionaea weitgehend angepasst.

Was man von Dionaea oberirdisch sieht, sind die Blätter, deren Spreite in so eigenartiger Weise zur Falle umgebildet ist, und die Blütenstände mit den weissen Blüten. Bevor ich aber auf diese eingehe, möchte ich mich den unterirdischen Organen zuwenden, da diese auch sehr interessant und im allgemeinen wenig beachtet worden sind. Sie bestehen aus einem mehr oder weniger horizontal wachsenden kurzen, dünnen Rhizom, das dicht von den sehr fleischigen Blattbasen eingehüllt ist. Von den älteren Blattbasen sind Stiel und Spreite bereits abgestorben. Die Blattbasen bleiben viel langer erhalten wie die oberirdischen Blatteile. In ihnen ist Reservematerial abgelagert; mit Jod zeigen sie die Starke-Reaktion! Die unterirdischen Organe von Dionaea stellen Zwiebel-Rhizome dar, wie sie nur von den Monocotylen bekannt sind. Diese Zwiebel-Rhizome setzen Dionaea in Stand, die sommerlichen Trockenperioden zu überstehen; hier sterben alle oberirdischen Teile ab und nichts kann von ihnen mehr gesehen werden. Ich war 1950 an einer bestimmten Stelle in Wilmington; im April und im Juni waren so VIELE Pflanzen vorhanden, dass man vorsichtig hat sein mussen, sie nicht zusammen zu treten; der Sommer war sehr trocken und als ich im September wieder dort war, konnte ich nicht eine einzige Pflanze entdecken. Im nachsten Frühjahre waren wieder alle Pflanzen da! Nur in Strassengräben, wo das ganze Jahr über Feuchtigkeit genug vorhanden ist, bleiben die oberirdischen Teile der Pflanze am Leben, bis sie von der Winterkälte getötet werden.

Die Zwiebel-Rhizome sterben am rückwärtigen Ende ab und wachsen am Spitzenende weiter. Hier befindet sich auch die Endknospe, die die jungen Blätter und den Blütenstand enthält, wenn sich die Pflanze im blühfähigen Alter befindet. Eine Vegetationsperiode endet mit dem senkrecht nach oben wachsenden Blütenstand, an dessen Basis sich eine Seitenknospe befindet,

die das Wachstum des Rhizoms fortsetst;dieses ist daher als ein Sympodium zu betrachten.
An einem alteren Zwiebelrhizomkann man meistens zwei Vegetationsperioden erkennen,wenn man eine Pflanze etwa im September ausgräbt.Mansieht dann die Blattbasen von der vorjährigen und von der diesjährigen Periode erhalten und kann die neue Knospe fur das kommende Jahr erkennen.Die äusseren Blattorgane dieser Knospe,der Endknospe zeigen eine starke Wachstums

die Entwicklung der

förderung des Unterblattes,während die Abkömmlinge des Oberblattes,Spreite und Stiel,stark verzögert ist, und von den letzteren entwickelt sich der Blattstiel - stark verbreitert - zuerst.Die Blattspreite,die Falle,hat -selbstverständlich - von jeher das grösste Interesse erweckt. Von Ihr erscheint zuerst die Mittelrippe.Diese ist nach unten

der Gestalt

gebogen und liegt zunächst dem Blattstiel dicht auf.Die Blattspreiteentwickelt sich in beiderseitlicher Auswuchse.Die Blattspreite von Dionaea gehort also zum pleuroplastischen Blatt-entwicklungs-Typ.Während des Wachstumsprozesses der Blattspreite bewegt sich die Mittel

sich

rippe nach aussen,sodass sie am Schluss in derselben Richtung wie dier Blattstiel befindet. Die beiden Spreitenhälften sind einander genähert,wie die Einbande eines geschlossenen Buches Am weistesten zurück im Wachstum sind die Randbörsten derSpreitenhalften.Sie sind noch

wie manein Buch offnet

gegeneinander gerichtet.Nun erst bewegen sich die Spreitenhalften voneinander weg:Die Falle

der Falle

offnet sich und ist bereit zum Insektenfang.Auch hier wird das Innere von der Blattoberseite gebildet.Bei Gewächshaus-Pflanzen oder bei Pflanzen,die von der Küste weit entfernt (kultiviert) im Freien wachsen ist dieses grün bis gelblichgrün.In Wilmington jedoch und auch in Oceanville .N.J.,also in küsten-nahen Gebieten beobachtet man eine grosse Mannigfalitgkeit in der Farbe der Fallen;in den meisten Fällen ist sie intensiv rot.Dies wird erreicht dadurch dass die Epidermiszellen reichlich Anthocyan enthalten.Ausserdem sind zahlreiche,mehrzellige

d

Verauungsdrüsen,die wie Himbeeren aussehen,vorhanden.Das Schliessen der geöffneten Falle wird verursacht durch (zweimaliges) Berühren von meistens 3 Kontaktborsten.Diese Kontaktborsten besitzen inihrer unteren Hälfte ein Gelenk,sodass sie in der geschlossenen Falle umgebogen werden können.

(Entwicklung!).Auf die Bewegung der Blatthälften will ich hier nicht eingehen.Zusammenfassend möchte ich aber sagen,dass man Dionaea-Blatt eine Arbeitsteilung beobachten kann,die der beim Nepenthes-Blatt ähnlich ist;Die Blattbasis dient der Speicherung von Reservematerial,der Blattstiel der Assimilation und die Blattspreite ist die Falle;selbstverständlich assimiliert diese auch,besonders mit der Unterseite,die ja grün ist.Noch ein Paar Worte,ob die Blatter eine Rosette bilden.Das Rhizom wächst horizontal; die Internodien sind sehr kurz. Da sich die Rosetten aus der Endknospe entwickeln und wahrend jeder Vegetationsperiode seitlich eine neue Endknospe angelegt wird,so wandert jedes Jahr die Rosette.Im Zentrum der Rosette ist der Bluten- bzw.Fruchtstand;in der neuen Rosette ist dann im Herbst der Fruchtstandstiel der vorherigen Vegetationsperiode ausserhalb des Zentrums So sah ich das an einer dauernd feuchten Stelle in einem St~~r~~assengraben.

Dionaea blüht in Wilmington ungefahr am ersten Sonntag im Juni!Die Bluten sind weiss und stehen in Dolden.Im Gegensatz zu den anderen Drosera-Gewächsen blühen immer mehrere Blüten zur selben Zeit.Die Blüten sind protandrisch.Dionaea besitzt eine Zentral-Placenta.Das Innere der Fruchtwand ist,wie das bei allen Bluten mit Zentraler Plazentation der Fall ist,ungefachert und die Fruchtwand ist wie eine Mütze uber die Samenanlagen gestülpt.Der Griffel ist hohl,eine Rohre und wir haben auch eine Rohrennarbe.Der Rand dieser Rohren wird von Fransen febildet.Wahrend des männlichen Stadiums der Blute sind diese Fransen nach innen geschlagen. Wenn die Blute ins weibliche Stadium eintritt,werden die Fransen nach aussen geschlagen,wie die Fang-Arme einer Seeanemone.Die Pollenschläuche wachsen auf jedenfall auf der Inneseite des Rohrengriffels zu den Samenanlagen;gesehen habe ich das jedoch nicht.Während der Blütezeit sidn die Samenanlagen weiss.Die reifen Samen sind schwarz und glanzend und die Samenschale ist verhaltnis mässig dick.Dadurch wird ihre Keimung - wahrscheinlich aufgezwungener Weise - bis zum nächsten Frühjahre verzögert.Während der Blütezeit sah ich eine grosse Menge von Keimpflanzen.Die Fruchte sind gleifalls schwarz;sie zeigen den vertrockneten Griffel mit der Fransen-Narbe.Sie reifen in den ersten Tagen im Juli.Sie springen unregelmässig auf und die Samen werden durch die federnden,verhlzten etwa 10 - 20 cm langen Fruchtstiele verbreitet.

Utricularia.In den New Jersey Pine-Barrens gibt es eine Reihe von Utricularia-Arten.Die meisten sind Wasserpflanzen,einige jedoch leben terrestrisch im feuchten Quarzsand.Nachfolgende Arten wurden beobachtet:Utricularia inflata ,U. purpurea and U. subulata - cleistogama a terrestrial species.

Utricularia inflata is a water plant,which can be found in fresh water ponds from Florida to Canada in Eastern No

mit dem gewohnlichen Mikroskop kann ich selbst verständlich jede gewünschte Vergrösserung erreichen.Mit der Verlängerungsröhre allein erziele ich eine etwa 15 x Vergrösserung.
Da ich fast ausschliesslich Tageslich,beim Photographieren durch das binoculare Mikroskop nach Möglichkeit intensives Sonnenlicht,verwende,bediene ich mich des sog. "day light type" des Kodachrome Films.Wenn ich Kunstlicht verwenden muss,dann gebrauche ich Blaufilter.
Ausserdem besitze ich ein Tele-Objektiv "Tele-Megor 180 cm f : 5,5" .Davon mache ich Gebrauch,wenn Pflanzen weit weg oder schwer zu erreichen sind.Beim Photographieren durchs Mikroskop - beim Gebrauch des binokularen Mikroskops verwende ich einfallendes Sonnenlicht - bestimme ich die Belichtungszeit nach der Helligkeit des Bildes auf dem Kamera-Schirm.
Die Selenzellen-Belichtungsmesser sind nicht empfindlich genug,um auf diese Weise die Belichtungszeit festzustellen.

The flowers of Aristolochia Goldieana.

2ith 20 photographics.

Aristolochia Goldieana Hook f. is a plant the flowers of which really strikes one's eye and of which there probably exist no illustrations, especially from the younger stades. I had opportunity to observe the flowering and also the development of the flowers in the Botanical Garden in Munich-Nymphenburg during the years 1936.1938 and 1940. There also were taken the photographics.

Literature of this plant is very scanty. The first mentions are found in "Gardener's Chronicle and Agricultureal Gazette" 1867, Pag. 1143/44 and 1167. The plant was collected first in a forest near the mouth of the river "Old Calabar" (West coast of Equatorial Africa) by Rev. Hugh Goldie, in whose honor the younger Hook named the plant Aristolochia Goldieana.

Later it was found in this region by other men also; it was even discovered on the island Fernando Po.

The plant is a twining plant, winding conterclockwise as a sinistrorse shoot. It has a subterranean tuber or tuberlike rhizome. The aerial parts of the pland annually die off.

*The Munich specimens were obtained 1932 from Kew; The description shall be confined only to the flowers and indeed only th the conditions I met in Nymphenburg. A few notices may be fouhd in "Engler Prantl: Die natürlichen Pflanzenfamilien, 2. Aufl. Leipzig 1935." The Aristolochiaceae are treated there by O. Chr. Schmidt. In the course of this article I shall discuss a few remarks.

In contrast with other Aristolochiaceae the flowers appear shortly above the ground (1936 there was one flower, 1938 6 flowers could be seen and then I observed still one flower, damaged by visitors of the greenhouses and which therefore I could open. The time of the anthesis is in July. The flowers show a positive geotropism, for the flowers, placed higher, likewise strive towards to ground by stretching the peduncle (Ill. # 8. 1938))

Trans. Linn. Soc. vol. XXV. p. 185. t. XIV.
J. Hutchin[...]n & J. M. Dalziel Fl. West Trop. Afr. I. 1927
75/88
Kew. Bull. (1928) 22-25.

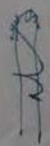
(21)

Like in all Aristolochiacoae,the perianth is simple,not separated into calyx and corlla,so it is not to say does it correspond with ~~[illegible]~~,wh[illegible] it corresponds. As already mentioned,this perianth reaches in Aristolochia Goldieana a tremendous size.If we take ill. # then we may easily state that the perianth is devided into three parts which - in the sequence from left to right - I want to mark them with "A" , "B", and "C".Part "A" follows immediately ~~[illegible]~~ the ovary;it includes in its base the gynostegium.Part "A" is ~~[illegible]~~ grayish - white,longidudinal wrinkeled,and diagonal orientated to the ground.When the flower reaches the latter,it touches it with the lowest part of "A",which is here very flat.On its apical end part "A" becomes rather narrow and with a torulose invagination it goes over into part "B" with is also very narrow in that region.This part "B" is darker than part "A" is fennel-shaped,this means toward part "C" it becomes essentualy wider.It is very especial in an older flower bud sharp bend;the longidudinal lists are very strong developed.Part "B" is followed by part "C",which in a flower bud a day before opening looks very much inflated (Ill. # and # 1936).Part "C" ~~[illegible]~~ is outside veined between the longidudinal lists, which continue from part "B".It ends with a short point directed towards above.Part "C" is outside grayishgreen and the veines and the lists are dark redbrown.The flower opens by the separation of three lobes;two are diagonal directed towards above,and the third larger basal lobe is is turned down.

Hoya D. blooms like all Hoyas. The flowers ~~are usually~~ appear all at the same time and are completely unfolded. In this way Hoya differs very much from Dischidia where the anthesis of the flowers occurs successive and where the flowers show a very strong stopping of the opening (Entfaltunghemmung).

I have to mention this because the plant was cultivated in Miami under the name D. Merrillii (Conng. in H. ...) and it is also mentioned in ... pg 163 by Goebel. when he speaks of "Lebensdauer der Infl." ~~I was clear myself that~~ When I examined the flowers of ~~Diff. Dischidia~~ species, cultivated in M. U. I was convinced that our pl. was a Hoya and Dr. Marie has ascertained what I already have supposed. (with this name a Hoya)

Hoya and Dischidia have another peculiarity. They bloom and after the anthesis the flowers with ~~the~~ flower-pedicels drop off, while the stalk of the inflorescence remains alive ~~life~~ on the plant. After a short or longer rest period ~~of~~ in Hoya carnosa more than half a year, ~~they~~ on the tip of this inflorescence stalk a cluster of new flowers appear. The cause of this fact is that on the tip of this stalk the growth point is not used up, there remains meristematic tissue. I have named these inflorescences 'perennial inflorescences'. i.e. they may stalk the develop of new flowers after a short or longer period of rest.



They may persist for many years. ~~I have made microscopical slides,~~ but unfortunately they were destroyed when I left Java in 1940.

See comments on the last sheet

(1)

Hoya Darwinii Loher

(With 5 illustrations)

In the Botanical Garden in Munich-Nymphenburg I had occasion to observe and study the growth and flowering on an interesting asclepiadiaceous plant native of the Philippines. Prof. E.D.Merrill, to whom I showed photographs of it identified the plant as <u>Hoya Darwinii</u> Loher. The accompanying photographs were made in Nymphenburg where two specimens of the plant have been in cultivation since about 1911 and which were sent by A.Loher of Manila to Dr. Goebel, late director of the garden. Mr.Loher was associated with a wholesale drug house in Manila, and during the many years that he resided there gave much attention to botanical field work, making very large and very important botanical collections in Luzon. He found this interesting species in the mountains of Rizal Province, east of the city of Manila . The species has hitherto never been illustrated. The original description was published in the Gardener's Chronicle, ser.III, 47: 66. 1910 and this original description was repeated in Fedde's Repert.Sp.Nov. 11: 96. 1912. Brief notes on the species are found in Merrill's Enum.Philip.Fl.Pl. 3: 352. 1923, he stating that the species occurs in forests at low and medium altitudes in Rizal and Tayabas Provinces, Luzon, and in Panay. Mr.A.D.E.Elmer, Leafl.Philip.Bot. 10: 3543-3547, merely mentions the species in a general discussion of the pitcher leaves of

He was a Bavarian student at Univ. of Munich etc hence his interest in Munich

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(2)

Hoya and Dischidia.

This species is a most interesting representative of the genus Hoya, which is closely allied to Dischidia, both genera belonging to the milkweed family (Asclepiadaceae). In Dischidia various species are known which possess normal flat leaves and peculiar pitcher leaves, these being placed in the section Aecidiophora by K.Schumann in his treatment of the Asclepiadaceae, Engler & Prantl, Nat.Pflanzenfam. IV (2): 1895. It is interesting to note that this species of Hoya produces pitcher leaves analagous to those of the allied genus Dischidia, and Loher notes, in his original description that "This plant is one of the most interesting Hoyas known to me, for it has dimorphous leaves."; the same general type of dimorphism previously well known in various species of Dischidia.

In both genera species are now known that have flat, fleshy normal leaves

~~on saucer~~ large

and very much larger, hollow pitcher leaves or saucer shaped leaves distichously. In nature, in ~~both~~ Hoya (Conc

and Conchophyllum, three allied genera:

~~and in~~ Dischidia, these hollow pitcher leaves are always inhabited

or saucer shaped leaves

by large colonies of small black ants, forming a type of symbiosis of benefit to the ants, in that the living plants provide them with a home, and to the plants in that its water requirements and much of its food ~~are~~ is provided by the hollow pitchers; water because there is

or under the saucer shaped leaves

always a certain amount of moisture in the pitchers, and axillary arranged closely appressed to the tree trunks on which they grow (Hoya imbricata Decne., H. pseudomaxima Koord. etc). ~~In all species of Hoya, Conchophyllum and Dischidia where these abnormal leaves occur, there is always, in nature, a symbiosis with colonies of small black ants, these insects living in the hollow pitcher leaves or under the saucer-shaped appressed leaves. (Hoya! Conchophyllum? Dischidia~~

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roots extend into the pitchers, or under the saucer shaped leaves and food from the ~~[illegible]~~ debris and excreta of the ants, as well as from ~~diseased~~ dead ants. In Hoya, as in Dischidia, and in Conchophyllum we know very little about the conditions that cause the development of the ~~pitcher~~ abnormal leaves on certain branches. They seem to have the same purpose in Hoya as Haberlandt describes for those of Dischidia.

Hoya Darwinii Loher is holoëpiphytic. The specimens I studied in Munich-Nymphenburg were attached to a branch with rough bark, and not planted in earth. ~~like~~ On the other hand Hoya carnosa R.Br. is usually grown in pots ~~therein is also a similarity to Dischidia~~. In nature many species of Dischidia and Conchophyllum and of Hoya are strictly epiphytic, but most frequently one finds them growing out of decayed parts of branches or trunks; while other species freely root in the ground. Thus various species are adapted to distinctly different conditions of growth.

The stems of Hoya Darwinii are slender, covered with a brownish bark, and twine counterclockwise. Their growth outstrips the development of the foliage. The internodes vary from 10 to 15 cm. in length. The opposite leaves are decussate as in all Asclepiadaceae. The normal leaves are coriaceous (those of Dischidia are rather fleshy), about 10 cm. long, 4 cm. wide, pointed, somewhat ? vaulted upward. The pitcher

6

dont understand fully what is meant — is this the word

(4)

leaves occur on rather fleshy short branches, are often (always ?) more or less crowded, and remain alive longer then do the normal leaves. These short branches bearing the pitcher leaves possess a terminal bud from which, after a shorter or longer rest period, often originates a branch with normal internodes and leaves("). The pitcher leaves very early in their development show a downward growth of their margins, in development the same as the pitcher leaves of Dischidia Rafflesiana This is a pleuroplastic development with an overdevelopment of the parts contiguous to the midrib. Thus the tissues of those parts toward the leaf tips develop very early into the permanent form of the pitcher leaves. In contrast to the pitcher leaves of Dischidia Rafflesiana, which are sac-like , those of Hoya Darwinii are flat and broad, occurring close togther, as noted above , crowded on the short branches in a decussate position. In the uppermost leaf pair, therefore the youngest ~~one~~ pair, frequently a single normal leaf develops while the other one of this pair developes into a pitcher. ( ). In such cases the pitcher is particularly large and covers the pitchers lower down. Portions of the branches between the pitchers become completely enclosed( ) There seems to be a tendency for the retention of moist air not only inside the pitchers but also between them. As in those species of

Dischidia (with dimorphous leaves) these pitchers of Hoya Darwinii are leaf monstrocities, but in the latter there are greated differences in the sizes of the pitchers. The first and oldest of these pitcher leaves on a short branch are the smallest, and in succession as other pitchers develop thay are larger. It is supposed that, as in Dischidia, growth and (or ?) hormones, auxines may have a very great influence on these pitchers, as to their size and development. In development the pitcher leaves are differentiated from the normal ones early. This of course does not answer the question as to what is the c ause of the presence of the assumed auxines and the development of the pitcher leaves on certain branches; in other words we know nothing abodt the conditions that bring about the development of the pitchers . Are there perhaps correlations between the formation of the short branches and the appearance of the pitchers ? or is the shortening of the internodes connected with the formation of pitcher leaves ? What is the role of hormones and perhaps auxines in this phenomenon ?

In 1940 I noticed an uppermost pitcher 6 cm.long, 8 cm.wide, and with

right word? thickness? a depth ? of only 1 cm; the length and width measurements are only the borders of the pitcher; the dimensions of the blade are naturalky luch larger, but further investigation was impossible because no part of

not very clear; this sentence is incomplete this ~~species~~ specimen, the species being very rare in cultivation, could be sacrificed. As noted above these ~~leafxpitchers~~ pitcher leaves are wide, dorsally compressed flat sacs. The inside, as in Dischidia, is dark purple in color and rich in stomata. Axillary roots extend into the pitcher as in Dischidia. There were no ants living inside the pitchers in the specimens cultivated in Munich, which merely indicates that the plant can thrive and that the pitchers are formed without the presence of these insects; Fober noted their presence in nature. On a plant with about 100 normal leaves there were about three short branches with aggregates of pitcher leaves. This was the situation in 1940 in reference to plants with strong vegetative growth under greenhouse conditions when the plants did not produce flowers.

Under greenhouse conditions, as with other species of Hoya, all flowers open at the same time. ~~As~~ All who are at all familiar with the two genera Dischidia and Hoya realize that there are very great floral differences between the two genera. In Hoya Darwinii, as in other species of the genus, the flowers unfold completely, being distinctly radiate, the paracorolla or corona forming horn-like apophyses. The inflorescences are erect, not pendulous, as in Hoya carnosa.

In taxonomic literature this is called the corona

D. coccinea Gr.
D. brunoniana Gr. 535 Griffith Icones Plantarum Asiaticarum IV Calc. 1854 Pl. CCCCX Malay 45

I hardly know what to say about this paper. It seems to me that it would have been very much better if the "pitcher leaves" of other species were discussed more in detail, with references to Pearson's article on double pitchers, Jour. Linn. Soc. Bot. in Dischidia. Again what about that most remarkable ~~Dischidia~~ Hoya imbricata, figured in Delessert Ic. 4: ~~1120~~ Bot. 1124 t.90; and again in ed 3, Blanco Fl. Filip. Bot. 434 as Collyris major ? as well as the allied Hoya pseudomaxima Koord.? In these the stem runs up the bark of trees, and I believe that all of the leaves are transformed--not into "pitchers" but into saucer-shaped (large) orbicular leaves, appressed very closely to the bark of the tree, the axillary roots attaching the plant to the tree under these saucer-like leaves, and under each leaf myriads of small black ants ! In a way this is a more remarkable development than in Hoya darwinii. Perhaps, after all, this is a job that should be done in Malaysia where one could assemble and study a wide range of these interesting forms with such abnormal leaves---Dischidia, Hoya, and Conchiphyllum for here is a third genus to be considered. It is safely true, however that most species of Hoya, and I think also most species of Dischidia have only normal leaves with no adaptations whatever for symbiosis with ants.

I cut out the statement that "you failed to observe ants", for Loher records this. All species of Conchophyllum, Hoya, and Dischidia that develop these pitcher leaves, or saucer-shaped leaves, are always symbiotic with ants in nature ! There are no exceptions. It is an interesting observation that the plants may be grown in greenhouses in the entire absence of ants, and that under such conditions they do develop "normal" pitchers. See the case in relation to Hydnophytum, Myrmecoidea, etc. and read Beccari's more or less monographic treatment of Malaysian species (in various families) having symbiosis with ants--- from the Palmae ! to the Rubiaceae ! in Malesia.

H o y a   D a r w i n i i   Loher.

(With 5 illustrations)

In the Botanical Garden in Munich-Nymphenburg I had occasion to observe the growth and flowering of an Asclepiadaceae, indigenous to the Philippines. Prof. E.D. Merrill, to whom I showed the photos of it, identified the plant as " Hoya Darwinii Loher ". These photographics were made in Nymphenburg, of a plant which was cultivated there in two specimens since about 1911 and which probably originates of original material, sent by Loher to Goebel, the ~~former~~ late director of that Botanical Garden. The photographics accompany this article; I believe they are the first pictures of this interesting plant. The original diagnosis of the Hoya Darwinii is to be found in "The Gardener's Chronicle" 1910, pag. 66. among "New noteworthy plants". It is also mentioned in "Fedde Repert. 11 (1912), 96.

Notes on the plant are also in "An Enumeration of Philippine Flowering Plants" by E.D. Merrill, I. Manila 1925 and II. Manila 1925. In the latter are the following notes: "In forests at low or medium altitudes, endemic (Luzon, Rizal, Tayabas, Panay). Local name: "Kalitkit". The latest notes are to be found in the "Leaflets of Philippine Botany", vol. X, articles 130 - 137, pag. 3546 (1938 - 1939): "Notes on Asclepiadaceae" by E.D. Merrill.

The plant is - I think - the most interesting representative of the genus Hoya. This genus stands very close to the genus Dischidia in the Milkweed family. It is known that in the genus Dischidia there are a few plants which possess pitcher leaves and which are united to the group of "Ascidiophora" by K. Schumann who has described the Asclepiadaceae in "Engler-Prantl, "Die natürlichen Pflanzenfamilien", vol. IV/2, "Leipzig 1895. ~~Our~~ Hoya Darwinii has now the same pecularity of producing pitcher leaves. In the genus Hoya this would correspond to the representatives of ~~the group~~ "Ascidiophora" in the genus Dischidia. Loher writes in the above-mentioned "Gardener's Chronicle": "This plant is one of the most interesting Hoyas, known to me, for it has dimorphous leaves." We have this dimorphism also in the Dischidia-species group, I mentioned. They form normal leaves with a flat stretched blade and pitcher leaves which are much bigger than the former, it is as in Dischidia. And in the same manner as in this genus we don't know anything about the conditions which cause the appearance of the pitcher leaves on a certain branch. They seem to have the same ~~"purpose"~~ function as Haberlandt describes is for the pitchers in Dischidia.

Hoya Darwinii is a holo-epiphyte; the specimens I saw in culture in Nymphenburg, were fastend on a rough-barked branch and not planted into the earth, like Hoya carnosa; therein also a similarity with Dischidia. The shoots are ~~thin~~ tiny, brownish barked and winding conterclockwise. Their growth outstrips the ~~MMM~~ ~~the~~ development of the foliage. The internodes have a length of about 10 - 15 cm. The leaves are on the nodes in a decussated position, as in all Asclepiadaceae. As already mentioned by Loher, the plant has two kinds of leaves: Normal leaves, coriaceous (the normal leaves of Dischidia are rather fleshy), about 10 cm long and about 4 cm wide, pointed and with a blade, vaulted somewhat upwards, and pitcher leaves on rather fleshy short branches. The latter are to be found arranged in a greater number together; they remain alive longer than the normal leaves. The short branches possess a terminal bud from which - perhaps after a shorter or longer rest period - several times originates a branch with normal internodes and normal leaves (Ill. # 2.) The pitcher leaves show very early a strong growth of the marginal parts of the blade in a downward direction. Their growth is the same as in the pitcher leaves of Dischidia Rafflesiana, this means a pleuroplastic development with an overdevelopment of the parts ~~of the~~ around midrib. Thereby the tissue of ~~the parts~~ ~~around~~ towards the ~~MMMM~~ tip of the leaf, the apically parts of the blade, pass over very early into the permanent form. In contrast to the pitchers of Dischidia Rafflesiana which are like sacs, the pitchers of Hoya Darwinii are flat and broad. They are on the short branches also in a decussated position and pressed close together. In the uppermost leaf pair - therefore the youngest one - frequently only a single leaf, is a pitcher, whilst the other is a normal leaf (Ill. # 5.) In this case the uppermost pitcher is especially big and covers the pitchers, situated below. Pieces of branches which are accidently between the pitcher leaves, become compactly enclosed. (Ill. # 3.) There seems to be a tendency to hold moist air not only in the pitchers themselves but also between them. As in Dischidia the pitchers are "leaf monstrosities", but in Hoya Darwinii there are more differences in the size of the pitchers. (The first ones on a short branch - the oldest - are the smallest, and in the following pitchers the size increases). I suppose that - as in Dischidia - growth hormones, auxines, have a tremendous influence. The development of the pitcher leaves differs very early from that of normal leaves. This - of course - does not answer the question what is the cause of the presence of such auxines and thereby of the pitchers on a certain branch, in other words, we don't know anything about the conditions of the appearance of pitchers; I already mentioned this problem. Are perhaps correlations between the formation of short branches and the appearance of pitchers? Or, is the shortening of the internodes connected with the formation of the pitcher leaves? What for a role play hormones - perhaps auxines - in this phenomenon? That are most interesting questions which come to me.x - In 1940 I noted on an uppermost pitcher a length of 6 cm, a width of 7 cm and a depth of only 1 cm. These length- and width- measurements are only the borders of the pitcher; the dimensions of the blade are naturally much larger, but the material is in this case so preciuos that it is impossible to cut off pitchers. As mentioned above, they are flat pressed, wide sacs. The inside is - as in Dischidia - colored dark purple and rich in stomata. Adventive roots are growing hydronastically into the pitcher (this also as in Dischidia), but, in contrast to Loher, I could not observe the presence of ants. On a plant with about 100 normal leaves thereare about 3 short branches with aggregates of pitcher leaves. So it was 1940 when the plants had a strong vegetative growth and when they did not flower.

x and which can be answered only in the natural habitats in the Philippines.

The blooming is - as in all representatives of the genus Hoya - :They bloom all at the same time.To this problem - the manner of flowering in Hoya and Dischidia,I will refer on another occasion. Here I only want to remark that between Hoya and Dischidia there is a great difference in the flowers and in flowering.The perianth of the flowers of Hoya Darwinii is completely unfolded;the paracorolla forms horn-like apophyses.The inflorescences are upright and not hanging as in Hoya carnosa (Ill. # 1.)

Text to the illustrations:

\# 1.) The flowering plant.(The name "Dischida Merrillii" is wrong)
We see the upright inflorescence and the flowers with the completely unfolded perianth and the hornlike apophyses on the paracorolla.

\# 2.) We see how a normal branch starts from a terminal bud of a pitcher bearing short branch.

\# 3.) A pitcher aggregate,seen from the side;we can see how the uppermost pitcher covers those,situated below.

\# 4.) A pitcher aggregate,seen from the lower side.A piece of a thin branch is enclosed by the pitchers.

\# 5.) Another pitcher aggregate,seen from the lower side.We see the border of the uppermost pitcher,covering the others below,and may observe that the one leaf of the uppermost pair is a pitcher (we see the border enclosing the 2 below) whilst the other one at the node is a normal leaf. (The leaf on the right side of the picture,with the little fissure on the blade).

Theodor Philipp Haas. Ph.D. January 1942.

with a flat stretched blade and pitcher leaves which are much bigger than the former,as i[illegible]chidia.And in the same manner as in this genus we don't know anything about the conditions which cause the appearance of the pitcher leaves on a certain branch.They seem to have the same "purpose" as Haberlandt describes for the pitchers in Dischidia.

Hoya Darwinii is a holo-epiphyte;the specimens I saw in culture in Nymphenburg,were fastend on a rough-barked branch and not planted into the earth, like Hoya carnosa;therein also a similarity with Dischidia.The shoots are thin, brownish barked and winding conterclockwise.Their growth outstrips the ~~[illegible] the~~ development of the foliage.The internodes have a length of about 10 - 15 cm. The leaves are on the nodes in a decussated position. as in all Asclepiadaceae. As already mentioned by Loher,the plant has two kinds of leaves:Normal leaves, coriageous (the normal leaves of Dischidia are rather fleshy),about 10 cm long and about 4 cm wide, pointed and with a blade,vaulted somewhat upwards,and pitcher leaves on rather fleshy short branches.The latter are to be found arranged in a greater number together;they remain alive longer than the normal leaves. The short branches possess a terminal bud from which - perhaps after a shorter or longer rest period - several times originates a branch with normal internodes and normal leaves (ILL. # 2.)The pitcher leaves show very early a strong growth of the marginal parts of the blade in a downward direction.Their growth is the same as in the pitcher leaves of Dischidia Rafflesiana,this means a pleuroplastic development with an overdevelopment of the parts ~~of the~~ around midrib. Thereby the tissue of the parts ~~around~~ towards the ~~[illegible]~~ tip of the leaf,the apically parts of the blade,pass over very early into the permanent form.In contrast to the pitchers of Dischidia Rafflesiana which are like sacs,the pitchers of Hoya Darwinii are flat and broad.They are on the short branches also in a decussated position and pressed close together.In the uppermost leaf pair - therefore the youngest one - frequently only a single leaf,is a pitcher whilst the other is a normal leaf (Ill.# 5.) In this case the uppermost pitcher is especially big and covers the pitchers, situated below. Pieces of branches which are accidently between the pitcher leaves, become compactly enclosed. (Ill. # 3.) There seems to be a tendency to hold moist air not only in the pitchers themselves but also between them. As in Dischidia the pitchers are "leaf monstrosities", but in Hoya Darwinii there are more differences in the size of the pitchers. (The first ones on a short branch - the oldest - are the smallest, and in the following pitchers the size increases). I suppose that - as in Dischidia - growth hormones, auxines, have a tremendous influence. The development of the pitcher leaves differs very early from that of normal leaves. This - of course - does not answer the question what is the cause of the presence of such auxines and thereby of the pitchers on a certain branch, in other words, we don't know anything about the conditions of the appearance of pitchers; I already mentioned this problem. Are perhaps correlations between the formation of short branches and the appearance of pitchers? Or, is the shortening of the internodes connected with the formation of the pitcher leaves? What for a role play hormones - perhaps auxines - in this phenomenon? That are most interesting questions which come to me. - In 1940 I noted on an uppermost pitcher a length of 6 cm, a width of 7 cm and a depth of only 1 cm. These length- and width- measurements are only the borders of the pitcher; the dimensions of the blade are naturally much larger, but the material is in this case so preciuos that it is impossible to cut off pitchers. As mentioned above, they are flat pressed, wide sacs. The inside is - as in Dischidia - colored dark purple and rich in stomata. Adventive roots are growing hydronastically into the pitcher (this also as in Dischidia), but, in contrast to Loher, I could not observe the presence of ants. On a plant with about 100 normal leaves thereare about 3 short branches with aggregates of pitcher leaves, So it was 1940 when the plants had a strong vegetative growth and when they did not flower.

The blooming is - as in all representatives of the genus Hoya - :They bloom all at the same time.To this problem - the manner of flowering in Hoya and Dischidia,I will refer on another occasion. Here I only want to remark that between Hoya and Dischidia there is a great difference in the flowers and in flowering.The perianth of the flowers of Hoya Darwinii is completely unfolded;the paracorolla forms horn-like apophyses.The inflorescences are upright and not hanging as in Hoya carnosa (Ill. # 1.)

Text to the illustrations:

1.) The flowering plant.(The name "Dischida Merrillii" is wrong)
We see the upright inflorescence and the flowers with the completely unfolded perianth and the hornlike apophyses on the paracorolla.

2.) We see how a normal branch starts from a terminal bud of a pitcher bearing short branch.

3.) A pitcher aggregate,seen from the side;we can see how the uppermost pitcher covers those,situated below.

4.) A pitcher aggregate,seen from the lower side.A piece of a thin branch is enclosed by the pitchers.

5.) Another pitcher aggregate,seen from the lower side.We see the border of the uppermost pitcher,covering the others below,and may observe that the one leaf of the uppermost pair is a pitcher (we see the border enclosing the 2 below) whilst the other one at the node is a normal leaf. (The leaf on the right side of the picture,with the little fissure on the blade).

IMMIGRANT IDENTIFICATION CARD
UNITED STATES
DEPARTMENT OF LABOR

HAAS
SURNAME

Theodor Philipp Israel
GIVEN NAME

Germany — Apr. 7,1892
COUNTRY OF BIRTH — DATE OF BIRTH

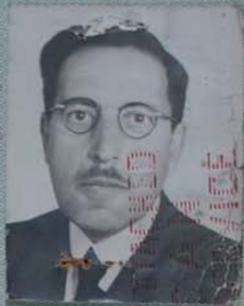
German — grey
NATIONALITY — COLOR OF EYES

San Francisco, Calif. — Pres. Pierce
PORT OF ARRIVAL — STEAMSHIP

SEP 21 1940 — Sec 5
DATE ADMITTED — STATUS OF ADMISSION

Dr. Theodor Philipp Israel Haas
IMMIGRANT'S SIGNATURE

[illegible]
ORIGINAL — IMMIGRANT INSPECTOR



ORIGINAL ORIGINAL

DEPARTMENT OF STATE
OF
THE UNITED STATES OF AMERICA

AMERICAN CONSULATE AT Stuttgart, Germany

May 20, 1940. 193

THIS CARD IS ISSUED FOR THE IDENTIFICATION OF THE PERSON WHOSE NAME APPEARS ON THE REVERSE SIDE AS THE BEARER OF ~~NON-~~QUOTA IMMIGRATION VISA No. 19124 German ISSUED BY THIS CONSULATE. THIS CARD IS NOT TRANSFERABLE AND WILL NOT BE VALID FOR PURPOSES OF IDENTIFICATION IN THE UNITED STATES UNTIL DULY SIGNED BY AN IMMIGRANT INSPECTOR AT A PORT OF ENTRY TO THE UNITED STATES.

A. John Cope, Jr.

Vice CONSUL OF THE U. S. A.

1148250

CITY OF PHILADELPHIA
COUNTY OF PHILADELPHIA
STATE OF PENNSYLVANIA

UNITED STATES OF AMERICA

I, Theodor Philipp Haas, residing at 712 Spruce Street, in the City of Philadelphia, State of Pennsylvania, United States of America, hereby submit the following affidavit to the Staats-Kommissar fur die Betreuung des Juden in Bayern, in relation to the estate of my deceased mother, Johanna Haas.

I am the only child of Johanna Haas (nee Neuhofer) and Adolf Haas. I was born in Munich, Germany, on April 7, 1892. My father, Adolf Haas, died in Munich on September 5, 1928. My mother, Johanna Haas, was deported to Camp Theresienstadt, Czechoslovakia, on the 26th of June, 1943, according to information I received through my cousin, Simon Neuhofer, Jr. I was informed by the same person that she died in Camp Theresienstadt in the spring of 1943.

In the absence of any will, I consider myself her sole heir.

I have been advised by my cousin, Simon Neuhofer, Jr., of Munich 22, Kanalstr. 33/1 L, son of my mother's cousin of the same name, and his wife Maria, that the following possessions were left by my mother in his custody:-

8 - Paintings
1 - Desk clock
1 - Field glass
1 - Piano (Bluthner pianino)
Photo albums and miscellaneous articles.

I hereby authorize said Simon Neuhofer to represent me in all negotiations pertaining to the estate of my deceased mother, to receive and to hold same for my later disposition.

Theodor Philipp Haas

Sworn to and subscribed before me
this 14 day of March 1946.

"K ö r b c h e n - B l ü t l e r".

Die "Körbchenblütler" führen den wissenschaftlichen Namen "Compositen", denn sie besitzen Blumen, die aus vielen, vielen ~~Blüten~~ Blüten zusammengesetzt sind, die also einen Blütenstand darstellen. Ein Gänseblümchen ist keine Einzelblüte, sondern ein Vereinigung von vielen solchen.

Der "Stiel", der die Blume trägt, geht über in die Blütenstands-Achse, die scheibenartig verbreitert ist und zahlreichen Blüten genügend Platz bietet, ausserdem aber auch beblättert ist. Diese Blätter sind grün und man bezeichnet sie, weil in der Blütenregion befindlich, als "Hochblätter"; man kann aber z.B. bei den Dahlien sehen, wie diese Hochblätter von den gewöhnlichen Laubblättern abzuleiten sind.

Man sieht hier, dass die Worte "Blume" und "Blüte" auch verschiedene Dinge bedeuten können; bei einer Rose decken sich beide Begriffe; hier ist das aber anders. Eine "Blume" ist, ganz allgemein gesprochen, lediglich ein mit der Fortpflanzung im Zusammenhang stehender Pflanzenteil, der einen auffälligen Schauapparat besitzt. Man würde z.B. niemals eine Lindenblüte, die so angenehm duftet, als "Blume" ansprechen können.

Die Compositen stellen mit den Orchideen die artenreichste Pflanzenfamilie dar. Sie ~~ist~~ sind über die ganze Welt verbreitet; in den Tropen gibt es auch baumartige Formen. In unserer einheimischen Flora sind sie so zahlreich vertreten, dass man an Hand von Beispielen, die jeder kennt, leicht einen Ueberblick über diese Familie geben kann, ohne dass Abbildungen nötig wären. Die nachfolgenden Zeilen sollen aber auch einen Beweis liefern für die Mannigfaltigkeiten in der Natur.

Zum Verständnis des Blüten-Köpfchens oder -Körbchens, wie man auch die Blütenstände bezeichnet, sei zunächst der Bau einer Einzelblüte geschildert. Diese be~~steht~~ sitzt ~~aus~~ eine 5-zipfelige Blumenkronen-Röhre, zu der die 5 Blumenkronenblätter verwachsen sind. Man kann das am besten etwa bei einer Sonnenblume, wo auch die Einzelblüten verhältnismässig gross sind, sehen. Die 5 Staubblätter sind mit ihren Staubbeuteln gleichfalls zu einer Röhre ineinander verzahnt. Der Griffel, der von dem unterständigen Fruchtknoten ausgeht (der Fruchtknoten befindet sich unterhalb der Blütenkrone bezw. Blütenboden), ist zuerst Fegeorgan, das den Blütenstaub, den Pollen, aus der Röhre herauskehrt (die Staubblatt-Röhre ist in senkrechter Richtung beweglich) und dann wird er empfangsfähig. Der Kelch besteht aus einem Haarkranz – Pappus geheissen –, der bei der Verbreitung der Früchte durch den Wind eine grosse Rolle spielt.

Von dieser Blütengestalt gibt es nun vielfache Abwandlungen, die sich auch im Aussehen des Köpfchens äussern. Zunächst kann die Blumenkronenröhre zu einem blattartigen, zungenförmigen Gebilde, das häufig noch 5 feine Zähnchen aufweist, verwachsen sein. Am Wiesenbocksbart kann man das sehr schön sehen. Ein Bocksbart-, ein Löwenzahn- oder Habichtskraut-Blütenköpfchen sieht ganz anders aus wie ein soches vom Arnica, das auch gelb ist oder wie eine weisse Margerite. Die Köpfchen der 3 erstgenannten bestehen aus ganz gleichgebauten Blüten, wobei nur die Länge der "Zunge" nach der Mitte zu abnimmt. Diese Compositen werden als "zungenblütige" oder "liguliflore" Compositen bezeichnet; sie besitzen nur Zwitterblüten mit funktionstüchtigen Staub- und Fruchtblättern.

Ganz anders liegen nun die Verhältnisse bei der schon genannten Margerite, die auch den weniger schönen Namen Wucherblume führt. Hier kann man aussen einen Kranz von weissen Blättchen, die aber Blüten angehören, sehen und innen von diesen umrahmt, viele kleine gelbe Blütchen erkennen. Die letzteren entsprechen ganz dem eingangs erwähnten Blüten-Schema und man nennt daher diese Gruppe von Compositen "röhrenblütige" oder "tubuliflore" Compositen. Diese Familie zerfällt also, um das nochmal zu wiederholen, in die Gruppe der "Zungenblütler" und in die der "Röhrenblütler".

Nachfolgend wollen wir uns mit den letzteren beschäftigen, denn hier ist die Mannigfaltigkeit am grössten.

Kehren wir nochmals zu unserer Margerite zurück. Wir sprachen davon, dass aussen am Köpfchen ein Kranz weisser Blättchen, die Blüten angehören zu sehen ist. Wenn man sie ausrupft - er liebt mich, er liebt mich nicht (die Sache geht meistens gut hinaus, da es ~~/////~~ fast immer 21 Blättchen sind!) - kann man an der Basis die Griffelchen und die Fruchtknoten erkennen. ~~Auch~~ Das lässt sich auch an den Falten feststellen dass, ~~aus~~ die weissen Blättchen aus 3 mit einander verwachsenen Blumenkronenblättern entstanden sind; sie endigen auch mit 3 Zähnchen. Diese Dinge sind ein wenig klein und man sieht sie am besten mit einer Lupe an; sie müssen aber doch angeführt werden, da sie zum Verständnis des folgenden nötig sind. Im Gegensatz zu den schon beschriebenen "Zungenblüten" bezeichnet man diese Gebilde als "Strahlenblüten". Besonders deutlich kann man ihren Griffel beim Huflattich beobachten, da sie hier besonders lang sind. Den Strahlenblüten stehen dann im Innern des Köpchens die sog. "Scheibenblüten" gegenüber; sie entsprechen dem Typus, von dem wir bei der Beschreibung der Einzelblüte ausgegangen sind.

Das Abblühen der Blütenstände erfolgt von aussen nach innen; es beginnen also die Strahlen-Blüten zuerst und nun zeigt sich etwas ganz Merkwürdiges: Die Strahlen bleiben so lange frisch, bis die letzte Scheiben-Blüte verblüht ist, selbst, wenn die Griffel schon vertrokknet sind, wie man auch sehr deutlich am Huflattich erkennen kann. Diese "Verwelkungs-Hemmung" der Randblüten zeigen auch die liguliflоren Compositen. Durch sie werden die Köpfchen auffälliger und der Insektenbesuch wird für alle Blüten gesichert. Die tierischen Bestäuber laufen auf den Köpfchen herum und vollziehen dabei die Bestäubung der Griffel. Dadurch kommt es zur Bildung der einsamigen Früchte, die bei der Sonnenblume, die aus Amerika stammt, besonders gross sind; es sind das die ölreichen, auch als Vogelfutter gerne verwendeten "Sonnenblumen-Kerne".

Da erlaubt sich der allbekannte Löwenzahn, dessen Charakterbild von der Parteien Gunst und Hass verwirret, schwankt (die einen halten ihn für nützlich, die andern für schädlich), eine "Extratour". Bei ihm ist die Fruchtbildung von der Bestäubung unabhängig. Wenn man die Knospen der Köpfchen, die noch von den grünen Hüllblättern umschlossen sind, quer in der Mitte abschneidet, sodass der Empfangs-Apparat der Einzelblüten, also die Griffel-Enden, die Narben, und auch die Staubgefässe entfernt sind, so bekommt man die Flug-Früchte genau so, wie wenn nichts passiert wäre. Diese Erscheinung beruht auf einem Vorgang im Zellgeschehen, der hier nicht näher erörtert werden kann. Die ganze Blütenpracht des Löwenzahns, die für die April-Wiese charakteristisch ist und die besonders seit der Kriegszeit so stark auftritt, (unmittelbar nach dem Kriege fehlten die Düngermittel für die Wiesen, das Gras fehlte stellenweise und da könnte sich der Löwenzahn ansiedeln) ist eine "überflüssige" Einrichtung in der Natur. Es ginge auch ohne dieselbe. Es sei auch noch darauf hingewiesen, dass sich die Köpchen des Löwenzahns abends und bei trübem Wetter schliesen, eine Einrichtung, die bei viele Kompositen-Köpchen ~~aufweisen~~ vorkommt. In den Blütenstands-Achsen sind häfig Gelenke, die von der Luftfeuchtigkeit beeinflusst werden, vorhanden. Dies hat zur Folge, dass sich die Strahlenblüten bewegen können So werden die Strahlen beim Gänseblümchen nach oben, bei der Kamille nach unten geschlagen.

Es war bereits davon die Rede, dass die Rand-Blüten die Köpchen auffällig machen. Bei den röhrenblütigen Compositen ist das nicht durchwegs der Fall. Die Strahlenblüten können ganz fehlen und die Scheibenblüten für den Insektenbeuch auffällig genug sein·.Das ist der Fall bei einigen Disteln,wie sie in Feldern und Wiesen stehen und wo ihre roten Köpfe weithin sichtbar sind.Auch die sehr häufige Kohldistel,wo sich mit Vorliebe Ohrenhöhler aufhalten,gehören hierher.Eine andere Einrichtung zur Sichtbarmachung des Köpfchens findet sich bei den Korn- und Flockenblumen.Hier sind grosse,aber unfruchtbare Randblüten vorhanden,die also keinen Griffel und keine Staubgefässe enthalten.Es ist hier genau so wie beim Schneeball.Die äusseren Blüten~~stand~~ sind gross,aber unfruchtbar sie über~~nehmen aber~~ nehmen für die vielen kleinen geschlechtstüchtigen Blüten die Funktion der Anlockung der Bestäuber.In der Gärtnerei sucht man die Zahl der grossen Blüten durch Züchtung zu vermeheren und die kleinen zu vermindern.Man gelangt auf diese Weise zum sog. "gefüllten" Schneeball,wie man ihn mit seinen kugeligen weissen Blütenständen in den Anlagen und Gärten findet.Wir werden einer Aehnlichkeit damit auch bei den röhrenblütigen Compositen noch begegnen.

Es gibt aber noch eine Möglichkeit,die Blütenstände auffällig erscheinen zu lassen,nämlich die,dass sich Blätter in den Dienst dieser Aufgabe stellen.Das können Laubblätter sein.So wird das Edelweiss durch die weisse,filzige Behaarung seiner,in der Nähe der Köpchen stehenden Laubblätter erst zu der schönen Blume, die für Vereine oft zum Abzeichen geworden ist.Aber auch die Hochblatt-Hülle selbst ~~kann~~,die die Köpchen äusserlich umgibt,kann den Anlockungs-Apparat liefern Es handelt sich dann um trockene,häutige Gebilde,die strahlenförmig das Köpchen umgeben.In unserer einheimischen Flora kann man das bei der Eberwurz und bei der sog. Sonnendistel,beides Pflanzen,die im späten Sommer blühen,beobachten. Besonders schön kann man es aber an den australischen Stohblumen,wie sie in den Gärten gezogen werden,sehen.Hier hat der Hochblattkranz leuchtende Farben;die Pflanzen ~~Blüten~~ werden gerne für Trockensträusse benützt.

Also Möglichkeiten über Möglichkeiten.bei den röhrenblütigen Kompositen.Fassen wir nochmal zusammen:Wir haben Strahlenblüten,auffällige Scheibenblüten,grosse unfruchtbare Schaublüten oder auch Hoch- oder Hüllblätter für die Anlockung der Bestäuber.

Auch in Bezug auf das Geschlecht können in den Köpfchen Unterschiede bestehen. Bei den zungenblütigen Kompositen sind alle Einzelblüten Zwitterblüten,bei den röhrenblütigen kommen aber Abwandlungen vor.Wir haben bereits die geschlechtslosen Schaublüten bei der Korn- bzw.Flockenblume kennen gelernt;es gibt aber auch Fälle,wo beide Geschlechter in der Blüte vorhanden sind,d.h. man~~kann~~ kann Griffel und Fruchtknoten und die Staubgefässe feststellen,aber nur die ersteren oder die letzteren bleiben jeweils funktionstüchtig.Kerner v. Marilaun,der bedeutende Wiener Botaniker hat für die-se Erscheinung den Ausdruck "Scheinzwitter geprägt.Sie kommt auch anderwärts vor,Besonders bei den Ahorn-Arten ~~z.B.~~So z.B. sind die Strahlen-Blüten des Huflattichs weiblich,während die Scheiben Blüten nur Blütenstaub erzeugen.Wenn nun die Griffelblüten und die Blütenstaubblüten auf verschiedenen Pflanzen sich befinden,wenn es auf verschiedenen Pflanzen männliche und weiblich Köpchen gibt,so werden die Compositen zweihäusig.Das ist der Fall bei der Pestwurz.Die weiblichen Pflanzen liefern bis zu einem Meter hohe Fruchtstände,während man an den männlichen Pflanzen nur kurze vertrocknete Köpchen sehen kann,wenn es auch zwischen den Einzelblüten Uebergänge gibt.Solche Uebrgänge ~~gibt es~~ kennt man auch vielfach zwischen Scheiben- und Strahlenblüten;.an ausländischen Pflanzen kann mm ~~auch~~ sehen,wie sich die Strahlenblüten von den Scheibenblüten ableiten,ein Vorgang, der hier nicht näher geschildert werden kann.

Die Köpfchen können sehr gross,aber auch sehr klein sein.Das erstere ist der Fall bei der ~~aus Amerika stammenden~~ Sonnenblume,diesem grossen Gewächs,das nur eine einzige Vegetations-Periode durchmacht,"einjährig" ist.Kleine Köpfchen dagegen haben wir beispielsweise bei der Schafgarbe.Hier können wir aber wieder etwas Neues beobachten:Die Köpfchen werden zu einem auffälligen "Köpfchen-Stand" vereinigt;man muss sich das einmal genau ansehen an einem so weitverbreiteten und häufigen Gewächs!Auch die schon erwähnte Pestwurz besitzt Köpfchenstände.Die Köpfchen können enger oder weiter auseinander stehen;es sei nur an Wasserdost,Kreis-Kraut (oder Kreuzkraut) oder an die Goldrute erinnert.

Was die Zahl der in den Köpfchen enthaltenen Einzelblüten anbetrifft,so sind hier gleichfalls Verschiedenheiten fest zustellen.Es kann zu einer Verminderung der Blütenzahl kommen.Der in unseren Wäldern häufige,violett blühende Hasenlattich,der zu den liguliflloren Compositen gehört,hat nur jeweils 5 Einzelblüen im Köpfchen.Am weitesten geht diese Reduktionserscheinung bei der Kugeldistel. Hier bestehen die Köpfchen aus einer einzigen Blüte,die von Hoch- oder Hüllblättern umgeben ist.Nun zeigt sich aber bei dieser Pflanze wieder etwas ganz Sonderbares:Die so stark reduzierten Köpfchen sind zu einem Stande vereinigt,der ganz das Aussehen eines Einzelköpfchens zeigt.

Fassen wir zusammen!Wir haben bei den Compositen folgendes: Vereinigung von Einzelblüten zu einem Blütenstand- Köpfchen-geheissen-,der wie eine Blüte aussieht,aber nur eine Bäume darstellt;Beispiel:Margerite.Vereinigung einer grossen Zahl von kleinen Köpfchen zu einem Köpfchen-Stand,Beispiel Schafgarbe,dann Veringerung der Blütenzahl im Köpfchen,Beispiel:Hasenlattich und Kugeldistel und bei dieser wieder das Aussehen eines Köpchenstandes wie ein Einzel-Köpfchen.

Diese Schilderung der vielen Mannigfaltigkeiten bei den Compositen wäre aber unvollständig,wenn wir nicht erwähnen würden,dass einige Vertreter dieser Famili zur Windblütigkeit übergegangen sind und ganz kleine,unscheinbare Blütenstände besitzen;hierher gehören die Beifussarten,von denen eine den Absinth oder Wermuth liefert,jenes alkoholische Getränk,das in Frankreich viel getrunken wird.

Die Compositen-Köpfchen haben,wie wir sahen,das Aussehen einer Einzelblüte; sie sind"Blumen".und so wundert es uns auch nicht,dass sich die Pflanzenzüchtung damit beschäftigt und "gefüllte Blumen" erzeugen will.In besonderem Masse ist das gelungen bei den Dahlien,Astern und Chrysanthemen,wie die Blumenpracht unserer Gärten zeigt.Unter "Gefüllt-Sein" einer Blume versteht man die Vergrösserung ihres Schauapparates.Diese kann,wenn die Blume eine Einzelblüte ist,zweierlei Ursachen haben.Entweder,es werden Staubblätter(=Staubgefässe) zu Blumenkronen-Blättern,was bei der engen Verwandtschaft der beiden leicht möglich ist, (man kann das sehr schön an den gross-blumigen Begonien sehen;hier können nur die Blütenstaub produzierenden,die männlichen,Blüten gefüllt sein)oder bei der Anlage der Blumenkronen-Blätter treten Vermehrungen auf.Ganz anders bei den Compositen-Blumen.Ein "gefülltes" Köpfchen ist ein solches - es kommen hierfür nur die röhrenblütigen Compositen in Frage - bei dem die Zahl der Strahlenblüten vermehrt,die der Scheibenblüten vermindert oder diese ganz unterdrückt sind;meist auf Kosten der Fruchtbarkeit,denn die Strahlenblüten der Kulturformen sind entweder weiblich,also nur Griffelblüten oder überhaupt degeneriert und steril;es ist hier ähnlich wie beim Schneeball,worauf bereits hingewiesen wurde.Es gibt gefüllte Gänseblümchen,wie ~~kk~~ gefüllte Astern Dahlien,und Chrysanthemen, die unsere Sommergärten schmücken.

Zum Schlusse sei ~~...~~ noch darauf hingewiesen, dass sich die Mannigfaltigkeit unserer Compositen auch auf die Verbreitung der Früchte ausdehnt. Der Löwenzahn, verschiedene Disteln ect. lassen ihre Früchte vom Winde fortführen. Der Kelch wird zu einer Haarkrone, die zuweilen gestielt sein kann, und die Früchte werden nach dem Fallschirm-Prinzip fortgetragen; dabei sind sowohl im Köpfchen als auch in der Haarkrone Gelenke eingebaut, die von der Feuchtigkeit beeinflusst werden, sodass diese Verbreitungs-Organe nur in Tätigkeit treten können und Früchte nur die Mutterpflanzen verlassen können, wenn das Wetter gut und trocken ist.- Bei der Sonnenblume oder der Wegwarte, deren Gartenform die mehr oder weniger beliebte Cigorien-Wurzel liefert, bilden die Früchte eine willkommene Nahrung für die Vögel. Diese holen sich dieselben von den Köpfchen weg, verlieren aber dabei ziemlich viel und sorgen so für die Verbreitung der Pflanzen. Beim Gänseblümchen wächst die Blütenstands-Achse nachträglich in die Länge und die platten Früchtchen fallen ab. Auch Ameisen sind bei manchen Arten an der Verschleppung der Früchte beteiligt; z.B. beim Hammellattich.

Damit sei diese Abhandlung abgeschlossen. Es sollte gezeigt werden, wie bei einer einzigen Familie schon die Mannigfaltigkeit der Natur ungeheuer ist und so können wir mit Faust sagen:

"Wo fass' ich Dich, unendliche Natur?"

Dr. Theodor Philipp Haas.

The Lattice Plant.

(Aponogeton fenestralis (Poir.) Hook.f.)

In islands, due to their isolated situation, we frequently may find living beings - plants and animals - the distribution of whose species is limited to a very small area. We call this "endemism". The representatives of such endemisms very often show interesting peculiarities. In the Canary Islands live insects which have lost their capacity of flight. Or, we may mention the "Birds of Paradies", famous for the beauty of their plumage. These birds are indigenous to New Guinea and the surrounding islands. In plants it is the same. It is reported that of the 935 plant species, native in New Zealand, 677 species would represent endemisms of those island, these are 72% of the entire flora of New Zealand. In the Canaries endemic species are 45% of the flora of these islands. In St. Helena there are even 80%. In our Hawaian Islands the endemic plant species form 78% of the plant species, living in this area.

To such an endemism our "Lattice Plant", Aponogeton fenestralis, also belongs. The name originates from the lacelike filigrane which shows the leaf blades. The plant is living as a submerged water plant in slowly running brooks in Madagascar, where the sunlight is somewhat moderated. The accompanying illustration should show this plant. Aponogeton fenestralis possesses very pretty leaves. These are interesting because of their "fenestration", the lacelike filigrane of their blades. We also find such a "fenestration", such a filigrane, in the thallus of the Californian lichen Ramalina reticulata, hanging in long gray beards from the branches of trees which are situated in the region of the salt containing fogs, coming in from the Pacific Ocean. We see this phenomenon also in the big leaves of the Aroideae Monstera deliciosa, the fruits of which we eat. This "fenestration" is caused by the fact that at an early stage of the development of the leaves, parts of the blades - in Ramalina reticulata, of the thallus - die off.

In our "Lattice Plant" the parts of the tissue between the leaf nerves, the parts of the green parenchyma, during the growth of the leaves. Thus the pretty network, which the blades show, is formed, essentially by the meshes of their leaf veines. The rest of the green parenchyma which encloses the veines or nerves assimilates the carbonic acid, contained in the water.

This pretty plant is sometime raised in botanical gardens. The cultivation is rather difficult, because the plant is to keep under very moderate light conditions; it cannot endure too much sunlight.

The Lattice Plant
(Ouvirandra fenestralis)

About 80 years ago,a French botanist collected in Madagascar 5 specimens of this singular plant,but for more than 50 years no living specimens were brought to Europe.The Rev. William Ellis,whose connection with Madagascar has produded marvellous changes in the past,and will influence all its future history,brought from that island the first living specimens some 25 years ago,and now it is to be found in most botanic gardens and in many private collections.It grows without much trouble,and in a short time will be an ornament in the windows of every cottager or artisan who is fond of plants.There is little interest in the inconspicuous flowers,but it would be difficult to imagine anything more delicate and beautiful than the exquisite network of the leaves.The plant grows under water,near the margin of running streams.Its thick root,or rather horizontal stem, creeps along the surface of the mud,throwing out long fine roots below and at intervals, on its upper surface,clusters of leaves.The leaves are of an oblong form,9 or 10 inches long,and 2 or 3 inches broad.They have a strong midrib,but the remainder rest of the leaf is like a living fibrous skeleton,formed by the interlacing of two sets of veins.The one set are longitudinal,and nearly parallel to the midrib and the margin of the leaf;the others spring from the midrib and pass outwards,towards the margin,crossing the longitudinal,series at right angles,forming quadrangular meshes.

Leaves,as a rule,are composed of numerous veins with cellular matter spread out between them,and uniting them so as to form a flat continuous surface.The leaf of the lattice plant seems as if it were composed entirely of veins;but when a leaf is examined by the microscope it is seen that the delicate veins are surrounded by a layer of cells. These cells are more numerous in some leaves which have the meshes oval - this form being produced by the filling up the angles of the ordinary form of mesh.Leaves are also occasionelly found in which the meshes are entirely filled up,so as to form a perfect blade.At first the leaf is of a pale yellowisch colour.In the general stages of its growth it passes through every gradation of colour,from that named to a dark olive,becoming before it finally decays,brown or nearly black.

Mr.Ellis thus describes the aspect of the living plant:-"It is scarcely possible to imagine any object of the kind more attractive than a full-grown plant,with its dark green leaves forming the limit of a circle, 2 or 3 feet in diameter, and presenting in the transparent water within~~g~~ that circle leaves in every stage of development, both as regards colour and size. Nor is it less curious to notice that these slender and fragile and flexible as a feather, still possess a tenacity and wiriness which allows the delicate leaf to be raised by the hand to the surface without injury."

The bauty of the growing plants is greatly enhanced by innumerable cells of oxygen entangled among its mehes and glittering in the sun which it has disengaged from the carbonica acid ags on which it lives.

The flowering stalk rises from the middle of the cluster of leaves. As it pushes itselr up to the surface of the water it is covered by a singular little cal, which falls off entirely ,and liberates the 2 short and fleshy branches on which the numerous small colourless flowers are borne.

At the period of the year when the thick fleshy root or creeping stem is stored with starch, the natives of Madagascar collect it and use it as an article of food. It is callen by them "Ouvirandrano" which means water-yam, because when cooked it tastes like the
~~Hunters raspberry~~
yaw. Botanists have adopted the native name for the genus giving it in accordance with
(Dioscorea)
their invariable practice, a Latin termination - Ouvirandra, and adding fenestralis, as the designation of the species in allusion to the remarkable structure of the leaf.

J. W.

Nor is it less curious to notice that these slender and fragile structures, ~~apparently~~
apparently not more substantial than the Spinnwebe gossamer and flexible as a feather, still possess a tenacity and wiriness which allows the delicate leaf to be raised by the hand to the surface without injury.

 (Lecture Notes, Open Box 8 ?)

Ladies and Gentlemen!

as specimens of plants in the Botanical Garden of Munich as
I have the great pleasure ~~my~~ to show you examples of the botanical treasurs ~~of the bota-~~ there
~~nical Garden in Munich Nymphenburg.~~ The photos I am glad to demonstrate here are made during more than 10 years. From several plante I made the photos during the development. The time is too short short to show you all these things. I invite you to a walk through the outdoor garden and then we have to go into the warmhouses. The tropical plantworld is much more conspicous than the vegetation in the moderate zones, especially in Munich with a reaative short summer. ~~[illegible]~~ About location and history of the Garden I have ref refered in two articles in "Parks & Recreation". We take ~~now~~ first an airplaine ~~and look~~ view ~~around~~ of a part of the garden. You see here the main Institute -building - the photo was taken on March 5th 1933 - and before it the sunken display garden. I will speak afterwards of this. Behind the Display garden was the bilogical systemat division surrounded from the pergola with the Cafetaria. Far in the west, on the right side you may see the houses of the Director and the Curator in charge. On this side were the Herbara ~~and~~ The Botanical Museum was on the first floor. Here was the entrance to the Garden, the house of the inspector, and here the greenhouses which we see afterwards. Here was the heating plant and the workshops etc. The systematic divisions and other parts of the Garden are not moreon this photo.

When we enter and have payed our fee of 50 Pf. ,about 25 ¢ then we see in summer some Mediterranean and Australic or New Zealaendic plants. On our rhight side is the sunken Display garden. I was used to demonstrate the beauty of the flowerworld at thedifferent seasons. Nearly below the snow came Crocus and Eranthis, then Schionodoxa, Scilla and vey very early also Daphne Mezereum, a wildflower in our woods. Later came early- and late flowering tulips ect. Large murseries were invited to exhibit their product. This was a good idea. The Garden had beautiful flowers and the nurseries a very useful ~~possibility~~ opportunity for propaganda. The sunken Display garden was surrounded of a wall of about 2 m. This wall was built of a porous limstone tuffa - the same material used later in the rock-garden. This ideal material for raising of rockgarden plants came from the prealpine country, from Polling, where it is a relic of the late glacial time. On this wall were raised cushion plant which bloomed already very early in spring. We had here also a whole row of Gentiana acaulis, or Clusii, a wildflower in April-May south of Munich and in the (There exists a calciphobous stalkless Gentian G. excisa or kochii)
limestone Alps. We prefered mostly specimens which were already acclimatized to grow

29

Mycorrhiza

in gardens.We often had difficulties with alpine plants directly taken from the Area. The center of the display garden was a square water bain in which waterlilies were to be seen.~~MMMMM~~ You see here a photo of the area in late summer .At this time were Canna indica,Astrs,Dahlias etc.in bloomIn the Background you see the pergola which was used tho demonstrate the different method, of climbing:Winding plants (clockweise and conter clockwise) climbing with special organs ~~Leaf~~- and shoot tendrils)Around the water basin were huge plants of Gunnera scabra and Chilensis. members of the Haloragidaceae I show you a specimen of Gunnera scabra from one of the corners. This is a ~~beautiful~~ gorgeous decorative leaf plant from Brazil.Goebel brought these plants ~~1925~~ 1913 back from his journey to that country and they grow very well.They bloom in early sprin During the winter the leaves are cut off and a little wood house,filled with fall-leaves protect the plants.The roots are interesting for their symbiosis with blue-algae in the peripheric tissue...The garden was divided in different divisions; separated by carpinus hedges I only may give the names:There was a bilogigal, [illegible], [illegible], water plants, and alpine plants. a systematic division.A division of economic plants - the German word is "Nutz-Pflanzen" - including drug plants and weeds.A geographic and a genetic division in which the origin of the local flora,rep.the simple laws of heredity were demonstrated.In an original Pinus silvestris forest was planted a large number of Rhododendron species:Rhododendron catwabiense and many other species,Acaleas and at the begin of June was a splendor of colors there which is not to describe.The Rhododendron shrubs needed no protection!and they overcame the winter very well.The fore-ground was planted with Chinese primeroses,Primula sinensis ~~with~~ in many varieties.Then came the fern ravine,a hollow way under trees in which ferns were raised and other plants which love moist air.In the fern ravine - for its construction red sandstone from North Bavaria was used - was a little brook the water supply for the garden.I have written about this problem in my article.In the fern ravin grew fern varieties with different leaves,mutations as they are raised mainly in England. Then came the "lake" and we were in the Arboretum.First a few words about labelling of the plants. This is a "black chapter" here in Philadelphia!In Munich the people have stolen the plants,but not the labels! The labels outdoors were mostly made from China.They were therefore pretty heavy;in this way nobody wanted to collect them.When China was not available woodden tags,paint c white were used;the name of the plante was painted upon this tags.The labels were fastened on a ribbon-iron.In the label was metioned first the family,then came the scien-

10. The streams cut deep into the rocks. This shows two photos of "gorges". The German word is "Klamm". # 10 is the Höllentalklamm, # 11. Die Partnachklamm. It is here very wet, the water runs down from the hight, it is rather dark here and the quick moving water causes much noise.
The following mountain slides are taken from the area around Mount Schachen (1900 m) near Partenkirchen. From 1922 until 1936 I was there every year because the Munich Botanical Garden, where I was working, had a mountain garden there. All these slides which you see are the result of bicycle tours during this time.

12 Sea of clouds on the Schachen. It was on July 3rd 1932 after a rainy day.

13. View from the "Meiler-Hütte" (# 3.) towards the Zugspitze. In the foreground is a moist meadow, the "Frauen-Alpl" (2 000 m) in which you find high-Alpine marshplants.

13 a. Eryophorum Scheuchzeri. Highalpine Woolgrass, growing on the "Frauen-Alpl"

14. View from the "Frauen-Alpl" to Schachen. You ~~see~~ can overlook the whole situation there. In the Background on the right, Partenkirchen.

15, 16, and 17 demonstrate the grandiosity of the landscape. # 17 shows clear the timberline

18, 19, 20 are slides from the botanical mountain garden. The conifer is Pinus cembra, the only European pine with 5 needles on the shortbranch. The cones remain closed and there is a bird, a nut-cracker, called "Tannenhäher" which opens these cones and picks out the big, nutlike, hard unwinged seeds. Only in this way the tree is distributed; it depends upon this bird
The little chalet is a former forest house and is now the home for the gardener during the short summer of 3 months. The house contains also a laboratory for research work.

21. A mountain forest near the timberline. There are Pinus cembra, Spruces, Dwarf Pines, Juniperus and between the European Rhododendron, Rh. hirsutum with red flowers in July. A few trees in the hight are already victims of the climate.

22. Schachen-Lake. Watch the slender growthform of the spruce. This happens with all needle trees in mountain land, also in the American Rockies. The Spruce, Picea excelsa, the "Norwey-Spruce" is native in this area.

23. Alpspitze and Hochblasen; watch the timberline!

24 Spruce forest in a lower altitude; behind the mountain forest and behind again the wall of the Wetterstein-mountains without any visible vegetation. Watch the little Crucifixus!

25.Food to the "Meiler-Hütte" is carried by mules.

26. Mountain sheep on the "Frauen-Alpl".Cattle cannot climb up so high on account of the narrow path.

27.Cattle.It is the AllgäueRace.Grey cows;raised mainly for milk.

28.Wetterstein Alm.,a typical rounch.Here the animals are kept.

We no leave the mountains and speak of the prealpine country,the "Alpenvorland".This is a glacial landscape.During the different glacial periods - we know that there were several ones,interrupted by warmer inter-glacial periods - the Alps carried an ice cap,isolated from the average European Ice cap.In contrast to the situation in North Germany, and also to the situation in North-America,the glaciers moved northward.In our area therefore everything is opposite to the situation in the north!The glacial periods are neamed for rivers.We have an earlier "Riss-Glacial-Period" and the last ice time is the "Würm-ice time",named for the outlet of the "Würm- (or Starnberger)See".We use now

29, a map of our area ,and we have to come back several times to this map.During the Tertiary the land,north of the Alps,was covered by a flat ocean the water of which became more and more fresh.Today the sediments of this flat ocean near the Alps are hard rocks,more in the north a water impermiable claylike marl of unknown thickness.The name of these sediments is "Molasse",the special name for the marl "Flinz".In the immediated neighborhood of the Alps the Molasse was folded with the Alps;we have already mountains of 1000 m hight,like the "Peissenberg",but these mountains don't belong anymore to the Alps.

30.Folded Molasse near Murnau.The pressure came from the south;the layers are vertically.The rivers have to cut themselves deep into this folded Molasse.

31.The Ammer-Valley (in the direction to north).You see in the foreground the diagonal incidenting rock layers.

32 and 33# Man has to overcome this deep valley by a bridge.This is the famous Echelsbacher-Brücke..It was built 1928 without any scaffold.The iron constructions were built from both sides and they met each other in the mid with a difference of only 30 cm From the bridge to the bottom of the Ammer are 78 m!.

The most important factor in area during the Würm-Ice-Time was the "Isar-Vorland-Gletscher.

the "Isar-Foreland-Glacier".The Isar is today the main stream.It runs into the Danube and belongs so to the system of the Black Sea.The names of many rivers are Celtic,like in the U.S. Indian.The early population in South-Bavaria was Celtic.Then followed the Romains and in the 5th century the Germanic Bavarians.The glacier had a length of 75 - 100 km,as we see them today in the Alai-Mountains in Central-Asia.The "Isar-Vorland gletscher" had several tongues.Two of them cut themselves so deep into the Molasse,that they are still today big lakes:The Ammer-See and the Würm-See.The first has a depth of 80 m,the latter of 115 m.It is supposed that the Ice was at once 2000 m thick,as it is today in Greenland.The glacier carried gravel-masses from the Alps to the north.These are the moraines,today chaines of hills.The Endmorains are the borderlines of the glacier in the North.So it was during the Würm-Ice-Time.The previous "Riss-Ice-Time" produced larger glaciers which went farther to north.Their endmoraines yet were lowered by the water of themelting Isar-Vorland-Gletscher of the Würm-Ive-Time.

34 is an airplane photo of that region.In the foreground the endmoraine of the Riss-Ice Time,then the village Baierbrunn and behind the forest the endmoraine of the Würm-Ice-Time in two waves with Hohenschäftlarn and Zell-Ebenhausen.On the left the Isar has cut itself into the gravels.In the background,in the upper corner you may recog nize that there was at once a lake;it was the "Isar-Lake",filled up by the Isar.

35.Airplane phot. of the Würmsee.Compare it with the map!

36,37,38. The landscape in the prealpine country.In the background the Alps.# 37 & 38 show the "Osterseen" which are also geologicly very interesting.I took the latter photo 14 days before I left Germany,in the first days of July 1940!The negative was developed in New York!The islands in the lake kling together.

38 a. Gentiana acaulis the blue Gentian.The glaciers brought to the prealpine country alpine plants and one of the most beautiful ones is the blue Gentian which you find in early May on many spots in the "~~XXXXXXXX~~ Alpenvorland".They grow on dry meadows and also between the gravels of the alpine rivers.On such a place is taken this photo.These flowers are protected against robbers.It is not allowed to pick them up or to sell them in flowershops.~~XXXXXX~~ On all railroad stations were posted pictures of protected plants! The police and a private organisation which also had the security service in th Alps - this organisation was named "Bergwacht" - took care for these protected plants.

The lakes in our area will disappear with the time.There is a process which we call "Verlandung".This means the vegetation fill up the lakes.

39. shows such a lake.The vegetation proceeds from the right towards the open water. In the foreground solid gound.

40. In this way a marsh develops.The water has here the same salt-conteint as the lake.Yet after a while a moss comes in,the bog-moss,,Sphagnum,German " Torfmoos".This causes the development of an elevated peat.# 40 shows that this process starts in "islands" upon the mrshes (The white fruit closters of the alpine woolgrass,Eriophorum alpinum,marks these islands).These islands melts together and so in place of a former marsh is now an elevated peat with quite different water conditions.It is mostly rainwater - the Sphagnum sucks it on like a sponge.The soil becomes rather acid and calciophobous plants grow there - in the limostone Alps and in the prealpine country grow exclusively calciophilouxs plants - we see Calluna vulgaris,the heath,the swamp clubmoss and also sundew of the carnivorous plants,but also dwarf-pines,Pinus montana which we know from the Alps and other alpine plants.The elevated peats are the most interesting plant societies in Bavaria!

41. Also the big lakes are submitted to the "Verlandung" - map -.The Ammersee ends in the north into a large marsh and the outlet,the Amper,is only navigable by small vessels as she moves in the region of the lake;afterwards she becomes tpp shallow.

A few words about weather.The weather in Middle-Europe is determined by 3 factors: A high aair-pressure,a "maximum" over the Azores,reaching often until England,the so-called "Azores-High",then a low pressure over Iceland-Greenland,the "Iceland-Deep",and over Sibiria in summer a depression,in winter a maximum,because cold air is heavy.
~~You may understand how important for the Germans it was to be informed about the "Iceland-Deep"~~ During the greatest part of the year there is westwind in Europe.This wind comes from the Atlantic ocean and brings rain.Mostly wet is the summer,especially during a so-called "Monsoon-Weather-Situation",this means a high pressure over England.In this case one depression from the Iceland-Deep follows the other and you may understand how important it was for the Nazis to be informed about the weather in Greenland.The moist air condenses on the edge of the Alps and therefore there is much rain.Very often the harvest of hay is in danger, and the wool keeps from because June is mostly very rainy.Cloudbursts with heavy

hails are very abundant in summer.Even the greenhouses of the Munich Botanical Garden have to be protected againsthail.For the peasants exists a hail-insurance. November and December are mostly cloudy.The blue heaven is not to be seen sometimes for days,or for more than a week.This is the reason why the air force has a limited value during these days. Lasting Snow appears mostly about Christmas or New Year and then persists a snow-cover for about 2 months.

42 shows a forest during the winter.

Very peculiar is in our region the so-called "Föhn",a very warm Southwind which can melt the snow even in winter. When air is sucked from the south - a depression over Bavaria, a maximum over the Mediterranean - then the air becomes warm on the south slobes of the mountains and when it sinks down on their opposite sides it becomes compressed and so warm a new.Many people are sentive againstthis wind.

The Alps have a west-eastern direction,as all mountain chains in the Ols World - in contrast to the mountain chains in the New World - The result of this fact is that Middle-European forests are so poor in species.Plants which retired towards the soutn during the glacial period colud not return anymore when the climate became more favorable. - When the snow melt in spring then comes usually a flood,carrying tremendous quantities of material out of the Alps.

43,# 43a.In May 1940 the flood was the highest since 40 years.The first shows the Isar in the Isar-Valley where the Isar cuts deep into the gravels,the second shows how it come to Munich itself.

44. The Isar near Ebnöd.In this way the Isar cuts itself into the Flinz,into the tertiaric Molasse- ground.In this picture -there is now a powder-factory - you see 3 stratas .The uppermost layer is humus ,rather thin ,carrying forest.Then follows a gravel layer and beow the already mentioned Flinz which is -in contrast to the gravel layer- water imperniable.On its surface the groundwater moves slowly nordward.It appears in this photo as springs,running as dark stripes along the flinz layer.

Map again.The outwash of the glaciers of the different ice-times covers a great deal of the country.The German word is"Schotter".The oldest outwash (the moraines Bayern),originating from the oldest ice-time,named for the river Mindel,is a hard rock,used as building material.Above this we have the outwashes of the Riss- and Würm Ice time.These form lose gravelmasses loose gravelmasses.The rivers Isar,Amper Würm when they had once more water ,originating from the melting glaciers,cut funnels into these gravel layers because their beds were not fixed.Even in historical times the Isar often changed her bed!.The gravel was carried farther north and you see it marked on the map as "Schotterzungen", graveltongues.Where the gravels dissapear,the Flinz appears,carrying the groundwater and we have swamps or marshes ~~there:the~~ Dachauer- and Erdinger Moos.

The alpine rivers have a great pushing power and this is used for producing electricity.There are the "Walchenseewerk" in which the water falls 285 m and the "Mittlere Isar" in which the Isar falls 85 m.The electricity supply of Munich is obtained a gret deal by the water power of the Isar,and the water power of the Inn is used for producing Aluminium in electrical ovens.

45.Where the Isar loses its pushing power gravel banks develop.Here you find sometimes highalpine plants.These gravel banks change with every flood during the year.

46.shows a very rare tree,the European ,or English Hew Taxus baccata,a 500 year old specimen of the "Eibenwald von Paterzell",a reservation for this very slow growing tree.

We speak now concerning the history of culture and art in South-Bavaria.This country differs in some aspect very nuch from the average Germany.The close situation to Italy ,the center of medieval art,is the cause of a stron Italian influence in Bavarian art.The Alps yet delayed the entrance of this art for about a century ~~in~~ Bavaria.The Bavarian late-gothic style,in which many city churches and village churches are built riches its highest point in the 15^{th} century.The Munich cathedral was built from 1468 - 1486.But this is the Italian "Quatrocento" which was already the time of Lionardo da Vinci!The coronation of the towers of the Munich-Cathedral is in the new Italian style,in renaissnace,and the German expression for these are "welsche Hauben",foreign caps!And in many village churches -as we shall see- we have also such "welsche Hauben"upon a late gothic spire. The Italian influence was speeded very essentually by the religious contact with Rome and by dynastic relations.Bavaria is a catholic country and following the conter-reformation during the 17^{th} and 18^{th} century nearly all romanesque or gothic churches received a barock- or rococo decoration of the interior,or new churches wer built in the new style.Thereby also a very strong French influence is tific name, the German name, if present, and at least the homeland and distribution of the plant. The same method was used in the greenhouses as I will show later. The trees and shrubs were ordered to the system. Farthest away from the city were the Conifers. There was mostly westwind, as it occurs the average time in South-Bavaria, so these sensitive plant were not too much in danger of smoke. In the arboretum were ecological groups like "heath", "dunes" and especially the rockgarden, called "alpinum". The "lake" before it marsh and peat. was the water reservoir for the garden. It contained also waterplants and showed the proceeding of the vegetation towars the water, the "Verlandung" as it happens in the prealpine country south of Munich. The "Alpinum" contained alpine plants of the whole world, especially , of course, such ones of the European Alps. Mostly the plants were cultivated first in briques with hollows and later they came to the rockgarden. There was also a division for calciophobous plants as they occur in the Central-Alps. There rocks of Gneiss from Tyrol and limefree earth. In connection with this "Alpinum" in Nymphenburg was a rockgarden in the Bavarian mountains in a hight of 1900 m (= 6,200 f) in contrast to Munich with about 500 m (= 1700 ft.). A gardener of the Munich "Alpinum" with a long experience in growing alpine plants took care for them on Mt. Schachen from June to September, during the short summertime there. I show you 2 photos from this marvellous spot near Garmisch-Partenkirchen. The trees are Pinus cembra, the only European pine tree with 5 needles. It grows in Bavria only on this place. The main difficulty in this original alpine rockgarden was to keep the plants in the beds in which they belong, therefore to prevent that they would escape. Another difficulty was the struggle against alpine weeds. Also in this rockgarden the plants had the same china labels as in Munich. The Schachen-Garden had a division of native alpine plants, growing around the area so that "mountain-climber" could inform themselves. Besides this plants which did not grow very well were raised in this hight. The gardener also had to collect the seeds. You know that in peace time the different gardens changed the seeds among them. During the lasy years the little chalet was used as a mountain laboratory for comparative research work on alpine plants. A picture, taken of the Botanical Garden in winter, may give you an idea of the winterly beauty.

which also occurs in our Mangrove flora in Florida in Rhizophora Mangle.The plant here is Brughuiera erippetala belonging also to the Rhizophoraceae, native in the East Indies.The first photo shows the flower.The seed in the fruit germinates in the motherplant.The hypocotyle with the root has the fruitwall with the pistil taken out from the flower and bears it like a cup.The following phot shos the germplant with the big hypocotyle and the root.The last photo in this group shows the young germplant with root By this vivipary the germination is transfered from the ground to the motherplant where the conditions are better.

The following houses are devoted to xerophytes,plants which possess adaptations to a dry and arid location.We already have seen such plants when we entered the greenhouses.Whilst there the water was stored in the leaves we spoke of leaf succulents.We have now the
of America
cacti and similar succulent forms of the Old World,like Euphorbias. The water is stored in the stem which also has the task of assimilation.We have "stem-Succulents" You see 2 photos;one shows cacty,the other Euphrbiaceae.The sidhouses contain smaller forms of these stemm succulents.I show you 2 photos.Eophorbia melophormis and obesa and hybrids between both,and a flowering Mamilaria,a catus.There are also many smaller leafsucculents
Soth African
like the most interesting Mesembrianthemums.The following photo shows Crassula pyramidlis with its short internodes.In these houses are kept also other plants,Sundews,Venus-Fly Trap which grows very good and Drosophyllum Luisitania,the only one xerophyte among the
rous
carnivous plants.Munich had the largest collection in Cacti in Europe.

We pass agin our glass door and enter the big palmhouse from the other side.The plants here are big Araceae,like Xanthosoma robustum,Colocasia,we see here a large collection of Bromeliaceae,including our Spanish moss,Tillandsia usneoides.We see here Hedychium,
hang
Alpinea,Costus,and many other plants.From the roof the beautiful flowers of Passiflora quadrangularis;the fruits are eaten under the name "Granadillas".There are also Dorstenias, very close related to the figues.I show you a picture of Marcgravia umbellata of Brasil with extraordinary inflorescences.These 5 leaves you see are nectar leaves.The plnat should be pollinated by Hummingbirds.

The Next large house contains the treeferns.It is one of the most beautiful houses:

The tree ferns grow in the tropics in a high altitude,about 2000 m where they have much moisture in the form of foags and where they have also much light.On the base of the co-lumn like stem they develop many roots which give the stem a certain stability,The crown is formed by the gigantic,fine shaped leaves.The fern trees belong to the "tuft-trees". This means an unbranched stemm bears a tuft of large leaves,forming the crown.Besides the fern trees we have such tuft-trees in the Cycads which we see later and once for all in the palms.I show you 2 pictures of this house.The average fern trees were Alsophila ex-celsa which grew rather well and which was raised from own spores.In the house was a lit-le artificial spring and in summer the glass roof could be sprayed,to prevent too much heat.Beside Alsophila excelsa were other members of the group Cyatheaceae.Only one Ci-bothium from Hawai was there.From 14 stems which Goebel ordered only one survived. Then was there Equisetum giganteum from South-America,a horsetail with stems of about 5 m hight and 5 cm thickness,the largest representative of the horsetails. Several specimens of Auracaria excelsa from the Norfolk Islands,the so-called "room-pine" was in this house.When the plants became too tall they had to be capped.In this way the "room pine produced new tips.Goebel made 1906 an experiment with this plant.The branches of Auracaria excelsa differ in their branching from the stemm.The latter branches radiary, the former only in 2 rows,they are bilaterale.Goebel planted such a branch as a craft and the branch retained this kind of branching the whole time.

The following house contains the Cycads,also very beautiful plants.Following their pri-mitive kind of propagation - they still have free male sex cells - they are placed on the begin of the plant system.I show you 2 members of the Cycads:Cycas revoluta,native in
We see only female plants;the Cycads are dioecious
South-Asia,and Dioon edule at home in Central America,including Mexico.Cycas revoluta
We
has a thick stem.When the plant comes to flowering it produces a closter of fertile leaves.These leaves differ very little from the sterile ones.The basal part has on the place of feathers the ovules, until to 8 ,and the rest of the leaves is pinnate as the sterile leaf.They ar only shorter and covered by brown hairs.After a while the plant produces a closter of sterile leaves.In this way always fertile and sterile leavs al-ternate.
h.w
That you may see the shape of the tree I show you a photo of Cycas revoluta which I took in the botanical Garden in Kyoto.In that country it is a favored outdoor
not
plant,but it comes ~~never~~ to blossom.Japan is too cold for it.

Dioon edule is also one of the most beautiful plants.It is the first plant among the Cycads in which also the female flowers are cones. The male flowers of the Cycads are always cones,sometimes of a length of more than 1 m.The first photo shows the plant with 2 cones and the second with the development of new leaves.These are at first smooth,but after a while they become hard and stiff,if they would be made from metal.

The next 2 houses are "cold houses",this means houses with a lower temperature.Here tea was raised,but in summer they were reserved for the beautiful art of the gardeners. One house was reserved for the different Begonia species and it was a splendor of color here.In winter the houses served for the collection of Proteaceae in which the garden was very rich.These plants were in summer outdoors.I only show you a Banksia spec. This family is especially interesting the name originates from Proteus,the "many shaped" in Greek mythology.The plants grow only in the Southern hemisphere.Their home is Australia,South-Africa,a part of South-America,the rest of the fabulous "Gondwana Land"! Between the 2 houses is again a pavillon,showing epiphytic Pteridophytes.Here were the epiphytic ferns Drynaria and Platycerium with different species,Psilotum,and some clubmossis.Ishow you here Platycerium biforme and Lycopodium ramosum.The latter plant shows very well the dichotomy in the branching.Spores were produced in the apicale parts of the branches.Platycerium biforme has sterile and fertile leaves of the latter only a kidney-shaped part is reserved for the sporangias.the other part has to assimilate,whilst the sterile leaves very soon become woody;they have to hold fast detritus falling down from above.In this way the Platycerias make their "flowerpot"in which they send their roots. You may see how wonderful epiphytes may be specialized.

With these photos I tried to demonstrate the reachdum of the Munich Botanical Garden in interesting tropical plants.They were interesting from the botanical standpoint,not from the idea of a gardener.Only too often the interests of the botanist and the gardener differ.This alos happened between Goebel and his garden-ingenieer.Icould not speak of many other plants of which I had not taken photos.I wanted only to give a small selection of peculiar plants.With these exhibition houses were connected several houses, serving only research work and propagation.her were also plants which could not be shown to the public.A few may be demonstrated.To the carnivorous plants belongs Heliamphora nutans,kept in a little small house,coming to blossom.You see here a huge specimen of

Dionea muscipula, the Venus Fly trap from North-Carolina. With this plant the garden was especially successful. They got flowers and seeds and could propagate the plant very well Manifestimentely the water was very good for the plant. I think it was rainwater, but I am not quite sure. photos should demonstrate Cephalotus folliculars, a very rare endemism of South-West-Australia. This plant has its peculiar history. Professor Francis E. Lloyd travelled to this spot and sent from there a big pice of turf, containing rhizomes of this interesting carnivorous plant. In December 1935 in a wooden box it arrived. some month later the plants developed marvellously. First came flat leavs but later one developed more and more pitcher leaves. You see here a middle form between both. The pitchers accept later a red color and the covering which is not movable atracts little animals by their colo contrasts. I will close with a photo of Aponogeton fenestralis, and endemism of Madagascar. It grows in limited light in brooks of that island. The tissue between the leaf veines atrophies very soon and in this way the fenestration occurs.

What I have shown you here in photos from outdoors and the greenhouses had a very helpful completion if the "Botanical Museum", an exhibition of plant specimens, preserved in formaline or alcohol in square glasses or dry on carbon bord. This Museum was my particular field of activity. I give you here a general veuw and a photo of one iron case. You may see herein a flower of Aristolochia Goldieana which bloomed in the greenhouse. Every specimen had its explaining description. In this way we could give a general view of the plant kingdom with original plants. The Museum had a systematical, a morphological, an oecological division. Plants whos products are used were demonstrated and at least a large pharmaceutical division showed the importance of the drug plants.

I have now to come to an end. The Munich Botanical Garden was really one of the most outstanding instrumentsof the botanical science. Nobody knows if and how it may survive this terrible war. For me it is a "paradise lost"!

The Martindale Herbarium fifty years in the Possession
of the Philadelphia College of Pharmacy and Science.

On April 3^{rd} 1944 it was just half a century since the Philadelphia College of Pharmacy and Science came into the possession of the Martindale Herbarium. This herbarium was presented to the college by Howard B. French, and Smith, Kline & French Co. of Philadelphia.

The Martindale Herbarium is one of the most comprehensive private collections in this country, and the Philadelphia College of Pharmacy and Science is keenly aware of its significance and worth. The Biology Department with the cooperation of the President and Dean is making a determined effort to preserve this precious gift and to utilize fully the splendid opportunities it affords.

The Martindale Herbarium is described in the "American Journal of Pharmacy", [redacted] Vol. 66,# 5. May 1894 by Beringer, A.M., Ph.G., in the book "The Botanists of Philadelphia and their Work" by John B. Harshberger, Philadelphia 1899, and finally in the "American Journal of Pharmacy", vol. 103.# [redacted] 2, February 1931 is a shorter article under "Medical and Pharmaceutical Notes", entitled: "An Unusual Herbarium" by Dr. M. S. Dunn, the present head of the Dept. of Biology of the college, who is in charge of the preservation of the Martindal Collection. The latter articles contain information from the first one from Beringer.

The writer of these lines, the last pupil of K. v. Goebel, the famous plant morphologist, was at one time assistant curator of the botanical exhibits of the Botanical Museum in Munich-Nymphenburg. He now has the privilege of doing laboratory work on~~f %~~ the Martindale Herbarium. He wishes to use this opportunity to tell something of the technical side of this plant collection.

Martindale spent a tremendous amount of work and money to build up this large herbarium of more than 200,000 specimens. Beringer estimated that it has a value of $ 15,000.- The 9 beautiful wooden cases which contain the Martindale Herbarium, and which Beringer mentions, are decorative, indeed, although improvements in housing facilities might be accomplished by substituting dust tight steel cases in which the fascicles might not be pressed together too tightly. We are facing the situation as it is

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hope only that later, when the war is over, a way will be found to obtain the light metal cases. in the meanwhile everything possible is being done to keep the sheets free from dust and dirt.

As already stated, the Martindale Herbrarium is a very comprehensive collection of plants. The sheets are filed in alphabetical sequence of species within the genera. Sometimes each species is enclosed by a species cover of white paper. This happens mostly when several specimens are present. Upon the outside of these species-covers very often are glued clippings of an identification book the origin of which we do not know. There are also peaces of pages from Asa Gray "New Manual of Botany", 8^{th} edition ( ). The different species are united within the genera, and enclosed by a genus-cover of a light-brown stiff Manila paper. The format of the sheets is larger than it is used in general.

Martindale purchased entire collections, for instance in 1861 the Ferdinand Rugel Collection. In July 1874 he bought in Interlaken, Swizzerland, the Brunner Collection. There are still booklets and notices, written by Martindale, concerning the purchasing of these collections. Martindale [redacted] remounted the specimens of the purchased collections and glued their labels upon the new sheets. These labels are often very interesting as they show that the Martindale Herbarium contains plants of the whole world. Among the collectors we find sometimes famous names like St. Hilaire, Schimper, Rusbey and others.

Among others, I found the following labels:

C.G. Thedenius, Stockholm,
Ex Museo botanico Holmiensi, communicavit N.J. Andersson,
(Both are from Stockholm, Sweden, with North-European plants)
W. Steinitz, Budapest, (with Hungarien plants)
Herbier de Ad. Chatin,
Herbier I.E. Planchon, (sometimes with signatures of Auguste de St. Hilaire from the years 1846/47.)
(Both with plants from France and West-Europe)
Flore des Environs de Rosenlaui, Faulhorn, Grimsel, Furca etc., ex Collection J. Brunner,
(With alpine plants)
Ex Herb. Postian. apud Colleg. Syriens. Protest. (by George W. Post, author of "Flora of Palestine") Beirut.
(With plants from Syria and Palestine)
Herbrarium Dr. Ferdinand Rugel of Tennessee. (Sometimes with signatures of Schimper from 1835/36, concerning Arabian plants, or Endres, dated from the twentieth of the 19^{th} century, written in German language, with plants from Germany)

P F L A N Z E N B I O L O G I S C H E   S C H I L D E R U N G E N.

(begonnen am 26.Oktober 1954.)

Mit den nachfolgenden Seiten möchte ich die Ergebnisse meiner botanischen Beobachtungen einem weiteren Kreise zugänglich machen.Ich bin mir der ungeheuren Schwierigkeiten,die mit dieser Aufgabe verbunden sind,voll bewusst.Seit 1940 bin ich in den U.S. und seit 1942 ist Philadelphia,Pa. meine zweite Heimat geworden.Nördlich vom Philadelphia,im südlichen New Jersey ist ein ausgedehntes Gebiet,New Jersey Pine Barrens genannt,das ein Dorado für den Botaniker ist;es ist vorwiegend Kiefern Land (daher der Name!),in dem aber sehr viele interessante Pflanzen vorkommen.Da dieses Gebiet sehr leicht von Philadelphia zu erreichen ist,verbringe ich viele Samstage oder Sonntage dort.Man hat auch manchmal Gelegenheit,im tiefen Winter,wenn kein Schnee liegt,die New Jersey Pine Barrens zu besuchen.Ausserdem reise ich - meistens im Juli - in die amerikanischen Tropen,um Tropenpflanzen kennen zu lernen.So war ich 1951 in Cuba,wo ich einige Tage in Soledad verbrachte,1952 und 1953 war ich in Honduras und 1954 in Costa Rica und Panama.Weitere Ausflüge in die Tropen sind beabsichtigt.

Ich wählte den gleichen Titel,den 1888 mein Lehrer Goebel fur eine seiner ersten botanischen Veröffentlichungen verwendet hat und vieles,was er in seinem "Vorwort" sagt, ist auch heute noch gültig,besonders in den U.S..Auch hier wird der Gebrauch des unbewaffneten Auges noch sehr vernachlässigt!Jedoch in einem wichtige Faktor unterscheidet sich Goebel's Arbeiten von dem meinigen.Als Leiter eines Instituts hatte er Helfer,Assistenten oder Doktoranden,zu Verfügung;Ich habe niemanden!Auf der andern Seite hat die Photographie, besonders die Farbenphotographie heute einen Höchststand erreicht,den man zu Goebel's Zeiten nicht ahnen konnte.Ich kann heute - ohne Atelier - alles photographieren,was ich sehe! Zur Verfügung stehen mir zwei Exakta Cameras (F. 2 Zeiss,Biotar und F. 3.5 Tessar),ferner verwende ich eine extra lange Verlängerungsröhre,die es mir gestattet,bis auf 6 cm ans Object heranzugehen und ,wenn das nicht genügt,habe ich ein sog. "Zwischenstück",mit dem ich - nach Herausnahme der Linse der Kamera - den Photo-Apparat aufs Mikroskop (binocular oder gewohnliches Mikroskop) aufsetzen kann.Dabei wird das Okular des Mikroskops als Linse verwendet.Mit dem Binokular-Mikroskop erziele ich Vergrösserungen von Ca. 150 x und etwas mehr.

P l a n t - G e o g r a p h y of G e r m a n y (14.Oktober 1943.)

To talk about the plant-geography of present day Germany is rather difficult.There are few countries in the world in which the soil is used so intensively as in Germany. The artificially overcrowded country demands urgently the extensive use [redacted] of every empty space for the production of food.The soil has to be fertilized as much as possible - by using of synthetic fertilizers - to give the large crop which is so desparately needed.Rivers and streams are regulated to shorten their way and to give free land which may be used.Moors are dried out by drainage and transformed into a more or less fertile land.Thereby the often very interesting original flora becomes destroyed! The forests are used much more than they should be and even during my stay in Germany I heared forest-scientists and -experts speak of the exhaustion and destruction of the once so beautiful German forest!

Though Germany is only 29.4 % woodland it belongs phyto plantgeographically to the "Eurasiatic-silvestric Vegetation Region",reaching from the Atlantic to the Pacific Ocean,the Old World part of the "circumpolare forest zone".This is a tremendous area, and when you are travelling on the Transsiberian Railroad you may se what "circumpolare forest zone" really means.You observe for days after days forest.I have never seen as much woodland as in Siberia.From the train you see a mixed forest with spruces, larcs,birches and others,the so called "Taiga",named for a Siberian City you pass, and on the railroad stations the natives bring berries to you which you know from the German woods.

Compared with the U.S. Germany is situated very far north.Munich,the southern most larger city has the same latitude as Quebec in Canada!But the climate is quite different.On the East Coast of the Eastern States we have cold ocean currents whereas all of Europe is favored by the warm Gulfstream.But also in other ways the situation is different.Take Philadelphia at 40th degree north.This geographical position corresponds to Sicily in the Mediterranean Sea,but climate and vegetation are similar to Bolzano ,or Merano in North-Italy,on the South-side of the Alps!.The Rhine-Mosel-Valley around Bingen-Coblenz is a warmth-oasis.It is so warm that famous wines and the Mediterranean Chestnut,Castanea vesca,are growing there.This region is located around the 50th degree north which goes through the north tip of New-Foundland!

Germany belongs mainly to the "Summergreen-Leaf Forest Region", the Southern stripe of the "circumpolare forest zone", like the Eastern States north of Cape Hatteras. These forests in Germany are very much poorer in species than the forests in the Eastern States, and in fall they have not the wonderful red color which we are enjoying during the "Indian Summer". In the Eastern States we have more than a dozen different oaks. In Germany there exists practically only one: Quercus Robur or pedunculata, the English Oak. Even the average forests are artificial. There was a time in which spruce forests were composed only of spruces. When deseases broke out among these trees, or caterpillas of mothes, living on the spruces, occured, the whole forest was lost. Therefore later on the forest- economists returned to the original mixed forest, a forest of spruces, mixed with different leaf trees. The English Hew, Taxus baccata, which grew in German forests, was eliminated on account of its slow growth. In this way man has contributed very much to the scarcity of species in the German woods. But another cause is natural. It goes back to the glacial period. Before this there was a warm climate in Europe. When the temperature dropped the more sensitive plants like Sassafras and others which existed during the Tertiary period in Europe, retired to the South. During the glacial period the folding of the Alps increased. The Europaean geologists believe that the oldest parts of Middle Europe, the Ardennes in France and the so-called Bohemian Masse are responsible for this event. These two old flakes in the earth crust pressed the Alps together. In the Old World all mountain chains - Pyrennaes, Alps, Himalaya etc. - run from west to east - in contrast to the mountain chains of the New World, Andes, Rocky Mountains etc. Therefore when the climate became more favorable, after the end of the glacial period, these plants could not return anymore. You will never find in Middle Europaean forests a Sassafras or a Spicebush! Otherwise Germany is a part of Europe and you cannot separate her from the land around. Political borders are not valid in plant-geography. Another fact is to be considered. We had in Europe - like in the Western Hemisphere - several glacial periods, unterrupted by warmer interglacial periods. After the last glacial period the climate changed several times in Europe. The pollen analysis has given us a proof of this fact. A few words about this important method The pollengrains show a certain resistance against decaying. Moors preserve these pollengrains best. By a machine a cylinder shaped sample of the moor, reaching from the surface to the ground,is taken out.The pollen grains in this sample are isolated,identified and counted.As a result of these investigations,we can say which trees or shrubs were dominant,and from this we are able to make conclusions of the climate of that time.As a result of the pollen analysis we can state the following facts:We know that the last glacial period lies back about 25 000 to 20 000 years,a very short time compared with the unity in geology: 1 million years!The carboniferous period ,for instance lies back several millions of years.In Norwey we find a mineral,a clay which shows different stripes the so-called "ribbon-clay".These different stripes are the result of different sedimentations - the sedimentation in summer is darker than the sedimentation in winter.In this way we could - as in the annual rings of the trees - count the years.By pollen analysis it was found that about 8000 B.C. the dominant trees were birches and pines;it was shortly after the last glacial period;during the "birch-time" there was a cold climate in Europe.That we are right in this theory is shown by the palaeolithic paintings in South-France.The palaeolithic man painted animals of his time:The mamouth and the rein-deer in South France!About 5500 B.C. Hazel and oak trees were dominant;the climate became warmer;we have an early warmth period.2500 B.C. we have mixed forest,the middle warmth period in which atlantic plants dominate.Until 1000 B.C. we have the transition to the "beech-time".This corresponds to the Bronze Age in Europe.Between 800 - 500 B.C. the climate became colder again and in historic times the temperature increased anew.The dominance of the Beech,Fagus silvatica, remains until, today,in as far as man has not changed this. For instance we know that many forests in South-Bavaria which are today spruce forests, were beech forests 100 - 150 years ago.Today we have beech forests mostly on hill sides in this area.The spruce grows quicker than the beech and the lumber is much easier to use.It is Picea excelsa,the "Norway-Spruce",originally a mountain tree.I may mention that finaly in our days a process was worked out to use beech wood for making paper and cellulose which Germany needs so much and which formerly was made exclusively from spruce- or pine wood,all soft woods.During the different climates and general conditions of existence,many plants imigrated from the surrounding lands and did not disappear when the conditions changed again.So,for instance,in South-Bavaria we can speak of different flora elements, in the local flora.We have there an atlantic,a steppe-like pontic flora element- still more abundant in Austria where it followed the Danube, We have a mediterranean flora element and the oldest is an arctic-glacial flora element conforming to the already mentioned "birch time". It is very interesting that in some few elevated peats in the prealpine land south of Munich we have the Dwarf Birch, Betula nana and this plant occurs only again in the Arctic!

Some words about the climate of today. As in all winter cold regions of the Earth, cold in winter, there is an interruption of the activity of the vegetation during the unfavorable season: Winter in which we have desert like conditions. When the soil is frozen and the plants are not able to take up water then the conditions don't differ essentially from those in deserts. The leaf-trees lose their leaves in fall to reduce transpiration and also the needle-trees, the evergreen stop assimilation in winter. Precipitation is sufficient in every season. In higher parts of Germany in winter they fall as snow which covers the land for months. So it is in the mountains, in South-Bavaria (the Bavarian high-plain has an altitude of 500 to 600 m above sea level, this is 1700 feet for Munich!), and in the eastern most parts of Germany, in East-Prussia, the coldest part of the country. Precipitation increases in summer. The weather is determined by 3 factors: The minimum in Iceland-Greenland, the so-called "Iceland-Deep", a high-pressure over the Azores, the "Azores-High" which reaches often to England, and by the air pressure in Siberia, in warm summer a minimum, in cold winter a maximum (cold air is heavier than warm one) Middle Europe is in the strike zone between these 3 power centers. In this way you may see how important it is that the Americans have occupied Iceland and Greenland, two of the most informiative points for forecasting the Europaean weather. But in Germany itself there is great variety concerning the temperature and moisture. The farther we go to east the more continentale the climate becomes. This means severely cold in winter, as I already mentioned, in East-Prussia. Compared with Philadelphia there is to say: In Germany there are not these cold winds and the months November and December are mostly very cloudy; sometimes for weeks the blue heaven is not visible! During the greatest part of the year there is westwind in Europe and it does not change as often as here in Philadelphia. The east winds in Europe, coming from inner Russia, are dry, but the westwinds, having their origin over the Atlantic Ocean, are wet and bring rains to the continent during the whole year. In summertime there is often a monsoon situation, over England a maximum (sometimes from the Azores), over Middle Europe a depression. The result is a longer lasting rain period. Especially moist is the land on the northside of the Alps where the rains condense. This is the case especially in June. The harvest of the hay is often in danger. There is the joke about an Englishman who was in Salzburg in summer, famous for much rain. It rained; he came again to Salzburg two years later; it was raining again. He said: "Salzburg seems to be a very moist city; it is still raining from the time I was here last, two years ago!" I have known dry summers in Germany when all the meadows were dried out; the alpine meadows remained green. But precipitation in summer sometimes comes as hail, and the damage of the falling ice peaces, having the seize of cherries to small eggs, is terrible particularly in South-Bavaria.-Another wind is characteristic of the Alps and the lands before them. This wind is called "Föhn". It is a very warm south wind, occuring also in winter. When over the Mediterranean there is a maximum and over South Germany a depression, then the air moves from south to north. On the south hills of the Alps it becomes warm and goes up. By the suction of the depression the air air goes down on the opposite side of the mountains and by compressing the temperature increases still more. This warm wind occurs very frequently and may melt the snow in winter very quick. Several plants follow this wind; they are called "Föhn Plants", like Saponaria ocymoides, a little member of the Caryophyllaceae, the clove-family. I gave these climatic facts because they are most important for the flora of Germany. This is also true of the soil. The acidity or the lime content decide the composition of the local flora. Calciophobous plants avoid calcium-carbonate containing soil, not gypsum soil. You may never find Lupines or Sarothamnus on limestine gravel, the average soil in South-Bavaria. A very beautiful dwarf shrub in the Northern-Limeston-Alps is Rhododendron hirsutum which occurs only on limestone rocks. In contrast to this plant Rhododendron ferrugineu grows in black humus which isolates this plant form the limestone around, or it grows on gneiss and granite. The same happens with gentian flowers and others; we call this "Vicariation".

I want now to describe parts of the German landscape. The north and the extreme south of Germany are glacial landscape and have much similarity to each other. In North-Germany the glaciers came from the mountains in Norwey. They moved from North to South. In South-Germany - that is South-Bavaria - the ice came from the Alps and the glaciers moved from south to north. In this way everything is opposite to North-Germany. The Norwegian glaciers have their end-mourainees northeast of Bremen to Magdeburg. The iceborne material is mostly sand in North-Germany, in South-Bavria gravel, because it was not transported as far as in the north. The landscape is sometimes very pretty. You may see little lakes, hills, covered by forest, and nice little villages between. On South-Bavaria you have the mountain chain of the Alps, often covered by snow, in the background. The most northwestern part of North-Germany is moor- and heath land. The moisture of the oceanic climate and therwith edaphic conditions make it possible that in this region there is no forest. We have elevated peats there, and the dominant plant is Calluna vulgaris. More in the south is the well known Lüneburger Heide, Luneburg Heath, in which also Calluna vulgaris is dominant. On some places you see the Juniperus communis as a tree. This conifer grows there like a cypress. This means that the side branches are also turned upright. These trees may reach a hight of 3 m and more. A great part of the North-German deepplain is covered by pine forest. I will later give you the names of the main trees in Germany. We never must forget that originally Germany was a forest land and forest would return if man would not prevent this. May I mention that even Tacitus describes Germany as a forest land? The northern most part of Germany is the coast of the North-Sea and the Baltic Sea. There are sanddunes and salt marshes and in this region we find many halophytes, plants adapted to a content of common salt in the soil. Behind this coast land partly is a fertile land, used for agriculture, cereals and cattle raising. When you are travelling from Berlin to Königsberg you see from the train pine forest above sandy underground. If this forest would be destroyed I am sure, North-Germany would become a sand desert! This forest continues to the neighboring Baltic States. The southern most part of Germany is formed by the Alps. Germany has in Bavaria only a small region of the Northern-Limestone-Alps. The greater part of the Alps belong to Austria, Swizzerland, Italy and France. In the mountains the lowest lavel is covered by mixed forest. We have here Elm trees, Ulmus montana, Maples, especially Acer Pseudoplatanus, the Sycomore Maple. This is the leaf tree which goes highest in the mountains, near the timber line. In Germany this tree is called "Berg-Ahorn", "Mountain-Maple". On its stem you find very abundant a characteristic lichen, the Lung-Lichen, Sticta pulmonaria. In this low mountain forest we have further the Ash, Fraxinus excelsior, the Alders Alnus incana and glutinosa, the Grey-and the Black-Alder, you have Willows, Hazelshrubs, and also Sorbus aucuparia, the "Mountain-Ash", going also nearly to the timber line. The tree has bright red fruits, which the birds like to eat. The German name for this tree is therefore "Vogel-Beere"= Bird-Berry. (The fruits are by far no "berries; they are like our apples spurious fruits, containing material of the shoot) You have in these described forests Sambucus nigra and racemosa, the "Black- and the Grape-Elder". And besides these woody plants there are a great number of subalpine herbs. If we climb higher the spruce begins to predominate and the leaf trees become scarcer and scarcer; sometime you find also some Juniperus communis shrubs.. And after a while we reach the timberline. The general conditions, especially the wind, makes it impossible that trees ~~can exist~~ (above the timberline). We have above the ~~timer line~~ latter a zone of coniferous dwarf shrubs, formed by Pinus montana, the German "Latsche" (the Mountain-Pine). Between theese Pinus montana shrubs we have the beautiful alpine Rhododendron hirsutum and ferrugineum which in early July has beautiful red flowers! Here we have sometimes also the rare Pinus cembra with 5 needles and the Larch, Larix europaea. Finally above the "mountain-pine zone", the wood plants disappear completely. We have only herbaceous cushion plants, which we appreciate frequently in our rock gardens. Only a few very small willows, Salix species, are still able to exist there. These little shrubs press their stem to the ground as an espalier-shrub. I name Salix retusa. And on some more moist places you find Salix herbacea, the herbaceous Willow. The stem of it is sunken into the soil and only the tip of the branches with leaves and flowers are using the short summer. I have seen this plant in a hight of about 2000 m! The situation of the hight of the mountains is very similar deserts. A few lichens indicate the end of every type of plant life. Several alpine plants you find also in the Bavarian High-Plain, I name the blue Gentiana acaulis, or the purple Primula farinosa, the wonderful smelling Daphne cneorum and others Their appearance goes back partly to the glacial period; they are relics of that time. May I mention that they are carefully protected against extermination?

Between the North-German deep plain and the Wall of the Alps and the high land before Germany is by far not flat. There is the "Deutsches Mittel Gebirge", the "German Middle Mountains, forming a broad zone in Germany. This mountain region comes from ~~France~~ West-Europa - the Ardennes, the Swiss Jura, they go through Germany and continue to the East in the Bohemian mountains, the Sudetes, the Bohemian Forst etc. The highest elevations of these mountains reach in Germany about 1800 m. They are of different geological origin, and therefore of different material. Some are very old (granite- and gneiss) mountains - much older than the Alps -, belonging to the varistic folding in the carboniferous era, and now eroded very much. Such old mountains are the Harz and the Bohemian Forest. Other are of volcanic origin, like the Eifel. We have mountains from the Triassic time, like the Keuper-Sandstone mountains on the Elbe-River and in the Jura - going from Swizzerland through Württemberg, North-Bavaria to Thuringia, we have sometimes an eroded high-plateau.

You see this very well when you are travelling from Ulm to Stuttgart in Württemberg.All mountains there have nearly the same hight.The slopes are covered by beech forest.I will not give the names of all these mountains,including the vogese and the Black Forest.You will find them in every map of Germany.In the highest elevations we have again the spruce,Picea excelsa.In lower lavels we have oaks,Quercus Robur,reaching sometime a tremendous seize as in the Spessart,Beech,Fagus silvatica,the main Forest tree,also Carpinus Betulus,the Europaean Hornbeam,is [redacted] dominant.All these trees and the pittoresque form of the mountains give the country a lovely appearance.The Germans compare it sometimes with the mountainous Swizzerland and speak of a "Fränkische" or a "Sächsische Schweiz"!.It is the land with the famous Wartburg in Eisenach,the land in which Goethe has passed the greatest part of his long life,Weimar, it is the the land on the Middle Rhine from Bingen to Coblenz,only to name a few especially beautiful spots in this region

The forest land is indeed the comparatively original vegetation.We have only a few places with "premeaval" forest.Such ones occur in the Bohemian Forest,near Mount Arber, and in several parts of the Bavarian Alps.You see here old,partly decayed [redacted] trunks of fallen trees,mosses,climbing plants,like Clematis alba;there are the "Europaean Jungles".You see also the Deadly Night-Shade,Atropa Belladonna,this important drug-plant which we cultivate now in America to obtain the valuable Atropin.Besides the more or less cultivated forests,the "tree-communities",we have land which is used for pruduction of food,or for industry etc.where you find coal,iron,or where ypu have other favorable conditions for the industry.The forest free land is used by agriculture in different ways. We have Wine is especially favored regions,in the so called warmth-oasises,as it is in the Rhine- and Mosel Valley,in the Palatinat,in Württemberg or in the Main-Valley.In earlier times the cultivation of wine was much more abundant in Germany than today.But the wine was so bad that it has to be spiced.This was one of the causes of the tremendous demand for spices in the Middle Ages in Germany.I will give a short description of the medeaval Mayence by Ibrahim ibn Jacub of the year 973 A.D..I quote:"Magandsha,this is Mayence,is a very large city.It is situated on a river which is named Rin = Rhine.It is rich in Wheat,barley,dinkel,in winyards and fruits.Peculiar is that there are also spices which occur only in the most far Orient,whilst the citty is situated in the farest Occident.We find here pepper,ginger,cloves,galgant etc.They are introduced from India where they occur in great quantities".I cannot speak here of the levante trade and its influfluence to German art and culture. Wheat is cultivated in different parts of Germany, for instance in the Danube Valley in Lower Bavaria, near Straubung, also in East Prussia, Silesia, Baden etc. The wheat in Bavaria which is mostly an agricultural land was too poor in glutin, which is important in bakery. So it has always to be used together with Roumanian wheat. During the last few years they raised also a variety which contained enough glutin. Also in this field the tendency for autarchy! In a part of Frankonia and Württemberg is raised dinkel, a primitive variety of wheat. The scientific name of wheat is Triticum vulgaris, that of dinkel, Triticum Spelta. It differs from wheat by the fact that the grains remain included by the glumes whilst the spike-axis breaks into pieces. Dinkelsbühl is a little town in Frankonia which has the name of this cereal. The main cereal in Germany is rye. It grows on areas where the climate is too rough for raising wheat. Germany is in this field far behind Russia where different wheat varieties are cultivated, adapted to the different conditions of existence in this vaste country. In other regions in Germany we have barley and oats. One of the most important food plants is the potatoe, besides local centers, mostly raised east of the Elbe. It is a gift of America to the Old World. Alcohol is also made from potatoes in Germany. Tobaco, also a child of America, is raised in the Palatinat and in Baden. A very important product of agriculture is the sugar beat, Beta vulgaris, var saccharum. Germany is the first sugar country in Europe, but the [illegible] sugar rations for the Germans are very small. They have learned to change the process of fermentation in that way that less alcohol and more glycerine is produced, that glycerine which they cannot obtain from fat, and which with they make gunpowder. May I mention here that they also produce from wood dust albumen as a food for cattle? They transform wood into sugar and in this solution they raise a kind of yeast, which, as living cells, contain albumen! Enough from these chemical stories! In the prealpine land, in Schleswig and on other different regions the meadows are used as pastures for raising of cattle. All these agricultural places have their own plant societies, weeds, partly native and finding good conditions for existance, or introduced by man from other, from foreign lands and continents. The weeds are an international society! Very interesting is that you find in German rye fields always the blue Cornflower, Centaurea Cyanos, the red Poppy, Papaver Rhoeas and the purple Corn-Cockle, Agrostemma Githago, or in Oatfields Galeopsis species. They are considered as "archaeophytes", weeds which wandered with the cereal and which ripen with them. In South-Bavarian meadows you will find flowers in great quantities. You may consider them as "weeds", but they are nice. In winter there are daisies which make now winterrest and bloom below the snow. In early spring, at the begin of April, and sometimes also in March, there are primeroses, Primula elatior and officinalis, the meodows look at that time lemonlike yellow ~~colored~~. In the second half of April, or at the begin of May they are full of dandelion, and in later May they are red, yellow and white mixed of different flowers, the red clover, the yellow ranunculus and a few umbelliferae which make the meadows white in June before the grass is cut. In this way also the appearance of the meadows changes in that country during spring. I cannot speak again of the beautiful alpine flowers which you find on some spots there as a relic of the glacial period.

I give you now a list of trees and shrubs which decide the German landscape. The country belongs to several provinces of the "Eurasiatic Forest-Zone", especially to the Baltic Province which includes East-Prussia, Poland, Germany with Bohemia, North-Swizzerland, Belgium and Holland. Characteristic is the predomination of the leaf trees. In mountain regions is - as mentioned - the spruce dominant, in sandy soils the pine. To the first ones belong beeches - and mixed beeches forests, oaks-hornbeam forests (Quercus Robur and Carpinus Betulus), to the latter Picea excelsa, the Norwey-Spruce, and Pinus silvestris, the Europaean Pine. Heaths and swamps we have in North-West-Germany, (reaching until Holland), around the lower Elbe region, Scleswig Holstein and on the coast of the Baltic Sea and swamps we find along the great streams. Only 3 trees are present in the entire tremendous Eurasiatic Forest-Zone: The Spruce, Picea excelsa, Sorbus aucuparia, the Mountain Ash, and Prunus Padus, the Closter-Cherry, both members of the rose family. The most distributed tree in Germany is the Pine, Pinus silvestris. It is a tree which is concerning soil very unassumingly. It grows in a very poor substrate, in sand soil. The tree has a strong taproot. The branches are irregular and the bark of the stem is brown in the region of the crown. The pine forests are mostly more or less monotone. The tree has 2 needles. Besides the North-German deep plain it grows on hillsides in the Lüneburger Heath, also in the Harz Mountains in Middle Germany, but not in General in South-Bavaria, only on some places where we have rock-heath we find this tree. Around and in elevated peats you find there also Pinus montana as a tree with a black bark. A real mountain tree is the Norwey Spruce, Picea excelsa. Below the timber line it grows in the Alps, in the Middle German Mountains, and also in East-Prussia. You may see the Norwey-Spruce cultivated in the Eastern States.It is a very beatiful tree and spruce forests belong to the most beautiful forest in the world.In contrast to the pine forests in which the ground is mostly covered by grass,the spruce forests are darker and as a result of more humid conditions in the forest,the ground is covered by different species of mosses.Sometimes you find the branches covered by lichens.especially pittoresque is the beard lichen,Usnea barbata.The root system of the spruce is very flat and the taproot does not go very deep.So a storm may do very much damage in a spruce forest.Especially in the Alps a storm may destroy a wide area and it will take years and years until the forest is grown again. On account of the advantages the spruce wood gives this tree is also planted in the plain replacing the beech,as I already have mentioned.-The Fir,<u>Abies pectinata,</u> is in its growth very limited.It is a very beautiful tree,but sensitive to frost.It grows especially in the Blackforest,but also in the Alps,the Vogeses and in the other Middle German Mountains The cones are - in contrast to spruce - upright and don't drop off as a whole.The scales drop off - the seeds are winged - and at least the empty rhachys remains on the branch. <u>Juniperus communis,</u>in our country called "Ceder" prefers to grow in the heath of Lüneburg and on other dry places.It goes high into the mountains,especially in its dwarf form:Juniperus nana.It grows also in New Hampshire in the White Mountains and somewhere else in the United States.Of the leaf trees the Beech,<u>Fagus silvatica</u> is the most important tree,and beech forests you find in the whole of Germany though the distribution is not equal.The forests in the Middle German Mountains are mostly formed by the beech. The Europaean Beech differs in some aspect from the American Beech,Fagus americana.You may see the Europaean Beech sometimes cultivated in our parks,mostly is a red leaved variety.The leaves ~~have a~~ differ in the shape ~~than its~~ from those of the American brother and the bark is darker A pecularity of Fagus silvatica is its flowering. It blooms shortly after the appearance of the leaves and is wind pollinated.In contrast to the American beech it does not bloom every year.During 2 or 3 years the beeches in the whole of Germany and everywhere else don't bloom.In so-called "beech-years" all beeches-including the leaf-varieties,come to blossom,as far they are in an age that they can bloom. Only in these years beeches produces their three-angled nut fruits.In the beech forests live a great number of plants which are only to be found in beech woods,which are "accompanying plants".To them belong Anemone Hepatica and nemorosa,or Neottia Nidus Avis,an interesting saprophytic member of the Orchid family.Many of the herbaceous plants in the beech forests bloom before the green

green leaf roof is closed.In this way they get light enough.These beech forests are characteristic for German leaf forests.In these forests it is the dominant tree and you find never so many different trees there,as in the woods around Philadelphia!The oak, Quercus Robur, or pedunculata is the oak in Germany.It is a wonderful tree, especially when it stands alone,free in the country and not in a forest.The English Oak,Quercus Robur, and still more the Lindentree,Tilia platyphyllos have a great demand for light.You will never see a Linden forest in Germany.The German poets and composers sing of the beauty of these trees,the symbol of strength.You know perhaps the song of Schubert:"Am Brunnen vor dem Tore da steht ein Lindenbaum"(On the fountain before the gate there is a linden tree).Such isolated trees of huge demensions may reach an age of several hundert years and we know many of the so called 1000 year old oaks or lindentrees.Oak forest are mostly mixed with other trees.A very conspicous tree is the English Walnut Tree,Juglans regia It is mostly raised in gardens or parks.It is very interesting that in the United States this tree grows,cultivated of course,only on the West Coast;it will not grow here in the Eastern States.It happens so often that Europaean plants grow on the West coast and East asiatic, Japanese,ones on the East coast and we have no satisfying explanation for this fact.I will name other trees and shrubs,very abundant in Germany,but not deciding for the picture of the landscape.Along rivers and lakes you may see different willows,the "Weeping Willow",Salix alba and other Salix species.To the same family belong th 3 poplars of Germany:Populus alba,Populus nigra ,the White and the Black Poplar,and Populus tremula the Trembling Aspen.The name derives from the fact that the leaves are mostly in motion on account of their thin stalks.We have in the Eastern States a similar poplar,Populus tremuloides.Betula verrucosa and pubescens are the main white birches.Carpinus Betulus is the Europaean Hornbeam.These trees form also little forests.Alnus incana and glutinosa are the Grey-and the Black-Alders,blooming in early spring.Alnus viridis,the Green-Alder,also living in the mountains,blooms later.Very abundant are the Elms,in South-Bavaria Ulmus montana,the Mountain-Elm,is the main representative there.It is a very tall tree with a rough bark and rough leaves.These are asymetric and we distinguish betweena plus- and a minor side from the midrib.Unfortunately this beautiful tree is -as in the U.S.- in great danger because of the "Dutch-Elm Decease" which is spread out by a beatle,eating the young leaves.The real cause is a fungus,leaving in the vascular boundles of the elm and the spores of this funges are distributed by the beatle. Another important tree is the Ash, Fraxinus excelsior We have different maples: Acer Pseudoplatanus, the Sycomore Maple, Acer platanoides, the Norwey Maple, Acer campestre, the Field Maple and in warmer regions Acer monspessulanum, very similar to the latter. In contrast to the American Silver- and Red Maple (Acer dasycarpum and rubrum) these trees are pollinated by insects whilst the latter are pollinated by wind Shrubs are Hazel, Corylus avellana, many shruby willows like Salix purpurea, in North Germany Myrica Gale, related to our Sweet Fern Myrica asplenifolia. Rhamnus Frangula and Rhamnus cathartica, Evonymus europaea, Sambusus nigra, racemosa and Ebulus are the Europaean elders, Berberis vulgaris is one of the hosts of the wheat-rust. To the dwarf shrubs belong once for all Calluna vulgaris and other members of the heath-family of the Ericaceae. If you compare this list ~~with~~ of German trees and shrubs with those of the Eastern States you may see how poor Germany is in tree- and shrub-species. These trees and shrubs I named are to be found in the whole of Germany. To talk about the herbaceous plants and the different flowers is impossible becaus it depends too much from the local conditions. The variability in Germany is too great to give a general view, and to give a general view of the vegetation and of the plant geography of present day Germany was the purpose of this talk.

Salt Plants in New York City.

You would not believe it possible that a great City, like New York, could present to the botanist so many objects of interest. We are not thinking only of the beautiful Botanical Garden in the Bronx and Brooklyn, but of the natural vegetation.

Let us talk about the case of the salt plants. By this we do not mean the sea-weeds (the marine algae) but the salt plants of the land. The accompanying photographies are made in September 1941 in Barren Island and Staaten Island.

In the areas of New York City which are situated on the coast, there are sand dunes and swamps or marshes. Here live the salt plants or halophytes. According to the moisture and the salt-content of the soil we find herbaceous plants, but also woody shrubs, often united to certain plant societies. The soil, being in the neighborhood of the ocean, or, during high tide even covered with sea water, contains more or less common salt. Also the air is more or less salty.. The common salt plays in the plant world an entirely different part than in the animal kingdom. When it is present in too large quantities it is even dangerous for the land plants. The salt-plants which are also to be found in deserts and salt steppes are exceptions. Among them there are also such ones as may support a greater content of common salt, but which also are able to grow without it. The first ones are called "facultativ-halophytes", the latter "obligate-halophytes".

We find both in our area. The landscape here is not absolutely flat; we have small hills where the soil is a little more dry. Here the first mentioned facultative - halophytes in general prefer to grow. Nearer to the sea shore we have more sand hills and sand dunes and, between these little heights, in the lower parts of the land, we find the salt marshes with the obligate-halophytes; this, generally speaking; a sharp distinction is not possible. The salt-marshes are still in the region of the tides. We make our walk in the direction of the sea.

Illustration Nr. 1. shows flowering branches of a Composite Plant:
B a c c h a r i s halimifolia L. ,Groundsel Bush,.If we observe in the first half of September the flowering shrubs,tall as a man,we may find that there are two kinds of individuals.Such ones as have little yellow heads and others which possess little white ones.The first mentioned produce only a yellow pollen and on the latter we may see the little stigmas,looking out from the involucrum (this is the unit of bracts) like brushes.When we observe the yellow heads with a magnifying lens,then we can see that the stigma is transformed into a"brush-organ" for the pollen,and that a normally developed ovary is not present.The plant makes the impression of a dioecious flower plant.This means that there are individuals which produce only pollen(called male and others which shows stigmas,able to function,and which possess normal ovaries (called female;exactly in Baccharis we have "Pseudo-Dioecy";in the male flowers we have atrophed ovaries and in the female ones anthers unable to produce pollen).
In Composites this is a very rarely case.Very far from here,on river-banks of the Old World,grows a herbaceous representative of this family,rich in species,which flowers in early springtime in the same manner:Petasites.

Ill. No. 2. P e t a s i t e s niveus L. from a river of the Northern Alps (Isar)

At the end of September on the male Groundsel Bushes the dry heads drop off and on the female plants we see the white pappus-hairs from the young,airborne fruits.

Ill. No. 3. M y r i c a carolinensis Mill.,Bayberry or Waxberry (= M,cerifera L.)
This shrub,belonging to the Myrica family is also dioecious;it flowers in springtime. The plant grows together with the aforementioned Composites.The branches,cut off, are fragrant.The berry fruits naturally only on the female plants, (or more exactly stone fruits,like the cherry) are blue grey.This color is caused by wax on their surface.This wax was sometimes used for candles.The berries are to be seen on the old stems (of the female plants),not on the young branches of this year which bear the leaves.We call this "cauliflory". It is often found in tropical plants,e.g. in the Cocoa-Tree,-The stems with the berries are used for dry bouquets for the winter.For this purpose the young branches are cut off.

Ill. Nr. 4. D i s t i c h l i s spicata (L) Greene, a grass, growing in the sand. It is one of the sandbinders in the dunes and characteristic of this area. From a subterranean rhizome, leaf-sprouts rise above the soil; they become longer the more we go backwards from the top of the rhizome.

Ill. No. 5. E u p hor b i a polygonifolia L., Sea-side Spurge. This plant grows in the dunes ~~as~~ like a little espalier shrub, lying flat on the soil. It gives thus little possibility for attacks by winds which could dry it out. We also find little espalier shrubs in high mountains, where similar conditions prevail. Like in the sanddunes they are pressed flat on the soil, or in this case on the rock.

Especially interesting are the plants which are shown in the following illustrations: Salsola Kali L., the Saltwort, and different species of Salicornia, the Glasswort.

Ill. No. 6. S a l s o l a Kali L, the Saltwort, and

Ill. No, 7. Some branches of this plant. (Salsola Kali is introduced from the Old World. Saltwort and Glasswort belong to the obligat-halophytes. They have to live under very severe conditions of existence. The relatively high content in common salt of the soil makes it very difficult to take off the water, which they need. Therefore, though the soil is often wet, inevery case it is physiologically dry, a phenomenon which we also find in in swamps or marshs where the water is rich in humus acids. By this , it must be understood that many of the salt plants accept a xerophytic shape, a shape which is adopted by plants, growing in deserts or on other dry places. Some of these remind one of Cacti, e.g. Cereus, though the reduction of transpiration is not so great as in that family.

Ill. No. 8. shows a vertically growing sprout of Salicornia ambigua Michx . We don't know exactly about the transpiration in xerophytes., either in Cacti or in halophytes. For the latter a strong transpiration was observed, and for this reason some investigators don't believe in the xeromorphy of the abligate-halophytes.-

Ill. No. 9. S a l i c o r n i a herbacea L., Slender Glasswort, growing in a little water-ditch in Saltwater..

Ill. Nr. 10. S a l i c o r n i a mucronata Bigel, Pointed Glasswort, a plant which is endemic in the Eastern U.S.A.,

Ill. Nr. 11. S a l i c o r n i a ambigua Michx., Woody Glasswort, growing in sand ,not far from the border of a swamp.This is a perennal in contrast to the first two mentioned.

ILL. Nr. 12. shows the three species of Salicornia growing together on a muddy place.About a quarter of an hour later the spot was flooded by seawater about 10 cm high and by evening it was dry again.The plants had to be in saltwater during the time of flood,

The roots of the Salicornia species are immediately below the surface of the soil and do not reach a greater depth.Therefore they live in the region of the most concentrated saltwater.Though the xeromorphy of Salicornia is doubted,also the inner construction of the sprouts reminds one so much of the cacti.2hen we make a cut through the fleshy sprout of Salicornia ambigua,we see that they have outside a green tissue of assimilation,enclosing a tissue for storage of water - saltwater - (the Salicornia species have a salty taste) - and in the center we find the vascular bundles .The same is in the Cactus family,e.g. in Cereus;here also we find outside a green tissue for assimilation,then a layer of cells for storage of water and,corresponding to the vascular bundles in Salicornia we have in Cereus a more or less developed corpus of wood.The Salicornia species are to be considered as stem-succulentsMthe leaves they have,are reduced to scales and pressed fast to the stem, There is no doubt,the transpirating surface of the plant is reduced!Salsola Kali still has stiffy,thorny leaves.

As mentioned above,Salicornia herbacea and S. mucronata are annual plants.In springtime they have short,fleshy cotyledones,also like the Cacti!Salicornia ambigua is aperenial.On the base of the sprouts of the last year are buds and from these the new fleshy green sprouts emerge.

The movement of the water in the plants in fall is very interesting.It can be observed that the water in the plants is wandering to the more highly situated, ,subordinate branches,so that they seem to be swollen;the lower parts look nearly dry,(See ill. Nr. 10.)In Salicornia ambigua,the sprouts of which are longer than in the other species,most of the internodes seem to be soft and swollen in October; someones between are also dry.The whole lower parts of the plants are not succulent.The fleshy internodes become yellow and afterwards the branches die;only their basal parts with the aforementioned little buds remain alive and these basal parts - it may be repeated again - are not succulent.They pass the winter and from here in spring a new life begins.With the annual Salicornia species the same thing happens, but here the whole plants die.Salicornia rubra,very similar to Salicornia herbacea, in fall take in its uppermost branches a very beautiful red color.About this wandering of the water in the plants we know absolutely nothing.Does it perhaps make the plants poor in water during the winter?This is a matter which would have only a purpose in the perenial Salicornia ambigua but not in the annual species?Is it one of the purposless features which we sometimes find in the plantworld?

With thus question,as yet not answered by science,we will finish our talk about salt plants.In our area we could find many other interesting things,such as some dune plants,distributed by wind in the form of "step-runners":~~The woody cluster~~ fruiting inflorescence, of fruits or parts of them break off and are rolled by the wind on the ground,e,g. Eragrostis ~~capillaris~~ (L.)Nees.
~~Panicum lanuginosum Ell, [illegible] millet species~~,The thorny or prickly fruits of another grass,of Sandbur,Cenchrus tribuloides L,or of the Composite Xanthium remain on peoples clothes or in the fur of animals and are distributed "exozoically".

We have only spoken of a few interesting things,but they will show that if we go with open eyes through the world we may always find things,worthy of observation, even,if they are only such modest objects as salt plants in the City of New York.

Theodor Philipp Haas. Ph.D.

spectabilis

Science News

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Agnes T. Masse (Beta Sigma) March 194_
Christine Leuf (Alpha Sigma)
Guest Columnist : Dr. M. S. Dunn

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Comments on our last meeting, at which Dr. Rubin spoke on war gases, have been most favorable. Don't forget that another of these entertaining and educational night meetings is planned for Wednesday, March 28, at 5 pm. Hear Professor Pines lecture on "Will you Be My Sweet Potato?"

Our thanks to Dr. Dunn for his "column." The guest columnist for April will be announced shortly.

Flash! There is a rumor that at the April meeting, we may have Dr. Osol lecture to us on subjects philosophical. Watch the bulletin board.

The AULD ACQUAINTANCE departments has one new item this month. We hear that Bob Speck, '44, a Beta Sigma booster, has been wounded in Europe.

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Please note the following errors appearing in the article by Dr. Haas in the previous issue:
Line 11 Delete "these"
Line 13 Change "lead" to "lead white"
Line 13 Change "a copper-containing mineral" to "containing copper"
Line 17 Add "It originated from Pistacia Terebinthus L."
Line 18 Change "silver" to "tin."
Our editorial face is slightly pink over these errata. Our apologies to Dr. Haas.

***

Report: "Day and Night Vision" by Dr. Selig Hecht, Columbia Dept. of Biochemistry, at the Franklin Institute on March 7.

The eye is a wonderful instrument. The light on a bright summer day is about 4000 photo-candles. 200 of these are received by our eye. In deep night in a forest, when we can still observe a white sheet, about .000 002 photo-candles are intercepted by the eye. This corresponds wit the sensitivity of one candle 14 miles away from the observer.

Our eye is a double apparatus, one working in daylight, the other in the night. The latter works for illumination under .002 photo-candles.

Our eye is a photographic factory, not only a camera, because it in- forms our brain each moment with a new "product." The retina, the fore- most part of the brain, contains besides the nerve fibers also a dye the visual purple, and two kinds of sensitive cells: cones and rods. ... retina needs twice as much oxygen as all other tissues of the body. ... one side of the entrance of the optic nerve, opposite the lens is a ... which is more sensitive. Here we have 160 000 cones per sq. mm. The... cover a spot about 1 mm in diameter. Around this, the cones decrease and more rods are found. With the cones we can see directly, with the rods indirectly.

The daylight apparatus adjusts itself quicker than the night appa... We see much quicker in the daylight. There are animals which have only one apparatus: owls and bats the night, chickens the day apparatus, ... fish have both. We can see colors somewhat in the night. During the d... the brightest part of the spectrum is yellow-red, but at night it is ... blue-green. This is found by comparing the sensitivity of cones and ... in day and night light. This moving of the brightest part of the sp... trum from red-yellow to blue-green is called the Purkinje Effect, nam... for Purkinje, a Russian scientist who first observed that blue flower...

looked brighter at night.

The speaker showed a blue and red disk. When the lights were dimmed the blue part appeared bright and the red was invisible, whereas when brightly illuminated, blue was dark. Thus it is seen that blue lights are <u>not</u> fitted for the blackout of cities against air raids.

.......Dr. T. Haas

Reports: "The Interior of the Earth" by Dr. J. B. Macelwane, head of the geophysics department at St. Louis University. Given at the Temple University Sigma Xi Club meeting on March 6.

The main information of the interior of the earth we get by earthquakes, of which we have one million each year. They are registered by seismographs which are based on the pendulum principle, a heavy mass which does not move when the earth moves. The waves arrive in different strengths and from different directions, and from the registrations we can make conclusions about the interior of the earth.

Below the surface there is a weathered crust and below it, the solid outer layer. This outer layer is thought to be 700 km thick, solid, and either crystalline or glass. There must be a difference between the earth crust of the continents and the bottom of the oceans. in the latter the earthquake waves travel faster.

After the outer layer we have the intermediate layer which extends about 2800 km. The speed with which the earthquake waves travel in this layer is about six times as fast as sound travels in steel. This speed stops suddenly at 2800 km and we don't know why. Here is a small layer of unknown structure. Below it is the core, about which we also know nothing.

.......Dr. T. P. Haas

The former theory that the interior of the earth is hot, and that only the crust is cool, has been discarded. Geologists have found a clear picture of only the first few hundred feet of the earth surface but this can be extrapolated. However - the extrapolations vary with different geologists.

Geophysics is the use of the methods and apparatus of the physicist to investigate the earth. The most common application of geophysics is seismology or seismic prospecting, used to delineate the boundaries of oil fields. Elastic waves are started by a small dynamite blast; the time required for the waves to travel thru the various strata to the oil field and return, is measured by accurate electrical connections. The principle of this "refraction prospecting" is similar to that of the critical angle of light.

Refraction prospecting informs us about only 5 miles of the crust. For greater depths, more energy is needed - in the form of earthquakes. The important thing that quakes have taught us, is that the earth's crust is solid. The shear strength let loose by a deep quake could be stored up only by a solid.

The earth as a whole has a high density, but the outer layers are comparatively light; this indicates a core of extremely dense material - possibly a heavy metal; possibly a substance whose molecules are constricted by enormous pressures; possibly matter in a new state, neither gas, liquid or solid.

.....C. E. Leaf

Report: Alpha Sigma meeting of March 1. Dr. N. Rubin spoke on "War Gases."

War gases are classified according to their effect, into lung irritants, vesicants, sternutators and lachrymators. For military use gases are casualty-forming, or used for a harassing effect. The latter are persistent (they remain in concentration at least 10 minutes) or non-persistent. In using gas, its availability, ease of storage, method of dispersal, and expense must be considered.

ollowing is a classification of the common gases. The chemical warfare symbol is noted for each.

Lung Irritants:

hlorine (Cl) is heavy, having vapor density of 2.5.

hosgene (CG) has odor of ensilage. Persistent.

hloropicrin (PS) has odor of burnt sugar. Persistent; also a lachrymator.

thyldichlorarsine (ED) has biting odor.

Vesicants:

ustard (HS) has odor of mustard, garlic, horse radish. Persists for 24 hours to several weeks.

ewisite (M_1) smells like geraniums. It induces an arsenic poisoning in the body.

Lachrymators:

hloroacetophenone (CN) has odor of apple blossoms. Non-persistent. Police tear gas.

rombenzylcyanide (CA) has odor of caustic soda. Non-persistent.

Sternutators:

damsite (DM) has odor of shoe polish. Non-persistent.

iphenylchlorarsine (DA) is odorless and non-persistent.

Protection - Gas masks are of two types, dependent or independent of the oxygen supply. The ormer are adsorption masks of activated carbon and soda lime; the latter are "fresh air" masks or xygen tanks. Gas-tight clothing may be impervious or "oilskin"; this may be worn only half an hour. mpregnated clothing is also used; a chemical is added to the fabric, which slowly liberates Cl_2.

Detection - usually by odor. A detector paper which changes from khaki color to red indicates mustard or Lewisite; the same gases are detected by a chalk which changes from brown to blue.

Decontamination - uses various chemicals such as sodium sulfate, caustic soda, chlorinated lime, iluted with earth or sand. The first aid treatment for Lewisite is H_2O_2; for mustard, chlorinated ime is used.

.... H. O. Juncher

eport on the March A. C. S. meeting, March 21, will be found in the next issue. The speaker is r. W. C. Rose of the University of Illinois, and the topic is "The Amino Acid Requirement of Man."

To the friends of Science news:

I feel as do the sponsors of Science News that there is a real need in this college for a publication with its aims and purposes. It is particularly significant and fitting that this effort should have had its origin in the Science clubs of the students body at a time when the members are tired by years of continuous study. It shows that under the uncertainties of our unsettled times, there is a vigorous spark only waiting for the proper oppotunity to be kindled into a lively fire.

Now and then we read that certain educators favor the "speed-up" plan for the peace-time college. I believe, however, that most teachers are not in favor of it, at least under the present setup. One should profit by and enjoy an education while obtaining it and not simply endure it. There must be time not only for work but also sufficient opportunity for meditation and relaxation. I do not believe that a very healthy educational picture is painted when we think of a permanently-tired student body sitting at the feet of permanently-tired professors.

The quest for truth should be vivid, vital and real to all concerned. It takes energy, and how may this energy output be maintaind for long by individuals suffering more and more from mental and physical fatigue? I, for one, when the time is ripe, shall be glad to go back to the old schedule.

Individuals differ in heritage, environment and training. The motives which urge them to secure a college education are many. They come to college, are placed in classes, and rub shoulders for years with many people representing various backgrounds. And all the while, their fresh young protoplasm is being stimulated to form suitable habits, thus permitting ever-increasing opportunity for the higher intellectual aspects of life.

A classroom is not only the place where basic training is obtained. It is the field for the constructive friendly clash of keen young minds and the place where a myriad of vista are opened for future exploration. The instructor is the guide, not the task-master.

It is impossible to enumerate in a few words the ways in which an individual should profit from a college education. On one hand, his gains should be general as a result of dipping into the cream of man's history and accomplishments; and on the other hand, specific in the form of a good foundation in his chosen field. An individual should gain in character as well as in information. He should learn to evaluate fairly on the basis of facts and to act wisely. He must come to know how to profit from the past as he plans for what is ahead.

And perhaps, his most valuable gain should be his ever-growing interest in and intelligently-sympathetic understanding of the problems and difficulties of others arising in part from his realization of how very weak even the strongest of us are.

Congratulations on your publication and best whishes for the future.

......Marin S. Dunn

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Poetry Dept.

No, the Sigma Societies aren't forsaking 'scope for pen. This gem reprinted from the February "Catalyst", serves as a warning to students who consider taking organic chemistry at P C P & S.

A German chemist called Knoring, from a bottle gently pouring
Little drops of brilliant sheen, drops of nitroglycerin.
Bunsen burner standing by, did not catch poor Knoring's eye:
A flash, a roar, an awful crash! It shattered window pane and sash.
From the cracks within the flooring,
They now extract what's left of Knoring.

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BETA SIGMA NEWS

A field trip to Horticultural Hall two weeks ago was most successful. Another trip, to Wissahicon Valley is planned for this Saturday, March 24. Watch the bulletin board for time and place of meeting.

Further Beta Sigma news may be found in the next issue, since it did not make the deadline for this one.

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Report: Meeting of the Micro Subgroup of the A. C. S., March 6.

A representative of Hercules Powder Co. spoke on the organization of their analytical lab. He mentioned that there were three divisions to the Hercules lab, the research, routine and standards, and methods development sections. He gave several valuable suggestions on the organization and running of analytical laboratories in general.

......R. H. Volk

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FLASH!

We have just received the good news that our next guest columnist is Dr. Reuning, who will write about photography. Look for his "picturesque" column in the April issue.

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We spoke about Science News to a junior the other day, and she said "What's that?" Now, for goodness sake, look over our little Zeitung and get yourself familiar with it; who knows, you may some day be inspired to contribute an article or abstract, and we'd be most grateful if you would.

Skunk Cabbage.

In our native flora the first sign of coming spring is the skunk cabbage. Symplocarpus foetidus Salisbury is its scientific name. People are repelled by the bad smell of the flower units, the inflorescences, from which the plant gets its name. But the plant is so interesting that it is worthwhile to examine it. Illustration 1 shows the flowering plant in early spring.

What does this bad smell mean? Is it only to annoy man? Not at all. The odor serves to attract pollinating insects - flies, little beetles - which are accustomed to lay their eggs on places with a similar smell, like decaying meat. The plant, like our Jack in the Pulpit, belongs to the Araceae family. Some members of this have inflorescences which smell like decaying fruits, others like excrements of mammals. They all attract the particular insects for pollination. Anthurium often cultivated in greenhouses, smells, as was said above, like decaying fruits; its inflorescences are surrounded by fruitflies, the famous Drosophila, so important for the studies of the laws of heredity.

Our skunk cabbage grows on moist places. It is native with us, but strangely enough it is also native in China. We have a serie of plants in our region which are native in the Eastern United States and in the Far East.; for instance the tulip tree is also a native of China. Other plants differ only in their species. In China, for instance, is the white mulberry tree (the food plant for the silkworm); in America we have the red mulberry tree, and our witchhazel blooms in November whilst the Japanese withhazel carries its yellow flowers about 5 to 6 weeks later. This strange fact is explained by a supposed land connection between the two areas during the last glacial period.

When we dig out a skunk cabbage plant we observe different things. First of all we note how deep rooted the plants are. This is, of course, true only of older specimens. We need a strong digging instrument because the relatively tremendous rootsystem goes about 20 to 30 cm and more deep. We note a thick vertical rhizome on the plant and on its apicale end a great number of stringlike diagonal growing roots with transversal wrinkles. These roots, looking sometimes like a thick earthworm,are anchored very fast in the soil.These roots are contractile roots on their uppermost,unbranched part and shorten themselves by shrinking.

Illustration 2 is a whole digged out plant (March 11,1945,Haverford,Pa.)

In this way they prevent the tip of the rhizome from appearing above the soil. These contractile roots are responsible for the fact that the rhizome is always kept on a fixed level.They hold down the almost vertical growing rhizome like ropes from all sides and pull it down.There are perhaps correlations between the growth of the rhizome and the pulling power of the contractile roots when one considers the large number in which they appear.These contractile roots die off on the deeper,older part of the rhizome and are replaced by new ones,appearing at the growing zone of the rhizome.

In early spring we see first the flower units which we call inflorescences, and soon later the leaves which become rather large in late spring.These leaves assimilate and produce the starch which is stored in the rhizome and which enable the plant to bloom so early.

We call a cluster of flowers,forming a more or less closed unit "inflorescence".We have already used this term several times.Such is also the case in our skunk cabbage.Its inflorescences are fleshy;we name this form of inflorescence "spadix",and the whole group of plants with similar inflorescences "<u>spadiciflorae</u>".To the spadiciflorae belongs also the palms.The inflorescences of the skunk cabbage are encircled by a big,stiff brownish-red and yellow sprinkled bract which we call "spathe".This spathe is present in nearly all members of the <u>Araceae</u> family.In the Calla-Lily (indeed no "Lily") this spathe is red or white and complete unfloded.It is not so with our skunk cabbage where it remains closed at its basal part and opens only at its apical part with a more or less large window. (Ill. #1)

The skunk cabbage belongs to the monocot .As a rule the flowers within this large group follow the "three-number".They have 2 x 3 petâles (more exact perigon leaves),2 x 3 stamens and 3 carpels.Our skunk cabbage and other members of the <u>Araceae</u> family make an "extra-tour". They follow the 4 number. This is an exception among the monocots. The flowers on the spadix have 4 almost white or purple petals, 4 stamens and a pistil with a square ovary. To prevent a self pollination the flowers on the whole spadix change their sex. The spadix is first female. This means that the pistils come out first, whilst the stamens remain covered by the peatals. After a few days the stamnes appear and let out their pollen content.

Illustration 3 shows the spadix in the different stages.

We call this "protogyny". Only during the anthesis of pistils and stamens does the plant produce the charac teristic bad smell. The latter seems to be linked with the color of the spathe because such smell is to be found together with the same color in other flowers belonging to quite different families. The changing of the sex of the spadix strats from the tip. It may be that the apical~~e~~ flowers remain male longer than the basal ones. It may also be possible that in the apical flowers in skunk cabbage the male sex is already favored. In many other members of the <u>Araceae</u> family the flowers on the spadix become unisexual and separated from each other in that way that the female flowers stay on the base of the spadix and the male ones above them. Also in these cases the female flowers bloom first.

The start of the development of the inflorescences takes place already in June of the previous year. In July the little spathe, including the spadix, are clearly to recognize. They are placed laterally on the growth point which produces only terminal leaves. During fall the inflorescences grow faster than the leaves and push the latter aside; so it looks if the inflorescences would stay terminal. But this is wrong. What is the cause of the quick growth of the inflorescences and the delaying of the development of the leaves we don't know. Perhaps growth substances, so-called auxine may be responsible for this fact, but we don't know nothing about the distribution of those hormones in the plant. With the growth of the leaves which starts pretty soon after the end of the anthesis,MM the inflorescences are turned aside again.During the summer the spathe decays and from the spadix develops a globule spurious fruit.It may take many years until a young plant,deriving from a seed,may produce flowers. The rhizome must have a certain strength.Before that time it is able to produce leaves only.

This is the life history of the skunk cabbage.We described only what is to be seen with the naked eye or with a weak magnifying lense.The use of the microscope would show us other things,for instance a lot of fine,needle-like crystals in the tissue,called raphides,which are considered a protection against eating by animals.But we wanted only to talk about things which can be observed outdoors in the field.

(1)

In as much I am a refugee from the present Nazi-Regime in Germany, ~~my~~ my German citizenship has been canceled because of my Jewish race origin. I am not actually now a citizen of Germany. My feeling is so strongly against the present Germany, because ~~on account of~~ I have suffered so much and my old mother is still suffering now, that I do not wish to have any identification with Germany, ~~and to be considered as an enemy alien.~~ I never intend to go back to that country. I do not want to be considered as an enemy alien in the U.S.

In connection ~~concern~~ with my professional scientific work as a botanist at the Philadelphia College of Pharmacy and Science in Philadelphia and as a voluntary helper at the Herbarium of the Academy of Natural Sciences in Philadelphia it is necessary that I should move about and therefore not to be classified as an enemy alien.

My expired German passport, bearing ~~baaring~~ a "J".

It shows that I am really stateless ~~stelase~~, following the official law decree of November 26th 1941 which deprived all Jewish persons who have emigrated from Germany before that ~~this~~ date of the German citizenship. It was a mistake at the Haverford Post Office for me to be registered in my identification book ~~where my red book I received to write~~ as "German" in ~~on~~ the place of "stateless, previously German"!

(1a)

~~from~~

[illegible] Haas

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(2)

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stateless,previously German

Philadelphia Pennsylvania

Theodor Philipp H a a s

Theodor Philipp H a a s

Munich (Bavaria Germany) April 7 1892

German

Theodor Philipp H a a s

3 6 6 3 2 7

712 - 14 Spruce St. Philadelphia, Pa. Philadelphia

Pennsylvania Spruce Street Hotel, 712 - 14 Spruce St.

Philadelphia, Pa.

I am really

stateless, previously German.

Unwanted Plants in the Kilmer Botanical Garden.

In our Kilmer Botanical Garden we do our best to raise drug plants for demonstration purposes for the students of the Philadelphia College of Pharmacy & Science. We have to take great care of these plants, and we do everything to keep them thriving under the very difficult conditions prevailing in the garden. We are surrounded by factories which contaminate the air. We have to keep away from our cultivated plants, as much as we can, the struggle for existence.

But we have in our garden still other plants, plants which we do not want, plants which we call "weeds". In general the word "weed" means a plant which is not desired by man, therefore, it has an anthropocentric significance. But this word has also a relative meaning. A plant may be considered very nasty in one country, but very desirable in another. For instance, we have in the Kilmer Botanical Garden Coltsfoot, Tussilago Farfara L. which grows abundantly in Middle-Europe, even on gravel and waste places. It grows, for instance, upon the rubble of bombed areas, a fact which was stated recently in Le Havre, France. (M. Debray & P. Senay "La flore ~~III~~ des ruines du Havre", Builletin de la Societé Botanique de France, XII. 1945). Here in Philadelphia, we have trouble, keeping the plants alive in summer, and probably our garden is the only place around Philadelphia where the plant may be seen, however it is naturalized farther north in the U.S. On the other hand, we cultivated in the Munich Botanical Garden Lobelia inflata, the Indian tobacco, as a drug plant, whilst around Philadelphia it is a fall weed. We cultivate it in our Kilmer Botanical Garden, but late in ~~IIII~~ the season it spreading out all over the garden. It is often difficult to cultivate certain plants on the spot where we want them, We have in our garden drug plants - also native ones - which seminate themselves in places where they do not belong, and grow there better than in their correct place. This problem is acute especially in Alpine gardens in the mountains, where it is often very difficult to keep the plants in the beds to which they belong. The next step is that the plants escape a garden and

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become"garden fugitives".When such a "garden fugitive" finds favorable conditions outside,it also may become a "weed".An example of this is the Japanese Honeysuckle,Lonicera japonica,which was introduced from Japan to Philadelphia in 1876 at the Centennial Exhibits in Fairmount Park.The plant escaped,spreading out all over the country,frequently supressing the native vegetation.Though the flowers have a wonderful sweet scent,the plant is considered as a "weed".

Weeds can be very pretty.We have later in the season a little vine,a morning glory,Ipomoea hederacea,a native plant of the tropical America,closely related to the sweet potato,Ipomoea Batatas.It has beautiful purple flowers,blooming in the forenoon,but we do not want the plant.The dayflower,Commeline vulgaris,which came from Asia,has very nice blue flowers,but it is a "weed" also!

In this article we speak only of flowering plants.Among the weeds there are also mosses and liverworts.Of the latter we find Marchantia polymorpha - we do not have it in the Kilmer Botanical Garden - but the writer of these lines found in a North-Philadelphia backyard,between the pave stones,a small Riccia.Strangely enough,among the weeds,there is not a single representative of the Gymnospermae

When man tries to protect the cultivated plants in the struggle for existence, the weeds fight against man and defend their existence with great tenacity.Very often the weeds are victorious!The weeds are very interesting creature,indeed! They have a very wide range of living abilities - much wider than the cultivated plants.They can still live on soils which are not suited anymore for the cultivated plants.Yet,it is strange that it is nearly impossible to replant many weeds which were taken out of the place where they grew before.Many weeds are very sensitive towards damage to the root system.A very high osmotic pressure inside the plant allows the weeds to take out water from dry and sterile soils,but the rootsystem has to be intact.Weeds,cut off or taken out from the ground wilt very quickly.All weeds have these properties in common without any regard to which family the particular plant belongs.

What enables the weeds to resist so victoriously the fighting man?There are mainly two things which the weeds possess to defend themselves.The subterranean system and the propagation give the weeds the ability to resist man's effort to exterminate them.The former is especially [redacted] important for perennials among the weeds.Many of them have stolones,aerial or subterranian runners,deep taproots etc. and they also have the ability to regenerate lost parts.When we decapitate a dandelion,after a while new plants appear above the [redacted] ground In many cases the semination is replaced by the mentioned runners.Other weeds have very small flowers and the ripening of the fruits and seeds escapes our attention.For instance,the flowers of the crab grass,Eleusine indica,are very small,smaller than the average grass flowers.The fruits of this grass are also very small (if the grass has self pollination,as many grasses have,is unknown) are and distributed/ [redacted] by wind,like dust.

Among the weeds are many species which bloom only once,and die,after producing fruits.We call such plants "hapaxanthic".We do not use the word "annual", because there are plants which live for many years until they come to bloom,and then they die after the ripening of their fruits.We have such plants among the palms (e.g. Corypha),and our Agave americana also belongs to them.Among the weeds are many [redacted] "hapaxanthic" plants whose vegetation period starts in spring and ends in fall.We have among them also such ones which need two years.They are called "biennuals",but they are also "hapaxanthic" plants.They produce in the first year a rosette of leaves and they bloom the following year.(This process is ruled by hormones) They die then, after the ripening of their fruits.The evening primrose,Oenothera biennis,is such a plant.Among the "hapaxanthic" plants we have also such ones with a shorter life period than a year.Among the weeds are many which produce several generations in one year.Parallel with this goes a tremendous production of fruits and seeds,and this is the other weapon with which the weeds fight for their existence.In Ithaca N.Y.,it was stated that a single plant of Solanum nigrum,the Black Nightshade, had produced 178 000 seeds,Erigeron canadensis ,Fleabane,,243 375 seeds (resp. oneseeded fruits).In Europe it was found that Galinsoga parviflora,a native of

Peru, present in Europe as a weed since the beginning of the 18th century, has 2 to 3 generations in one year, a strong plant - it is a composite - produces 36 to 38 fruits per head and about 300 000 fruits as a whole. It takes about 4 weeks until a germ plant produces the first flower and the fruits retain their germination power for 1 to 2 years. Galinsoga parviflora was cultivated in 1794 in the botanical gardens of Madrid and Paris and escaped perhaps from the latter; it is sometimes named "French Weed". It is quite possible that the plant was introduced to this country via Europe! - We have these named three plants in our Kilmer Botanical Garden!

Another fact is also striking. We have in Philadelphia during summer more or less tropical conditions. This enables us to keep outdoors a number of greenhouse plants during the months of May until nearly November. But this fact gives also tropical weeds the possibility to live with us during these months. These tropical weeds are mostly hapaxanthic plants which pass the winter in the form of fruits and seeds. The winter cold is not able to kill them. It is even possible to keep the seeds of the tropical sensitive plant, Mimosa pudica, alive outdoors in the ground during the winter.

Tropical conditions in Philadelphia! This leads to the question, where do our weeds come from and especially where do the weeds in the Kilmer Botanical Garden come from? This is a very interesting question, a question which is connected with the problem of how plants travel. Is it not strange that plants should travel, the plants which are rooted in the soil? Yes, the plants do travel and they travel very great distances. First of all, fruits and seeds can travel. Some plants have means of throwing their ripe fruits or seeds away. We have juicy fruits which are explosive. We have "touch me nots", Impatiens species whose ripe fruits explode, when touched. The Mediterranean squirting cucumber, Ecballium Elaterium which has an inside pressure of nearly 25 Atm., can throw the hard seeds about 10 m away. The dry splitting fruit, the regmas ~~parts of the fruits~~ of the tropical sandbox tree, Hura crepitans, are thrown still farther away.

But much larger distances are passed if foreign means are used, such as wind, water or animals. The fruits and seeds of these plants are marvellously adapted to each kind of distribution. If they are transported by wind then they are either very small, like dust, or possess structures to be airborne (the fruits of the dandelion are parachutists, the winged fruits of maple trees work like a propeller; by these means the fall velocity is decreased and there is the possibility that the wind may carry the fruits away). If the fruits are distributed by animals, they may be either juicy in order to be eaten, or dry and spiny to be carried outside of the animal, on the fur. In the first case the fruits assume a conspicuous color, when they are ripe; before that time they do not differ from the color of the foliage. Birds take plants with them on their wide travels, either by eating the fruits, (such fruits are mostly red, birds seered best like we do), or, in the case of water-plants, very often with the dirt of their feet. A great agency for the distribution of fruits and seeds is the ocean currents. Many fruits have a waterproof surface and contain air, so they remain buoyant for a long while. Connected with this adaptation is a long lasting germination power. We know that fruits of the tropics are transported by the ocean currents to the Arctic. The coconut is extremely well adapted to ocean travels, yet it was man who distributed the plant so widely, because it is an important foodplant. It is a plant of the Pacific and was brought by the white man in the 16thcentury to the Atlantic Ocean. All these described means do not anwer the problems with which plant geography is faced. We often have highly specialized familiies distributed over the whole globe. The Droseras, the sundews, and the Utricularias, the bladderworts, are little carnivorous plants with highly developed shoots and leaves, with which they catch their prey and these complicated organs show all the representatives of these families in the same way without any regard if we find them in India or in the tropics of South-America or in Australia, and at last in our own country.

When people wandered in the early times they took with them their most important food plants, either in the form of fruits and seeds, or, when possible, also as tubers and bulbs. Herodotus tells us that the phenicians who sailed around Africa at the time of the Pharao Necho (600 BC),had wheat (exactly Emmer,Triticum dicoccum,the wheat of the antiquity with the chromosome number 2 x = 28) with them.They planted it in South-Africa,waiting there for the ripening of the crop. Having repared their boats during this time,they continued their journey after the harvest.The South-Asiatic banana was taken across the African continent by slaves in form of the tubers (the tubers remain moist for a long time) and found in West-Africa by the Portuguise.The Greeks made the acquaintance with the banana (and also with the sugar cane) at the occasion of the expedition of Alexander the Great to India (300 BC);the Romans knew also of it (Pliny),but the knowledge of the plant was lost.That the American Indians,who came probably from Asia across the Bering Street,had no Old World food plants,like millet,wheat or rice, with them has perhaps its cause that they were hunters and fishers!

But man takes with him not only the plants he wants,he takes also with him such ones which he does not want,the weeds!This is very interesting;we can observe this fact still today.When we go into the New Jersey pinebarrens and visit an habited place we always shall meet some weeds,poke weed,ragweeds,or some members of the goosefoot family,like Chenopodium album,,the pigweed,and a few other plants which are not native there.This is the case even in the interior of that wast,little populated are!

About the travelling of the weeds we have generally no records.When the writer of this article saw in "Life Magazine" a picture of American soldiers in North-Africa,together with American Opuntia cacti,it was in possible for him to find dates about this "American invasion of the Old World".The American agave,Agave americana,naturalized now in Italy until Merano and Bolzano on the south edge of the Alpes,came to that country in 1561.The story of Galinsoga parviflora was already revealed;another cosmopolite among the weeds is Erigeron canadensis,the bitterweed.It is mentioned first in 1655 in a botanical garden in France,but it came probably in the 18th century to Middle Europe from the Mediterranean.Linnaeus speaks of the American origin of that plant and its far distribution in South-Europe.It looks as if the weeds would form an "international undergound organization" and, when they are discovered, they would cynically say: "Yes, I am here!" We shall see that the weeds really are an "international society"! We might say: "The cultivated plants travel with the will of man, the weeds travel against the will of man!"

Some weeds have travelled and travel many thousand of years together with the cultivated plants. Their fruits and seeds ripen with these of the latter and they are not separable from them. We have in Middle-European rye- and wheat fields a certain group of weeds which ~~are~~ are called "archaeophytes". To them belong the red poppy <u>Papaver Rhoeas</u>, the blue student button or corn flower, <u>Centaurea cyanos</u>, the corneo cockle, <u>Agrostemma Githago</u>, and others. In oats filods we find the hemp nettle, <u>Galeopsis Tetrahit</u>. (The name "corn" has no relation to our corn or Maize. In German "corn", or better "Korn" means rye, the main cereal in Germany). Only cornecockle and hemp nettle reached North-America as weeds. The "archaeophytes" of which it is believed that they have the same origin as the cereals which they accompany and with which they travel, find, in general, suitable living conditions only in these cereal fields, and they disappear after a while when the locality is used for other purposes. As far as we know with maize travel no "archeophytes". It is much easier to keep the large grains free of weed seeds.

From the viewpoint of the plants, we can say: "The weeds travel with intention!" Under these circumstances we may understand that today the weeds have a wide distribution, and many are cosmopolites.. The writer of this article has read a recent paper, published in India about weeds which were found on the grounds of the Hindu University in Benares (An ecological Study of the Vegetation of the Benares Hindu University Grounds by R. Misra, "The Journal of the Indian Botanic Society, vol. XXV # 2., May 1946). There were recorded 12 weeds which we have also in and around Philadelphia. In the bombed area of Le Havre in France (the article was already mentioned) there are 18 which grow with us. These are <u>cosmopolitan weeds</u> ~~or~~ or "world weeds" <u>international weeds</u>; we find them in the whole world where they find suitable living conditions. Be-sides these ~~cosmopolitan~~ world weeds we have in all countries, also in Philadelphia, a larger or smaller number of <u>local weeds</u>. These are weeds which are native in that particular country and find only ther thier living conditions.

World
~~International, cosmopolitan~~ weeds are for instance Chenopodium album, or Galinsoga parviflora, or Erigeron canadensis., local weeds in this country are Lepidium virginicum, pepper grass, Eupatorium rugosum, white snakeroot, In Le Havre there ~~is~~ are Urtica urens, a European nettle, Mercurialis annua, a European member of the spurge family (Euphorbiaceae) such ~~as~~ local weeds, whilst we have in India for instance Corchorus ~~Crchorus~~ acutangularis, a relative of Corchorus capsularis, the Jute, belonging to the linden family (Tiliaceae) as a local weed. In Benares and also ~~1936~~ in Le Havre the "world ~~cosmopolitan~~ weeds" make about 10% of all recorded weeds, but a strong separation between the latter ~~"International"~~ and "local" weeds is impossible. We, in this country, imported so many weeds from Europe which are not to consider as "world weeds"!.

What is the origin of the weeds in the Eastern Untited States? According to Dr. John M. Fogg's statement (John M. Fogg Jr.: "Weeds of Lawn and Garden, University of Pennsylvania Press, Philadelphia, Pa. 1946), ther are:

53 % of all weeds from Europe or Eurasia
32,5"" " " " N. America
8 " " " " " Eastern Asia or India
5,5" " " " " tropical America
1 " and less " Africa

We mentioned some dates indicating the arrival of American plants to Europe. but in general we have no records when not American weeds came to this country. Working with our Martindale Herbarium, we stated that many weeds came to the Eastern United States as ballast plants with the ship ballast. (Th. Ph. Haas, "The Martindale Herbarium Fifty Years in the Possession of the Philadelphia College of Pharmacy & Science", Journal of Pharmacy, November 1944). The ships contained dirt in order to stabilize them during the crossing of the ocean. This dirt was taken from the neighborhood of the ports where they started their journey, and included also fruits and seeds of weeds of thar area. This dirt was thown out again on so called "ballast grounds" in the vicinity of the American harbors where they arrived. On their way back to Europe the ships used machines or food as ballast. We had such "ballast grounds" near Philadelphia-Camden (they are now covered by streets), New York and the opposite bank of the Hudson and the East River, and near Boston and Baltimore. From these "ballast grounds" weeds may have spread out. During the 70 and 80 th years of the last century, also during the Civil War, Martindal and his friends did much research work in this field. The majority of the boats came from Europe at that time and this may be a hint as to why so many weeds originate from Europe. During World War I also dirt ballast came from Europe; the Academy of Natural Sciences in Philadelphia has done research work on this. In World War II ships contained also dirt ballast, especially Russian boats, but investigations were impossible. We have no particular "ballast grounds" anymore. Some boats threw out the dirt before entering the rivers, and during the war the surrounding of harbors could not be visited because of military reasons. For this after-war period we have no new records about new weeds.

It is certain that many weeds followed the trade roads. We know that the cockleberry, Xanthium spec., native in the Southern U.S., came with the wool to Europe. In the neighborhood of railroad stations we find sometimes weeds as "adventivous plants". So is in Philadelphia at 19th Street N. on a little slope of the street, near the Pennsylvania Railroad Station a locality where for several years has grown a hapaxanthic weed, Plantago arenaria, a native of South- and Middle Europe. Being a drug plant, we took some plants from there and cultivate them in our Kilmer Botanical Garden. Many of the "ballast plants" disappeared again after a shorter or longer period, but many survived, and are now members of the "international society" which weeds form today in our country and everywhere else.

During the season we fight in our Kilmer Botanical Garden abou 50 different weeds, weeds in the sense of unwanted plants. On account of their medicinal value some plants, which generally are considered as "weeds" are cultivated in the Kilmer Botanical Garden, and they are mentioned as such in the list of "our" weeds which now follows. The listed weeds originate in Europe, North America, tropical America, East and tropical Asia, including India, and we have a probably recent invader from Japan: Mazus japonicus (Thumb.)Kuntze. Ill. # 1. (the oldest specimen in the local herbarium of the Academy of Natural Sciences dates from 1918). We have spring, summer and fall weeds. In our list of the plants which the writer of this article observes since several years, we follow again Dr. Fogg:

L I S T !

These are the unwanted plants which are to be found during the year in the Kilmer Botanical Garden and the surrounding area. Some of them disappear in one year and come back in another ~~year~~. Some weeds bloom in spring, e.g. some grasses. Others have their vegetation period druing the hottest months, June, July and August like Euphorbia maculata or Molugo verticillata, and especially Eleusine indica (the ill. # 2 is taken on the side walk on the corner of 8[th] Street South and Spruce Street in Philadelphia in about July 1948; it grew between the pave stones) and it is rather difficult to get rid of them. Then we have fall weeds, blooming in late August, Eupatorium rugosum is such one. Galinsoga parviflora blooms from early summer until late into fall, untill it becomes killed by a frost. Poa annua and our little Japanese Mazus japonicus blooms during the whole seson.

The weeds are in general inconspicuous, small plants, but though they are undesired ~~by~~ and neglected by average people, their story is amazing; it took us around the world where they came from as unwanted plants!

List of the Weeds in the

Kilmer Botanical Garden.

(43rd St., Kingsessing- & Woodland Ave.)
(West-Philadelphia)

Latin Name:	English Name:	Family:	Origin:	When present:
Cynodon Dactylon	Bermuda Grass	Gramineae	Palaeo-, Neotropic	VI/IX
Digitaria spec.	Finger Grass	"	Europe	"
Eleusine indica	Crab Grass	"	Trop. Asia, India	"
Panicum dichotomiflorum	Fall Panicum	"	N. America	VII/VIII
Poa annua	Low Spear Grass	"	Europe	whole season
Setaria verticillata	Bur Foxtail	"	"	V/VI
Cyperus strigosus	Sedge	Cyperaceae	N. America	VIII/IX
Commelina communis	Dayflower	Commelinaceae	Trop. Asia	VII/IX
Allium vineale	Wild Onion	Liliaceae	Europe	IX/XII
Polygonum aviculare	Comm. Knotweed	Polygonaceae	Eurasia, N. America	V/XI
" longisetum	Bristly Lady's Thumb	"	Asia	VIII/XI
Rumex acetosella	Sheep Sorrel	"	Europe	VII/VIII
" obtusifolius	Bitter Dock	"	"	whole season
Chenopodium album	Pig Weed	Chenopodiaceae	"	V/XII
" ambrosioides, var. anthelminticum	Wormseed (also cult.)	"	Trop. America	VII/XI
Amaranthus hybridus	Amaranth	Amaranthaceae	"	IX/XI
" retroflexus	Rough Pigweed	"	"	"
Phytolacca americana	Pokeweed (also cult.)	Phytolaccaceae	N. America	VII/X
Mollugo verticillata	Carpet Weed	Aizoaceae	Trop. America, Africa	VII/IX
Arenaria serpyllifolia	Thyme-leaved Sandwort	Caryophyllaceae	Europe	whole season
Stellaria media	Chickweed	"	"	"
Portulaca oleracea	Purslane	Portulacaceae	"	VII/IX
Capsella Bursa-Pastoris	Shepherd's Purse	Cruciferae	"	V/VI
Lepidium virginicum	Peppergrass	"	N. America	V/XI
Rorippa sylvestris	Yellow Cress	"	Europe	"
Potentilla norvegica, var. hirsuta	Rough Cinquefoil	Rosaceae	Eurasia, N. America	VIII/XI
Trifolium repens	White Clover	Leguminosae	"	whole season
Oxalis europea	Sour Grass	Oxalidaceae	Europe	"
Euphorbia maculata	Creeping Spurge	Euphorbiaceae	N. America	VI/IX
Malva rotundifolia	Common Mallow	Malvaceae	Europe	VIII/IX
Rhus Toxicodendron	Poison Ivy	Anacardiaceae	N. America	shrub
Oenothera biennis	Evening Primrose	Onagraceae	"	fall (biannual)
Ipomoea hederacea	Ivy-leaved Morning Glory	Convolvulaceae	Trop. America	VIII/X

Continuation

Latin Name:	English Name:	Family:	Origin:	When present:
Verbena urticaefolia	White Vervain	Verbenaceae	N.America	VIII
Solanum nigrum	Black Nightshade	Solanaceae	Eurasia,N.America	VIII/XI
Datura Tatula	Purple Jimson Weed	" (also cult.)	Trop. Amer.	VIII/IX
Verbascum Blattaria	Moth Mullein	Scrophulariaceae	" "	VIII,fall,(biannual)
Mazus japonicus		"	Japan	whole season
Veronica peregrina	Neckweed Speedwell	"	N. America,Europe	VIII
" serpyllifolia	Thyme leaved Speedwell	"	N. America	VIII/XI
Plantago lanceolata	Narrow-leaved Plantain	Plantaginaceae	Europe	whole season
Specularia perfoliata	Venus'Looking Glass	Campanulaceae	N. America	VIII
Lobelia inflata	Indian Tobacco (also cult.)	"	"	IX/XI
Achillea Millefolium	Yarrow (also cult.)	Compositae	"	VII/XII
Ambrosia artemisiifolia	Common Ragweed	"	"	VIII/IX
Bidens frondosa	Stick-tights	"	"	fall
Erigeron canadensis	Bitterweed	"	"	VIII/XI
Eupatorium rugosum	White Snakeroot	"	"	XI/ XI
Galinsoga parviflora	Galinsoga	"	Trop. America,	whole season

Scientific Plant Photography.

by Theodor Philipp H a a s ,Ph.D. ,Botanist.

I am a botanist,and especially a plant morphologist,iterested mainly in the shape of plants and in the enormous multiplicity (Mannigfaltigkeit) which we can observe in the plant kingdom.I am studying this in roots,shoots and flowers, and I am teaching it in a college.

I want to photograph in color what I see with the naked eye and by the use of a dissecting microscope,which reproduces subjects in three dimensions.For my work magnifications up to 150 x are sufficient.I must emphasize,I am by no means a professional photographer,but a scientist,and plant photographing is only a tool for my scientific work ,and not the main purpose!On the other hand I have a long experience with plant photographing,and - as a botanist - I am trained to observe many things to which the avarage person would not give any attention.When many of my pictures are considered as beautiful,so I can only say,many plants are beautiful indeed!

Besides photographing plants outdoors or in greenhouses,I also must photograph illustrations in books and magazines,in color and black and white,for my teaching purposes.

In this article I must talk about the techinical side of my plant photographing About a year ago I obtaines a "Kine Exakta II" , a single lens mirror reflex camera,and I am indeed very satisfied with it.I have an extention tube which is longer than usual and enables me to go very close to the subject.Close up photography plays a decissive part in scientific plant photography.I also have a microscope attachment which I place upon my Bausch and Lomb dissecting microscope. Between the attachment and the camera one or two parts of the extention tube must be placed.These rings increase the magnification.The lens of the camera is not used; the eye piece of the microscope replaces it. (Ill. Finally,I obtained recently a lens hood and a conversion filter to be able to use outdoor - day light-Kodachrome films inddors,pwhen exclusively arti artificial light is present.

When outdoors or on fieldtrips, I have with me my camera, the extention tube (packed into am metal container), the lens hood, a tripod with a pan head swivel (Kugelgeelnk), a piece of black cloth, and an electrical exposure meter. I am using 35 mm "day light" Kodachrome films. I possible, I always use f : 22 on account of the sharpness in depth of focus. This is especially important in close up photography. I first focus with f : 3.5 and afterwards I reduce the opening to f : 22. I read on my meter the exposure time for black and white and multiply with 5. Then I have aproximately the correct time for color pictures. When possible I always use a tripod and time exposure. The greatest difficulty that I have outdoors, in the field, is wind current. If I cannot wait for a quiet moment, then I must decide each time how far I can go with closing the diaphrame, respectively how much I must shorten the exposure time. In some cases I have to make free hand shots at $^{1}/_{25}$ sec. or less. The fact that with the Kine Exakta II I can see the picture before I take it, is extremely helpful. In green houses there is no wind, but I must always a longer exposure time, even in the presence of sunshine. The glass absorbs a great amount of light, especially ultraviolet light. This is the cause that tropical plants, cultivated in green houses, look more or less different from ones, grown out of doors. For this reason I am going in summer for a few weeks to Miami, Fla., and farther south.

When I make time pictures, I mostly use the " B " on the "speed regulating knob", and read the time with the watch. This is the safest way when photographing under tropical conditions.

Before I take a picture, I see on the screen of the camera how close I have to go. This is necessary, when I wish to photograph parts of plants or flowers, or the interior of the latter etc. With the camera alone I can go to a minimum of 50 cm, when I screw out theobjective. If I wish to go closer, to get a higher magnification, I must make use of the extention tube. If I use only the two adapter rings of the latter, I can reduce the distance to 25 cm. I must confess that artificial light is present.

When outdoors or on field trips, I have with me my camera, the extention tube (packed into a metal container), the lens hood, a tripod with a pan head swivel (Kugelgelenk), a piece of black cloth, and an electrical exposure meter. I am using 35 mm "day light" Kodachrome and for black and white the Kodak Panatomic X film. If possible, I always use f : 22 on account of the sharpness in depth of focus. This is especially important in close up photography. I first focus with f : 3.5 and afterwards I reduce the opening to f : 22. I hold the meter aside of my camera and face it towards the object I wish to photograph. When I expose fife times lon ger than when using the Panatomic X film, then I have aproximately the correct time for the Kodachrome film. If possible I always use a tripod and time exposure The greatest difficulty that I have outdoors, in the field, is wind current. If I cannot wait for a quiet moment, then I must decide each time how far I can go with closing the dia-phrame, respectively how much I can shorten the exposure time. In some cases I have to make free hand shots at $^{1}/_{25}$ sec. or less. The fact that with the "Kino Exakta" I can see the picture before I take it, is extremely helpful. In green houses there is no wind, but, I must always longer expose, even in the presence of sunshine. The glass absorbs a great amount of light, especially ultraviolet light. This is the cause that tropical plants, cultivated in green houses, look more or less different from ones, grown out of doors. For this reason I am going in summer for a few weeks to Miami, Fla. and farther south.

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[2a]

Text to the three negatives

17 and 18 are black and white photographs of Kodachrome slides,taken from colored book illustrations.# 18 is a colored illustration of Nepenthes, a South Asiatic pitcher plant,paited by Ernst Haeckel,the famous German zoologist,taken from his book "Kunstformen der Natur" (art forms of nature) ,Jena 1900.

18. is a black and white photography of a Kodachrome slide of Rafflesia Arnoldi R.Br.,taken from the first description in the Transactions of the Linnean Society vol. 13, 1820.

16 . is a black and white photography of a kodachrome slide of Franklinia Alatamaha Bartr. ex Marsh.,a member of the tea family,and named by John Bartram for Benjamin Franklin.After the discovery by John Bartram in   the plant was never found again on the spot where it was stated for the first time.

as much as I can,I like to make close up photos at home or in the laboratory. I then have at my disposal many more convenient conditions.To make close up photos in the field is often not very easy,especially when the plants are small or low growing (Ill.)The photographing scientist has sometimes to go "very deep into the subject".Sometimes he has to lie flat on the ground.In swamps, e.g. in Cranberry bogs,to make close up photos may be very unpleasant,especially,when the mosquitos also are interestedin what this strange person is doing! We have to bring sacrifices to science!

In some cases it is necessary to make vertical photos.This can be done by turning the pan head to 90° .This makes plant photographing a little bit more complicated,but the pictures then look more natural,and more of the plant may appear in it.

When I make close ups in the laboratory or at home,I place the camera into a horizontal position (Ill.) Herewith I also use the pan head.The camera has to be exactly horizontally.When I use the entire extention tube ans screw the objective out.I can reach a distance of 6 cm,and byusing f : 22 the sharpness of the depth of focus is still suffcient.Herewith I have to increase the exposure time about two times,and again I focus first with f : 3,5 . In this case also,I have to decide how many parts of the extention tube I must use,and how close I have to go.This depends of what I wish to show.As background I use a white or black glass plate.

With the distance of 6 cm (by using the entire extention tube) I get a magnification of aproximately 15 x.If this is not enough,I have to use my dissecting microscope.Here also I use day light,if possible,even direct sun light because I use the day light type of the Kodachrome film.In both cases I am using over head light.I can use this kind of illumination also with the microscope. With the Bausch & Lomb dissecting microscope the objective is still far away from the object.Only in a few cases I use light from below (using the mirror). With the other way of illumination I have much better results,and also the colors are reproduced much better.By using the microscope,the contrast plate of the latter serves as background. There are only two difficulties when photographing through the microscope. These difficulties are the exact focusing, and the determination of the exposure time, but by experience I obtained quite satisfactory results. For instance I was able to photograph the minute stigma of the ragweed flower, a hair of the stinging nettle, and even the ovules of the giant water lily Victoria Cruziana.

By placing the camera into a horizontal position and by using parts of the extention tube, I also photograph book- and magazine illustrations, and also larger photographic plates. This is done with diffuse day light, never with direct sun light. Some of the illustrations in this article are made in this way.

FinallyI have a gadget which enables me to photograph larger black and white diapositive slides (the so-called normal slides for projection) to a 35 mm size which I can then use together with my Kodachrome slides. On the other hand I also can photograph my color slides in black and white for use in publications, which is impossible with color slides. In this way I made the plant illustrations for this article. By using the blue conversion filter I can also make color duplicates of my color slides. The gadget is a wooden box with an electric bulb inside and a white opale glass as a cover. This box is connected with a ring stand. I have then a C clamp with a pan head, and with this I fasten the camera in a horizontal position on the rod of the ring stand. By using parts of the extention tube, I can see on the screen of the camera how the slide which I wish to photograph, fits in. The illumination takes place from below, and all parts of the opale glass around the slide which should be photographed, are covered with black paper. This work is done in the dark room or at night. After focusing with f : 3.5. I again use f : 22. Unfortunately the exposure time must be determined by experience. The electrical meter does not work, But also here I have good results.

With this article I have tried to describe how a scientist can use photography as a tool for his purposes. I am very enthusiastic with my Kine Exakta II The single lens system and the mirror reflex construction gives the scientist unlimited possibilities. The Kine Exakta II is a wonderful instrument in the hand of the plant morphologist, and together with the Kodachrome film we can appreciate the tremendous progress which shows today modern scientific plant photography!

Observations on Utricularia inflata and Utricularia cleistogamea.

a Contribution to the Biology of Utricularia.

In his article "Morphologische und biologische Studien", chapter V., "Utricularia" in the "Annales du Jardin Botanique de Buitenzorg" [1.] 1891, G o e b e l, my teacher, writes: "Man mag die Utricularien betrachten in welcher Beziehung man will, stets wird man finden, dass sie zu den interessantesten Pflanzenformen gehören, mag es sich nun handeln um ihre Morphologie, Anatomie oder Biologie."

This article deals with observations made during 1945 to 1947 (concluded in July) on two Utricularia species, growing in the New Jersey pine barrens. It illustrates the sort of research which should be done on the native flora. I will report on U. inflata which grows in abundance at Medford Lakes, N.J., and U. cleistogamea, growing in the same area,

Utricularia inflata was studied in an artificial pond, owned by a group of local residents. I visited this place which is easy to reach from Philadelphia, many times during the period. During the flowering time the plant forms starlike floating organs which keep the inflorescences upright above the surface of the water.

The genus Utricularia is distributed throughout the Old and the New World. Its representatives are either free floating in freshwater, some are living submerged in the mud, and others as terrestrials in a wet substrate. U. inflata belongs to the first, U. cleistogamea to the last type.

There is very little written about the life history of these two species. We have literature about taxonomy and distribution, and studies on the bladders. But apparently nobody has observed the life cycle of these extremely interesting plants.

1.) Annales du Jardin Botanique de Buitenzorg, vol. IX, , Leyden 1891. Pag. 41.

I can only refer to the already metioned article in the "Annales du Jardin Botanique de Buitenzorg", further to "Pflanzenbiologische Schilderungen", chapter [redacted] V. "Insectivoren" 2.), and finally to the "Organographie der höheren Pflanzen", 3rd ed 3.) in which G o e b e l had laid down his observations.

There are three [redacted] Utricularia species which form starlike floating organs during the flowering period: The two species in Eastern North-America, U. inflata Walt., and U. radiata Small., and U. stellaris L. from East India. It is always striking when species of the same genus, living so far away from another, show the same adaptations for an equal task!

I will describe the life cycle of Utricularia inflata and compare it with that of the European Utricularia vulgaris L. [redacted] which I know well from personal experience abroad. When I watched the growth of these interesting waterplants, many questions came to my mind, but I see no possibility of answering them. As with so many "wild plants", we cannot duplicate artificially the natural conditions under which they thrive. Light, temperature, salt content and color of the water are of deciding influence. I remember Utricularia vulgaris in Europe, as it grew in a stagnant pond outside of the Ammersee, near Diessen (Upper-Bavaria) which I visited for several years. One year there was much rain and the whole area was flooded. This Utricularia looked then quite different than it did in previous years. It was much more green and the shoots were more delicate: Th salt content of the water had changed. I took several plants with water from the locality in a big bottle to the Munich Botanical Garden and placed them in an open square glas jar in an unheated sunny greenhouse. Even though I used the same water in which they grew, the plants died after a realtively short time: Light-and temperature conditions had changed. Only in the small shallow concrete basins outdoors they could be kept alive. Thus, experimental work seems impossible.

2.) Pflanzenbiologische Schilderungen", chapter V. Marburg 1889, ~~pag. 150~~ # 3
3.) "Organographie der höheren Pflanzen" 3 edition, [redacted] vol. 1., Jena 1928, p.131

The life cycle of these two Utricularia species may be shown with the aid of the drawings[1]. (Ill.# 1.). Both plants live, of course, in qiet water. ~~This has to be so deep.~~ This has to be so deep that the ice cannot reach the bottom of the lake or pond, as freezing would probably kill them, at least Utricularia inflata. Utricularia vulgaris and other European species pass the winter in form of turions on the bottom of the water or in the mud. However I do not know if these turions are able to withstand freezing. The turions are spherical, mucilaginous structures without bladders which are characteristic for the genus Utricularia. They are rich in starch and reach the size of a pea. About in April they rise to the surface of the water. This rising is a problem, as the turions are lacking in bladders which are thought responsible for this phenomenon. Goebel thought that with the first activity of assimilation at the beginning of the vegetative period air becomes stored intercellularly in the tissue. The quantity of this air increases, and in this way the plant rises. I have to talk later about this problem. The turions then float on the surface of the pond and after a time, depending upon temperature, they begin to sprout from the tip. Somewhat later a branched Utricularia vulgaris plant floats immediately beneath the surface of the water. I emphasize this fact because I will show later that in U. inflata it takes much more time for the plants to arrive there. The turions of U. vulgaris, from which the plants have developed, decay and disappear. From June to August the floating plants produce their upright stalked lemon-yellow flowers. In August, on the tips of the branches the development of a new turion can be recognized. These new turions are completed about September and shortly afterwards the rest of the plants disappears. With the shortening of the days, about October[2] the turions sink to the bottom

1.) Mr. Henry Stempen in Philadelphia was so kind to make these drawings.
2.) In Middle-Europe the summer is much shorter than in Philadelphia. Munich where I made my European observations, has about 48° N., corresponding with Quebec; it has an altitude of about 500 to 600 m above sealevel)

of the pond and stay there during the winter. The cause of the sinking is likewise not known.;it may be due to the weight of the stored starch;each year the story is repeated.

Quite different, now, is the life cycle of Utricularia inflata. First of all, the plant does not make turions at all, but passes the winter on the bottom of the lake as a whole. I was in Medford Lakes in late October 1945, and observed the sinking of the plants, and in September 1946 I observed the beginning of this phenomenon. (Comp. pag. 3)

In about [redacted] March or April the apical/ parts of the branched shoots, where assimilation is more active, begin to rise slowly from the bottom of the lake. These tips appear purplish red, and under the 600 power microscope, it is to state that the cells contain rather small chlorphyll grains and anthocyan dissolved in the cellsap. This anthocyan is responsible for the dark color of the shoots. If light is lacking, it is missing, and the latter appear bright green. I kept some shoots for a while in a class room of the Philadelphia College of Pharmacy & Science in a flat pan. They throve but were green. Such green branches float later in the season also on the surface of the water. They seem to die;I don't know the cause of the disappearance of the anthocyan. [redacted] The bladders also contain anthocyan. The red coloration starts at the mouth of the trap, [redacted] gradually spreading throughout the bladder. The latter are red when they are young and turn to a deep blue when they grow older. (The same happens also in the European U. vulgaris) Under high power magnification is to state that the young shoots are covered by glands whose function is unknown, (perhaps they produce mucilage as other Utricularia species (Comp. p. 12)) and that they end with a colorless thorn, perhaps a "Vorläuferspitze"!

In early spring the growth of the inflorescences begins. As I stated (in September 1946) they are already present in the previous fall;the beginning of their development takes place during the summer of the previous year. The inflorescences of Utricularia inflata show several interesting peculiarities. I want to refer to Goebel's description in the mentioned article[6] and the drawings plate XXIIXXIII

6.) Annales du Jardin Botanique de Buitenzorg, vol. IX., Leyden, 1891, pag. 90.

In my article I want to show the ecology of this interesting plant. Goebel has only alcohol material available and could not study the living plant on its habitat. He recived it by Prof. William Gilson Farlow - Cambridge, Mass. (1844 - 1919). On account of the historical value at the end of this article I will bring the facsimile of the letter in which Goebel thanks Farlow for having sent him <u>Utricularia inflata</u>. The letter is in the file of the Farlow Herbarium and its publication is by the courtesy of this Institute.

As Goebel repeatedly stated, it is impossible to distinguish between shoot and leaf in <u>Utricularia</u>. Without committing myself, I would prefer mainly to talk of shoots, of determinate and indeterminate branches, in German "Kurz" und "Langtriebe." The first ones are the runners with an unlimited growth in length, the latter are branches which are limited to a certain length. We shall have to do with both of them.

The inflorescences of <u>U. inflata</u> occur on the base of the bladder bearing organs. (Ill. # 2.) These are much branched structures with a limited growth in length and in a decussated position on the main shoot. When the inflorescence are formed, in September of the year previous to their flowering, they look like little balls or globules, of the size of a pinhead, tightly enclosed by about 6 claws which ultimately expand into the floating organ. This is then formed by mostly 6 determinate branches in a starlike arrangement. Goebel calls them "Schwimmkörper", floating bodies, and says of them 7.): "Als Mittelformen zwischen Blättern und Ausläufern können die Schwimmorgane der Inflorescences von Utricularia inflata berachtet werden." Since these floating bodies are definitely limited in their growth in length, I would like to consider them as determinate branches. Their basal portion is unbranched, while the apical part has a sheaf of short tiny branchlets, suggesting a "paint brush", and increasing the stability of the uprigt floating inflorescence. At the beginning thes branchlets are trmned inward, in thr direction to the flower buds. The floating bodies do not carry bladders, but they

7.) Annales du Jardin Botanique de Buitenzorg, vol. IX., pag. 99.

contain a great number of intercellular spaces.I was again in Medford Lakes in April 1947 with Dr. Scholander of Swarthmore College in Swarthmore,Pa.,who is in the possession of the equipment to make a micro gas analysis.We stated the pale appearance of the floating bodies in contrast to other parts of the plants. They lack in chlorophyll. When Dr. Scholander tried to take out some gas from the intercellular spaces he had some difficulties.In these intercellular spaces happens the same as in the bladders:there is a great underpressure.When we pushed a needle into them we heard the little crackling of the released underpressure,and water pooros in.The gas was air.It may contain during daytime more O,during night more CO_2 which is replaced pretty soon by N.The air comes into the intercellular spaces from the water by diffusion and the tissue is strong enough to withstand the waterpressure.This aircontent of the tissue may be also the cause of the rising of the shoots(comp. pag.4.).I think with the increasing size of the intercellular spaces more and more air is sucked in. Even preserved in formalin water the air remains in the floating bodies.In spring the intercellular spaces become so large that they are easily seen with the naked eye.

In Utricularia inflata the floating bodies are not as swollen as in U. stellaris,but much longer,yet they are at least 10 times thicker as the average shoot.Their cross section shows essentially the same picture as that of U.stellaris,8.) or the not swollen shoots of Myriophyllum:That is in the center there are reduced vascular bundles,surrounded by a layer of a few cells and large intercellular spaces which are separated by plates with a single layer of cells.In this way,a cross section looks like a wheel in which these plates form the spokes. The floating bodies are arranged in a whorl on one node which is extended to a little disc.Below them is an unbranched internode which soon begins to stretch in order to bring the floating apparatus to the surface of the water.Above the

8.) Goebel,Pflanzenbiologische Schilderungen,pag. 137,ill.36 and 37.

wherl there is also a unbranched internode which is the inflorescence stalk, carrying the yellow flowers. At the beginning of the growth of the inflorescence the latter is about 10 times shorter than the first mentioned internode. The very young inflorescences with the future floating bodies which, on that stage are not swollen yet, are visible on the main shoot about 30 cm away from the latter's tip. At that stage in spring the plants are still deep under the surface of the water. This is in contrast to U. vulgaris where the plants arrive first at the surface and start afterwards with the development of the inflorescences. In U. inflata the stretching of the lower internode begins, the floating bodies filling themselves more and more with air, and during this process the main shoots rise more and more, lifted by the floating bodies. The latter move slowly away from the flower buds with which they were closely connected, and the branched apical portion becomes diagonal upright; the whole formation looks like a crown. At that time, the inflorescences are still about half a meter beneath the surface of the water The main part of the plants are, of course, still deeper. The inflorescences reach the watersurface first with the tips of the floating bodies. In about April the lower internode has a length of about 15 to 20 cm, the inflorescence stalk about 5 cm. When the floating bodies have reached the surface of the water, they immediately spread out horizontally and lift the inflorescence out of the water. How this process takes place, if the floating bodies grow faster on the innerside (the side towards the inflorescence), is unknown. This happens near the end of April; although there are a few inflorescences still to be seen out of the season, in June and even later. I was in Medford Lakes in December 14, 1946. One of the artificial ponds was drained of water in order to faciliate cleaning. I came to the spring which supplies the lake. This spot was rather deep and I collected a specimen which had a nearly completely developed inflorescence. This inflorescence was still beneath the surface of the water, and I doubt if the flowers would bloom so late in the season. We have here the same phenomenon as in Europe where we have in springs Mentha aquatica as a submerged water plant throughout the whole year. The temperature of the water is nearly the same during the entire year - about

8 to 10° C. - so there is practically no change in the envirement - like in the tropics.I was in Medford Lakes in May 5,1946 [redacted] The pond was nearly covered with starlike floating organs with their centrally held inflorescences.The majority of the flowers were still closed,although the infloresence stalks had increased in length.In the mid of May the flowers were in full anthesis(I observed it in May 19,1946 and in May 15,1947.)The surface of the pond appears almost yellow from the abundant flowers which made a very attractive picture.This should demonstrate several photos taken in 1945,46 and 47.

Ill.# 3.,taken in May 5,1946 shows the rising of the inflorescences from the dept the flowers are still closed

4,5,6, show the full anthesis (mid of May 1945/47)

8 (1947) shows in its right parthow the branched portion of the floating bodies increases the stability.

9 (1946)taken above a bright part of the bottom of the lake.It shows the (cloudlike) darker parts of the plants which form the counter weight for the floating inflorescences;they are the bladder bearing shoots,still relatively deep beneath the surface of the water

10. (1946) shows the arriving of an inflorescence above the surface of the water.It shows how the tips of the floating bodies arrive first on the surface.The inflorescence stalk itself is still short and the flowers are still under water. (left side)

The inflorescence stalk is very sensitive to the infuense of gravity.If the floating apparatus happens to be turned from its normal horizontal position,it reacts immediately ,exhibiting a negative geotropism,and to less extend positive phototropism.In June 8,1946 I took a plant out of the pond and brought it to the nearby Camp Ockanickon,and even during this short time,the inflorescence stalk showed a bending reaction!This quick reaction is most important for the plant. Frequently,the wind upsets the floating apparatus,and the inflorescence lies upon the surface of the water. In this case the upright bending inflorescence stalk lifts the flowers up from the water and by stretching it brings the flowers again in their normal position,in which they can be pollinated. In some

Ill. # 11 shows (left side,below) an upset floating apparatus where the flowers have already reached their normal position.

cases,the floating apparatus does not reach the water surface,or it may sink below the latter.When this happens,the inflorescence stalk stretches itself so much, that the flowers are still above water level. How the auxines work in this case, is not known.

The anthesis of a single flower is usually 4 days. The lowest flower in the inflorescence opens first, so the sequence of flowering is tipward; it is according the development of the flowers in order as noted on the left side. By stre-

1
6 3
5
4
2

ching of the inflorescence axis the flowers move away from each other This scheme shows the blossoming sequence from above; # 1 is the lowest and oldest flower. As in all members of the Lentibulariaceae these flowers are dorsiventral. The peduncle is first ~~[illegible]~~ vertically oriented, but bends down about 90°; therefore the perianth is first horizontally and later vertically. Afterwards the perianth drops off, and a green fruit develops.

There is a marked difference in the structure of the internode below and above the swimming bodies. The former is stringlike and flexible and contains in the center very few sclerenchyma, while the inflorescence stalk is stiff and brittle and ~~passessed~~ possesses a complete sclerenchyma cylinder, situated near the periphery. Compared with the general dimensions of the plant, the inflorescence with the floating apparatus appears as a monstrosity.

Ill. # 13 shows the plant with a not full developed inflorescence
" # 14 flowering plants taken out of the water (Medford Lakes 1946)

It looks as if the swimming bodies and the inflorescence stalk with the inflorescence represent a "land form" while the internode below the "Schwimmkörper" belongs to a "water form". The fact that the land form of variuos aquatic plants develops underneath the water level is well known. One of Goebel's pupils noted that, if the carbohydrate production overbalances the salts, the "land form" develops even in the water. So, I think the light and the carbohydrate production has something to do with the development of thefloating apparatus and the inflorescences. A proof of this fact I found in September 1946. Plants which float during summer on the surface of the pond possess many more inflorescence primordia than those which remain on the bottom of the pond.

When the plants are in bloom the main shoots are still about 20 cm or more beneath the surface of the water. They form the counterweight, so that the inflorescences remain upright. The submerged plants are much branched and cling together. To insure cross pollination there are time differences in the development of the inflorescences (comp.ill. # 3).

After anthesis and fruit ripening (the latter I have not studied), the floating bodies break off and decay. The inflorescence stalk with the green fruits then floats awhile upon the water and disappears also. Meanwhile the main shoots rise toward the surface of the water, and about June, or beginning of July they form huge masses, floating until fall immediately below the latter - to the discomfort of bathers! (Ill. # 15.)

Not all plants of <u>Utricularia inflata</u> follow this discribed pattern. A considerable quantity of plants remains on the bottom ~~of the whole year~~. They do not bloom. They are laying loose on the bottom, not anchored in mud like <u>Utricularia purpurea Walt.</u> which I saw blooming ~~for~~ the first time on Sim's place in the New Jersey pinebarrens in August 13, 1947.

At the beginning of September, actually on September 8, 1946, the following facts were observable: On both, floating and non-floating plants, the older parts of the shoots begin to die off. In this way branches now become separate individuals. Later, the young, red-purple shoot tips of the floating plants of about half a meter or more move downward. The cause of this phenomenon is as yet unknown. A ~~MM~~ starch reaction with J was negative. Perhaps auxines may be responsible.

There are still other unsolved problems. What causes the blooming plants to float at the surface of the water during summer and a part of fall, while non-blooming ones remain on the bottom? The latter show only a few inflorescence primordia, while the former show them in abundance? Is the occurance of inflorescences on floating plants depending upon the inflorescence of light, which ~~MM~~, of course, is less with plants on the bottom of the lake? Are the "Schwimmkörper" air reservoirs, supplying the blooming plants with air? Sometimes the floating plants show little swollen shoots and appear to contain much air.

Quite different from the free floating Utricularias is the life of terrestrial living species. G o e b e l describes such ones in his "Pflanzenbiologische Schilderungen", and especially in his article in the "Annales du Jardin Botanique de Buitenzorg, but also in his "Organographie" 8.)

I had the opportunity to observe the life of U. cleistogama (Gray) Britton in the New Jersey pinebarrens. All Utricularia species are hygrophytes 9.). G o e b e l says about the "Land-Utricularias": "Die Land Utricularien leben zwar auch an feuchten oder nassen Stellen, vielfach an solchen, die vom Wasser überrieselt werden, aber sie sind nicht untergetaucht; einige leben übrigens im Moos der Baumrinden als Epiphyten." 10.) Utricularia cleistogama [redacted] lives as an accompanying plant with a green alga, identified by Dr. Francis Drouet, Chicago as Zygogonium ericetorum Kg. This alga forms dark purplish sheets upon wet, greyish quartz sand, the subsoil of white cedar swamps and cranberry bogs. It grows on places which are not covered with vegetation. These localities are a little elevated; in Medford Lakes, for instance, it grows on the edge of cranberry bogs. This is true also in Oceanville, N.J., and in Bishops Bridge, N.J., near Berlin, N.J., the localities where I observed the plant. These spots are rather wet, but not flooded. The sheets have a thickness of about 1 to 2 mm, and the pinlike inflorescences are to observe, coming out of the substrate. When one finds the alga, one is almost certain to find the Utricularia accompanying it.

8.) Annales du Jardin Botanique de Buitenzorg, vol. IX,
Organographie der höheren Pflanzen, vol. I. and III., 3rd edition

9.) Hygrophytes are plants which are living in a moist surrounding (in contrast to the xerophytes, living under arid conditions). They are divided into marsh- or swamp- and into water plants, the hydrophytes, with transitions between them.

10.) Pflanzenbiologische Schilderungen, p. 129.

Concerning the alga, in Engler-Prantl "Die Natürlichen Pflanzen-Familien" there is the following remark [11.]: "Zygogonium ericetorum Ktz. ist fast kosmopolitisch verbreitet und eine Alge stark sauerer Wasserstellen." There is still an article by F.E.Fritsch: "The Morphology and Ecology of an extreme terrestrial Form of Zygogonium ericetorum." [12.], describing his observations in England. This is the only literature I could find. The alga sheets are known as "meteor paper"; I saw them occasionally in Europe, but I don't remember to have ever observed the dark purplish color, caused by the - probably - anthocyan content of the alga cells. The conditions in the latitude of Philadelphia are quite different from such ones in Europe/in more northern latitudes.

Utricularia cleistogamea is a very small plant. It forms silvery, hairfine, branched threads. These threads have a length of about 5 cm and perhaps more. They carry on short stalks small colorless bladders with very long bristles on a nose-like elongation on the mouth. With these bladders the plants catch their prey, which consists in diatomes, protozoa etc., contained in the soil. These threads, seen under low magnification, have relatively large, juicy colorless looking cells and in the center a vascular bundle. The shoots possess also mushroom like gland hairs. These gland hairs, trichomes, may produce mucilage which may the runners enable to penetrate easier into the substrate, and which may also hold fast mud and debris as it was stated by Francis E.Lloyd for *Utricularia purpurea*. [13.]

The silvery threads are the subterranean runners, indeterminate branches of *U. cleistogamea*, corresponding with the main shoots of the free floating *U.inflata*. They grow horizontally in the wet sand immediately underneath the alga sheet, and in the latter between the alga threads. They are so intermixed with the latter and detritus that it is rather difficult to prepare the tiny runners out of the substrate.. The well known books of Harshberger, Stone, and Britton and Brown do not illustrate or describe the subterranean parts of the plant.

11.) Engler-Prantl "Die Natürlichen Pflanzenfamilien", 2nd ed., Vol. 3. Chlorophyceae, p.369 & 372, Leipzig 1927.

12.) Annales of Botany, London 1916

13.) Francis E.Lloyd: The structure and behavour of U. purpurea, Canadian Journ. Res. 8:234-252, 1933a

The runners end with swordlike green flat organs, coming out of the alga sheet. They are partly upright, or lie flat upon the Zygogonium sheet (drawing (ill. # 16.). They have a length of 1 to 2 mm. In his "Organographie" (1928) Goebel calls these organs which we see on all terrestrial living Utricularias, "phylloclades". I prefer this designation to one of leaves, because they are a direct continuation of the subterranean growing shoots. These organs are intensively green, and show a very spongy structure. They serve the assimilation and the breathing.

Since October 1946 I have cultivated successfuly U. cleistogamea. I potted the plants with the substrate and keep the pots in Sphagnum under a glass plate Until November 1946 I kept the plant outdoors and since that time I have them on the window in my laboratory. I water the plants - except during the weekend - everyday with destilled water. They produced a great number of upright oriented phylloclades, and even in December a few flowers. The flowering activity then ceaded, but new flowers - cleitogamoues and one chasmogamous flower appeared again in the first half of March 1947, and since that time the plants are blooming (cleistogamous) and fruiting. The phylloclades were very numerous and remained green throughout the whole winter and spring, and they are still alive in September 1947. So, it is relatively easy to cultivate Utricularia cleistogamea in contrast to U. inflata or especially U. purpurea.

What conditions obtains in the natural habitat? This leads to the question does U. cleistogamea survive the winter as plants or only as seeds?. I was in November 24, 1946 in Bishops Bridge, N.J., and in December 14, 1946 in Medford Lakes N.J.. We had severe frost for several days and the leaves of Vaccinium macrocarpa showed some ice cristals. The alga and the subterranean runners of the Utricularia were at that time still intact. Only the parts of the phylloclades above the ground were dead. Yet shoots, observed out of the substrate, especially on the branching points, showed that the phylloclades were still present. Then came a long and severe cold period late in winter 1946/47. I was, in early May and even June, at the locality in Medford Lakes and - in contrast to the previous year when we had a mild winter - I could not find any U. cleistogames, and also in the sand I could not see any runners, though the alga was intact. On June 15, 1947 on another place in the N.J. pinebarrens I found some flowering plants (also with chasmogamous flowers), and a few seedlings. These latter showed still the presence of the brown seed. This seed produces a relatively short, bent shoot which soon begins to form a branching center. From here start a number of shoots which again produce branching centers and which as ususal possess bladders and which end with phylloclades. Concerning our question about overwintering, I would say in mild winters, the plants survive, perhaps only the branching centers, which because of their small size are very difficult to see. In strong winters, the plants die and only seedlings appear in the next year.

Goebel shows in his articles several other terrestrial Utricularias also with phylloclades. Such land Utricularias grow in the Western hemisphere and also in the East Indies.

Utricularia cleistogames has its name from its cleistogamous flowers. These are whitish, very tiny little structures, which develop a fruit, looking like a pin head. The brown inflorescence stalk developing in the branching centers has a length of about 3 cm and has a few scale like bracts. The fruits have a central placenta and many, relatively large seeds. Below the first flower, in the axil of a leaf scale, there is probably a growth point, because from there starts frequently a new cleistogamous flower with a peduncle, reaching a length of about 1 to 2 cm. This can be repeated several times.

Goebel writes in his "Organographie" that cleistogamous flowers present a hunger- , a starvation form. This is true. The food supply is, on places where U. cleistogames grows, rather limited. In Medford Lakes there is a locality on the edge of the road where a pitcher plant grew which was much larger than other pitcher plants (Sarracenia purpurea), growing in the nearby bog. As Dr. E.T. Wherry supposes, dust particles from the road may fertilize the plants. In 1945 and 1946 I saw on the same spot plants wich chasmogamous yellow flowers, characteristic of U. subulata L. I saw such plants later on, especially at the end of the season in Oceanville and in Bishops Bridge. I agree with Fernald in his statement *U. cleistogamea* is a variety, and as we can say with great probability, a hunger variety of *U. subulata*. *U. cleistogamea* is much more abundant than *U. subulata* and there are also transitions between cleistogamous and chasmogamous flowers. Other terrestrial *Utricularias* have also the ability to produce cleistogamous flowers. It is an adaptation on the part of these plants to survive under such difficult conditions. The question why chasmogamous and cleistogamous flowes of *U. subulata* and *cleistogamea* grow so close together, a fact which was hinted to me by Fernald, I cannot answer. Perhaps they go back to individual differences.

As in *Utricularia inflata* several questions came to my mind. One is: Why does *U. cleistogamea* always live together with *Zygogonium ericetorum*? How do they come together? I suppose that the alga is first on the spot. The locality in Medford Lakes is under water until June (to prevent the freezing of the cranberries). Afterwards the alga sheet develops and later the *Utricularia* is observed. The plants bloom during the whole season and produce ripe fruits. I suppose they are distributed by wind and find favorable conditions upon the alga sheet in which they germinate. Perhaps with the rain water the seeds penetrate deeper into the substrate. I had no opportunity to study the germination.

Like with *U. inflata*, in *U. cleistogamea* there are still many problems which should be solved in the future.

Summary

Utricularia inflata Passes the winter as a whole on the bottom of the pond and does not make turions.

The inflorescences are iniciated during summer of the previous year. Their growth after a rest period during winter, continues in the spring, starting in March or April.

The inflorescences occur on the base of the bladder-bearing organs, therefore lateral on the shoot. They develop to monstrous size in comparison with the size of the entire plant.

The inflorescences are kept afloat on the surface of the water by aproximately 6 floating bodies which are considered as determinate branches. ("Kurztriebe")

The inflorescences extend to the surface of the water before the rest of the plant bodies, forming a kind of counter weight for the upright floating of the latter.

During summer (after their arrival there) the plant bodies form huge floating masses, yet a number of plants stays on the bottom of the pond throughout the whole year. These plants, generally, do not have inflorescences.

In September the floating plants begin to sink again. After the dying off of the older parts of the shoots, the young parts move slowly, with their tips forward, to the bottom of the pond and stay there during winter, together with the non floating plants.

Utricularia cleistogamea is a land Utricularia. It lives in wet sand always in association with Zygogonium ericetorum Kütz.

In the sand this Utricularia forms a tiny, netlike branched system of bladder bearing shoots. These, covered with gland hairs, ~~bearing bladders~~, penetrate the alga layer and form green [illegible] as brea[illegible] the alga threads, and also lying flat above the alga sheet.

The flowers are cleistogamous. This is considered as a starvation stage. Better fed they make chasmogamous flowers, especially toward the end of the season. Plants with the latter belong to U. subulata, plants with cleistogamous flowers to U. cleistogamea. Therefore the latter is a hunger-variety of the former.

The production of cleistogamous flowers is considered as an adaptic[illegible] surviving under the difficult conditions under which the plants have to [illegible] in Oceanville and in Bishops Bridge. I agree with Fernald in his statement *U. cleistogamea* is a variety, and as we can say with great probability, a hunger variety of *U. subulata*. *U. cleistogamea* is much more abundant than *U. subulata* and there are also transitions between cleistogamous and chasmogamous flowers. Other terrestrial *Utricularias* have also the ability to produce cleistogamous flowers. It is an adaptation on the part of these plants to survive under such difficult conditions. The question why chasmogamous and cleistogamous flowers of *U. subulata and cleistogamea* grow so close together, a fact which was hinted to me by Fernald, I cannot answer. Perhaps they go back to individual differences.

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When I saw for the first time the amazing picture of the blooming pond in Medford Lakes in the mid of May, I beame so enthusiastic that since that time, each year I make my pilgrimage to this spot. Yet the plant morphologist is not satisfied only to see this phenomenon; he wants to know how it develops, he wants to know the origin and he is asking nature. Hans Driesch say: Research is a questioning to which nobody is answering.

Slides 1 and 2.

These slides schow you the pond in Medford Lakes, covered with the floating inflorescences of Utricularia inflata. The genus Utricularia includes plants which belong to the most interesting forms in the plant kingdom, and Goebel is correct when he says: You may look on the Utricularias in which relations you wants, and you will always state that they belong to the most interesting plants, no difference if you are thinking of their morphology, anatomy or biology." I am observing Utricularia inflata and Cleistogama since 3 years and since I know how to go to Sim's place in the N.J. pinebarrens, I will extend my observations also to Utricularia purpurea.

Utricularia inflata has its name of the mostly 6 swollen, starlike arranged, branches which keep the inflorescence upright floating. I want to talk about how the plants are living in their natural habitat..

3 shows a branch of Utricularia inflata about in August. I want to emphasize that in the genus Utricularia we cannot distinguish between shoot and leaves; their functions and structures are very much alike. Utricularia inflata is a waterplant. You may see the bladders, but here is a young inflorescence iniciated. During winter these branches of the plant are on the bottom of the pond. On that time the inflorescence primordia have the size of a pinhead. In early spring they begin to grow: The lower internode (sitting on the base of the leafbearing sidebranches) begins to increase in length, the 6 branches which includes the inflorescences tightly, moves away, and the intercellularspaces fill themselves with air. The latter lifts then the plant up. The penetrating of air into the intercellular spaces is a very intersting process. I was this spring with a fresh collected specimen in Swarthmore College where there is the equipment for gaz analysis. Dr. Scholander stated that in the intercellular spaces there is a strong underpressure which causes a diffusion of the air into these intercellular spaces.

That in the intercellular spaces of the water plants an under pressure musst occur also in other cases.Goebel writes in one of his letters to his friend Julius Sachs in October 1892 of a "negative pressure " in water-plants.I do not know if physiologists have done work on this subject.

Ill. # 4 shows you how the inflorescences appear on the surface of the water.The floating apparata rieach the latter first with their tips and then they spread out qquite flat and lift the inflorescence out of the water.. This floating apparatus consists of mostly 6 determinate branches.These branches are pale,they lack in chlorophyll in contrast to the other parts of the plant,and they contain very large intercellular spaces.Their baseal half is unbrached and the branched part has no bladders.The branchlet here are directed towards the inflorescence but when they are "in action",this means when the flowers are blooming they increase the stability of the floating inflorescence as we shal see on later slides.

5 shows again the blooming lake

6 and 7 shows you closer pnapshots.You see how the tips of the floating apparatus reachse first the sirface and by spreading out it lifts the inflorescence out of the water.The inflorescence stalk is still short,the flowers closed. For # 7 I took the tripod into the water and you see,taken from a low level,how cojplete flat these 6 short-branches are spread out,and you see also how the terminal branchlets increase the stability.

In # 8 I tried to photograph also the submerged parts of the plants.They are these cloudy dark spots-contrasting with the bright bottom of the pond..They are the conterweight for the floating inflorescences.

9 and # 10 show that the inflorescences with the floating apparatus are rather large structures in comparison with the general dimensions of the plant.# 9 shows that the internode underneeth the whorl of the short branches is much ahead .It seems that the tha floating apparatus with the inflorescence should reach as soon as possible the water surface and then the stretching of the inflorescence stalk takes place.# 10 I photographed in Medford Lakes,immediately after I had taken out the plants from thewater.This was necessary because the inflorescence stalk reacts very quick to the influence of the gravity Brought out of its vertical position it bends very quick upright.This is very important for the plant.When the wind turns over the floating apparatus,the inflorescence stalk brings the flowers very quick in their normal position as shows
Ill. # 11.

The flowering time reaches its peak in the mid of may.After this time the number of the [illegible] of the inflorescences decreases and and during summer you would not see them at all.[illegible] After the anthesis the floating apparatus disaapears.The short - branches die,the fruit stalks float for a while with their green fruits on the water-surface,but they disapperar also.In the meanwhile the parts of the plants which formed the counter weight for the inflorescences and which were during that time relatively deep underneeth the watersurface have reached the latter .During July and Augst they
it is taken from the same spot as # 2 .
form huge floating masses which I tried to photograph in # 12.In September I observed that the older parts die off and the younger parts with the tip ahead move solowly to the bottom of the lake.When you are bathing then you will state that also upon the bottom the pond are branches of Utricularia.These parts remain there through out the year.In September the shoots possess already the primordia of the inflorescences for the next year.The plants which remain on the bottom of the pond are very poor in such primordia.I want to mention that the plants contain relatively small chlorophyll grains and in the cell sap anthocyan.Especially reach in Anthoscyan are the bladders.When these are young then the latter is red,when they are older dark blue.

In # 13 I tried to give an idea about the life cycle of Utricualria inflata.Mr. Henry Stempen, one of our students,was so kind to make this drawing.I wanted to compare it with the life cycle of the European U. vulgaris which I had the opportunity to observe abroad. The main difference is that U. inlfata makes no turions in winter,and that the mainpart o of the plants is immediately underneeth the surface during their flowering time.
Interesting is that U.i. has a counterpart in U. stellaris in India,also making a floati ting app
Quite different is now <u>Utricularia cleistogama</u> which also grows in the pinebarrens.

In contrast to U. inflata,U, cleistogama is a terrestrial Utricularia.It lives in wet quartz sand in symbiosis with a greenalga Zygogonium ericetorum which covers the latter. Goebel speaks of Utricularias which leave in the tropics between the stems of the moss, U. cleistogama between the threads of the alga.In the well known books of Britton and Brown,Witmore Stone and Harshberger the subterranean part is not illustrated.This forms fine slivery threads,covered with bladders and also glands.These threads,subterranean runners are branched and they correspond with the shoots of U.inflata.The runners end with a green swordlike phylloclade which appears above the algasheet and which is sometimes upright of lies flat upon the algasheet. The shoots and especially the bladders are covered with detritus and from this the Utricularia takes its food, diatomes, protozoa etc. If the gland produce a mucilage which attracts the prey, or if the antennas of the bladders attracts the prey, I don't know. Again here the gret convergence with the Indian Utricularia elachista GoeB, of which Goebel says that it makes exclusively cleistogamous flowers.. And as in our case where Utricularia cleistogama has only cleistogamous flower and U. subulata has chasmogamous ones, Goebel admitts the possibility that also U. elachista may have a counterpart with flowering plants. You may see that also this little plant is rather interesting.

The following slodes show you the plant:

14 Utricularia cleistogama and subulata together
15 " " with a fruit. The subterranean parts are rich in bladders
16 " " branches with bladders
17 " " the bladders more enlarged
18 " " runner, ending in a phylloclade.
19 " " scheme of the growth.

rising is a problem,as bladders are not responsibpe for it.As mentioned,the turions have no bladders at all.Goebel thought that with the first activity of assimilation at the beginning of the vegetative period,air is stored intercellularly in the shoots.The quantity of this air increases,and in this way the plant becomes lifted.The turions then float on the surface of the pond,and after a shorter or longer time they begin to sprout on the tip.Somewhat later a branched <u>Utricularia vulgaris</u> plant floats immediately underneeth the surface of the water.I emphasize the fact that the plants are immediately underneeth the surface of the water,because I ~~have to~~ shall show later that in <u>Utricularia inflata</u> it takes much more time until the plants arrive there.The turions of <u>U. vulgaris</u> from which the plants have started decay and disappear.From June until August the floating plants produce their inflorescences with their lemonlike yellow flowers.Already in August,on the tips of the branches the development of a new turion can be recognized.These new turions are complete about September, and shortly afterwards the rest of the plants decays and dissapears.With the shortening of the days,about in October (in the north situated Middle-Europe the summer is much shorter than in the latitude of Philadelphia;Munich,where I was living and where I made my European observations,has about 48° N., latitude corresponding with Quebec, ~~in~~ Canada;it has an altitude of about 500 to 600 m above sealevel),the turions sink to the bottom of the pond and pass there the winter. What causes the sinking is also unknown;it may be the weight of the stored starch which makes the turions heavier than water.Each year the same story is repeated.

All European <u>Utricularia~~s~~</u> species which float in the water as <u>U. vulgaris</u>, <u>U. neglecta</u>, <u>U. minor</u> etc. make turions in the same way.However,as in this country there is in Europe a species - <u>U. intermedia</u> - which lives in the mud and exhibits a division of work in its shoots.The mud is covered about 1 to 5 cm with water.There are green shoots,creeping on the surface of the mud,having no bladders,and these send colorless shoots into the mud,carrying relatively large white bladders.Also this type makes turions in the same way as <u>U. vulgaris</u>,and everything e~~l~~lse dies off in winter;but it looks as though the winter cold greater does not kill the turions, which are hidden in the soft mud~~.~~.The old winterbud remains on the plant is very long ~~to ob-~~ ~~serve on the plant.~~ ?

Quite different, now, is the life cycle of Utricularia inflata. First of all, ~~t~~ the plant does not make turions at all,but passes the winter on the bottom of the lake as a whole.I was in Medford Lakes in late October 1945,and observed the sinking of whole plants.In September 1946 I had the opportunity to observe the start of this phenomenon.

In about March or April the apical~~s~~ parts of the branched shoots, where ~~where~~ the assimilation is more active, begin to rise ~~XXXXXX~~.slowly from the bottom of the lake.These tips appear purplish-red.The young bladders are red; but when they grow older they turn to a deep blue.This is also the case in the European U. vulgaris.Whether this red color has any influence to the growth of the shoots in spring (absorption of the growth increasing rays) is not known.At the same time the growth of the inflorescences starts.I observed in ~~As I stated in~~ September 1946, that the inflorescences for the following year are already present in the previuous fall;their development, having taken place during the summer.

The inflorescences of Utricularia inflata show ~~several~~ several interesting peculiarities.I wish ~~want~~ to refer to Goebel's description in the mentioned article in the Annals du Jardin Botanique de Buitenzorg pag. 99 and the drawings plate XII. and plate XIII., ~~#~~ 96 -100.In my article I wish ~~want~~ to show how this interesting plant lives, and how it is placed in its surroundings.As Goebel repeatedly described ~~stated, in Utricularia~~ it is impossible to distinguish between shoot ~~XXXXX~~ and leaves.Without taking a standpoint on ~~to~~ this question I ~~would like to~~ prefer ~~as much as possible~~ to talk of shoots, ~~or~~ branches, and ~~of~~ long- and short branches. as much as possible. The first ones are the runners,shoots with unlimited growth in length,the latter are such ones which are limited to a certain length.~~XXXX~~ We shall have to ~~t~~ talk of both of them.

The inflorescences of U.inflata occur on the base of the bladder baering organs.These are greatly ~~much~~ branched ~~creatures~~ with a limited growth in legth.When the globules

inflorescences are formed in September ,they look like little balls or globes ~~of~~ the size of a pin head,tightly enclosed by about 6 claws which ultimately expand into the floating organ.This floating starlike organ is then formed by mostly 6 formations.Goebel calls them "Schwimmkörper","swimming bodies".In the Ann. d. Jard. Bot. d. Buitenzorg he says of them on page 49:"Als Mittelformen zwischen Blättern und Ausläufern können die Schwimmorgane der Inflorescenzen von U. inflata betrachtet werden".Since the "Schwimmkörper" are definitely limited in their growth in length,I would like to consider them as shortbranches,in German "Kurztrieb".Their basal portion is unbranched,whilst the apical portion produces a sheaf of tiny branchlets, suggesting a sort of "paint brush".These branchlets are turned inward,in the direction of the flower buds.The swimming bodies do not carry bladders.They contain a great number of intercellular spaces which become filled with gas of an unknown composition.Until yet I do not know if it is air,oxygen,or ~~even~~ CO_2,and it is also not known how this gas is secreted into the intercellular spaces.With the increasing growth these intercellular spaces become larger and larger until they are easily seen with the naked eye.In U. inflata the swimming bodies are not so much swollen as in U. stellaris ,but they are at least 10 times as thick as the average shoots.Their cross section shows essentially the same picture as that of U. stellaris (Goebel,Pflanzenbiologische Schilderungen,page 137,ill.36 and 37),or also as the ~~not so swollen~~ smaller shoots of Myriophyllum which are not swollen. That is in the center there are reduced vascular bundles,surrounded by a layer of few cells and large intercellular spaces, which are separated by plates with a single layer of cells.So, a cross section looks like a wheel in which these plates form the spokes.The swimming bodies are arranged in a whorl.Below them is an unbranched internode which pretty soon begins to strech in order to bring the floating apparatus to the surface of the water.Above the whorl there is also an unbranched internode.This is the inflorescence stalk,carrying the yellow flowers.At the beginning of the growth of the inflorescence the latter is about 10 times shorter than the first mentioned internode.The very young inflorescences with the future swimmingbodies which, ~~on that stage~~ are not swollen yet, are visibel ~~on the~~ on the main shoot on its length of about 30 cm from the tip of the shoot backward. At that ~~stage~~ stage the plants are still deep underneeth the surface of the water. This is in contrast to U. vulgaris, where the plants arrive first at the surface and then ~~start afterwards~~ ~~with~~ starts the development of the inflorescences. In U. inflata ~~starts then the~~ the stretching of the lower internode begins, the swimming bodies fill themselves ~~more and more~~ with gas, ~~and during this process~~ and also the main shoots, ~~themselves~~ lifted by the swimming bodies rise ~~more and more, lifted by the swimming bodies~~. The latter move slowly away from the flowerbudes with which they were so closely connected, and the branched apical portion becomes diagonally upright. The whole formation looks like a crown. At that time the inflorescences are still about half a meter ~~underneeth~~ beneath the surface of the ~~pond~~ water. The main plants are, of course still deeper. The inflorescences finally reach the water-surface ~~finally~~ first with the tips of the swimming bodies. ~~In~~ About April, the lower internode has a length of about 15 to 20 cm, the inflorescence stalk about 5 cm. When the swimming bodies have reached the surface of the water, they immediately spread out completely horizontally and lift the inflorescence out of the water. How this process takes place, if the swimming bodies grow faster on the innerside, is unkonwn. This happens close to the end of April; although there are a few inflorescunces, as "late comers" ~~to be seen~~ still in June and later. I was at Medford Lakes on May 5, 1946. The greatest part of the pond was covered with the starlike floating organs with their centrally held infloresceeces. The majority of the flowers were still closed, although the upper internodes - the inflorescence-stalks - had increased in length. Especially ill. ? shows the coming up of the floating apparata from the depth of the water. On May 19, 1946 the inflorescences were in full anthesis; the surface of the pond appeared almost yellow from the abundant flowers, which produced ~~this yielded~~ a very attractive picture! (Ill.

The inflorescence stalk is very sensitive to the influence of gravity. If the floating apparatus happens to be turned from its normal horizontal position, it reacts immediately, exhibiting negative geotropism, and to a less extent positive heliotropism. On June 8, 1946 I took a plant out of the pond and ~~brought~~ took it to the nearby situated Camp Ockanickon, and even during this short time,the inflorescence -stalk showed a bending reaction!This quick reaction is very important for the plant.Frequently the wind turns over the floating apparatus,and the inflorescence lies upon the surface of the water.In ~~tis~~ This case the upright bending inflorescence stalk lifts the flowers away from the water,[redacted] and by stretching afterwards it brings the flowers again in their original position,~~in which~~ so they can be pollinated.In some cases the floating apparatus does not reach the surface of the pond,or it may also sink below ~~the latter~~.Also in this case the inflorescence-stalk stretches itself so much,that the flowers are still above the ~~water level~~ surface.How in these processes auxine~~s~~ work is not known The anthesis of a single flower lasts mostly 4 days.The lowest flower in the inflorescence opens first,so the sequence of flo~~rsing~~ wering is ~~tipward~~ upward.As in all members of the Lentibulariaceae these flowers are dorsiventral.The peduncle is first vertically oriented,but bends down about 90°;therefore the perianth is first horizontally and later vertically oriented.Afterwards it drops off and if pollination ~~took~~ takes place,the green fruit develops.

There is a marked difference in the structure of the internode~~s~~ below and that above the [redacted] swimming bodies.The former is stringlike and flexible and ~~contains nearly~~ in the center contains very few sclerenchyma, ~~whilst~~ while [redacted] the inflorescence stalk is stiff and brittle and posses a complete sclerenchyma-cylinder,situated farther peripherally.Compared with the general dimensions of the plant,the inflorescence with the floating apparatus appears ~~a~~ to be a monstrositiy! (Ill. ?
It looks if the swimming bodies and the inflorescence-stalk with the inflorescence represent a [redacted] " land-form" ~~whilst~~ while the internode below the "Schwimmkörper belongs to a "water-form".The fact that the land-form of various aquatic plants develop already ~~underneeth~~ beneath the water level is well known.One of Goebel's pupils noted that,if the [redacted] assimilates overbalance the salts,the"land-form" starts,even in the water.So,I think the light and the forming of assimilates has something to do with the development of the inflorescences.A proof o~~f the fact~~ of this fact is that I found in September 1946,Plants which float during summer on the surface possess

much more inflorescence buds than those which remain on the bottom of the pond.

When the plants are in bloom and the starlike swimming apparatus keeps the inflorescences upright ~~afloat~~ and floating, the branched, bladder-baering shoots are still 20 cm and more beneath the surface of the water. In this respect U. inflata differs markedly from U. vulgaris, in which the shoots are immediately ~~underneeth~~ beneath the surface of the water. The main part of the ~~[illegible]~~ U. inflata plants form the counterweight, so the inflorescences remain upright. The submerged plants are much branched and kling together and produce many inflorescences, which occur lateral, not terminal on the shoots (As already mentioned, they develop on the bases of the bladders baering organs). In the interest of cross pollination there are at time, differences in the development of the inflorescences. Ill. #   shows how the swimming bodies come up from the depth.

After Anthesis and fruit-ripening (the latter I have as yet not studied), the swimming bodies, having lost the greatest part of their chlorophyll, break off and decay. The inflorescence-stalk with the fruits then floats upon the surface of the water, ~~[illegible] June, or beginning of July~~. Meanwhile the whole plants themselves rise toward the surface of the water, and ~~at~~ about June, or beginning of July they form huge masses, and floating immediately ~~underneeth~~ beneath the surface until the fall and add ~~to the~~ discomfort ~~of~~ to bathers! #   showsa floating branch.

Not all plants of Utricularia inflata follow this described pattern. As already indicated, a considerable quantity of the plants ~~[illegible]~~ remains on the bottom of the lake throughout the whole year, and these plants do not bloom. At the beginning of September, actually on September 8, 1946 - the following points were ~~observable~~ observed: On both, floating and non-floating plants the older parts of the shoots begin to die off. In this way branches now become separate individuals. Further, the young, red purple shoot tips of the floating plants, ~~in the~~ with a length of about half a meter, move downward. The cause of this phenomenon is yet unknown.

There are still other unsolved problems. What causes the blooming plants to float at the surface of the water during summer and a part of fall, while non-blooming ones remain on the bottom? The latter show in fall only a few inflorescence buds ~~whilst~~ while the former show such in abundance. Is the occurence of inflo-

What the alga is is concerned,in Engler-Prantl "Die Naturlichen Pflanzen-fam families",vol.3.second edition,Leipzig 1927,Chlorophyceae,there is on page 369 and 372 the following remark:"Zygogonium ericetorum Kütz. ist fast kosmopolitisch verbreitet und eine Alge stark saurer Wasserstellen".In the"Annales of Botany",London 1916,F.E. Fritsch publishes an article :"The Morphology and Ecology of an extreme terrestrial Form of Zygogonium ericetorum" He describes what he has seen in England.I also have seen the dry sheets of the alga in Europe - called "Meteor Paper",but I don't remember to have ever observed the dark purplish color.The conditions in the latitude of Philadelphia are quite different from such ones in Middle-Europe.

Utricularia cleistogamea is a very small plant.It forms silvery,hairfine, branched threads.These threads have a length of some cm..They carry on little stalks small colorless bladders with very long bristles on the mouth.With these bladders the plants catches their prey,which consists in diatomes, protozoa etc.These threads,seen under low magnification,have large,juicy looking cells and in the center a vascular bundle.The shoots possess also gland hairs. These threads are subterranean runners,long branches.They grow horizontally in the wet sand immediately underneeth the alga sheet and in the latter between the alga threads.They are so intermixed with the latter and detritus that it is rather difficult to prepare the tiny runner out of the substrate.The books of Harshberger and Stone do not show in their pictures the subterranean parts of the plant.

The runners end with swordlike green flat organs,coming out of the algasheet. they are partly upright,or lie flat upon the Zygogonium sheet.They have a length of 1 to 2 mm.In his "Organographie" (1928) Goebel signifies these organs which we see on all terrestrial living Utricularias, as Phylloclades.I like this better than to speak of leaves,because they are a direct continuation of the subterrane growing shoots.These organs are intensively green and show a very spongeous structure.They serve the assimilation and the breathing

Since October 1946 I cultivate successfully Utricularia cleistogamea.I took the plant with the substrate out,pottet them and keep the pots in wet Sphagnum unter a glass plate.I had the plants until November outdoors and have them now in the laboratory on the window.I water the pots everyday with destilled water. The Philadelphia Water is not suited.They produce a great number of upright phylloclades and even in December a few flowers.The phylloclades look quite fresh green and I am thinking if the lifetime of them is not limeted and if thgy are replaced by new ones.The runners are rather branched and I observed even in December the appearing of new shoots with phylloclades.The making of new branches with new bladders would give the plants the opportunity to catch new prey.I was in November 24, ~~[illegible]~~ 1946 in Bishops Bridge and in December 14,1946 in Medofrd Lakes.We had already severe frost for several days and the leaves of Vaccinium macrocarpa showed some ice cristals.But the alga and the subterranean runners were completely intact.The parts above the algasheet were dead and I saw no phylloclades above the ground,but prepared shoots showed the phyllocla- ~~des are still present.~~

des are still present and I belicave that the subterranean system and the alga do not die in winter.The subterranean runners branch frequently.The branches spread out starlike to all sides,and there is evidence that the growth continues during winter or is perhaps temporarely stopped during the cold period.I believe that Utricularia cleistogamea is a perennial and produces in spring new flowers adn phylloclades,coming out of the algasheet.This process starts from the buds with their starlike branching.

Goebel shows in his article in the Ann. d. Jard. Bot. de Buitenzorg several other terrestrial living Utricularias also with phylloclades.Such land Utricularias grow in the Western hemisphere and also in the East Indies.

Zygogonium ericetorum the winter? Without any doubt the soil freezes through. Like with Utricularia inflata, in Utricularia cleistogamea there are still many problems which should be solved in the futere.

Summary:

Utricularia inflata passes the winter as awhole on the bottom of the pond and does not make turions.

The inflorescences are developed during summer of the previous year. Their growth, after a rest period during winter, continues in spring, starting in March or April.

The inflorescences occur on the base of the bladder-bearing organs, therefore lateral on the shoot. They develop to monstrosities in comparison with the dimensions of the entire plant.

The inflorescences are kept afloat on the surface of the water by generally 6 swimm bodies, which are considered as short branches.

The inflorescences arrive on the surface of the water before the plants themselves. During summer, (after their arrival there) the latter form huge floating masses. Yet a part of the plants stay on the bottom of the pond throughout the whole year. These plants do (generally) not have inflorescences.

In September the floating plants begin to sink again. After dying off of the older parts of the shoots, the young parts move slowly with their tips ahead to the botoom of the pond and stay there together with the non floating plants during winter.

Utricularia cleistogamea is a land Utricularia. It lives in wet sand together with a green-alga Zygogonium ericetorum Kütz.. In the sand, the Utricularia forms tiny, branched bladder bearing shoots. These branches with bladders penetrate the alga layer and form there green swordlike phylloclades, as breathing organs between the alga threads, and also lying flat above the algasheet.

The flowers are cleistogamous. This is a hunger stage. If the plant is better fed it makes chasmogamous flowers especially toward the end of the season. Plants with the latter belong to U. subulata

[13]

plants with
~~the~~ cleistogamous flowers to U. cleistogamea. The latter is therefore a hunger-variety of U. subulata. The production of ~~To produce~~ cleistogamous flowers is an adaptation to survive under the difficult living conditions under which the plants has to live."

My Visit to the Atkins ~~Botanical~~ Garden and Research Laboratory in Soledad-Cienfuegos,

Cuba, in June 1951.

In Soledad, near Cienfuegos, Cuba, is situated Harvard University's tropical botanical garden, called "Atkins ~~Botanical~~ Garden and Research Laboratory". The writer wanted to visit this garden to see and study outdoor growing tropical plants, to collect specimens for the museum of this College, and to take kodachromes for teaching purposes. This article is illustrated by some of the photographs which were taken there.* He is indebted to Dr. I. D. Clement, Director of the garden for reading this article and giving suggestions. Though the author is a botanist and the trip was mainly botanical, the reader of the American Journal of Pharmacy may find in this article something which may interest him.

The writer left Philadelphia by Greyhound bus ("Limited") for Miami and Key West June 12th and flew then in 40 minutes from there to Havana. From there he went with the bus of the Menendez Lines to Cienfuegos, and a ~~logia~~ local taxi brought him finally to Soledad, ~~one of the suburbs of~~ a sugar estate near Cienfuegos. The bus trip Havana - Cienfuegos takes mostly 6 hours. The rider also sees the country in this way. The land is intensively cultivated. There were large sugar cane fields, obviously planted not too long ago. There is also much husbandry. There are no forests; the dominant tree is the Royal Palm, Roystonea regia, scattered all over the country, and also a few very tall Kapok trees, Ceiba pentandra with a whitish bark and large buttress roots can be seen. Only along the high way there were shade trees; from the moving bus they were not to identify. [Such I was told they were mostly Ficus, especially the ...] There was much traffic on the high way:

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* I use for my photographic work a German made camera "Kine Exakta". It is a single lens mirror reflex camera (35 mm) which is extremely useful in the field and in the laboratory. As accessory tools I have a 20 cm long extention tube and a f : 5,5 / 180 mm tele photo lens (Tele - Megor). The former I use for close up pictures; it can be divided into different parts, according to the necessity. For this purpose the f : 3,5 Zeiss Tessar lens can be taken out of the camera and be placed upon the extension tube. It is the great advantage of the Kine Exakta that one can see the picture on the screen before it is taken, and that there are no difficulties with parallax. In this way the photographer may decide how large the close up picture should be, and how many parts of the tube he must take. By using the entire extension tube and focusing the lens to 0,5 m, the latter can be placed as near as 6 cm from the object. Herewith one obtains an enlargement of aproximately 15 x. On my trip I took close up pictures in the hotel room! The tele lens enables me to photograph landscapes, flowers and inflorescences far away or high in the trees. I have used these tools very successfully on my journey. The illustrations in this article were taken again with the Kine Exakta from the original kodachromes. 35 mm black and white negatives were made and from these enlarged positives.

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automobiles, trucks and also many natives, horse back riding.

on long lease from the Soledad sugar estate
Atkins ~~Botanical~~ Garden covers a rather large area. It is ~~leased for 99 years to Harvard University by a large sugar plantation~~. In 1951 This year the garden is 50 years old and a semi-centennial publication is in preparation. In "Harvard House" (Ill. were ~~are~~ the headquarters. Here were are the offices, the laboratories, the library and the work rooms for fruits and seeds. In the garden there ~~is~~ also a small house for germination and propagation and for planting seedlings. A very beautiful high way lead~~s~~ from "Harvard House" to ~~the guest house~~ "Casa Catalina" on a hill top. as it looked when I was there (Ill.)Here were ~~are~~ accomodations for 8 students and 4 staff members. After I had left → This part During July the guest house was ~~is~~ occupied by graduate students, who - under the leadership of a Harvard Professor - had ~~have~~ the opportunity of becoming acquainted with tropical botany and its problems. Because the area of Soledad is relatively dry, in August the group moves to the Lancetillas Botanical Garden in Tela, Honduras, which belongs to the United Fruit Company in Boston. This garden is situated in the tropical rain forest.

Casa Catalina ~~The guest house~~ has a large screened porch. Most of the houses in Cuba have screened windows without glass; it is a tropical country where frost never occurs. From Casa Catalina the visitor has a wonderful view of the Trinidad mountains far away. (Ill.)
Atkins Garden is mainly an arboretum with trees and shrubs from the tropics of both hemispheres, palms included. There are also banana-, sugar-, cassava- and papaya plantations for experimental work. The administration of the garden is interested mainly in agronomy, the branch of agriculture, dealing with field crops! It possesses a list of the plants, grown in the garden. The writer picked out the names of those which were of pharmaceutical, economic, or pure botanical importance, and a botanically trained native employee drove him with a jeep to the particular plants

In the banana plantation there are raised fruit bananas with fruits which can be eaten raw. There are also three specimens of Musa textilis. The pseudo-stem is very fibrous. The fibres are used as "Manila hemp" for ropes, mainly for the Navy ~~because the latter remain floating when wet~~. The fruits of this banana are not ediable. During the last war this Musa textilis was more important than the fruit banana. The former is native to the Philippines, but also the latter is of South-Asiatic origin. (Ill.)

It was brought to the Western hemisphere from West-Africa (it went with the slave trade across whole tropical Africa).The banana is a tuber plant like the potato.But while the potato tuber lasts only one vegetation period,the banana tuber is persisting.It is rather big and has many buds like the potato.From these buds develop more or less tall pseudo-stems,formed by the enlarged petioles of the giant leaves.These enlarged petioles,the leaf sheaths,are arranged in a spiral.The whole structure is herbaceous and is easily to cut through with a kitchen knife.The bananas are the largest herbs in the world.When the pseudostem has reached a certain age,the inflorescence pushes through on a long stalk. In the axils of big bracts are the banana flowers with their inferior ovaries,mostly arranged in two transversal rows.From these flowers develop the mostly seedless bananas which we eat. (Ill.   show the Chinese dwarf banana,Musa Cavendishii,The pictures were taken in Chapman's Field,Miami,Fla. June 38,1951).The seeds are atrophied;no fertilization takes place.The fruits develop parthenocarpously.The propagation is done only asexually by planting the tuber or parts of it,possessing buds,like the potato!There are two kinds of edible banana fruits,ones which can be eaten raw,and ones which can only be eaten baked or fried (in gries).The latter is called "plantain".It is eaten ~~salted~~ fried abundantly in Cuba.Botanically,the banana fruit is a berry,the flesh,the pulp,contains a great amount of starch.In the banana which we eat raw,during the ripening process this starch is converted largely into sugar.In contrast to this,in the plantain the pulp remains starchy and tastes not sweet.

There is a rocky part in the garden.Here are cultivated numerous succulent Euphorbias. (Ill.   )They are all natives of tropical Africa.They live there under arid conditions like the cacti in the Western hemisphere,and are similar in their shape to the latter.The cactus shape is not at all limited to the cacti!Though some of the succulent Euphorbias still have leaves,their shoots are fleshy and green.The latter store water (therefore the plants are stem succulents),but contain also chlorophyll and have the ability to assimilate,thus more or less replacing the leaves.Ill.   shows a Cereus,a true catus of the Western hemisphere.

The oldest part of the garden looks like tropical jungles (Ill.).A dominant part is played here by the palms.Palms are really "the Kings of the Tropics"!In our hot houses they are in the wrong place;they are like birds in the cage!Palms must be seen outdoors!Then it is easy to understand that botanists can become "palm crazy"!

The dominant tree in Western Cuba is,as said,the "Royal Palm",Roystonea regia. According to their foliage we distinguish between feather- and fan palms.The Royal Palm is a beautiful tall feather palm where the large old leaves with their large green base drop off entirely from the trunk.The latter appears then smooth,greyish white,as if made of concrete.In other cases ,the bases of the leaves remain on the trunk.The vascular bundles of the leaves,containing silica,withstand decay longer than the rest of the tissue.In this way the trunk of many palms,like the Cabbage Palm,Sabal spec.,looks more or less fuzzy. In some cases the fibers on the plam trunk are more or less stiff and are used for brooms;they come into commerce under the name "Piassava".The palms,belonging to the monocots,have no cambium circle,and therefore wood,in the botanical sense,cannot be present. But the tissue of the pith in which the vascular bundles are dispersed,may also contain silica,and in this way it may become extremely hard.This is the case with the stem of the coconut palm.The "wood" is called "porcupine wood " and is used for canes and furniture. The "Royal Palm" is economically very important.The trunk is used as building material, the leaves for thaching the roofs of cottages (such a roof should last about 15 years and it keeps the house cool).The oil containing fruits are fed to pigs.

The most spectacular impression was made upon the writer by an Asiatic fan palm,Corypha umbraculifera L.,the"Umbrella Palm".In contrast to the Royal palm its trunk is densely covered with dead leaves.They bent downward and remain on the trunk.Only the upper part of the palm shows the large green fan leaves alive. (Ill.).As a rule,in all monocots,the stem can grow indefinitely,when the flowers or inflorescences are initiated laterally on the growing point,the location where in the bud the formation of leaves and flowers as minute structures takes place.In this case the growing point produces terminally leaves only.But when flowers and inflorescences are initiated terminally,then the fruiting exhausts the growing point with the result that the plant,or,at least,the flower producing shoot,dies.For this reason,the Agave dies after fruiting.Since it can grow for many years/ until it coms to bloom and fruit,the Agave is named "Century Plant" [illegible] It takes about 20,not 100 years,until it blooms.In contrast to this the Aloe which looks much like the Agave,can grow indefinitely:the inflorescences stay laterally.For the same reason the pseudostem of the banana dies after the ripening of the fruits, but the traveller's tree,belonging to the same family,can make a tall stem.In the case of the banana from the tüber one or several new pseudostems are produced.

The same happens now with the palms.In most of them the inflorescences stay laterally and they can grow indefinately in height.Ill. show a flowering and fruiting Coconut Palm (photographed in Key West June 28,1951).Yet in Corypha the inflores cence is situated terminally.It was the writer's great fortune to see in the Atkins garden a fruiting specimen of Corypha umbraculifera and he used all/ his photographic facili ties (normal lens and tele-photo lens),knowing that there are very few pictures in existance to show this magnificent event!The author [illegible] was told that this particular plant was 22 years old.It had started blooming in October 1950 and it was still standing when this article was written,according to the latest information from Soledad.Unfortunately, no photographs,taken at the beginning of the flowering, are available.In June 1951 the plant was fruiting.The lower leaves,still green,were bent downward above the dead leaves The leaves,close to the infructescence took a horizontal position.The infructescence itself showed a pale yellow coloration,originating from still present flowers,but one could [illegible] also see the very numerous globular unripe green fruits.The inflorescence- or infructescence axis is the direct continuation of the trunk of the palm,and mesured about a third of the length of the latter.The whole palm,including the infructescence axis may have had a [illegible] aproximately height of 150 feet! (Ill.)

Of pharmaceutical important plants may be mentioned first Cola acuminata from Africa. The plant - a shrub - was just fruiting;the fruits were not ripe yet.The seeds of this plant contain caffein and are used in making Cola beverages. (Ill.).The fruits are relatively large pods,staying together in variable numbers.(sometimes 4,3,2 or one) Acacia Catechu was just blooming.The little flowers have white filaments of the stamens. (Ill.).Of other legumes was in bloom Myroxylon toluifera L.,the plant from which tolu balsam comes.It showed little white flowers young fruits.In these pod fruits only the terminale ovule develops to a seed. The other part of the pod, toward the peduncle remains sterile and flat; in the ripe fruit it acts like a wing, similar to that of the maple fruit. Haematoxylon campechianum was not blooming. Then there was nutmeg, Myristica fragrans. The plant is dioecious; the male plants were in flower, the female were fruiting, yet the fruits were smaller than usual, probably as a result of the dry weather. Flowering and fruiting at the same time was Santalum album, the white sandel wood, probably a root hemiparasite. From all these plants specimens for the Museum were taken. They are now mounted and preserved in alcohol in the show cases. Very important as a parfume plant is Cananga odorata, an Asiatic Anonaceae, from which Ylang-Ylang is obtained by enfleurage (Ill.   . The flowers have 6 lemon ~~yellow~~ petals, and exhale a marvelous, delicate scent. The tree grows also in backyards in Havana. There is only one pharmaceutically important plant which is used also as a display plant: It is called "Golden Shower", and cultivated in all tropics. The scientific name is Cassia fistula, a legume, and the long cylindrical woddy podes, called "Manna", contain a brown pulp which acts as a purgative. Such a tree was just blooming in a private garden in Soledad. It had almost no leaves, but was full of the brught yellow inflorescences (Ill.   ) It was gorgeous! There are so many beautiful display plants in the tropics: Hibiscus species with all varieties of flowers (our "Rose of Charon", Hibiscus syriacus, does not grow in the tropics), Quisqualis indica with large white flowers which turn to red when they are older, Bougainvillea with red or purple bracts, surrounding the small whitish flowers. Poinciana regia, the royal poinciana, the "flamboyant tree" from Madagascar, Plumeria species, the "Frangipani" and many, many others. Unfortunately, the pictures lose too much in a black and white reproduction!

After a stay of 4 days in the Atkins Botanical Garden, the writer returned then to Havana the same way he came. He stayed there for three days. Fortunately he enjoyed in Havana the assistance of a former graduate of this College. In Havana the author saw the Botanical Garden and the Estatión Experimental Agronómica in ~~St. Jago~~ Santiago de las Vegas, a suburb of Havana. Here are carried on research works on Strophanthus and Dioscorea, cortisone plants, (~~In cooperation with Soledad~~), and on other medicinally important plants. But most interesting is the experimental work with Hibiscus canabinus L, the "Kenaf Plant", which they do in cooperation with the U.S.Dept. of Agriculture. (Ill.   ) Because of its importance a little may be said about this plant and why research work is done with it. The problem is the following: The U.S. obtains her main sugar supply from Cuba. The sugar is shipped to this country in jute bags. The jute is produced mainly in India and Pakistan, and imported from there. If now, by any event, we should be cut off from these counties, as it happened during World War II with the rubber producing countries, our sugar import from Cuba would suffer. The jute plant, Corchorus capsularis, a native of India and Pakistan, does not grow very well in the Western hemisphere. A substitute, and a good one, for jute is Kenaf, Hibiscus canabinus L., also an old cultivated fiber plant in its native India and Pakistan. In contrast to jute it can be grown very well in the Western hemisphere. So in a time of emergency we could produce here enough fibers for our sugar import from Cuba. This is the project; we do not want to disturb our good relations to India and Pakistan! Yet with the Kenaf plant we have still another problem. Hibiscus canabinus is a so called "short-day plant". It is known that the length of the days influences the flowering of the plants. On herbaceous plants one observes that the stem stops growing in length, when they start blooming. "Short-day plants" begin to bloom when the days are short. (In contrast to this, there are also "long-day plants", which bloom when the days are long; flowering hormones play a decisive part in this problem). In the tropics, where Kenaf should be raised, the days are relatively short. For instance, in June, in Soledad the dawn starts aproximately $^3/_4$ hours later than in Philadelphia and the same happens when night falls earlier. During the author's stay in June twilight came always around 7 to 7.30 p.m. Eastern Standard Time! In moderate Zones where the days are longer, the summer is rather short for Kenaf. We could raise tropical plants for instance in Philadelphia because we have here in many aspects tropical conditions; accordingly many tropical weeds grow here but for most of the tropical plants which have a longer vegetation period, the summer is too short. For many of these plants the summer starts too late. The Kenaf growers are also experimenting with new machines to obtain the fibers in an economical way. These machines should come from France or Germany. Ill.   shows another interesting fact. The plants in the field differ from each other in the shape of their leaves, some bloom, others do not. They do not follow the "short-day" pattern and have not flowers. All old cultivated plants are hybrids of numerous different varieties. When they are raised from seeds, then they segregate. If we would raise our potatoes from seeds we would get plants with different qualities,regardless of the plant with which we started.The potatoes were already hybridized with the American Indians who used it first.We also would get qualities which we do not like.Fortunately we raise potatoes from the tubers,which are not based on a sexual process,and which,therefore, have the same qualities as the mother plant,A similar situation is found also in the date palm which was introduced to California** . The date palm is one of the oldest Old World cultivated plants,used already by the Sumerians, more than 5000 years ago.Herodotus describes that only the offshots which the palm makes on its base (Ill.) are used for propagation.Raised from seeds - the date stone - dates with different qualities would be the result,beside the fact that,being dioecious, aproximately a half would be male and would produce pollen only.*** Yet the ancient people knew that they had to pollinate the female flowers to prevent the dropping off of the unfertilized fruits.The fertilization of the date palm was a religious act,and the Museum of Metropolitan Art in New York has Assyrian stone reliefs from Assurbanipal's palace,showing a priest in the action. (Ill.)

Before the author left Cuba he wanted to pay a visit to a very unusual fan palm which he has seen in small specimens in the Atkins Garden.The name is Copernicia Torreyana León,a relative of the Brasilian wax palm,(Copernicea cerifera Mart.,(The wax is known as "Carnauba wax" and is contained in the substance of which record dises are made).Copernicia Torreana has fan leaves without petioles;the blades are attached directly to the trunk.This palm grows native only in Cuba!(Ill.)

The next morning the writer flew back to Key West and returned to Miami.Here he studied the mangrove,visited the Fairchild Tropical Garden and Chapman's Field,the experimental Station of U.S.Dept. of Agriculture.This is an extremely interesting place.

** Bulletin # 54,Bureau of Plant Industry " Persian Gulf Dates and their introduction
***into America by David G. Fairchild,Agricultural Explorer,December 1903.
Circular # 728,U.S. Dept.of Agriculture.Washington DC. "Date Culture in the Unites States,By Roy W. Nixon,August 1945,revised March 1951.

A ~~My~~ Visit to the Atkins Garden and Research Laboratory in Soledad-Cienfuegos, Cuba,

in June 1951.

In Soledad, near Cienfuegos, Cuba, is situated Harvard University's tropical botanical garden, called "Atkins Garden and Research Laboratory". The writer visited this garden to see and to study outdoor growing tropical plants, to collect specimens for the museum of his college, and to take kodachromes for teaching purposes. This article is illustrated by some of the photographs which were taken on this trip*. Though the author is a botanist and the trip was mainly botanical, the reader of the Amerioan Journal of Pharmacy may find in this article something interesting to him.

The writer left Philadelphia by Greyhound bus ("Limited") for Miami and Key West June 12th and flew then in 40 minutes from there to Havana. From here he went by way ~~with the bus~~ of the Menendez Lines to Cienfuegos, and a local taxi brought him finally to Soledad, a sugar estate near Cienfuegos. The bus trip from Havana ~~to~~ Cienfuegos takes about ~~mostly~~ six hours. The rider also sees the country in this way. The land is intensively cultivated. There were large sugar cane fields, obviously planted not too long ago. The plants looked greyish-green. There is also much husbandry. There are no forests; the dominant tree is the royal palm, Roystonea regia (H.B.K.) Cook, scattered all over the country, and also a few very tall Kapok trees, Ceiba pentandra L. with a whitish bark and large buttress roots can be seen. Only along the highway there were shade trees; from the moving bus they were not ~~to identify~~ identifiable, but the writer was told they were Ficus trees, especially Ficus benjamina L., native to tropical Asia. There was much traffic on the highway: automobiles, trucks, and also many natives, horse back riding.

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* I use for my photographic work a German "Kine Exakta". It is a single lens mirror reflex camera (35 mm), which is extremely useful in the field and in the laboratory. As accessory tools I use a 20 cm long extension tube and a f 5,5 / 180 mm tele photo lens ("Tele-Megor"). The extension tube I use for close up pictures; it can be divided into different parts, according to necessity. For this purpose the f 3,5 Zeiss Tessar lens can be taken out from the camera and placed upon the extension tube. It is the great advantage of the Kine Exakta that one can see the picture on the screen before it is taken, and that there are no difficulties with parallax. This enables the photographer to decide how large the close up picture should be, and consequently how many parts of the extension tube he needs. By using the entire extension tube, and focusing the lens to 0,5 m M, the latter can be placed as near as 6 cm from the object, and an enlargement of aproximately 15 times may be obtained. The tele-photo lens enables me to photograph landscapes, flowers and inflorescences far away or high in the trees. The illustrations in this article were taken again with the Kine Exakta I photographed the original 35 mm kodachromes in black and white (35 mm black and white film), and from the 35 mm negatives, enlarged positives were made.

Atkins Garden covers a rather large area. It is on long lease from the Soledad sugar estate. In 1951 the garden was 50 years old and a semi-centennial publication is in preparation. In "Harvard House" (plate 1.) are the headquarters. Here are the offices, the laboratories, the library and the work rooms for fruits and seeds. In the garden is also a small house for ~~the~~ germination and propagation, and for planting seedlings. A very beautiful highway (plate 2.) leads from "Harvard House" to "Casa Catalina" on a hill top and to the garden itself (plate 4.) "Casa Catalina" (plate 3.) was the guest house and accomodations for 8 students and 4 staff members were there. After the writer had left Atkins Garden, this past July the guest house was occupied by graduate students, who - under the leadership of a Harvard Professor - had the opportunity of becoming acquainted with tropical botany and its problems. Because the area of Soledad is relatively dry, in August the group moved to the Lancetilla Gardens in Tela, Honduras, a botanical garden which belongs to the United Fruit Company, Boston. This garden is situated in the tropical rain forest. "Casa Catalina" is now the Director's residence and preparations are made to accomodate guests in "Harvard House" which is undergoing extensive alterations to provide more efficient working and dwelling quarters. "Casa Catalina" looks now somewhat different; "Harvard House" has not changed essentially.

From "Casa Catalina" the visitor has a wonderful view of the Trinidad mountains far away (plates 5 - 7.). Atkins Garden is mainly an arboretum with trees and shrubs from the tropics of both hemispheres, palms included. There are also banana- , sugar- , cassava - and papaya plantations for experimental work. The administration of the garden is interested mainly in agronomy, the branch of agriculture, dealing with field crops! It possesses a list of the plants, grown in the garden with notes where these plants are located. The writer picked out those plants which were of pharmaceutical, economic, or pure botanical importance, and a botanically trained native employee drove him with a jeep to the particular plants.

In the banana plantation are raised fruit bananas with fruits which can be eaten raw. (plate 8.). There are also three specimens of Musa textilis. Née Their pseudo-stem is very fibrous. The fibers are used as "Manila hemp" for ropes, mainly for the Navy, because they do not weaken in ocean water, nor rot so easily as do fibers from other plants. The fruits of Musa textilis are not edible. During World War II, this plant was more important than the fruit banana, Musa sapientum. Musa textilis (plate 9.) is native to the Philippines, but also the

Havana (II)

University of Havana Garden

Artłocarpus altilis, Breadfruit

Nolina spec. Liliaceae

Plumeria tricilor Ruiz & Pav., Frangipani. Apocynaceae, tropics

Estación Experimentál Agronómica, Santiago de las Vegas - Havana

Muehlenbeckia platyclada Meissn. Polygonaceae, Salomon Isl.

Mussaenda luteola Delile, Rubiaceae, Abessynia, Arabia

Hibiscus cannabinus L., var. vulgaris and var. viridis intermixed, Malvaceae, Pakistan, India

Schizophragma hydrangeoides Sieb. & Zucc. Saxifragaceae, Japan

Hatta:

Copernicea Torreana Leon, Palmae, Cuba

Key West (II)

Hura crepitans L. Sand-box tree, trop. America

Cymopolia barbata (L.) Harv. Dasycladaceae, Gulf of Mexico

Miami II.

Pontederia lanceolata Nutt., Pontederiaceae,, S.E.U.S.

" cordata L. E.U.S.

Carica Papaya L. Caricaceae, tropics cult.

Schefflera spec., Araliaceae

Cocoloba uvifera L., Seagrape, Polygonaceae, trop. America

Ipomoea Pes-Capráe (L.) Sweet., Convolvulaceae, tropics

Hymenocallis keyensis Small, Amaryllidaceae, S.Fla.

Cassytha filiformis L. Lauraceae

Fort Pierce, Fla.

Sabal Palmetto (Welt.) Todd., Cabbage Palm, Palmae, S.Fla.

Wilmington, N.C.

Dionaea muscipula Ellis, Droseraceae

Mayaca Aubletii Michx., Mayacaceae, S.U.S.

Washington DC.

Zizania aquatica L. Gramineae, E.U.S.

Victoria Cruziana d'Orb., var. Trickeri (Henkel) La Plata. Nymphaeaceae

Lotus speciosus Willd. Nymphaeaceae, India

Soledad

Roystonea regia (H.B.) Cook., Palmae, Cuba, Car/ibian Area
Saccharum officinarum L. Gramineae
Succulent Euphrobias

Cereus, Cactaceae

Caryota spec. Palmae

Corypha umbraculifera L. , Umbrella Palm,

Hyphaene thebaica Mart. N. Africa

Cocos nucifera L, Cocos Palm, tropics cult.

Adansonia digitata L., ~~[illegible]~~ Bombacaceae, trop. Africa

Myroxylon toluifera L., Leguminosae, trop. Asia

Santalum album L. Santalaceae, trop. Asia

Dillenia phillipinensis Rolfe, Dilleniaceae, Phil/ippines

Cassia fistula L., Golden Shower, Leguminosae, trop. Asia

Poinciana regia Boj. Leguminosae, Madagascar,

Quisqualis indica L. Combretaceae, India,

Bougainvillea spectabilis

Artocarpus heterophylla Lam.

Ficus religiosa L., Moraceae, India

My Visit ~~of~~ at the Harvard-owned Atkins Botanical Garden and Research Laboratory in Soledad-Cienfuegos, Cuba in June 1951. [1a]

In Soledad, near Cienfuegos, Harvard University owns a botanical garden, called "Atkins Botanical Garden and Research Laboratory". I wanted to visit this garden to see and study tropical plants, to collect museum specimens, and to take kodachromes for teaching purposes. This article is illustrated by some of the photographs which I took there. ~~May I say here something about the technical side of this part of my tasks?~~ [I use for my photographic work a German made camera "Kine Exakta". It is a ~~one~~ single lens mirror reflex camera (35 mm) which is extremely useful in the field and in the laboratory. As accessory tools I have a 20 mm long extension tube and a ~~H/~~ f: 5,5 / 180 mm tele lens (Tele-Megor). The former I use~~d~~ for close up pictures; ~~and~~ it can be divided into different parts, according to the necessity. For this purpose the f : 3,5 Zeiss Tessar lens can be taken out of the camera ~~and~~ be placed upon the extension tube. It is the great advantage of the Kine Exakta that one can see the picture before it is taken, and that there are no difficulties with parallax~~e~~! In this way the photographer may decide how large the close picture up of the flower should be and how many parts of the tube he must use. The extension tube can be displaced as near as from the object to obtain I can go with my extension tube until 6 cm ~~distance and have an~~ enlargement of aproximately 15 times. On my trip I took close up pictures in the hotel room! The tele lens enables me to photograph landscapes and flowers or inflorescences high in the trees, or plants far away. I used extension tube and tele lens very successfully on my journey.] Foot note.

I left Philadelphia by Greyhound Bus for Miami and Key West June 12th and flew then in 40 minutes from there to Havana. From here I went with the bus of the Menendez Line to Cienfuegos, and a local taxi brought me finally to Soledad, one of the ~~suburban places~~ suburbs of Cienfuegos. The trip lasts normally 6 hours; the rider sees in this way also the country.

Atkins Botanical Garden ~~is~~ covers a rather large area. It is leased ~~by~~ to Harvard University for 99 yrs ~~from~~ by a large sugar plantation ~~for 99 years~~. This year the garden is 50 years old and a semi-centennial ~~issue~~ publication is in preparation. Ill. 1 shows the headquarters. Here are the offices, the laboratories, the library and the work room for fruits and seeds. (There is also a small house for germination and preparations for planting in the garden). A highway leads

or tuber plus the large [illegible]
The banana plants possess a [illegible] tuber with many buds
growth points – like the potato – and from these develop
the herbaceous pseudostems, formed by the widened
petioles of the ~~[illegible]~~ leaves and arranged in spirals.
The bananas are the largest herbs in the world.

[illegible]
palm ways. According to the leaves there are 2 types of
palms: such ones with fan shaped and such ones with pinnate
leaves. Therefore we speak of fanpalms and featherpalms.
~~We see this also on tropical epiphytic orchids~~. For the same
reason the ~~[illegible]~~ onion can bloom only once, Clivia and
other bulb-possessing Amaryllidaceae many times.
The country is intensively cultivated. There are large ~~fields~~ sugar
cane fields, [illegible] ~~[illegible]~~ plants [illegible]
[illegible] ~~[illegible]~~
[illegible] are few trees to be seen, [illegible]
[illegible] ~~[illegible]~~ The [illegible] are [illegible]
~~[illegible]~~ The traffic on this highway was [illegible]
[illegible]
[illegible]

Estatión Experimental Agronómica St.Jago de las Vegas

[28]