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About the Institute
The Hunt Institute for Botanical Documentation, a research division of Carnegie Mellon University, specializes in the history of botany and all aspects of plant science and serves the international scientific community through research and documentation. To this end, the Institute acquires and maintains authoritative collections of books, plant images, manuscripts, portraits and data files, and provides publications and other modes of information service. The Institute meets the reference needs of botanists, biologists, historians, conservationists, librarians, bibliographers and the public at large, especially those concerned with any aspect of the North American flora.

Hunt Institute was dedicated in 1961 as the Rachel McMasters Miller Hunt Botanical Library, an international center for bibliographical research and service in the interests of botany and horticulture, as well as a center for the study of all aspects of the history of the plant sciences. By 1971 the Library's activities had so diversified that the name was changed to Hunt Institute for Botanical Documentation. Growth in collections and research projects led to the establishment of four programmatic departments: Archives, Art, Bibliography and the Library.

The notes on Dodoens herbal (p2) are the germ from which my study, the history of Botany began A.A.

I was 15 when I made these notes on the copy which had belonged to Mr. Palmer (wood engraver) which father was trying to sell for the widow's benefit.

1

...les &

...es Robertson
...race.

...in Mr Figgis
...ds an arum
black

...ring of

Botanical Notes & Cuttings

November 11th. 1894 Agnes Robertson
9 Elsworthy Terrace.

Red Arum.

In April 1892 I saw in Mr Figgis garden at Wildwoods an arum with a red spadix & black

Artificial Colouring of Flowers

To change the colour of flowers by artificial means would seem to any true nature-lovers to be little short of sacrilege, and yet it appears to be rapidly coming into fashion. The stalks, we are told, are dipped into solutions of aniline dyes. After this has been done for a few hours, the colouring matter passes into the veins of the flowers, "producing the most bewitching and beautiful colourations." The hollow-stem flowers, such as the tulip, hyacinth, and jonquil, are particularly susceptible to this system of treatment.

Extracts from an old herbal

A NIEVVE HERBALL
or Historie of plantes.
First set foorth in the Doutche or
Almaigne tongue by that learned
D. Rembert Dodoens, Physician to the
Emperour: and now first translated
out of French into English by Henry
Lyte Esquyer.
At London
By me Gerard Dewes, dwelling
in Pawles Church yard at the signe
of the swanne.
1578

(The names by which "plantes" are called in this "Herball" are in some cases very quaint & pretty. e.g.

Josephs flowre (or Goates beard)
Agnus castus (or chast tree)
Our Ladies bedstraw
" " Seal. (Black Bryony)
" " thistel
" " Quichion
Oculus Christi
Herbe grace (or garden rue)
Palma Christi (a kind of orchis)
Mayden Lecke
May blossoms } lily-of the valle
" lilies }
Flowre gentille a purple velvet flowre
Red patience (kind of dock)
Mawdelein
Blessed thistle
(Acorns called) Akernel
Goe to bed at noon
Grace of God
St Jhon's grasse, St John's worte

St Christopher's herbe
Jack by the Hedge
Judaical Herbe
S. Peter's wurt
S. James' "
Strangleweede }
Chokeweede } Broomrape
Mayweede (Stinking Chamomile)

(The following supposed medicinal etc properties of plants are curious)

Fennel

"The rootes pounde & layde too with honie are good 'gainst the bitings of madde dogges"

"It is good against the bitings of scorpions & other wicked & venimous beastes."

Galbanum

"If it be put into the holowe & naughtie tooth, it taketh away the ache of the same"

Maidenhair fern

"Capillus veneris as yet greene, pounde & layde to the bitinges of venemous beastes & madde dogges prevayleth very much, & layde upon the head, causeth heare to come agayne in places that are pilde & balde."

"A cap or garlande of maydenheare worne upon the head healeth the ache & payne of the same as Plinie affirmeth."

(Poisonous herbs are spoken of as)
"Venemous & noughtie herbes."

Of horsetayle or Shavegrasse.

"Whan the great Shavegrasse or horsetayle beginneth to spring, it bringeth foorth rounde naked, & hollow stemmes, rough & full of joyntes; yea their roughnesse is such, that Turners, Cutelers, & other Artificiers, do use them to polish, & make playne, & smoth their workes, as the heftes of knyves & daggers etc".

Here are some extracts from other authors about the equisetum:-

"My Garden" by A. Smee F.R.S.

"The Equisetums or Horse-tails, are an interesting class of plants, as they contain so much silex as to be capable of being used for polishing".

Green's herbal

Equesetum Hyemale - Royal Horse tail. - This is the best species for polishing wood & metal, being the hardest & roughest; hence our old writers call it shavegrass. It is much used by the white-smiths & cabinet makers under the name of Dutch rushes. The Northumberland dairy-maids scour their milk-pails with it. Gerarde says, that the women scour their pewter & wooden things there with, &

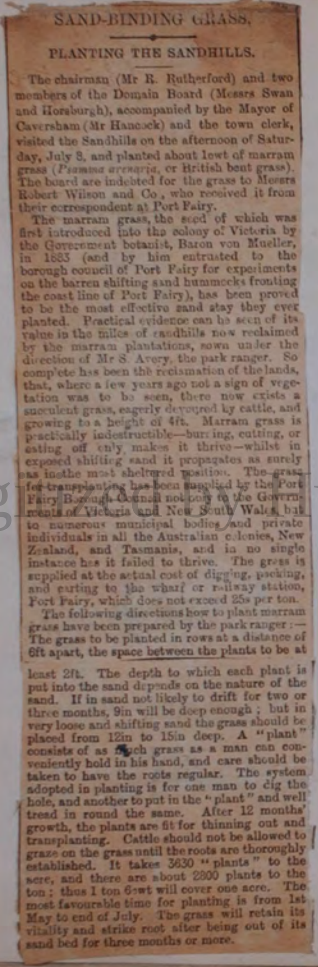
thence call it pewterwort; & that the fletchers & comb makers rubbed & polished their work with it."

"Rambles in search of flowerless plants"
M. Plues

"On the borders of mountain streams in the Yorkshire dales we have occasionally met with the naked stems of the Rough Horse tail or Shave-grass. The stems are of a glaucous green, very rough from the presence of a large quantity of the silex crystals, minutely striated, & bearing a small cone. This plant is imported from Holland for polishing wood, ivory, & metal; it forms a natural file. Mr Baird, in his "Flora of Berwickshire," tells us that "the dairy-women of Nunwick & Chipchase, where the plant is plentiful use it for smoothing their milk vessels." "

"Jumping Beans" extract from "Daily Telegraph." Nov. 11. 1894

Another curiosity is added to the many which Nature has already shown us. It takes the form of the "jumping bean," from Mexico, and some specimens imported by Messrs. Melchers, Runge, and Co., Fenchurch-avenue, have now been added to the collection of the Royal Botanic Society of London. The beans, which are "so volatile," are about the size of large cherry stones, of a triangular form, and contain the larvæ of a peculiar moth, "carpocapsa saltitans." How the insect gets inside the bean, which externally shows no hole or defect whatever, is like the question of how the fly got into the amber; but the idea is that the moth lays its eggs inside the fruit when the latter is young, and the husk then gradually grows over them. If the bean is laid on a flat surface—a table or a plate—it will soon begin to hop and jump, and wriggle from side to side in a most curious manner. These movements are caused by the gyrations of the jumping creature inside.



SAND-BINDING GRASS.

PLANTING THE SANDHILLS.

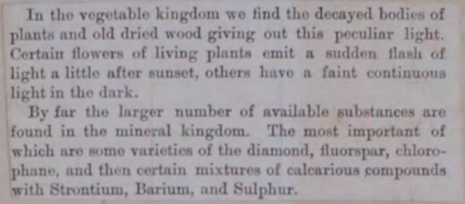
The chairman (Mr R. Rutherford) and two members of the Domain Board (Messrs Swan and Horsburgh), accompanied by the Mayor of Caversham (Mr Hancock) and the town clerk, visited the Sandhills on the afternoon of Saturday, July 8, and planted about 1cwt of marram grass (*Psamma arenaria*, or British bent grass). The board are indebted for the grass to Messrs Robert Wilson and Co, who received it from their correspondent at Port Fairy.

The marram grass, the seed of which was first introduced into the colony of Victoria by the Government botanist, Baron von Mueller, in 1883 (and by him entrusted to the borough council of Port Fairy for experiments on the barren shifting sand hummocks fronting the coast line of Port Fairy), has been proved to be the most effective sand stay they ever planted. Practical evidence can be seen of its value in the miles of sandhills now reclaimed by the marram plantations, sown under the direction of Mr S. Avery, the park ranger. So complete has been the reclamation of the lands, that, where a few years ago not a sign of vegetation was to be seen, there now exists a succulent grass, eagerly devoured by cattle, and growing to a height of 4ft. Marram grass is practically indestructible—burning, cutting, or eating off only makes it thrive—whilst in exposed shifting sand it propagates as surely as in the most sheltered position. The grass for transplanting has been supplied by the Port Fairy Borough Council not only to the Governments of Victoria and New South Wales, but to numerous municipal bodies and private individuals in all the Australian colonies, New Zealand, and Tasmania, and in no single instance has it failed to thrive. The grass is supplied at the actual cost of digging, packing, and carting to the wharf or railway station, Port Fairy, which does not exceed 25s per ton.

The following directions how to plant marram grass have been prepared by the park ranger:—The grass to be planted in rows at a distance of 6ft apart, the space between the plants to be at least 2ft. The depth to which each plant is put into the sand depends on the nature of the sand. If in sand not likely to drift for two or three months, 9in will be deep enough; but in very loose and shifting sand the grass should be placed from 12in to 15in deep. A "plant" consists of as much grass as a man can conveniently hold in his hand, and care should be taken to have the roots regular. The system adopted in planting is for one man to dig the hole, and another to put in the "plant" and well tread in round the same. After 12 months' growth, the plants are fit for thinning out and transplanting. Cattle should not be allowed to graze on the grass until the roots are thoroughly established. It takes 3630 "plants" to the acre, and there are about 2800 plants to the ton; thus 1 ton 6cwt will cover one acre. The most favourable time for planting is from 1st May to end of July. The grass will retain its vitality and strike root after being out of its sand bed for three months or more.

Extract from
Otago Times July
1893

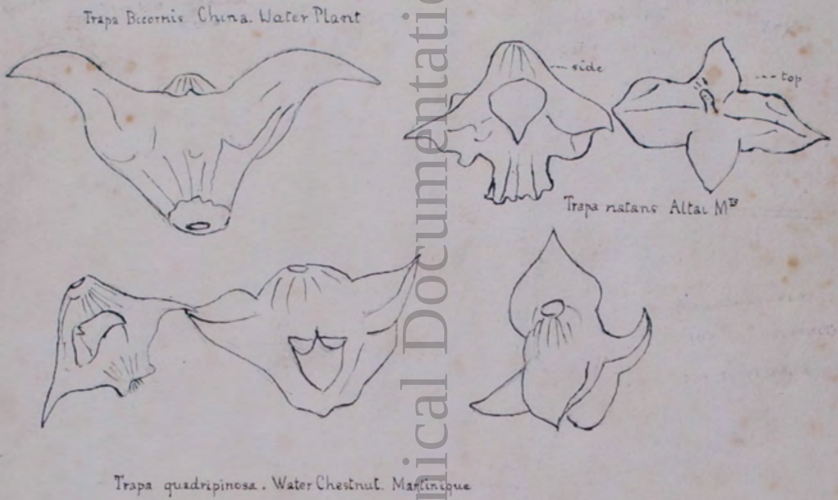
Flashes of light evolved
from plants



In the vegetable kingdom we find the decayed bodies of plants and old dried wood giving out this peculiar light. Certain flowers of living plants emit a sudden flash of light a little after sunset, others have a faint continuous light in the dark.

By far the larger number of available substances are found in the mineral kingdom. The most important of which are some varieties of the diamond, fluorspar, chlorophane, and then certain mixtures of calcarious compounds with Strontium, Barium, and Sulphur.

Tropaedum majus. Garden nasturtium. Miss E. C. Linneus first observed the T. majus to emit sparks or flashes in the mornings before sunrise



SPECIES OF "TRAPA" IN MUSEUM OF ROYAL BOTANIC SOCIETY, LONDON

AR delt

Nov 2/94

April 18. 1894
Flowers obtained at
Botanical Gardens
Show

Flowers of
Arnebia echioides
Prophet plant

Note the dark spots (Prophets finger marks) in the young flower which fade out as the flower gets older

Habitat Arabia

Stipules

Times
June. 9. 94

THE LINNEAN SOCIETY.—At a meeting of the Linnean Society in their rooms in Burlington-house, on Thursday, the president, Mr. Charles Baron Clarke, F.R.S., taking the chair, Sir John Lubbock, M.P., F.R.S., read a paper on "Stipules and the Protection of Buds." He said that the paper on that occasion was a continuation of one he had previously read there. Stipules were the small leaflets at the base of the petiole of many plants. Vancher, in his History of Plants, many years ago called attention to the fact that some species of rockrose had stipules, while others had none, and suggested that it would be very interesting to attempt to ascertain the cause of the difference. To this, Sir John Lubbock went on to say, he would give the answer. Stipules served for several purposes in the economy of plants, one of the most general being the protection of the young leaves in the bud. The various plans adopted by nature for the protection of buds were a very interesting part of botany. The young leaves were very delicate; they suffered much, as gardeners knew too well, from frost, and afforded a tempting food to insects and other animals. Moreover, their development was a slow process, the buds of the following spring being formed in many cases during the preceding summer, even as early as June or July. These delicate structures were in some cases protected by leaves, in others by scales, by hairs, by glands, by gum, by mucus; in many cases they nestled between the stalk and the petiole of the leaf, and lastly, in very many cases, they were protected by the stipules. This was not, however, the only function of stipules, which in some species were developed into spines, in others into glands, while in some they assisted in performing the function of true leaves. Sir John Lubbock described the form and arrangement of the stipules in a great many species and the purposes they served in the economy of the plants. He pointed out that when stipules were absent there was some other arrangement for the protection of the bud, and in regard to the special problem suggested by Vancher in the case of the species of rockrose, he showed that in those which had broad petioles the petioles served for the protection of the bud and there were no stipules; while when the petioles were narrow stipules were developed and served the same purpose. This, then, seemed a complete and satisfactory answer to Vancher's problem. A vote of thanks to Sir John Lubbock for the paper was cordially passed. There were two exhibitions in the lecture-room—one by Dr. John Lowe, of flowers punctured by insectivorous birds for the purpose of attracting insects, and the second, by Mr. Raymund Dowling, of dwarf glaucous pine and remarkable nuts from Japan.

Extracts from Nature Notes 1894

The Daisy a Meadow Plant (p. 95).—Certainly, I should say, unless the term "meadow" is strangely restricted in its application. Nor do I think that even if only the riverside pastures, which in Yorkshire are called "ings," are included under that designation, the daisy could be omitted from the list of their characteristic plants. In my numerous notes of walks over Fulford Ings, Clifton Ings, Middlethorpe Ings, Bootham Stray, Knavesmire, and similar low-lying grass tracts around York, it always finds a place, often with a remark indicating its abundance. The same is the case for Oxford and Abingdon, and their low meadows by the Thames. But a field at Ledsham, near Castleford, in Yorkshire, showed me the daisy in its greatest profusion and beauty. I, at any rate, should call that field a meadow. It was situated at a distance of two miles, perhaps 100 feet above the level of the river Aire. Receiving the drainage, by a gentle slope, from a higher background, it was kept fairly moist. On nearing this field, which is known as Ledsham "Dale," in May, 1883, it seemed as if snow covered from the profusion of daisy flowers in it. Its extent is perhaps six acres; I can but roughly guess. I took some pains to form an estimate of the number of blossoms in that space, and concluded that there could not, after all deductions for sparsely covered parts, be less than three millions visible at once. Indeed, 150 to the square yard seemed a fair average, and that would work out to a much larger total. Where the flowers were most crowded I put my hat down, and found that it covered fifty of them, which gave rather more than one to each square inch. The same field gave cowslips by hundreds. It lies upon magnesian limestone. At Abbotsbury, in Dorsetshire, I have seen pasture slopes on the lower parts of the downs look equally snow-like with the Ledsham meadow, and from the same cause.

William Whitwell.

ST. JOHN'S WORT.*

TOWARDS the end of June the little golden suns of the greater St. John's wort are to be seen with their halves of fine red-tipped stamens and glistening petals, set in a setting of dull green leaves. They grow on a high bank in an unfrequented lane, and it is a yearly custom of mine to visit this lane on Midsummer Eve and to gather the aromatic leaves and flowers; partly for the sake of an old friend who manufactures a certain healing lotion from the resinous plant, but more particularly from a simple love of the beautiful flower itself—

> "Hypericum all bloom, so thick a swarm
> Of flowers, like flies, clothing her slender rods
> That scarce a leaf appears."

But Cowper's lines more accurately describe the true St. John's wort (*Hypericum perforatum*), so common by our roadsides and field-borders; and, indeed, it is this with which the old customs are associated. My particular flowers are of purest yellow, except for a short time when the reddish pollen is thick upon their stamens, and year after year they make their appearance in the deep green lane, which I like to think is only known to myself.

With careful fingers I gathered my little golden suns, and as I strolled slowly homewards in the sweet twilight all the old tales and associations connected with the St. John's worts came thronging into my mind. But especially my thoughts went back to the old Pagan days when blooming at the summer solstice, the day dedicated to the sun in heathen mythology, they became the symbolical plants of the time. They belonged to Baldur the Beautiful, the Sun-god, the Apollo of the north, and in those days were known by his name. But with Christianity came new associations. The summer solstice was now dedicated to St. John the Baptist, and the sacred plant was no longer called Baldur's flower, or Baldur's blood, but was named after the saint who first brought the light of saving grace to a world sunk in darkness. The bright and undefiled flames of the great prophet's watch-fires were seen imaged in the Hypericum's golden bloom, and Columba, the apostle of Iona, who had much in common with St. John the Baptist, also loved this flower so well that it became known among the Gaels of Ireland and Scotland as "the herb which St. Columba carried," or as St. Columba's wort (*Beach nuadh Columcille*).

The sacred plant of heathen mythology was now the sacred plant of Christendom, and in many countries was held as a safeguard against the approaches of evil. In the Netherlands, it

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* *Hypericum calycinum.*

An Odd Horse Chestnut.—About the middle of October, my attention was called to a large horse-chestnut tree upon Clapham Common, near the parish church, which was putting forth a quantity of new leaf-buds. I have observed it closely since, and estimate that the number of buds has been about one-tenth of that which would represent the ordinary spring produce of the tree. They are almost entirely upon the south and south-east branches. Many of the buds have fully opened, and produced normally-expanded leaves; others seem arrested in their growth, though showing the usual fresh and vivid green proper to them. Some of the uppermost of the new leaves already hang limp and discoloured, caught by the early frosts. Two informants assured me that the tree had borne flowers shortly before I began to notice it, but I did not myself see these, nor any remains of the spikes upon the branches.

Nov. 11, 1893.

I

LEAF-SHAPES AND MOISTURE.

IN a very short time spring will be with us again. Already the tiny buds on the trees and shrubs have begun to swell, and in some cases have burst from the dingy coats which shielded them from the icy winds and frosts of winter. In a few weeks the sombre brown of the woodlands will give place to the tender green of the early year, with fresh inducements to us to wander through the glades and mossy pathways. At such a time as this it is seasonable to ask you to open your eyes as you pass along the woody paths and notice how varied are the shapes assumed by the leaves of the trees above, and of the herbage at your feet. It is exaggerating very little to say that every variety of form and structure assumed by the foliage of the different plants, serves some definite purpose in the life of the herb or tree in which it occurs. It is well to inquire what the conditions are which surround each plant in its native home, and from a knowledge of these to attempt to explain the meaning of the shapes and structures which occur in its organs.

A great German botanist—Stahl—has done this in one important respect with leaves. Java happened to become his home for a time; and whilst there, one of the things which struck him most was the extreme humidity of the atmosphere. He very naturally applied this to his favourite subjects, the plants, and asked himself what effect this condition might have upon their structure. A little observation and reflection showed him, how harmful it is to the leaves, and indeed to the whole plant, if rain, or other moisture, be allowed to remain standing on them for any length of time.

In the first place, its slow evaporation greatly interferes with that which should go on from the interior of the plant through the numerous pores in the leaf surface. Then, again, it rots the tissues of the leaf, as may be seen in many greenhouses, where

III

But, perhaps, the most universal adaptation displayed by leaves to free themselves from water is the formation of long slender apices and pointed teeth along their margins.

Go among the water-loving willows and sprinkle their leaves with water, and observe how quickly and readily the drops run down and fall off from their tapering extremities.

A considerable part of Stahl's work is occupied in a consideration of these apices, and a few simple experiments mentioned there are so instructive, and yet so easily performed, that I would advise you to repeat them. He marked half-a-dozen leaves with long slender ends; three of these he left as they were, the apices of the others he cut off and rounded. He then sprinkled all six with water, and watched. He found that while the leaves with the pointed ends were quite dry in twenty minutes, those which he had rounded were still moist, and remained so for upwards of an hour. The leaves of our willows and poplars are good examples to confirm this.

I will not mention any other of the numerous means adopted by the vast variety of leaves to be found in our English forests and hedgerows, but will leave you to observe the rest for yourselves, believing that in doing so you will find much pleasure and enjoyment.

RUDOLF BEER.

The relation of the form and position of the leaf to rainfall may be easily studied in our common lime, the leaves of which it is most interesting to watch during a shower. Owing to their sloping position the pointed apex is lower than the stalk, so that raindrops falling on the polished surface all run towards the tip, where they collect in a larger drop which rapidly twists off from the point. It is also worth while to notice the shape of the leaf-stalk. In many plants its upper surface is grooved, forming a channel well fitted to carry off the water which has fallen on the blade, but in the lime there is no such channel, the leaf-stalk being rounded, and the same will be found to hold in other trees, *e.g.*, black poplar, where the leaves slope downwards towards a pointed apex. Where the water is run off from the tip it is at once got rid of, but if carried off by the petiole gets only as far as the twig or branchlet; in cases such as these, herbaceous plants have often developed ingenious ways for getting rain drops down to the ground. The lines of hairs running down the stem of the common chickweed from the base of the leaf-stalk to the next lower node form a well-known instance.

Professor J. Wiesner, an Austrian botanist, has recently been studying the behaviour of plants under artificial rain. He finds that under continuous rainfall many plants soon shed their leaves and decay, while others can stand it for many months. The first set he calls *ombrophobe*, the second *ombrophil*. As we should expect, plants growing in dry places are generally ombrophobe; but the Professor did not find that plants loving damp situations

AUGUST IN NEW ZEALAND.

ALTHOUGH most of the imported weeds and grasses never cease growing, and many of them flower throughout our short winter of eight or ten weeks, still it is during this month that first a more general awakening may be noticed. In the garden, where during winter on the bare unbudded boughs the kingfishers perched, watching in the rain for homeless, wandering worms, now peach and apricot blossom in shades of pink. In the warm days the English bees are out in hundreds, though the solitary native bee does not emerge from its cell for two months. Several shrubs in the bush provide a vast amount of pollen, and honey may be procured from the small fragrant flowers of the wax-white heath that grows on barren hill-sides and tops. In warm days its low-growing blossoms give forth a delicate scent like laurel leaves crushed.

Towards the end of the month the clematis may be noticed, festooning in white wreaths the tops of the low-growing trees. It always flowers in a conspicuous fashion, as if proud of its virgin beauty. The leaves of the "fern flower" are also above ground on the warmer slopes. Our earliest sundew has acquired this name because it appears in greatest quantity after fires have destroyed the heavy fern growth that covers thousands of acres in the north. Above the clammy insect-trapping leaves a few pink open cup-blossoms hang. They expand in the sun, and close rather early in the afternoons. English daisies are plentiful, and short-stalked golden dandelions lie close on the nibbled grass.

On the fuchsia branches the wax-eyes may be noticed sucking honey from the flowers in all attitudes, circling the boughs or hanging head down, like athletes on a bar. Indeed, a fuchsia tree at this season exhibits a considerable amount of colour. It is everywhere deciduous, and in autumn upon the mountains its sere and yellow leaf contrasts well with the sombre colouring of the evergreen bush. Though not so magnificent as the better-known South American species, yet *Fuchsia excorticata* is well worth looking into. The flowers pass through various shades of colour. They are at first green, blotched with dull-gleaming purple, then later red. The petals, at first black, become later a bright purple, and in the mid and short styled forms the pollen is of a beautiful mazarine blue.

WILD LIFE IN TASMANIA.

VI.

IT may readily be imagined that in a timbered country like this, there are several descriptions of what is technically known as "bush." For example, there is the "green bush," the grand old primeval forest, standing in all its silent majesty as it has stood thousands of years. This description of bush, when rooted in good soil, is often fairly easy to travel in when one gets a little used to it, for, although there is plenty of timber, it is nearly all large, and one does not encounter the masses of small sticks which so frequently encumber the poorer soils. Then there is the "bush" which arises after a fire has devastated the country, and this is the worst of all to travel in; the big timber which has been destroyed by the fire is replaced by an army of seedlings, which rapidly develop into saplings, and these so close together that nothing short of hacking one's way with axe and slash-hook is of any avail to the explorer. The thistles and fireweed (the latter belonging to the groundsel family) are always the first plants to show up after a fire, and this will occur miles away in the bush, quite distant from any other plants of the kind. However, as the seeds are winged, and will fly a long distance before a good breeze, this may be accounted for; it is not so easy to explain the fact that the seedling trees above referred to are often quite different to the trees that were growing there before the fire. The dogwood is one of the scrubs which arise in this way, often appearing in poor soil after a fire has passed over it and the original scrub has been scorched out of existence.

The most open bush of all is on the plains, where the trees are much more scattered than in the good land, and of a more gnarled and stunted appearance, though often of a great size even here. The larger timber consists chiefly of peppermint gums, and the undergrowth of honeysuckle trees, he-oaks, gum saplings, small ti-tree, and various species of heath and rushes. The "green bush," the virgin forest as yet unmarred by the touch of man, is a land of beauty and delight such as can hardly be conceived. Scarcely ten minutes' walk from the knoll on which our little cabin is perched, is a glade of lovely tree-ferns, where, seated on the trunk of some fallen tree, and shaded from the fierce rays of the sun by the long drooping fronds of the giant ferns, we may look into the face of Nature as we never could in a more civilised country. The ground beneath our feet is mossy and littered with dead leaves and twigs, and the log upon which we are seated has also a thick covering of green moss.

The very trunks of the tree-ferns themselves are a study, for upon them is growing quite an assortment of delicate little mosses and ferns, which hang from the brown fibrous stem like hair from the back of some monstrous bear. For our fronded beauties are not all straight up and down; some run almost horizontally after the first few feet from the ground, and we may, if we please, scramble along one so inclined and take a seat in the feathery crown.

Nature Notes:

The Selborne Society's Magazine.

No. 58. OCTOBER, 1894. Vol. V.

ROSEMARY.

"Grow for two ends, it matters not at all,
Be't for my bridal or my burial."
HERRICK.

JULY weather had brought with it all my favourite flowers. Bright marigolds, with their golden haloes of spoke-like petals—the flowers of middle summer, so dear to the heart of the cottager, which, alternately with the rose, have given their name to the most beautiful of cathedral windows—marigolds and white lilies, Canterbury bells, holly-hocks, sweet-williams, carnations, scarlet lychnis, damask roses, and lavender.

My garden is full of flowers, and yet it is not by any means large. Its principal feature is a paved walk running from one end to the other, with wide flower-beds on either side, traversed at intervals by narrow, box-bordered paths. At the further end is a high wall entirely covered with a grape-vine, and beneath this vine, with its jagged flickering leaves, is my favourite herb-bed, where many of the herbs of olden times grow in fragrant and wholesome profusion.

Great bushes of lavender stand here, like sentinels, and as they lift their countless spikes of purplish-grey flowerets, a reflection, or rather a continuation of their sweet colouring is to be found in the blossoming herbs below—in the lilac whorls of the delicately up-springing thyme, and in the deeper purple of the larger flowering sage, with its hoary stems and leaves; in the labiate blossoms of the spearmint and marjoram, and in the pale blue flowers of the rosemary—those frail blossoms, so strangely attractive, as they appear among the dark, narrow leaves of the aromatic shrub!

Pennyroyal, horehound, ground-ivy, and rue are also to be found in my herb bed, but it was the bush of dark-leaved rose-

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Varieties of Lomaria spicant (Hard fern)

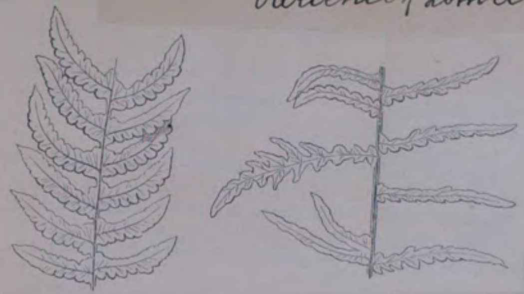

Fig. 793.

Fig. 794.

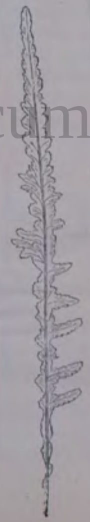

Fig. 795.

Fig. 802.

Fig. 803.

COLIN CLOUT'S CALENDAR.

I

XII. SUNDEW AND BUTTERWORT.

SHOWERY June weather, with gleams of sunshine interspersed, is just what the little blue butterwort best loves: and coming out into the patch of bog above the home fields to look for it this morning, I find its strange spurred flowers out by dozens, among the mossy bits where the undrained pools lie thick with red rusty sediment between the tufted grassy islets, and the peat yields like a saturated sponge beneath one's hesitating feet. There is nothing wilder and more natural left in England than these frequent oases of marshy ground, dotted about through the great sheet of artificially drained and cultivated farm-land that covers the plain or the hillside; and here alone one might compile a special calendar from spring to autumn—a chronicle which should note from day to day the budding of the rushes and the sedges, the flowering of the flags and featherfoils, the fruiting of bog-asphodels and great osmunda ferns. Everywhere else, save on a few lonely moors or heaths and barren mountain-tops, our true native flora has been mostly killed off before the spread of tillage and the steady march of those cultivated weeds which came to us first from western Asia, and which are now making the tour of the world with English seed-wheat and English clover. We can hardly say, indeed, what the real English flowers of the plains were originally like; for some of them must now be quite extinct, and others must have grown weedier and coarser to suit the new circumstances brought about by extended cultivation. But here on the peaty hillside hollows, and in the unreclaimed bogs, bits of which may be found almost everywhere, a totally different type of vegetation still abundantly survives. Reedy tussocks of cotton-grass and bog-rush rise in little islands from the level turf; and in between them the shallow water stagnates and reddens in the hollows with the iron-mould of decaying leaves and skeleton club-moss. These lower bits, beside the trickling rills that slowly drain off the overflow from the pools, are the favourite haunts of sundew and butterwort; and what gives them their special interest to the rural mind is this—that here, side by side in treacherous friendship, grow the two most ruthless and marvellous among our English insect-eating plants.

Sundew, perhaps, is the best known to the world at large of the two uncanny things, by name at any rate; if for no other reason, at least on account of Mr. Swinburne's exquisite and musical lines: the only entire poem, I fancy, which he has ever devoted to any single natural object; for, in spite of his vague pantheistic nature-worship, man, not nature, is the real centre round which the eddy of his thoughts revolves. Here you have an entire plant, lifted, root and all, from its moist bed—as curious a herb to look at as any in the world; and indeed it is no wonder that so fantastic a creature should have been the one weed to attract in passing our weirdest poet's special attention. The leaves are round and long-stalked, pressed

II

flat in a tuft or rosette against the ground, and rather red than green externally even at a first casual glance. But when you look closer, you see that the actual blade itself is more or less faintly greenish, and that the redness of its surface is due to a number of living and moveable viscid hairs, each consisting of a long neck, capped by a little globular crimson gland as big as a pinhead. Some of the leaves have folded over their edges or rolled in upon themselves; and if you open them you will find in the centre two or three decaying carcasses of flies. Whenever the insect lights upon the blade, attracted by the bright red glands with their honey-like secretion, he gets clogged at once by the sticky hairs, and cannot drag himself away from the corrosive acid for all his frantic efforts. For my own part, I cannot watch the poor creature struggling to free his legs and wings from this horrible, impassive, blood-sucking plant without at once assisting him out of his trouble; for my instincts will not allow me to appraise the "divine dexterity" of nature in causing destruction so highly as some of our idealistic humanitarians have done; it is impossible not to feel a little thrill of horror at this battle between the sentient and the insentient, where the insentient always wins—this combination of seeming cunning and apparent hunger for blood on the part of a rooted, inanimate plant against a breathing, flying, conscious insect. But with a little bit of raw beef one can see the whole process just as well, and far less cruelly; for after all, man shrinks from seeing what unconscious nature does not shrink from designing with minute prevision and care. As soon as the fragment of meat is placed upon the leaf, the clubbed ends of the glandular tentacles hold it fast by their sticky secretion, and the other tentacles around bend over to enclose it, exactly as the arms of a polyp sweep together to catch their floating prey. If you put a dead innutritious object on the blade, the glands bend over at first, but shortly relax again; when the object is a living fly, however, they clasp it tightly, and the more it struggles the more it excites the surrounding tentacles to close over it and hem it in securely. There it is gradually dissolved and digested, its juices going to supply the plant with materials for the production of its flower and seed.

The butterwort is a less savagely insectivorous creature than the sundew; yet its taste for fresh meat is almost as indubitable as that of its cruel red-leaved neighbour. Its foliage is pale hoary green, covered with little crystalline-looking white dots, which produce an abundant viscid fluid, easily drawn out into long threads by the touch of a finger. When an insect lights upon it, his legs are clogged by the fluid; and the edge of the leaf then curls slowly inward, so as to push him into the centre of the blade, where the digestive power seems to be strongest. But what is most interesting of all about the butterwort is the fact that it is peculiarly adapted for attracting insects from two distinct points of view—for food, and as fertilizers. While it lays itself out to catch and eat miscellaneous small flies with its gummy leaves, it also lays itself out to allure bees with its comparatively large and handsome blue mask-shaped flowers. It has a deep spur behind each blossom, which secretes a big drop of clear honey: while its irregular shape is fitted neatly to the bee's body, its stamens are placed in the right position to brush against his back as he enters the tube, and its lip is covered with

STRANGE TROPICAL PLANTS.

LECTURE AT THE LONDON INSTITUTION.

Up till quite recently travellers' tales as to the curiosities of tropical vegetation have been taken very guardedly. It would appear, however, that the later investigations of science by no means give support to the cheap scepticism with which hitherto some of these tales of wonder have been received. Mr. Morris, the assistant-director at Kew Gardens, who has spent many years in the tropics, lectured at the London Institution last night on some vegetable curiosities that he or other botanists have tested and found to be genuine. There is, for instance, the cocoa-nut pearl. More than a century ago an old Dutch botanist described large pearls which he asserted were found in the milk of the cocoa-nut. But the statement was derided at the time and ultimately forgotten. The pearls, however, are what our American cousins would call a solid fact. The cocoa palm has a fondness for taking up lime salts in its sap, and occasionaly seizes the opportunity to deposit some of the mineral in the milk cavity of the fruit precisely as does the oyster within his muscular coat. The concoa-nut pearls are a little duller than the mussel pearls, but otherwise their composition is identical. Pearls are reputed by ancient writers out of the buds of the jasmin and magnolia, but there is no confirmation of this yet. Concerning that industrious reed the bamboo, Mr. Morris had a good deal to say. One of its eccentricities is that it deposits true opals in its joints. These vegetable opals are much prized by the natives of the Celebes for charms against disease. Other trees deposit their mineral matter in rougher and less elegant fashion. Sir F. Abel found a tree in India with a slab of naturally deposited limestone in its trunk 8ft. in length. A good deal of the Indian teak which comes to this country has to be rejected on account of the stony matter it contains, which plays sad havoc with saw blades and edge tools. There are many tropical shrubs and herbaceous plants which possess medicinal and chemical properties that are still a puzzle to science. What, for instance, can be made of the gymonemia or "taste-spoiling" plant of Southern India? If you chew the leaves there is a slightly sweet taste in the mouth. But the next moment you find that the palate has become absolutely dead to the taste of sugar or other sweet substances, while quinine tastes like chalk. Then there is what we may call a "taste improver" in West Africa (Sideronglia), a second cousin to the gutta percha family, which heightens the sensitiveness of the palate, especially to acid fruits, for several hours. In tropical America, at a certain season of the year, the natives turn a bright yellow all over. This means that they have been drinking of the vintage of the Moritia palm, which is obtained from the pulpy fruit, and constitutes the principal native drink for the whole of the fruiting season. The wild tamarind of Jamaica, which is largely browsed by horses, has the startling effect of causing their manes to drop off and their tails to become barren of hair. But the natives take no notice of the scarecrow appearance of the horses, to whom this novel feed is otherwise quite nutritious. Jelly making plants are common in the tropics. The leaves of cyclea if placed in water speedily convert the fluid into a solid jelly. They abound in "pectose"—a sort of mucilage. But one of the most serious characters is the Pisonia of New Zealand, which is shockingly carnivorous. It hangs out seed pods covered with a sort of bird lime, which first attracts flies to their doom, and then fixes the birds which come after the flies. It may be remarked that cats are fond of studying the phenomena here presented. These are only a few of the curious facts Mr. Morris vouched for in his lecture last night.

Lecture on Thursday
Nov.
1894.

THE IVY-LEAVED TOADFLAX.

(Linaria Cymbalaria.)

"This pretty little trailing plant" is now "perfectly naturalized on old walls and sometimes on rocks over the whole of England, and the southern half of Scotland."* In 1597 Gerarde says that it "growes wilde upon walls in Italie, but in gardens with us;" and in 1640 Parkinson declares that "it groweth naturally in many places of our land." In 1816 we read in Green's Herbal that it "is a native of Italy; but now become common upon walls in and near London." It was known in Worcestershire forty years ago, and probably earlier. It is also known in France under the names of Linaire Cymbalaire, Mère de mille enfants, and Lierre de la terre. Its Dutch name is Muur bloemtje (wall bloom); in Germany it is

[taly "the plant of
of which the most
Snapdragon, and
weed,‡ and in the
cal Sussex names
Creeping Jenny.||
which the plant
of its long rooting
luces itself by its

, "Linaria," were
cause its principal
num (flax). The

distinguishing characteristic of the genus is the form of its flower, and from this our little plant is called Linaria, although no part of it bears any resemblance to the Flax plant. It was formerly referred to the genus Antirrhinum (Snapdragon), but is now separated from it, on account of its spurred corolla. "Antirrhinum" in Greek signifies "'opposite the nose,' from the mask-like appearance of the flowers."¶ The Greek actors always used masks; and as they had to make themselves heard out of doors, these had large mouth openings. This explains why the Snapdragon flower is called "personate" (mask-like), and how it got its generic name of Antirrhinum, by being, as a country child once told me, "the flower that opens its mouth." Gerarde says that the Snapdragon, Calves' snout or "Todeflax" has "flowres fashioned like a frog's mouth, or rather a dragon's mouth, from whence women have taken the name Snapdragon." This explains the origin of the syllable "toad" in Toadflax.

The specific name, Cymbalaria or Cymbalarica (from the Latin Cymbalum, a cymbal), is the one which Gerarde uses, calling it Cymbalaria Italica, and saying "Matthiolus calls it Cymbalaria (to which Lobel addes) Italica Hederaceofolio .... and lastly Columna calls it Linaria Hederaefolio," of which our name Ivy-leaved Toadflax is a literal translation. It is difficult to see the connection between any part of this plant and a "cymbal," but as Gerarde places it

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* Sowerby. † Hulme, "Familiar Wild Flowers." ‡ Baxter.
§ Johns, "Flowers of the Field." || Arnold, "Flora of Sussex."
¶ Johns.

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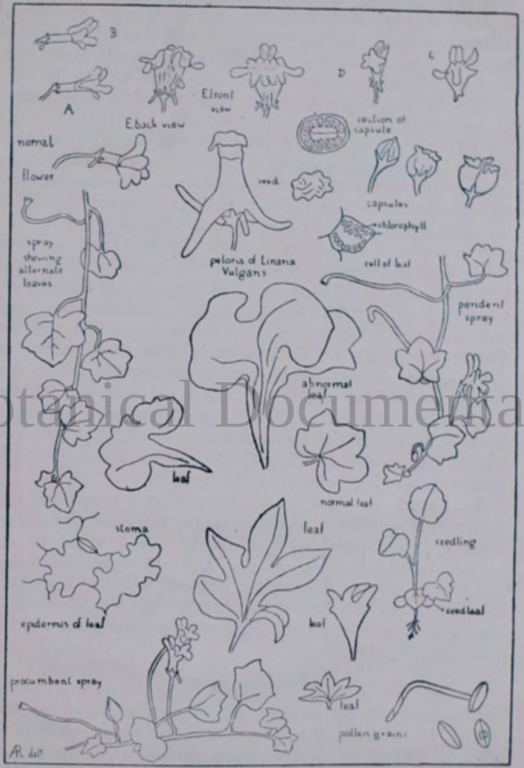
B
A
E back view
E front view
D
C
section of capsule
normal flower
seed
capsules
chlorophyll
cell of leaf
spray shewing alternate leaves
peloria of Linaria Vulgaris
pendent spray
abnormal leaf
leaf
normal leaf
stoma
leaf
seedling
epidermis of leaf
leaf
seed leaf
procumbent spray
leaf
pollen grains
AR. del.

LINNEAN.—*April 5.* Dr. B. Shillitoe exhibited some specimens of a primrose having abnormal leaf-like bracts immediately below the true calyx, and found growing with ordinary flowers of the same species.—

35

ISHING YOU

erry Christmas and a Happy New

me "Waratah" from Australia

Cutting from Saturday Review
August 1895

THE INFLUENCE OF ISLANDS ON VARIATION.

THE offspring of an animal and the wind-sewn seedlings of a plant grow to maturity stamped with the image of their parents. Like begets like among the herbs of the field and all the creatures of the land and waters. But there is no mechanical rigidity in the organic world. Each individual wears its type with a difference and is unlike its fellows in some minute respect. What the omniscient Duke would call the "law" of variation is a prince-consort of the reigning "law" of inheritance.

The existence of the individual variations is within the observation of all, and yet the types persist, so that it needed the patient labour of Darwin to convince the world of their mutability. The perpetual individual variations seem in most cases to survive for only a few generations: they seem endowed with the most feeble powers of resistance. The fact that they perish, however, depends less on their own nature than on the forces operating upon all organisms. Explain it how one may, it appears to be the case that, when crossing takes place, minor divergences of structure are eliminated in favour of deeper-seated identities of structure. Moreover, after an animal or plant is born, such is the exquisite adaptation of organism to environment that the variation has less chance of survival than the normal type. By taking instances where the normal amount of intercrossing is impossible, and where the organisms grow up in an environment different from that to which they have been adapted, one may see that in the absence of these factors the variations are inherited as freely as the type, so that the type is slowly modified.

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woman's emancipation should encounter so persistent an opposition in that France "où s'éleverent dès l'aube de la Révolution les premières voix revendicatrices de tout le droit social et politique du sexe." The answer he finds in the essential hostility of the Latin spirit, and in the equal antagonism of the Roman Catholic Church. The majority of women, subjugated as they are to these two influences, are themselves "anti-féministes." What Alexander Dumas said in 1880, when he described the several types of Frenchwomen who must, in the nature of things, be adverse to any sort of change in their condition, is as true to-day as it was then. And as for those who are on the side of progress and amelioration, M. Lacour can only characterize them as "des maladroites sublimes." Even Olympe de Gouges, whose passionate championship of her sex shook Robespiere out of his sophism, injured her cause by indiscretion but what of her too zealous descendants, "s'obstinant demander l'egalité totale, au nom du Droit—elles n'on rien obtenu et ne pouvaient rien obtenir. Ferventes d l'absolu, elles devaient échouer." Not by such tactic as these will the modification of the rigid Code Napoléo be accomplished, "qui dresse devant nous féministes les pires barricades avec son fort ciment de droit romai et de droit catholique amalgamés."

To a certain extent, of course, the same difficulties ar encountered by those who seek to extend the freedom c women in England. They also suffer from the indiffer of the mass, and pray likewise to be saved fron

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consequence of the excellent traffic returns and purchases for the reinvestment of dividends. The most noteworthy increases in traffic receipts are shown by the Caledonian with £18,300 increase over last year, the North British with £8165, the London and North-Western with £7420, the Great Western with £6129, the Great Eastern with £5465, the Midland with £5280, the London and South-Western with £3786, the Brighton with £3270, the North-Eastern with £2578, the Great-Western with £2570, the Lancashire and Yorkshire with £2287, the Chatham and Dover with £1995, the South-Eastern with £1909, the North Staffordshire with £1247, &c. The decreases in traffic returns were few and unimportant.

The African Market remains the centre of business :-

Daily Graphic Sept 21st 1895

(N.B. I have since been informed by one of the gardeners that the leaf was covered with match boarding covered with green baize before the chair was placed on it)

A BOTANICAL RAFT.

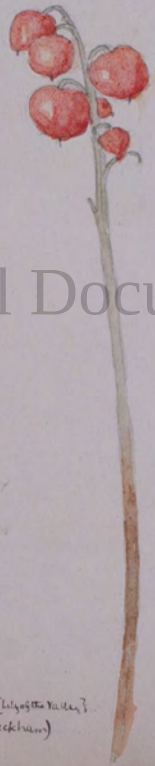
To the Editor of the Daily Graphic.

Sir,—We have now growing in the gardens of the Royal Botanic Society a remarkably fine plant of Victoria Regia. Quite recently I counted eleven large leaves, several of which were over seven feet in diameter, and for some time we have had a new flower open every day. As it may be interesting to your readers, I send a photograph of myself sitting on a leaf floating on the water, which I hope you will be able to reproduce, showing the enormous buoyant power it possesses, the total weight supported being 150lbs.—Yours faithfully,

J. W. Sowerby, Assistant Secretary.
Botanic Gardens, Regent's Park.
September 17th.

A BOTANICAL RAFT: THE VICTORIA REGIA IN THE BOTANIC GARDENS, REGENT'S PARK.
(Photographed by Salmon and Son, Hampstead Road.)

1160



Convallaria Maialis {Lily of the Valley}
(A. J. Robertson Esqr. Peckham)

A. R. delt.
Oct 12. 1895

Growth of Trees.

	percent of growth
From 6 A.M. To 9 A.M. –	$8\frac{2}{3}$
9 – to noon . . .	$1\frac{1}{3}$
noon – 3. P.M.	none
3 – 6. PM	none
6 – 9. PM.	$1\frac{1}{3}$
9 – 12. PM	$3\frac{7}{8}$
12 – 6. A.M	85

The greatest growth in 24 hrs
were Banksia rose $6\frac{1}{2}$ inches

Geranium	$5\frac{3}{4}$
~~[illegible]~~	
Wattle	$4\frac{1}{3}$
Apple	$2\frac{1}{4}$
Pear	$1\frac{1}{3}$

E. H. Thompson – Tasmania

"Knowledge" Nov. 1. 1895

Extract from The Quarterly
Record of the R. Botanic Society
Jan: Feb: & Mar: 1895

which live upon them, forming little birds-nest like masses of fibres. Similar structures, but having the form of tubercles, are to be found upon the roots of Alders and some leguminous plants. The Alders are plants which grow on the banks of streams, and send out their roots into the water; upon these the tubercles are very large, sometimes several inches in diameter. In the Lupin, where they are admirably shown, they are very small, and the uses they subserve in the plants are still far from being known.

These Mycorhyza, or Fungus-roots as they are called, are found in several positions upon the roots of the host plant. In the common mycorhyza of forest trees they are peripheral, that is, they grow only upon the surface of other roots, forming a felted mass lying against the

Towards the end of the season another kind of germ last thing the plant does is to burst the tubercles, and they remain in the soil until another crop of Lupins is put into the ground, when the same thing is repeated.

Experiments have been made showing the enormous benefits it has derived from the fungus. We had on the one hand Lupins which were cleaned and put into the ground after being rubbed with soil containing the germs, and others without; the last died from want of nitrogen, while the others grew vigorously and formed fruits.

Thus the experiments of many men have proved what was formerly denied, that there are little organisms in the soil which have acquired power of taking up the free nitrogen of the air. It may be possible by treating the soil in a different manner to make the germs provide it with the nitrogen so essential to plants, which has now to be done by the application of very expensive nitrates. The more they are studied the more likely is it that some practical advantage will be the result.

Colloquial plant names.

I Aylesbury Bucks

Celandine	Crazy
Cuckoo-flower	Lady's smocks Smell smocks
Bird's foot trefoil	King fingers
Wild pansies	Bird's eyes
Briza quaking grass	Quakers
Wild arum	soldiers
Small convolvulus	weather vine

II Winchelsea sussex

Ivy leaved toadflax	Kitty-run-in the street.

III Eversholt Beds:

Purple orchis	cuckoo
Kingcups	water-bubbles
Poppies	headaches
Field Woodrush	Chimney sweepers

Extracts bearing on Botany from "Travels in West Africa" by Mary H Kingsley
Published by Macmillan 1897

Describing the West Coast rivers :—

"Each channel, at first sight as like the other as peas in a pod, is bordered on either side by green-black walls of mangroves, which Captain Lugard graphically described as seeming "as if they had lost all count of the vegetable proprieties, & were standing on stilts with their branches tucked up out of the wet, leaving their gaunt roots exposed in mid-air." .... At high water you do not see the mangroves displaying their ankles in the way that shocked Captain Lugard. They look most respectable, their foliage rising densely in a wall irregularly striped here & there by the white line of an aërial root, coming straight down into the water from some upper branch as straight as a plummet, in the strange, knowing way an aërial root of a mangrove does, keeping the hard straight line until it gets some two feet above water level, & then spreading out into blunt fingers with which to dip into the water & grasp the mud. - - - - - - - - - - - - -

At corners here & there from the river face you can see the land being made from the waters. A mud bank forms off it, a mangrove seed lights on it, & the thing's done. Well! not done, perhaps, but begun; for if the bank is high enough to get exposed at low water, this pioneer mangrove grows. He has a wretched existence though. You have only got to look at his dwarfed attenuated form to see this. He gets joined by a few more bold spirits & they struggle on together, their network of roots stopping abundance of mud, & by good chance now & then a consignment of miscellaneous débris of palm leaves, or a floating tree trunk, but they always die before they attain any considerable height. Still even in death they collect. Their bare white sticks remaining like a net gripped in the mud, so that these pioneer mangrove heroes may be said to have laid down their lives to make that mudbank fit for colonisation, for the time gradually comes, when other mangroves can & do colonise on it, & flourish, extending their territory steadily; & the mudbank joins up with, & becomes a part of, Africa"

Description of climbing plants seen when on the river Ogowé:-

"The climbing plants are finer here than I have ever before seen them. They form great veils & curtains between & over the trees, often hanging so straight & flat, in stretches of twenty to forty feet or so wide, & thirty to sixty or seventy feet high, that it seems incredible that no human hand has trained or clipped them into their perfect forms. Sometimes these curtains are decorated with large bell shaped, bright-coloured flowers, sometimes with delicate sprays of white blossoms."

Description of the "river lettuce" in the Ogowé.—

"In addition to grass creeks & sandbanks, the obstacles to the navigation of side streams, on the Ogowé & its neighbouring rivers are swamps of papyrus, exceedingly lovely, but difficult to get through, & great floating masses of river lettuce (Pistia stratiotes). It is very like a nicely grown cabbage lettuce, & it is very charming when you look down a creek full of it, for the beautiful tender green makes a perfect picture against the dark forest that rises from the banks of the creek. If you are in a canoe, it gives you a little apprehension to know you have got to go through it, but if you are in a small steam launch, every atom of pleasure in its beauty goes, the moment you lay eye on the thing. You dash into it as hard as you can go, with a sort of geyser of lettuces flying up from the screw; but not for long, for this interesting vegetable grows after the manner of couch grass. I used to watch its method of getting on in life. Take a typical instance: a bed of river lettuces growing in a creek become bold, & grow out into the current, which tears the outside pioneer lettuce off from the mat. Down river that young thing goes, looking as innocent as a turtle dove. If you pick it up as it comes by your canoe & look underneath, you see it has just got a stump. Roots? Oh dear no! What does a sweet green rose like that want roots for? It only wants to float about on the river & be happy; so you put the precious humbug back, & it drifts away with a smile & gets up some suitable quiet inlet & then sends out roots galore longitudinally, & at every joint on them buds up another lettuce; & if you go up its creek eighteen months or so after, with a little launch, it goes & winds those roots round your propeller. The fierce currents of the wet season, when the main river scours into the creeks, & the creeks start fresh currents of their own with their increased waters, play great havoc with these lettuce beds, & plots of them get cut off from the main bodies. These plots float off down river, & as soon as they get into a bit of slack water or hitch on a rising sandbank, they collect all other floating things that come their way & start as islands. The grass soon chokes off its companion the lettuce, & makes the island habitable for other plants; & so you have a floating island."

Mr. Smee says "Yellow flowers as they wither never become blue or red."

Myosotis versicolor, the "changing" or "yellow & blue" forgetmenot", an English annual, has the corolla "At first pale yellow, & turning blue as it fades" (Handbook of British Flora, Bentham & Hooker)

The total quantity use
the nitrate of potash.
the flowers of the Catt
were larger, brighter,

This year I
summer, that is to
plants with small qu
addition to the nitrat
favourable report on

I suspect fr
plants sets free the

THE GRANGE,
CARSHALTON,

10/6/97.

DEAR MR. VEITCH,

I have put together a few observations on the chemical composition of the Cattleya, together with some suggestions as to its food requirement, which I trust may be of some interest to yourself and to the members of the Orchid Committee.

In the *Gardeners' Chronicle* of February, 1894, there was an article on the chemical composition of Cattleya Labiata, and also giving the analyses of rain-water in temperate and tropic climates, which showed a large increase in the amount of nitric acid in the rainfall of the tropics compared with temperate zones.

Country.	Authority.	Milligrammes.
Liebfrauenberg (Alasce), France ...	Boussingault	0·18
Rothamsted, England	Lawes and Gilbert	0·42
Java	Homans	2·30
Isle of Réunion	Raimbault	2·65

This is as may be expected, for it is well known that thunder rain contains nitric acid, derived from the rapid oxidation of the nitrogen of the atmosphere by the electric discharge, combining immediately with the pure ammonia in the atmosphere, forming ammonia nitrate.

In connection with this subject it is well to take into account the chief constituents of the air.

Professor Frankland published in the Journal of the Chemical Society (vol. xiii.) the results of analysis of the composition of airs from various sources, which demonstrated that the composition of the atmosphere exhibits certain fluctuations, confined, however, within very narrow limits.

The air near the sea contains about the same proportion of carbonic acid as that resting over land. The sea air was richer both in carbonic acid and oxygen by day than by night.

	Average by Sea.		New Granada.	Bogota.	
	Day.	Night.		Dry Season.	Rainy Season.
Nitrogen	78·886	79·006	79·946	78·932	78·966
Oxygen	21·060	20·961	21·014	21·022	20·996
Carbonic Acid	·054	·033	·040	·046	·038
	100·000	100·000	100·000	100·000	100·000

	Chamonix, 3,000 feet.	At the Grand Mulets, 11,000 feet.	Mount Blanc, 15,732 feet.
Nitrogen	79·086	79·087	78·989
Oxygen	20·881	20·802	20·950
Carbonic Acid	·063	·111	·061
	100,000	100·000	100·000

The Carbonic Acid in the atmosphere appears to increase with altitude to attain its maximum at 11,000 feet, and then again diminishes in quantities above that height.

In the neighbourhood of our large towns the atmosphere is injuriously affected by the products of the combustion of coal, in the form of sulphurous and sulphuric acid and ammonia, and in some places—for instance, the Tyne and Clyde—by chlorine given off from the chemical works. There is also given off some of the more volatile petroleum oils, which form a greasy slime, which in fogs is deposited on the glass of our plant-houses, and falling upon the leaves of the plants, interferes with their power of osmosis and exosmosis so necessary for their well-being.

I have myself noticed that the quantity of ammonia in the atmosphere was subject to considerable variation; the greatest amount was detected on days when the electric currents were feeble or totally absent. I have also observed that the amount of oxidisable matter present in the atmosphere had no relation to the quantity of ammonia present.

I think it is probable that the relation of ammonia to carbonic acid has a considerable influence upon the growth of epiphytal orchids. This is the probable cause that many orchids—such as Oncidium Varicosum on the one hand, and Phælenopsis on the other—cannot be kept in vigour for any length of time in this country.

The analysis of old and new pseudobulbs shows that there is less mineral matter in old bulbs when compared with the new. Apparently these plants have great difficulty in obtaining the earthy salts, and are, therefore, obliged to withdraw from the old bulbs some portion of their earthy constituents. We know that allowing the flowers to remain on the plants until they have withered is followed by the shrivelling of the pseudobulb and with the exhaustion of the plant; the better the variety the more delicate the constitution of the plant and the greater the exhaustion caused by flowering.

	Old Pseudobulbs.	New Pseudobulbs.
Dry substance, per cent.	9·12	8·07
Nitrogen, per cent	1·21	1·14
Mineral matter (ash), per cent. ...	0·41	0·63
Constituents of the ash in 100 parts.		
Potash carbonate	29·90	30·69
Lime carbonate	52·02	35·23
Magnesia carbonate	12·05	14·47
Lime phosphate	3·42	10·68
Iron oxide	0·16	0·17
Silica	2·42	8·77

It occurred to me that it would be desirable to find out which, if any, of the earthy constituents were removed from the pseudobulb by the flowers. For this purpose I sent up to my friend, Prof. Ogston, a large number of fresh-cut blooms of the largest and best varieties in my collection of Mendelii, Mossiæ, and Purpurata.

The analysis of the fresh-cut Cattleya flowers gave:

Water	84·27
Vegetable substance	13·72
Ash soluble	1·18
Ash insoluble	0·83
	100·00

	The percentage composition of fresh cut flower.	Percentag composition dried flowe	Percentage composition of the incinerated ash.
Water	84·270	nil	nil
Organic matter	13·720	87·21	nil
Phosphoric acid	·058	·39	3·10
Potash	·634	3·19	25·00
Lime	·348	1·84	14·40
Magnesia...	·120	·60	4·71
Sulphuric acid	·034	·17	1·35
Silica	·164	·57	4·50
Carbonic acid, iron, soda, alumina ...	·702	6·03	46·94
	100·000	100·00	100·00

The carbonic acid in the ash was originally present in the bloom as organic compounds (nitro-hydro-carbons) combined with the potash, lime and magnesia.

I do not, at present, see in what manner the epiphytal species in their native habitats obtain the alkaline and earthy salts, especially the silica, which is not easily soluble, and does not exist in a soluble condition to any large extent in any soil.

I may mention in passing that chlorophyll (C_9, H_9, NO_4) is the green colouring matter of plants. Ammonia and nitric acid salts appear to promote the combination of nitrogen with the hydrocarbons in the formation of this substance, but the absence of or the exposure of plants to an excess of sun-light seems to interfere with its formation. It may be that under these conditions another product, with a formula of C_{19}. H_{20}, NO_5 is formed.

Cyanine and Xantheine, the colouring material of flowers, are closely allied to Chlorophyll.

Cyanine is found in red and blue flowers; in the former the juice is acid, in the latter neutral. Blue flowers may change to red, but never become yellow, and they fade away until their colour disappears.

Xanthine, the yellow material of flowers, is insoluble in water. Yellow flowers as they wither never become blue or red. Neither of these substances have at present been obtained in their pure state, but a deduction of their chemical composition may be be inferred from blue indigo (C_{16}, H_5, NO_2) compared with white indigo, which has a formula of C_{16}, H_6, NO_2.

Comparing the analysis of the blooms with the composition of old and new psuedo-bulbs, it is evident that a large amount of the mineral constituents of the psuedobulb are abstracted by the flower. The question cultivators have to consider is, in what manner can these plants recuperate by the re-absorbtion of these mineral constituents into their organisms, for it is evident, if they are not furnished ~~with a~~ means of obtaining a fresh supply, they will continually withdraw these substances from their old psuedobulbs, with a result, impoverished growth, smaller and smaller in size, poorer blooms and ultimate death.

I therefore thought that it would be well to experiment upon an old and starved variety of Trianœi. I fed this plant once a week, during the growing season, with 2 or 3 ounces of water, which contained nitrate of potash, nitrate of ammonia, phosphate of ammonia, and carbonate of magnesia, of the strength of ½ an ounce of nitrate of potash and ½ an ounce of nitrate of ammonia, with a small quantity of the other salts, with the result that the plant made stronger growth, produced a greater number of flowers, which were brighter in colour. In 1895 I tried a larger number of plants, and I was so satisfied with the result, that in 1896 I added nitrate of potash and nitrate of ammonia each week during the summer to the rain water tanks of the Cattleya house.

The total quantity used during the summer was 1lb. of the nitrate of ammonia and 1lb. of the nitrate of potash. This worked out at the rate of 2·5 grains per gallon. Many of the flowers of the Cattleya which were shown at the Drill Hall on May 9th this year were larger, brighter and had more substance than in previous years.

This year I intend to increase the amount to 5 grains per gallon during the summer, that is to say, from May to September. I also propose to treat some of the plants with small quantities of phosphate of ammonia and carbonate of magnesia, in addition to the nitrate of ammonia and potash. I expect that I shall be able to make a favourable report on a future occasion on the results of these experiments.

I suspect further observations will prove that the assimilation of phosphates by plants sets free the phosphorous, which combining with the nitro hydrocarbons of the tissues will tend to promote inflorescence, and will probably increase the germinating power of the seed of epiphytal orchids.

I am, yours faithfully,

A. H. SMEE.

Cutting from the Athenaeum. July 3 1897

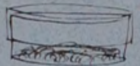
LINNEAN.—*June* 17.

—Dr. D. H. Scott exhibited original preparations by Prof. Ikeno and Dr. Hirase, of Tokio, illustrating their discovery of spermatozoids in two gymnospermous phanerogams, namely *Ginkgo biloba* and *Cycas revoluta* (cf. *Bot. Centralblatt*, Bd. lxix. Nos. 1-2, 1897, and *Annals of Botany*, June, 1897). The slides showed the spermatozoids while still in the pollen-tube, before the commencement of active movement. In the case of Ginkgo one section showed the two male generative cells, closely contiguous and enclosed in the pollen-tube. The general structure resembles that in many other conifers at the same stage, *e.g.*, *Juniperus virginiana* and *Pinus silvestris* (Strasburger, 'Hist. Beiträge,' iv. plate 2). In Ginkgo, however, each generative cell showed a distinct spiral coil, situated in each cell, on the side remote from its neighbour. Another preparation of Ginkgo showed a series of sections across the micropyle, passing through a pollen-tube and its generative cells, the plane of section being in this case approximately parallel to the surface of contact of these two cells, through which four of the sections passed. In the two terminal sections of this series the spiral coil was clearly shown, consisting of about three windings. The spiral is connected with the nucleus of the cell, but whether it is itself of nuclear or cytoplasmic origin is not certain. In the preparation from *Cycas revoluta* several pairs of generative cells were shown; in some cases the pollen-tube enclosing them was intact. The spiral coils in some of the generative cells were surprisingly clear, consisting of about four windings. A distinct striation was visible in connexion with the coil, probably indicating the presence of the numerous cilia described by the Japanese discoverers. The facts admit of no other interpretation than that given by these authors, namely, that in both Ginkgo and Cycas each generative cell gives rise to a spiral spermatozoid; the latter by its own movements (actually observed by Dr. Hirase in the case of Ginkgo) no doubt travels from the end of the pollen-tube to the female cell.—In a discussion which followed on this highly important subject, Dr. W. T. Thiselton Dyer, Mr. W. Carruthers, Prof. E. Ray Lankester, Prof. Howes, and the President took part.—

MUMMY PLANTS.

There is a fact incidental to the discovery of the mummies with which few of the public are acquainted: they have afforded botanists the opportunity to compare the plant-life of the Mosaic period with the plant-life of this day. Within the mummy-wrappings have been found no less than fifty-nine species. Some of these are represented by the fruits employed as offerings to the dead, others by the flowers and leaves made into garlands, and the remainder by the branches on which the body was laid out during or after embalmment, and which were enclosed with the offerings within the linen wrappings that enveloped the mummy. These plant-remains were hermetically sealed within the wrappings, and thus have been preserved with scarcely any change. By placing the plants in warm water, a series of specimens was obtained which, although gathered four thousand years ago, are as satisfactory for the purposes of science as any collected at the present day. These specimens consequently supply means for the closest examination and comparison with their living representatives. The colours of the flowers are still present—even the most evanescent, such as the violet or the larkspur, and knapweed, and the scarlet of the poppy. The chlorophyl remains in the leaves, and the sugar in the pulp of the raisins. It is difficult (says Mr. Carruthers, of the British Museum), without actual inspection of the specimens of plants employed as garlands, to realize the wonderful condition of preservation in which they are. Those specimens consequently supply means for the closest examination and comparison with their living representatives. Thus examined and compared, their absolute identity with the present indigenous forms of the species represented is demonstrated in the clearest manner. With scarce an exception the most learned botanists have not been able to detect any peculiarity in the living plants which is absent in those obtained from the tombs. Thus through four thousand years, since Seti I. decreed the slaughter of the Hebrew babes, and the daughter of Pharaoh, Thermuthis, preserved the infant Moses from the waters of the Nile, these flowers and vines, trees and plants of Egypt, have fallen with every winter's decay, and at the coming of spring have appeared on the earth again, bearing the same form, features, and colour that they carried to their season-sleep.

At U.C.L in the Spring Term 1898 Prof: Oliver was growing various fungi (discobolus, pilobolus etc) on an organic stratum in a glass box whose lid was also of glass



These fungi shot off their spores which adhered to the inside of the lid in groups, & Mr. Coomara Swamy made this micro photograph of a small part of the lid to shew the spores. The large round black object near the bottom of the photograph is a cap of pilobolus

TREE-PLANTING AND RAINFALL.

Last week at the Y.M.C.A., Durban (says the "Agricultural Journal"), the General Secretary (Dr. C. H. Haggar) delivered a lecture on "Climate-Making—Arboriculture and Rainfall." . . . . . Whenever forests have been destroyed, the climate has been changed, and for the worse also. Wherever forest has been allowed sway the balance has been restored and the climate improved. Rain is caused by a lowering of the temperature of moisture-laden atmosphere, and the consequent condensation of the vapour which the air contains. As the air cools the particles coalesce and form drops which fall as rain. Any conditions reducing temperature, any influence causing to ascend moisture-laden currents, are conducive to rain. Trees and mountains do this. The air from the Bay of Bengal rises as it goes landwards; the moisture descends in rain, a portion rising higher becomes snow on the Himalayas; what is left, robbed of moisture, passes over Thibet cold and dry. Mountains are sometimes in wrong places. In Australia nearly all high land is near the coast, so that in places there is at times [illegible]in. of rain in 12 hours; in the interior, before the artesian wells, there were not 24in. in 24 years. In some parts the wells are now helping the rainfall. The green colouring matter in plants absorbs the carbon from the atmosphere, the carbon dioxide which makes the air unhealthy, and it liberates the oxygen without which we cannot live. The food of the plant is poison to man. Vegetation reduces temperature. When did you find a leaf hot? Plant bananas round your dairy, and on the hottest day your butter will be hard. A dairy so surrounded will be 20deg. cooler. With the atmosphere at 80deg. the evaporation over a forest is equal to an inch of rain in a day. A large tree will in 12 hours take up 700 gallons of moisture, or give off by evaporation nearly 200,000 gallons. Take a green branch from a tree and place it in water in the sunshine, but out of a draught, and see how much water is absorbed. Forests and trees increase the rainfall. Take South Australia: Twenty years ago it was regarded as waste of labour to plant wheat; the rainfall was capricious and fanciful. An enthusiastic scientific arboriculturist obtained permission to plant trees. He set out to manufacture the weather and manage the climate, followed by sallies of sarcasm, pious and profane; countless thousands of trees were planted; the rain god was harnessed to the farmer's plough; hundreds of miles of waving wheatfields are seen as the result, and the wheat is sent as flour to Natal. Thirty years ago famous fruit-producing districts in the United States were reduced to barrenness in consequence of destruction of forest and frequent floods. Men bewailed the dispensations of Providence. Natural law was then a force to be feared rather than a friend to be entertained. Arbor Day, however, is a great institution to-day. Now these districts are regaining glory because tree-planting has been renewed. The countries bordering the Euphrates, parts of Turkey, Greece, Italy, Spain, and Egypt have become incapable of cultivation through lack of rain since forests were destroyed. Where forests have been destroyed rainfall has been injured; where arboriculture has been carried on, climatic conditions have improved.

Johannesburg Star
Sat July 29
1899

Des vignes de huit siècles

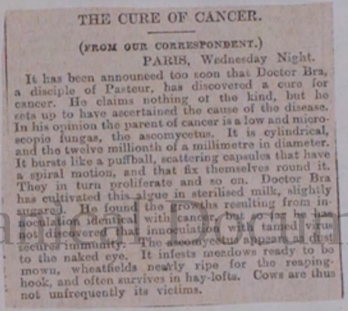
(Dépêche de notre correspondant)

Chateaubriant, 23 septembre.

Des vignes de huit cents ans, voilà qui vaut la peine d'être signalé.

Elles existent dans les environs de l'ancien prieuré de Saint-Jean-de-Béré, faubourg de Chateaubriant, fondé au onzième siècle par Brient et auraient été plantées, il y a huit siècles, par les premiers moines de ce prieuré. Elles sont presque redevenues à l'état sauvage.

Cependant les années de chaleur elles donnent encore des raisins.



THE CURE OF CANCER.

(FROM OUR CORRESPONDENT.)

PARIS, Wednesday Night.

It has been announced too soon that Doctor Bra, a disciple of Pasteur, has discovered a cure for cancer. He claims nothing of the kind, but he sets up to have ascertained the cause of the disease. In his opinion the parent of cancer is a low and microscopic fungas, the ascomycetus. It is cylindrical, and the twelve millionth of a millimetre in diameter. It bursts like a puffball, scattering capsules that have a spiral motion, and that fix themselves round it. They in turn proliferate and so on. Doctor Bra has cultivated this algue in sterilised milk, slightly sugared. He found the growths resulting from innoculation identical with cancer, but so far he has not discovered that innoculation with tamed virus secures immunity. The ascomycetus appears as dust to the naked eye. It infests meadows ready to be mown, wheatfields nearly ripe for the reaping-hook, and often survives in hay-lofts. Cows are thus not unfrequently its victims.

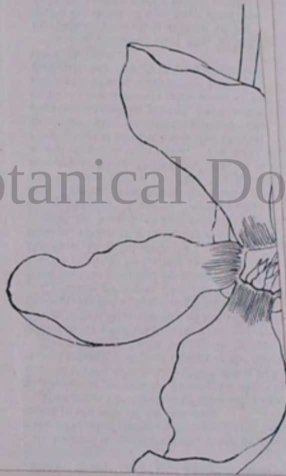


FIG. 6.

Doubling.

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FIG. 3.

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possible. The only check will
general balance of nutrition.

Spread

I was much struck to find an

May 11, at the Hotel Cecil, the President occupying the chair. Among those present were the Duke of Teck, Sir Bernhard Samuelson (past President), Sir David Dale (past President), Sir Lowthian Bell, Sir Courtenay Boyle, Sir Andrew Noble, Sir Henry Mance, Prof. Dewar, F.R.S., Prof. Ayrton, F.R.S., Dr. Ludwig Mond, F.R.S., Mr. Norman Lockyer, C.B., F.R.S., and Mr. B. H. Brough (the Secretary). After the loyal and patriotic toasts had been duly honoured, Prof. W. C. Roberts-Austen, C.B., F.R.S., proposed "Scientific and Professional Societies," which was acknowledged by Sir John Evans, F.R.S., and by Mr. J. Wolfe Barry, C.B., F.R.S. The toast of the evening, "Prosperity to the Iron and Steel Institute," was proposed by Sir Courtenay Boyle.

THE CULTURAL EVOLUTION OF "CYCLAMEN LATIFOLIUM."[1]

ON the occasion of the discussion on "Variation in Plants and Animals," which took place on February 25, 1895, it occurred to me that it might be useful to give an illustration of the amount of change which has been effected in a plant by continuous selection under cultivation in a comparatively short time. I, therefore, placed upon the table an example of the wild and of the cultivated form of the garden "cineraria" (*C. cruenta*).

The choice of this species was purely accidental. It was, however, violently impugned. It was contended that the garden cineraria was not the result of the development of a single species, but that it was of multiple origin, and the result of the intercrossing of several. It was further contended that its change from the wild form had not been gradual, but by discontinuous steps or "sports." Neither contention seemed to me well founded. But I admit that, owing to the lapse of time since the so-called "improvement" of the cineraria commenced, it is impossible to give formal proof that the process has been what I described. Mr. Darwin met with the same difficulty. He remarks: "We know hardly anything about the origin or history of any of our domestic breeds" ("Origin," 6th ed., p. 29). As is, however, well known, he regarded them as the result of accumulation by selection of successive slight variations. But he also tells us that "the chance will be infinitely small of any record having been preserved of such slow, varying, and insensible changes."

It seemed to me important, therefore, to obtain the history of some cultivated species which would not be open to the objections urged in the case of the cineraria.

After some consideration I selected the plant known in gardens as *Cyclamen persicum*. Owing to the kindness of the skilful horticulturists who have worked upon it, I am able to place on record a nearly complete history of the changes it has undergone.

The genus *Cyclamen* belongs to the small order *Primulaceæ*, which in its affinities is somewhat isolated. *Cyclamen* itself is distinguished from the rest of the tribe *Lysimachieæ*, to which it belongs, by the reflexed segments of the corolla.

Cyclamen persicum, Mill., is a name given by gardeners to a form slightly modified by cultivation of *C. latifolium*, Sibth., a species confined to Greece and Syria. There is a good figure of the type in Sibthorp's "Flora Græca" (t. 185). It has pink flowers, with a ring of darker colour at the throat. The species is said to have been first cultivated in Europe at Lille in 1731 ("La Semaine Horticole," 1897, p. 23), having been introduced from Persia. There must have been some error as to its origin, for Boissier points out that the species is not found in that country ("Flora Orientalis," vol. iv. p. 12). In all probability it was obtained from Syria. The Lille plant ultimately went to Ghent, and it has been asserted that all the cultivated forms in existence are descendants from this one individual. The assertion cannot be proved, but is not improbable. It is known to have been a variety with white flowers. As will be shown, the forms now in cultivation have been derived from a white-flowered one, which in turn might well have been derived from the Lille plant.

Such a modified form was, in fact, that described by Miller, in 1768, in the eighth edition of his "Gardener's Dictionary," under the name of *Cyclamen persicum*. He describes the flowers as "pure white with a bright purple bottom." It was figured in the *Botanical Magazine* in 1787 (t. 44), and it has come down little altered to our own day. In 1875 Boissier describes it as "forma hortensis a me nunquam spontanea visa." It still exists in cultivation, and is the (old) "crimson and white" of Messrs. Sutton. It seems always to have been popular in cultivation on account of its agreeable fragrance. This confirms the Syrian origin of the original stock, for a white-flowered form "is found in Palestine which is very fragrant" (*Roy. Hort. Soc. Journ.*, N. S., vol. xiii. p. 163).

Early in the century some colour variations were in cultivation. Several as well as the typical *C. persicum* were figured in the "Flore des Serres" in 1877 (t. 2345). These record the amount of change from the wild type which had been accomplished in a century and a half. One striking seminal sport (*C. persicum*, var. *laciniatum*) is figured in the *Botanical Register* in 1827 (t. 1095). It is remarkable for spreading corolla-segments broader than usual, and cut at the edges. It does not appear to have been perpetuated, but in some degree it anticipated some of the remarkable modern developments.

I am informed by Mr. James Martin, the accomplished propagator of Messrs. Sutton, that the recent remarkable development of the cyclamen began about 1860, and, at any rate in their hands, started with the old "crimson and white." It will be seen from the accompanying figures how little this differs from the wild type. Fig. 1 represents a flower of the latter from a plant imported by Messrs. Sutton from Syria after six years of cultivation. It is not appreciably altered. Fig. 2 represents a flower of their "crimson and white"; it only differs from the wild type in having shorter, broader, and less twisted corolla segments.

In considering the progress which has been made since 1860 under the skilful hands of Mr. Martin and others, it is important to bear in mind that there is no question of hybridity. *Cyclamen latifolium* has resisted every attempt to cross it with any other species. We are dealing then with the evolution under artificial conditions of a single species. Further, in the following statement, I have confined myself to the result of continued self-fertilisation, and have not thought it necessary to investigate the results of crossing races which have assumed characters more or less distinct.

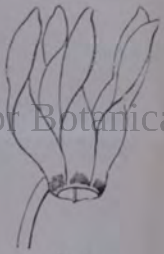

FIG. 1.

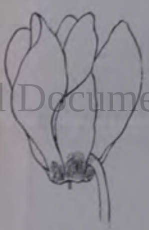

FIG. 2.

Size.

Mr. Martin strongly insists on the principle laid down by Mr. Darwin from De Vilmorin, that "the first step is to get the plant to vary in any manner whatever" ("Animals and Plants under Domestication," vol. ii. p. 262). As Mr. Martin puts it, "the breeder must work with nature." It is his practice to seize the smallest deviation, even so small an indication as the slightest difference in a cotyledon of a germinating seed. The first direction of work would, however, for commercial purposes, be to develop the size of the corolla. Figs. 3 and 4 show two stages which have been reached by progressive selection from "crimson and white." Messrs. Sutton have sent me photographs of the largest flowers hitherto produced by them. Fig. 5 is copied from one of these. The vertical depth is 3 inches. This is more than double that of the form with which they started; the increase in breadth of the segments is at least six times. This represents the continuous work of forty years. As the work was not done for a scientific purpose, the whole of the progressive steps have not been preserved or recorded. Only saleable stages have survived. But Mr. Martin emphatically denies that they have been attained by other than progressive selection, or

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[1] "The Cultural Evolution of *Cyclamen latifolium* (Sibth.)." By W. T. Thiselton Dyer, C.M.G., C.I.E., F.R.S. Received and read at the Royal Society, March 18.

that they have been reached by leaps and bounds. In developing any particular character it is, to use his own words, always done by a "ladder," *i.e.* continuous self-fertilisation and selection. The stage shown in Fig. 3 owes its preservation to its having retained fragrance. Beyond this stage fragrance has been lost.

An interesting question is whether there is any limit to the extent to which an organ can be developed, and if so, what? It is to be hoped that Mr. Martin will continue his work in this direction and strive, if only as a matter of scientific interest, to increase the size of the corolla to the maximum possible. The only check will probably be found to be the general balance of nutrition.

Fig. 3.

Spreading.

I was much struck to find amongst a magnificent series of specimens, kindly sent me by Messrs. Sutton, forms with the segments of the corolla spreading instead of reflexed (Fig. 6).

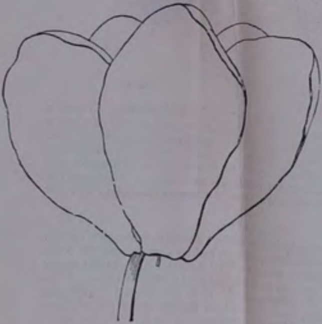

Fig. 4.

I have received even more striking examples from Messrs. Hugh Low and Co. This is remarkable because, as I have already pointed out, the latter is a distinctive generic character in *Cyclamen*. Although the alteration in the appearance of the flower is enormous, the structural change is slight. It is merely a matter of direction of growth. It amounts, however, to the loss of a generic character and a reversion to a more generalised type. The change is therefore essentially atavistic.

I was unable to obtain from Mr. Martin any explanation of how this particular variation had come about, but he informed me that it had been of frequent occurrence. Spreading flowers had always been destroyed as departing from a desirable type. More recently, on account of their orchid-like habit, they had taken the popular fancy, and had been preserved.

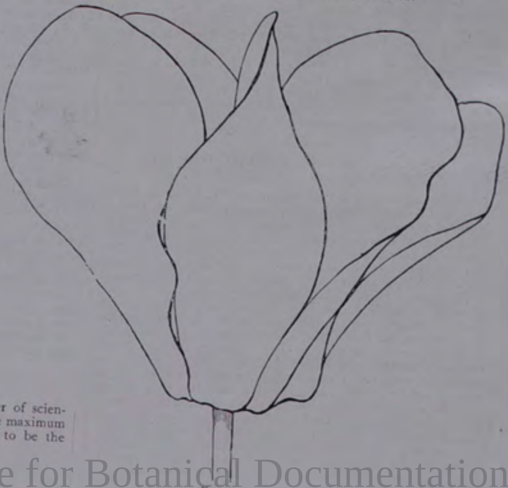

Fig. 5.

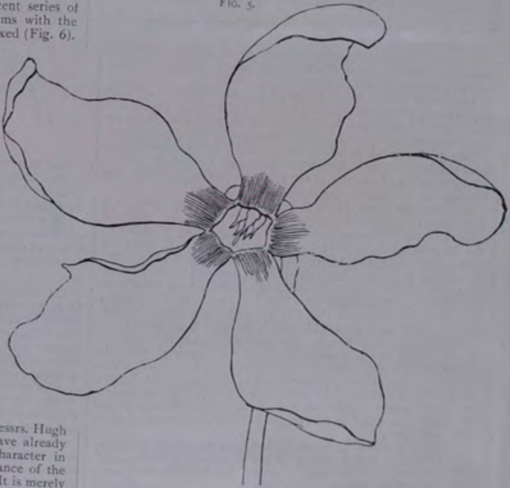

Fig. 6.

Doubling.

Even in the wild type there is a tendency to a slight multiplication of the corolla segments. Mr. Martin has worked and has produced flowers su

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In this case the basis of the new
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in Fig. 10, which represents the
by Messrs. Hugh Low and Co.

upon this, and has produced flowers such as shown in Fig. 7. He seems to think that there is no limit to which this multiplication cannot be carried practically, and hopes in time to produce "mop-headed" flowers like a chrysanthemum. The so-called doubling of flowers, as in the rose, is a teratological phenomenon, and is due to the conversion of stamens into petals. But in *Cyclamen* this is not the case. The stamens, which are normally equal in number to the corolla segments, are also multiplied. Although a quinary symmetry is general in the *Primulaceæ*, *Trientalis*, a near ally of *Cyclamen*, ordinarily exhibits a considerable range in the number of parts of the flower. Here again *Cyclamen*, under artificial conditions, shows a reversion to a more generalised type.

Colour.

There is evidence that seminal variation as regards colours occurred at least as early as 1820, but the modern forms with large coloured flowers, according to Mr. Martin, originated in a different way and can be traced back to the old crimson and white. That preserves the crimson ring round the throat, but is otherwise an albino. There is nothing remarkable in this. Any species in nature may produce white flowers; albinism is in effect the commonest of all variations. "Giant white" (Figs. 4 and 5) is a pure albino, in which the crimson ring has been suppressed.

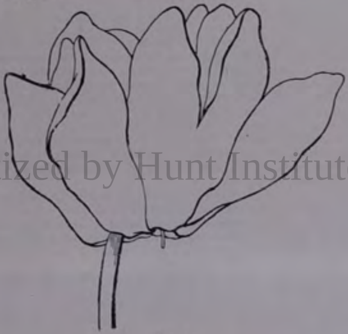

FIG. 7.

The modern coloured forms were obtained in the first instance by selecting forms in which the coloured ring showed a disposition to spread into the white corolla segments The first indication would be a scarcely perceptible streak. By selection from self-fertilised plants the streak was widened into a stripe. Continuing the process, the stripes united, and a uniformly coloured flower was obtained.

The more striking colours, such as that of "Vulcan," which is a dark crimson, were, however, obtained not by progressive selection, but amongst the progeny of cross-fertilised plants.

I learn from Messrs. Hugh Low and Co. that coloured varieties, of course when self-fertilised, come true from seed. This is in accordance with a well-known principle (Darwin, "Cross and Self-fertilisation," p. 460).

The Butterfly Form.

This has been obtained independently by several horticulturists. The segments are partially spreading, and concave on their inner surface. One of the most remarkable is that raised by M. de Langhe-Vervaene; it is represented in Figs. 8 and 9. He informs me that "these are the products of the eleventh year of improvement." He adds: "I never crossed them with any other strain; I do not like crossing races; I prefer improving them." He has kindly favoured me with the following detailed account of the mode in which the strain has been developed and improved. I quote it in his own words:—

"Les Cyclamen Papilio que j'ai obtenus sont issus directement des *Cyclamen persicum*, var. *giganteum*.

"Il y a environ une douzaine d'années je remarquais parmi mes semis de Cyclamen une plante qui attira mon attention par l'extrême beauté de son feuillage dentelé et marbré. En examinant la plante, je vis qu'elle portait une grande quantité de boutons; ceux-ci étaient de forme plus arrondie et plus courte que ne le sont généralement ceux des *Cyclamen persicum*. La plante fut mise à part; quand elle commença à fleurir, elle m'étonna par la forme bizarre de ses fleurs. Ces diverses circonstances m'engagèrent à en recolter les graines.

FIG. 8.

"L'année suivante j'obtins quelques jeunes plantes. Au moment de leur floraison, elles purent être comparées à la plante mère.

"Les plus parfaites de ces plantes furent choisies pour servir de porte-graine, et leurs fleurs furent fécondées entre elles. L'année suivante je fus assez heureux pour constater un nouveau progrès; mes gains surpassaient leurs parents que j'avais conservés. On pouvait apercevoir, dans ces semis aux caractères persistants, le point de départ d'une race nouvelle.

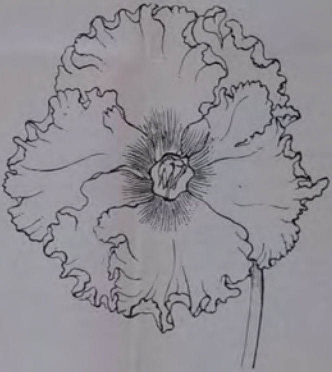

FIG. 9.

"Je continuai dans cette voie; au bout de quatre ans, j'étais en possession de quelques sujets fort remarqués. Les pétales des fleurs étaient amples et plus longs; ils se redressaient comme les ailes d'un papillon qui s'apprête à prendre son vol.

"La race se caractérisa chaque année davantage.

"Encouragé par le résultat déjà obtenu, je m'occupai à rechercher la diversité des coloris. Après quatre années je ne

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possédais dans mes semis que des plantes à fleurs rouges ; j'avais en triant les sujets pour la reproduction toujours écarté les fleurs les moins brillantes. Il s'agissait maintenant d'obtenir des fleurs à couleurs pâles. Des efforts nouveaux furent fait dans cette voie ; je vis au bout de deux ans après apparaître la première fleur aux pétales blancs et à onglet rouge ; dès lors les croisements se multiplièrent au point qu'après la neuvième année la perfection des formes et des coloris est telle que tous ceux qui voient mes Cyclamen Papilio sont unanimes à reconnaître leur mérite et leur perfection des fleurs."

In this case the basis of the new strain was found in a marked variation or "sport." The deviation from the type could not, however, have been very marked. The most remarkable feature in "Papilio" as now developed is the curled and toothed margin of the corolla segments. These peculiarities repeat characters which occur elsewhere in the order. In *Soldanella* the toothing is conspicuous: curling occurs in cultivated varieties of *Primula sinensis*. It is interesting to observe in "Papilio" that in the primary variation there was a correlation between the toothing of the corolla segments and of the leaves.

Cresting.

The most remarkable form which has made its appearance under cultivation is that in which a plumose crest has developed on the inner surface of each corolla segment. This is shown in Fig. 10, which represents the "Bush Hill Pioneer," raised by Messrs. Hugh Low and Co. I quote the account of its development with which they have been so good as to furnish me:—

FIG. 10.

"This interesting variety was first observed in our nurseries some four years since, but how it originated we are unable to say.

"At that time, the only peculiarity about the variety was a *very slightly raised rib* running part of the way up the petals, and showing *no tendency to branch*. This was, however, considered sufficiently curious to follow up, and we seeded it with its own pollen.

"The young plants from this *showed a decided improvement*, the rib in some cases *showing a marked tendency to branch*. The best varieties (ten in number) were again fertilised with their own pollen, and the plants now being exhibited by us have resulted, although, needless to say, they are among the finest obtained up to the present, though *all* show a further improvement, *every flower* having a well-branched feather on the petals.

"We have this year found some colour in one plant, and we believe we shall have no trouble in obtaining crested flowers in a variety of colours."

The corolla segments of *Cyclamen* have no mid-rib. The appearance of such a structure is a reversion to the original leaf-type. The development of a crest from a mid-rib carries reversion very far back indeed. The branching of a leaf-structure in the plane in which it is expanded is common enough; branching in a plane at right angles to this is rare. Leafy outgrowths frequently occur from the mid rib in the cabbage (Masters' "Teratology," p. 455). In this case the structure of the leaf approximates to that of a stem, of which, indeed, the leaf may be regarded as a modification.

An interesting fact with regard to this singular variation is that it has appeared more than once, and independently. It first occurred in 1885, but seems afterwards to have been lost sight of (*Gardener's Chronicle*, 1885, p. 536). It has also occurred in a red-flowered form in France (*Revue Horticole*, 1897, pp. 98 and 130), in which case it was also perpetuated by seed.

I have not succeeded in discovering any similar structure in any primulaceous plant occurring in a wild state. Dr. Masters, however, informs me that it has been observed in cultivated forms of *Primula sinensis*. The tendency thus seems to be latent in the order, though why it should be so I am unable to explain.

Some theoretical interest appears to me to attach to the rapid development of so striking an ornament of a corolla segment. Such appendages are frequent enough in orchids, and are regarded as adaptations to cross-fertilisation by insects. Their gradual evolution might be thought to require a long period of time; but in the present case we have definite evidence that such a structure may be developed by selection with great rapidity.

Conclusion.

(1) The facts which I have stated appear to me to establish the result that, when once specific stability[1] has been broken down in a plant, morphological changes of great variety and magnitude can be brought about in a comparatively short space of time. This appears to me to have a very important bearing on the rate of evolution. Mr. Darwin quotes Lord Kelvin as insisting "that the world at a very early period was subjected to more rapid and violent changes in its physical condition than those now occurring"; and he adds, "Such changes would have tended to induce changes at a corresponding rate in the organisms which then existed" ("Origin," sixth ed., p. 286). That changes may be effected with considerable rapidity cannot, I think, be denied.

(2) It is further, I think, abundantly proved in the present case that, though sudden variations do occur, they are, as far as we know, slight as long as self-fertilisation is adhered to. The striking results obtained by cultivators have been due to the patient accumulation by selection of gradual but continuous variation in any desired direction.

(3) The size which any variable organ can reach does not appear to be governed by any principle of correlation. Large flowers are not necessarily accompanied by large leaves. Under natural conditions size is controlled by mechanical limitations and by the principle of economy. Nature cannot afford to indulge in anything unnecessary for the purpose in view (see Darwin, "Origin," 6th ed., p. 117).

(4) The general tendency of a plant varying freely under artificial conditions seems to be atavistic, *i.e.* to shed adaptive modifications which have ceased to be useful, and either to revert to a more generalised type or to reproduce "characters which are already present in other members of the same group" (see Darwin, "Origin," 6th ed., p. 127). This conclusion must, however, be accepted with caution, for we must remember that in a case like the present we are only acquainted with variations which have been preserved with a particular end in view.

(5) The case of "cresting" shows that the plant still possesses the power to strike out a new line and to develop characters which would even be regarded as having specific value, as in the total change which has been effected in the form of the leaf in *Primula sinensis*. If such a race developed any degree of sterility with other races, it would have satisfied Huxley's criterion for the artificial production of a new species.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

OXFORD.—The Savilian Professorship of Geometry being vacant by the death of the late Prof. Sylvester, the Electors will proceed to the appointment of a successor in the course of the present Term. The duties of the Professor are defined in the following provisions of the Statutes:—"The Savilian

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[1] For a general discussion of the principles of variation and specific stability, see NATURE, vol. li. pp. 459-461.

THURSDAY, JUNE 10, 1897.

PLANT PATHOLOGY.

Diseases of Plants induced by Cryptogamic Parasites. By Dr. Karl Freiherr von Tubeuf. English Edition, by William G. Smith, B.Sc., Ph.D. Pp. xv + 598. (London: Longmans, 1897.)

WHEN the German edition of this work appeared, early in 1894, it at once took rank as one of the most comprehensive and accurate treatises on the subject that had as yet appeared, and the English edition we now have to welcome still deserves this tribute to its merits, for the author has taken the opportunity of adding considerably to the already bulky volume.

The fungus-diseases of plants now number so many forms, that no apology is necessary for treating them separately from the very numerous other diseases of plants; but it should be clearly borne in mind that only part of the very wide subject of the pathology of plants comes under this head, as may be readily seen on comparing the new edition of Frank's "Krankheiten der Pflanzen," which has appeared in the interval, and of which the first volume is devoted to the diseases due to non-living agents, the second to those caused by parasitic plants (not fungi only), and the third to pathological states induced by animals.

Thus comprehensive works on the whole range of this vast subject are not wanting, and the student should observe that the standpoint from which a treatise like this is written differs considerably from those assumed by writers on the general subject of pathology, or those who deal with the morphology and physiology of the fungi.

Berkeley, Frank, Sorauer, and Hartig have shown that the diseases of plants constitute a theme by itself which may be treated with reference either to the symptoms and progress of the pathological conditions, where the victim of disease furnishes the principal phenomena discussed, or to the causes or agents which induce these pathological conditions. These agents may be internal or external, and the latter comprise factors of the non-living environment, or living organisms—animals or plants in anti-biotic relations to the host, or victim.

The present large volume, of more than 600 pages with 330 illustrations, is devoted, as said, to the narrower theme, and bears witness to the astonishing progress made in the study of the parasitic fungi during the last quarter of a century.

Its subject-matter is principally the fungi themselves, and in character it partakes of the nature of a flora or diagnostic list, and a treatise on symptoms and therapeutics, with bibliographical references for those who wish to launch further into this particular arm of the sea of knowledge. It is thus neither a complete treatise on the biology of fungi, nor a detailed work on pathology, but—and in this reside its peculiar characteristics—a volume compiled to meet the wants of an increasing class of students who wish to know something of the parasitic fungi themselves and what plants they attack; something of the mode of attack and the symptoms induced; and something of the suggestions for combating the diseases which have been supplied by experiments in the field. It is thus a typical example of a class of book evolved under the stimulus of the practical spirit of the age, and, in fairness to all be it said, of a high standard of excellence as scientific literature; further, it will be of no use to the crammer, to the examinee, or the dilettante, but must take its place on the shelf of the serious worker, the true naturalist, and the educated cultivator of plants as an indispensable work of reference.

The book consists of two parts, of which the first contains chapters on the nature of parasites and parasitism, the reactions between host and parasite, infection, predisposition, preventive measures, and the economic importance of the diseases of plants, together with a short summary of the facts of symbiosis.

The second, and far larger part, is devoted to a systematic account of cryptogamic parasites—the fungi proper, slime-fungi, bacteria and pathogenic algæ being included. The system followed is that of Brefeld, the saprophytic forms being omitted.

Objection may be made to the inclusion of the algæ and symbiotic forms, such as mycorhiza, the organisms of the leguminous nodules, lichens, &c.; but Tubeuf has something of his own to say about these matters, and although I do not agree with his strained attempts to classify the phenomena of saprophytism, parasitism, and symbiosis, and regard his selection and definition of the terms *nutricism* and *individualism* as particularly unfortunate and misleading, I think that he was quite right in discussing these matters here, if only to help in emphasising the real nature of parasitism by contrast.

The author has avoided several pitfalls. It would have been easy to give way to temptations to discuss in detail several disputed points, especially as Tubeuf is himself an investigator with strong views of his own; but it is noticeable throughout that he attempts a fair summary of the published accounts. The fault of over-description has also been wisely and ably avoided, and this, on the whole, without sacrifice of usefulness; though it must be borne in mind that a good deal of preliminary acquaintance with the subject is necessarily demanded from the reader. Again, there is sufficient treatment of theoretical matters to make the book attractive to botanists not specially concerned with pathology in detail, and, further, the hints on practical therapeutics, though necessarily short, appeal to the cultivator himself, and show that the book is designed to help him.

One fault of omission must be mentioned, if only in justice to those who have done good work in this country: the English literature is almost wholly ignored. We hesitate whether to blame the author—who only follows the too common practice of continental writers—or the editor for this. In any case the latter might have included references to Massee's and Somerville's experiments with *Plasmodiophora*, in his notes, to say nothing of other work by English botanists.

A feature in the work, which adds immensely to its value, is the selection of photographic illustrations of the diseased plants themselves, showing how the victims of fungus attacks look. This is as near an approach to taking the student into the field and showing him the disease at work, as can possibly be made in a book; and when we reflect that this—so to term it—clinical study is as important for plant diseases as it is in the case of human diseases, its importance is obvious. Few people are aware how much there is to be seen and learnt in the natural history of the diseases of forest and field and garden plants, and Tubeuf's examples should stimulate botanists to pay more attention to the subject. It is true the reproductions of the photographs are by means of the detestible "process blocks," which disfigure most of the books of the present age; but I suppose we must agree that the choice lies between these or none, as prices and means go.

It will be evident that the book is too large for even a brief review of more than the principal headings, but there are one or two features of importance which stand forth in salient contrast to anything met with in similar works.

These are signs of the times. One of the most striking is the far too meagre note on "selection of hardy varieties"—the word "hardy" does not accurately translate the original. From all sides we are now hearing that different varieties of vines, potatoes, wheat, &c., show different disease-resisting powers, and Tubeuf says, "An important method for the protection of plants from disease . . . consists in the selection and cultivation of varieties and species of plants able to resist the attacks of parasitic fungi."

The very brief account of what has been done with the vine, and the reference to what has been discovered about wheat, will only leave the reader hungry for more information.

In Eriksson and Henning's exhaustive volume on wheat-rust—to which I can discover no reference here, the author confining his remarks to a note they published last year in the *Zeitschrift f. Pflanzenkrankheiten*—the student will find that as matter of fact some varieties of wheat suffer little, and others much from *Puccinia*; and their extended investigations show that no mechanical theory as yet proposed explains this, but that a complex physiological phenomenon is here before us. They also show that the *Puccinia* of wheat-rust also varies, both morphologically and in its physiological relations to the disease. We have, in short, to face the fact that the culture of wheat-rust (for we do cultivate it), as well as the culture of cereals, result in the variation of both fungus and cereal, and it appears that selected varieties of both arise and are propagated.

Such varieties of parasitic fungi are also known in other groups—*e.g. Peridermium*, *Gymnosporangium*, *Ustilago*, &c.—and Tubeuf gives a short note under the respective heads; and we have several indications that physiological races are as common among parasitic fungi as they are among bacteria.

Clearly it is matter for experimental inquiry how far these variations are independent or concomitant, and it may be considered that one of the strongest reasons for encouraging the carrying out of agricultural experiments on a large scale, and the gathering of statistical results, that scientific men can urge, is the hope that more light will be thrown on the relations of these variations, and that we may succeed in utilising the knowledge in the practical evasion of disease. I remember being strongly impressed, in 1880-81, by the varietal differences between the *Hemileia* on coffee and that on *Canthium* in Ceylon, and even then threw out the hint that the former had been derived from the latter; but the comparative immunity of *Coffea Liberica* as contrasted with *C. Arabica*, suggested that it was not impossible that a disease-resisting coffee should be found.

The subject is complex, and bristles with difficulties; but that is no reason for hesitating as to the experimental inquiry; and indeed it has already been commenced in several countries, as the reports from Australia, America and elsewhere show.

Another feature of interest and importance in Von Tubeuf's book, is the chapter on "preventive and combative measures," involving the treatment of diseased plants by means of chemicals. Here, again, I notice a lack of attention to the English literature: Berkeley, and others of our countrymen, had experimented with sulphur in various forms, long before most of the authorities mentioned had taken the matter up. Still, it is quite true, the introduction of Bordeaux-mixture, and its employment on the enormous scales adopted in France, Australia, America and elsewhere, have taught us much, and suggested more. It is a common mistake to suppose that the intelligent application of remedial measures to plant-diseases does not pay—there are plenty of witnesses to the contrary; but, unfortunately, school and university courses generally have allowed of so little attention to the knowledge that must be utilised in carrying out such measures, that even skilled farmers, foresters, and other cultivators of plants, have to enter upon these experiments quite unequipped for carrying them out properly.

Tubeuf's chapter on the "economic importance of diseases of plants" may be cordially—if sadly—recommended to all who are interested in the very necessary extension of technical education by the institution of agricultural schools and colleges. He quotes the losses due to the Californian vine-disease (1892) at 10,000,000 dollars; in 1891 the wheat-rust cost Prussia over 20,000,000*l.*, and Australia something like 2,500,000*l.* Even allowing for large exaggerations—though reports from Sweden, India, Ceylon, the West Indies, and elsewhere suggest similarly large losses from fungus epidemics—in these estimates, it is evident that we have here to deal with annual losses of which even a saving of a very few pounds *per cent.* would be worth consideration; and the comparatively meagre experiments to hand hold out hopes of much more considerable saving, if steps are taken in time, with a due and intelligent knowledge of the problems to be faced, and the methods of facing them.

This must suffice for our review of this excellent book, the technical details of which are well treated, of the highest importance, and abounding with interest to the naturalist and botanist, as well as to the technologist and practical cultivator.

H. MARSHALL WARD.

CAPTAIN LYONS' REPORT ON THE ISLAND OF PHILÆ.

A Report on the Island and Temples of Philæ. By Captain H. G. Lyons, R.E.; with an Introductory Note by W. E. Garstin, C.M.G. (Printed by order of H.E. Hussein Fakhri Pasha, Minister of Public Works in Egypt, 1897.)

THE proposal to build a dam at Philæ, which was brought before the Egyptian Government a few years ago, at the instance of Mr. Willcocks, of the Irrigation Department of Egypt, will be fresh in the memory of many of our readers, even though the details of the "αἰὲν ἀριστεύειν καὶ ὑπείροχον ἔμμεναι ἄλλων," often cited by the original of the medal.

A few notes follow, on a less well known side of Sir William Lawrence's early work, from the pen of a distinguished pupil.

IN MEMORY OF LAWRENCE.

In the domain of surgery the name of Lawrence is held in high honour as that of a practitioner and observer of the utmost skill and originality. As a teacher at St. Bartholomew's Hospital and in the theatre of the College of Surgeons his services to the profession which he had adopted are recognised as having been invaluable. It is, however, not perhaps so well known that he was also a pioneer in those branches of research which more recently, under the direction of Darwin and Wallace, have effected such a revolution in our conceptions of the great scheme of zoological development. Not that it can be claimed for Sir William Lawrence that he anticipated the modern creed as to the descent of man, for he expressly repudiated the tenet of a common line of ancestry for man and brutes. Still, however, his lectures on the "Natural History of Man," delivered as professor to the Royal College of Surgeons, were far in advance of the opinions of the day, and were full of new thought and suggestion. They were published in 1816, and went through at least eight editions. Although now superseded by other works, they are still a mine of carefully collated facts to which the student refers with pleasure and profit. As is well known, they brought upon their author a storm of persecuting zeal, at the head of which was Abernethy, Lawrence's senior colleague at the hospital! In a second course of his college lectures Lawrence referred to these proceedings, and in a tone of manly independence claimed the right to think for himself and to express his opinions in his own terms. "These privileges, gentlemen, shall never be surrendered by me; I will not be set down nor cried down by any person, in any place, or under any pretext. However flattering it may be to my vanity to wear this gown, if it involves any sacrifice of independence, the smallest dereliction of the right to examine freely the subjects on which I address you, and to express fearlessly the result of my investigations, I would strip it off instantly." This was bold language in a young man, and one who in his profession was of course a candidate for public favour. It was indeed by this high endowment of moral courage that Lawrence was enabled to approach the topics which he treated of in a manner which was so far in advance of the current modes of thought, and so eminently advantageous to the age.

Lawrence's personal bearing was an index of his character. His stature was tall and his manner dignified, and his face was, in its expression of intellectual calm, one of the noblest ever worn by man.

JONATHAN HUTCHINSON.

JULIUS SACHS.

JULIUS SACHS[1] was born at Breslau October 2, 1832, and died at Würzburg on May 29, 1897. Although his health had been seriously impaired for years, his last illness was not of long duration. He was regularly at work in his laboratory during the Easter vacation, and only took to his bed about the middle of April. A few days before the end came, he sank into coma and died without pain. Of his early career I have not been able to learn anything: I remember to have heard him say that his first teacher was Purkinje, under whom he published two or three zoological and geological papers. His first official post was that of Privat-Docent at Prague. In 1858-59 he was at Tharandt, in 1860 at Chemnitz. In 1861-62 he was appointed Professor in the Landwirthschaftliche Institut at Poppelsdorf, near Bonn. In 1867 he was called to the chair of Botany in Freiburg, and in *1867* he obtained the professorship at Würzburg, which he held up to the time of his death.[2]

It is not easy for a botanist of these days to estimate the debt of gratitude that he owes to Sachs. We have grown up in the modern school, and we mistake for our natural environment a state of things which his labour of forty years painfully built up for us. There is a natural blindness of the child to the parent, or the apprentice to his master, and this we can only partially overcome.

The place of Sachs in the history of Botany is, I am inclined to think, even higher as a teacher than as a discoverer. He will be more permanently known for his "Experimental Physiologie" (1866), by his "Lehrbuch" (first edition, 1868),[1] his "Geschichte der Botanik" (1875),[2] and his "Vorlesungen" (1882),[3] than by his "Collected Papers" (1892-93). The earliest of these volumes, the "Experimental Physiologie," seems to me in some respects the best. If we compare it with previous books on the physiology of plants we feel an enormous advance, not only in the fire and vigour with which it is written, but especially in the absence of compilation; it reads like an original paper rather than a treatise, and it was in fact largely founded on the activity of twelve of the best years of his life. Between 1853, when his first paper appeared in the Czechish journal *Ziva*, until 1865, just before the publication of the "Experimental Physiologie," he published (according to the Royal Society's Catalogue) sixty-eight papers, of which, however, the two or three earliest ones were not botanical. The book gives internal evidence of being written with the delight of a strong man in his work, and Sachs has been heard to say that he wrote it with a pleasure greater than that given by any of his later books.

On the other hand he spoke, if I remember aright, somewhat wearily of the years of section-cutting and microscopy needed for his "Text-Book." This may serve to remind us of what we are apt to forget—the mass of original matter hidden in this admirable book. In his last book, the "Lectures" of 1882, he returned to what best suited his turn of mind—a broad, general view of physiology. At the same time he handed over the re-editing of the histology, the detailed morphology and classification in the "Text-Book," to his friend and pupil Goebel.[4]

The "Text-Book" has no doubt had a greater effect on botany than any one of his other books. The modern botanist is sometimes assumed to be ignorant of taxonomy, but a man who has worked practically through Sachs' "Text-Book" knows more of the classification of the vegetable kingdom as a whole, than the older botanist who knew the phanerogams minutely, but little beyond them. As a single proof of the fruits arising from a proper understanding of the taxonomy of plants, it may be pointed out that palæobotany has only been rendered possible as a science by the sort of knowledge inculcated by Sachs. Witness the work of Solms Laubach and Nathorst and others on the continent, and of Scott and Seward in this country, as compared with the efforts of earlier workers. The effect of Sachs' "Text-Book" in England was intensified by the great revival of scientific teaching instituted by Huxley, in which the all-importance of practical work was insisted on. And thus the learner of those days had the good luck to be supplied with Sachs' "Text-Book" just when he was spurred on by his teacher and by the spirit of the times to examine the histology and physiology of plants for himself.

As a teacher in the laboratory Sachs' position was equally great. He was most generous in receiving pupils, and those of us who had the good fortune to be of that number must always *remember* with gratitude his genial welcome and the pains he took with us over our work. To some it was a first introduction to a *research* laboratory, to a region where, if examination is not quite

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[1] I believe that Sachs never made use of the title of von which was conferred upon him.

[2] For the above facts I am indebted to the kindness of Prof. Kunkel of Würzburg, and Prof. Marshall Ward.

[1] The English translation of a later edition appeared in 1875, under the name of "Text-Book."

[2] English translation, 1890.

[3] English translation, 1887.

[4] English translation, under the title of "Outlines of Classification, &c." 1887.

banished, it is so much in the background as to be forgotten. It was extraordinarily invigorating to fall into the midst of a group of young men each engaged in his problem, and ruled over by a kindly despot full of resource and enthusiasm, and both willing and able to give us questions to solve. His tendency was to do things in a broad, handsome manner. He liked to have a flush of material, and he sacrificed it royally; for instance, in his work on roots he used 3000 beans. He insisted on things being done in a sound, cleanly manner, and especially inculcated the proper cultivation of experimental material, often reproving his pupils if they did not give light enough to their plants. He liked the practical details of cultivation, and would take pleasure, for instance, in showing his pupils the proper way of moistening earth for germinating beans; with the remark that this ought not to be done by a gardener, and adding "Das macht mir Spass" as a further reason for doing it himself. He preferred simple methods and broad results, and was essentially a man of round numbers. He did not deal in elaborate apparatus, and had indeed a somewhat unreasonable dislike for "Sogenannte Genauigkeit." But this was rather the dislike of unnecessary exactness, or of exactness misplaced—a valuable point of view in an experimentalist. He had, however, a liking for mechanism, as his invention of the recording auxanometer and of the klinostat shows.

As a lecturer he was admirable, and illustrated his words on the blackboard with evident pleasure and in the most life-like of sketches.

His papers have been collected in two volumes, published in 1892-3, many of the researches having appeared in his celebrated "Arbeiten," three well-known volumes, in which it was the highest ambition of his pupils to obtain a place.

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Thus, in regard to nutrition, he established, by the most brilliant of his researches, the connection between carbon-assimilation and the existence of starch in the chloroplasts; yet his fame seems to me to rest with even greater certainty on the fact that he saw more clearly than any modern botanist the overwhelming importance of a just view of assimilation, and that he had the intellectual force needed to drive it into the minds of a generation of botanists.

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FRANCIS DARWIN.

PROFESSOR R. FRESENIUS.

CARL REMIGIUS FRESENIUS, whose death occurred last week, was born at Frankfurt-on-Main on December 28, 1818. After a preliminary training at a pharmacy in that town, he devoted himself to the study of natural science, more especially of chemistry and botany. In 1840 he entered the University of Bonn, but a year later went to Giessen, where Liebig chose him as assistant in his laboratory. He graduated at Giessen in 1843. In 1845 he was called to the professorship of chemistry, physics, and technology at the Agricultural Institute at Wiesbaden, with which he has since been identified. The chemical laboratory at Wiesbaden, founded, owing to his exertions, in 1848 by the Government of the Duchy of Nassau, has since been much enlarged, a school of pharmacy being added in 1862, and a research laboratory for agricultural chemistry in 1868. The direction of the latter was taken over by his son, Dr. Henry Fresenius, in 1881. Fresenius received the title of Geheim Rath of the Duchy of Nassau in 1855. His best-known works are his "Qualitative Analysis" (first published in 1841) and his "Quantitative Analysis" (published in 1846); both have passed through very numerous editions, and have been translated into almost every European language. His numerous original memoirs (there are 162 titles in the Royal Society's Catalogue between the years 1842 and 1883) deal almost exclusively with analytical chemistry. One of his earliest papers (1843) deals with the composition of a mineral water from Java, and this was a subject to which he frequently returned. A series of papers on the mineral waters of Nassau (1864-68) are well known. Many of his later papers are published in the *Zeitschrift für Analytische Chemie*, which he founded in 1862, and which he continued to edit until his death.

T. E.

THURSDAY, JUNE 10, 1897.

PLANT PATHOLOGY.

Diseases of Plants induced by Cryptogamic Parasites. By Dr. Karl Freiherr von Tubeuf. English Edition, by William G. Smith, B.Sc., Ph.D. Pp. xv + 598. (London: Longmans, 1897.)

WHEN the German edition of this work appeared, early in 1894, it at once took rank as one of the most comprehensive and accurate treatises on the subject that had as yet appeared, and the English edition we now have to welcome still deserves this tribute to its merits, for the author has taken the opportunity of adding considerably to the already bulky volume.

The fungus-diseases of plants now number so many forms, that no apology is necessary for treating them separately from the very numerous other diseases of plants; but it should be clearly borne in mind that only part of the very wide subject of the pathology of plants comes under this head, as may be readily seen on comparing the new edition of Frank's "Krankheiten der Pflanzen," which has appeared in the interval, and of which the first volume is devoted to the diseases due to non-living agents, the second to those caused by parasitic plants (not fungi only), and the third to pathological states induced by animals.

Thus comprehensive works on the whole range of this vast subject are not wanting, and the student should observe that the standpoint from which a treatise like this is written differs considerably from those assumed by writers on the general subject of pathology, or those who deal with the morphology and physiology of the fungi.

Berkeley, Frank, Sorauer, and Hartig have shown that the diseases of plants constitute a theme by itself which may be treated with reference either to the symptoms and progress of the pathological conditions, where the victim of disease furnishes the principal phenomena discussed, or to the causes or agents which induce these pathological conditions. These agents may be internal or external, and the latter comprise factors of the non-living environment, or living organisms—animals or plants in anti-biotic relations to the host, or victim.

The present large volume, of more than 600 pages with 330 illustrations, is devoted, as said, to the narrower theme, and bears witness to the astonishing progress made in the study of the parasitic fungi during the last quarter of a century.

Its subject-matter is principally the fungi themselves, and in character it partakes of the nature of a flora or diagnostic list, and a treatise on symptoms and therapeutics, with bibliographical references for those who wish to launch further into this particular arm of the sea of knowledge. It is thus neither a complete treatise on the biology of fungi, nor a detailed work on pathology, but—and in this reside its peculiar characteristics—a volume compiled to meet the wants of an increasing class of students who wish to know something of the parasitic fungi themselves and what plants they attack; something of the mode of attack and the symptoms induced; and something of the suggestions for combating the diseases which have been supplied by experiments in the field. It is thus a typical example of a class of book evolved under the stimulus of the practical spirit of the age, and, in fairness to all be it said, of a high standard of excellence as scientific literature; further, it will be of no use to the crammer, to the examinee, or the dilettante, but must take its place on the shelf of the serious worker, the true naturalist, and the educated cultivator of plants as an indispensable work of reference.

The book consists of two parts, of which the first contains chapters on the nature of parasites and parasitism, the reactions between host and parasite, infection, predisposition, preventive measures, and the economic importance of the diseases of plants, together with a short summary of the facts of symbiosis.

The second, and far larger part, is devoted to a systematic account of cryptogamic parasites—the fungi proper, slime-fungi, bacteria and pathogenic algæ being included. The system followed is that of Brefeld, the saprophytic forms being omitted.

Objection may be made to the inclusion of the algæ and symbiotic forms, such as mycorhiza, the organisms of the leguminous nodules, lichens, &c.; but Tubeuf has something of his own to say about these matters, and although I do not agree with his strained attempts to classify the phenomena of saprophytism, parasitism, and symbiosis, and regard his selection and definition of the terms *nutricism* and *individualism* as particularly unfortunate and misleading, I think that he was quite right in discussing these matters here, if only to help in emphasising the real nature of parasitism by contrast.

The author has avoided several pitfalls. It would have been easy to give way to temptations to discuss in detail several disputed points, especially as Tubeuf is himself an investigator with strong views of his own; but it is noticeable throughout that he attempts a fair summary of the published accounts. The fault of over-description has also been wisely and ably avoided, and this, on the whole, without sacrifice of usefulness; though it must be borne in mind that a good deal of preliminary acquaintance with the subject is necessarily demanded from the reader. Again, there is sufficient treatment of theoretical matters to make the book attractive to botanists not specially concerned with pathology in detail, and, further, the hints on practical therapeutics, though necessarily short, appeal to the cultivator himself, and show that the book is designed to help him.

One fault of omission must be mentioned, if only in justice to those who have done good work in this country: the English literature is almost wholly ignored. We hesitate whether to blame the author—who only follows the too common practice of continental writers—or the editor for this. In any case the latter might have included references to Massee's and Somerville's experiments with *Plasmodiophora,* in his notes, to say nothing of other work by English botanists.

A feature in the work, which adds immensely to its value, is the selection of photographic illustrations of the diseased plants themselves, showing how the victims of fungus attacks look. This is as near an approach to taking the student into the field and showing him the disease at work, as can possibly be made in a book; and when we reflect that this—so to term it—clinical study is as important for plant diseases as it is in the case of human diseases, its importance is obvious. Few people are aware how much there is to be seen and learnt in the natural history of the diseases of forest and field and garden plants, and Tubeuf's examples should stimulate botanists to pay more attention to the subject. It is true the reproductions of the photographs are by means of the detestible "process blocks," which disfigure most of the books of the present age; but I suppose we must agree that the choice lies between these or none, as prices and means go.

It will be evident that the book is too large for even a brief review of more than the principal headings, but there are one or two features of importance which stand forth in salient contrast to anything met with in similar works.

These are signs of the times. One of the most striking is the far too meagre note on "selection of hardy varieties"—the word "hardy" does not accurately translate the original. From all sides we are now hearing that different varieties of vines, potatoes, wheat, &c., show different disease-resisting powers, and Tubeuf says, "An important method for the protection of plants from disease . . . consists in the selection and cultivation of varieties and species of plants able to resist the attacks of parasitic fungi."

The very brief account of what has been done with the vine, and the reference to what has been discovered about wheat, will only leave the reader hungry for more information.

In Eriksson and Henning's exhaustive volume on wheat-rust—to which I can discover no reference here, the author confining his remarks to a note they published last year in the *Zeitschrift f. Pflanzenkrankheiten*—the student will find that as matter of fact some varieties of wheat suffer little, and others much from *Puccinia*; and their extended investigations show that no mechanical theory as yet proposed explains this, but that a complex physiological phenomenon is here before us. They also show that the *Puccinia* of wheat-rust also varies, both morphologically and in its physiological relations to the disease. We have, in short, to face the fact that the culture of wheat-rust (for we do cultivate it), as well as the culture of cereals, result in the variation of both fungus and cereal, and it appears that selected varieties of both arise and are propagated.

Such varieties of parasitic fungi are also known in other groups—*e.g. Peridermium*, *Gymnosporangium*, *Ustilago*, &c.—and Tubeuf gives a short note under the respective heads; and we have several indications that physiological races are as common among parasitic fungi as they are among bacteria.

Clearly it is matter for experimental inquiry how far these variations are independent or concomitant, and it may be considered that one of the strongest reasons for encouraging the carrying out of agricultural experiments on a large scale, and the gathering of statistical results, that scientific men can urge, is the hope that more light will be thrown on the relations of these variations, and that we may succeed in utilising the knowledge in the practical evasion of disease. I remember being strongly impressed, in 1880–81, by the varietal differences between the *Hemileia* on coffee and that on *Canthium* in Ceylon, and even then threw out the hint that the former had been derived from the latter; but the comparative immunity of *Coffea Liberica* as contrasted with *C. Arabica*, suggested that it was not impossible that a disease-resisting coffee should be found.

The subject is complex, and bristles with difficulties; but that is no reason for hesitating as to the experimental inquiry; and indeed it has already been commenced in several countries, as the reports from Australia, America and elsewhere show.

Another feature of interest and importance in Von Tubeuf's book, is the chapter on "preventive and combative measures," involving the treatment of diseased plants by means of chemicals. Here, again, I notice a lack of attention to the English literature: Berkeley, and others of our countrymen, had experimented with sulphur in various forms, long before most of the authorities mentioned had taken the matter up. Still, it is quite true, the introduction of Bordeaux-mixture, and its employment on the enormous scales adopted in France, Australia, America and elsewhere, have taught us much, and suggested more. It is a common mistake to suppose that the intelligent application of remedial measures to plant-diseases does not pay—there are plenty of witnesses to the contrary; but, unfortunately, school and university courses generally have allowed of so little attention to the knowledge that must be utilised in carrying out such measures, that even skilled farmers, foresters, and other cultivators of plants, have to enter upon these experiments quite unequipped for carrying them out properly.

Tubeuf's chapter on the "economic importance of diseases of plants" may be cordially—if sadly—recommended to all who are interested in the very necessary extension of technical education by the institution of agricultural schools and colleges. He quotes the losses due to the Californian vine-disease (1892) at 10,000,000 dollars; in 1891 the wheat-rust cost Prussia over 20,000,000*l.*, and Australia something like 2,500,000*l.* Even allowing for large exaggerations—though reports from Sweden, India, Ceylon, the West Indies, and elsewhere suggest similarly large losses from fungus epidemics—in these estimates, it is evident that we have here to deal with annual losses of which even a saving of a very few pounds *per cent.* would be worth consideration; and the comparatively meagre experiments to hand hold out hopes of much more considerable saving, if steps are taken in time, with a due and intelligent knowledge of the problems to be faced, and the methods of facing them.

This must suffice for our review of this excellent book, the technical details of which are well treated, of the highest importance, and abounding with interest to the naturalist and botanist, as well as to the technologist and practical cultivator.

H. MARSHALL WARD.

CAPTAIN LYONS' REPORT ON THE ISLAND OF PHILÆ.

A Report on the Island and Temples of Philæ. By Captain H. G. Lyons, R.E.; with an Introductory Note by W. E. Garstin, C.M.G. (Printed by order of H.E. Hussein Fakhri Pasha, Minister of Public Works in Egypt, 1897.)

THE proposal to build a dam at Philæ, which was brought before the Egyptian Government a few years ago, at the instance of Mr. Willcocks, of the Irrigation Department of Egypt, will be fresh in the memory of many of our readers, even though the details of the "αἰὲν ἀριστεύειν καὶ ὑπείροχον ἔμμεναι ἄλλων," often cited by the original of the medal.

A few notes follow, on a less well known side of Sir William Lawrence's early work, from the pen of a distinguished pupil.

IN MEMORY OF LAWRENCE.

In the domain of surgery the name of Lawrence is held in high honour as that of a practitioner and observer of the utmost skill and originality. As a teacher at St. Bartholomew's Hospital and in the theatre of the College of Surgeons his services to the profession which he had adopted are recognised as having been invaluable. It is, however, not perhaps so well known that he was also a pioneer in those branches of research which more recently, under the direction of Darwin and Wallace, have effected such a revolution in our conceptions of the great scheme of zoological development. Not that it can be claimed for Sir William Lawrence that he anticipated the modern creed as to the descent of man, for he expressly repudiated the tenet of a common line of ancestry for man and brutes. Still, however, his lectures on the "Natural History of Man," delivered as professor to the Royal College of Surgeons, were far in advance of the opinions of the day, and were full of new thought and suggestion. They were published in 1816, and went through at least eight editions. Although now superseded by other works, they are still a mine of carefully collated facts to which the student refers with pleasure and profit. As is well known, they brought upon their author a storm of persecuting zeal, at the head of which was Abernethy, Lawrence's senior colleague at the hospital! In a second course of his college lectures Lawrence referred to these proceedings, and in a tone of manly independence claimed the right to think for himself and to express his opinions in his own terms. "These privileges, gentlemen, shall never be surrendered by me; I will not be set down nor cried down by any person, in any place, or under any pretext. However flattering it may be to my vanity to wear this gown, if it involves any sacrifice of independence, the smallest dereliction of the right to examine freely the subjects on which I address you, and to express fearlessly the result of my investigations, I would strip it off instantly." This was bold language in a young man, and one who in his profession was of course a candidate for public favour. It was indeed by this high endowment of moral courage that Lawrence was enabled to approach the topics which he treated of in a manner which was so far in advance of the current modes of thought, and so eminently advantageous to the age.

Lawrence's personal bearing was an index of his character. His stature was tall and his manner dignified, and his face was, in its expression of intellectual calm, one of the noblest ever worn by man.

JONATHAN HUTCHINSON.

JULIUS SACHS.

JULIUS SACHS[1] was born at Breslau October 2, 1832, and died at Würzburg on May 29, 1897. Although his health had been seriously impaired for years, his last illness was not of long duration. He was regularly at work in his laboratory during the Easter vacation, and only took to his bed about the middle of April. A few days before the end came, he sank into coma and died without pain. Of his early career I have not been able to learn anything: I remember to have heard him say that his first teacher was Purkinje, under whom he published two or three zoological and geological papers. His first official post was that of Privat-Docent at Prague. In 1858-59 he was at Tharandt, in 1860 at Chemnitz. In 1861-62 he was appointed Professor in the Landwirthschaftliche Institut at Poppelsdorf, near Bonn. In 1867 he was called to the chair of Botany in Freiburg, and in 1867 he obtained the professorship at Würzburg, which he held up to the time of his death.[2]

It is not easy for a botanist of these days to estimate the debt of gratitude that he owes to Sachs. We have grown up in the modern school, and we mistake for our natural environment a state of things which his labour of forty years painfully built up for us. There is a natural blindness of the child to the parent, or the apprentice to his master, and this we can only partially overcome.

The place of Sachs in the history of Botany is, I am inclined to think, even higher as a teacher than as a discoverer. He will be more permanently known for his "Experimental Physiologie" (1866), by his "Lehrbuch" (first edition, 1868),[1] his "Geschichte der Botanik" (1875),[2] and his "Vorlesungen" (1882),[3] than by his "Collected Papers" (1892–93). The earliest of these volumes, the "Experimental Physiologie," seems to me in some respects the best. If we compare it with previous books on the physiology of plants we feel an enormous advance, not only in the fire and vigour with which it is written, but especially in the absence of compilation; it reads like an original paper rather than a treatise, and it was in fact largely founded on the activity of twelve of the best years of his life. Between 1853, when his first paper appeared in the Czechish journal *Ziva*, until 1865, just before the publication of the "Experimental Physiologie," he published (according to the Royal Society's Catalogue) sixty-eight papers, of which, however, the two or three earliest ones were not botanical. The book gives internal evidence of being written with the delight of a strong man in his work, and Sachs has been heard to say that he wrote it with a pleasure greater than that given by any of his later books.

On the other hand he spoke, if I remember aright, somewhat wearily of the years of section-cutting and microscopy needed for his "Text-Book." This may serve to remind us of what we are apt to forget—the mass of original matter hidden in this admirable book. In his last book, the "Lectures" of 1882, he returned to what best suited his turn of mind—a broad, general view of physiology. At the same time he handed over the re-editing of the histology, the detailed morphology and classification in the "Text-Book," to his friend and pupil Goebel.[4]

The "Text-Book" has no doubt had a greater effect on botany than any one of his other books. The modern botanist is sometimes assumed to be ignorant of taxonomy, but a man who has worked practically through Sachs' "Text-Book" knows more of the classification of the vegetable kingdom as a whole, than the older botanist who knew the phanerogams minutely, but little beyond them. As a single proof of the fruits arising from a proper understanding of the taxonomy of plants, it may be pointed out that palæobotany has only been rendered possible as a science by the sort of knowledge inculcated by Sachs. Witness the work of Solms Laubach and Nathorst and others on the continent, and of Scott and Seward in this country, as compared with the efforts of earlier workers. The effect of Sachs' "Text-Book" in England was intensified by the great revival of scientific teaching instituted by Huxley, in which the all-importance of practical work was insisted on. And thus the learner of those days had the good luck to be supplied with Sachs' "Text-Book" just when he was spurred on by his teacher and by the spirit of the times to examine the histology and physiology of plants for himself.

As a teacher in the laboratory Sachs' position was equally great. He was most generous in receiving pupils, and those of us who had the good fortune to be of that number must always remember with gratitude his genial welcome and the pains he took with us over our work. To some it was a first introduction to a research laboratory, to a region where, if examination is not quite

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[1] I believe that Sachs never made use of the title of *von*, which was conferred upon him.

[2] For the above facts I am indebted to the kindness of Prof. Kunkel of Würzburg, and Prof. Marshall Ward.

[1] The English translation of a later edition appeared in 1875, under the name of "Text-Book."

[2] English translation, 1890.

[3] English translation, 1887.

[4] English translation, under the title of "Outlines of Classification," &c., 1887.

banished, it is so much in the background as to be forgotten. It was extraordinarily invigorating to fall into the midst of a group of young men each engaged in his problem, and ruled over by a kindly despot full of resource and enthusiasm, and both willing and able to give us questions to solve. His tendency was to do things in a broad, handsome manner. He liked to have a flush of material, and he sacrificed it royally; for instance, in his work on roots he used 3000 beans. He insisted on things being done in a sound, cleanly manner, and especially inculcated the proper cultivation of experimental material, often reproving his pupils if they did not give light enough to their plants. He liked the practical details of cultivation, and would take pleasure, for instance, in showing his pupils the proper way of moistening earth for germinating beans; with the remark that this ought not to be done by a gardener, and adding "Das macht mir Spass" as a further reason for doing it himself. He preferred simple methods and broad results, and was essentially a man of round numbers. He did not deal in elaborate apparatus, and had indeed a somewhat unreasonable dislike for "Sogenannte Genauigkeit." But this was rather the dislike of unnecessary exactness, or of exactness misplaced—a valuable point of view in an experimentalist. He had, however, a liking for mechanism, as his invention of the recording auxanometer and of the klinostat shows.

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In his later years his life was overshadowed by broken health, and his nature—sensitive and self-centred—was never compatible with a serene or happy life. Those who came under his influence must be glad to forget the less happy side of the picture, and remember with gratitude how much they owe to Sachs.

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CARL REMIGIUS FRESENIUS, whose death occurred last week, was born at Frankfurt-on-Main on December 28, 1818. After a preliminary training at a pharmacy in that town, he devoted himself to the study of natural science, more especially of chemistry and botany. In 1840 he entered the University of Bonn, but a year later went to Giessen, where Liebig chose him as assistant in his laboratory. He graduated at Giessen in 1843. In 1845 he was called to the professorship of chemistry, physics, and technology at the Agricultural Institute at Wiesbaden, with which he has since been identified. The chemical laboratory at Wiesbaden, founded, owing to his exertions, in 1848 by the Government of the Duchy of Nassau, has since been much enlarged, a school of pharmacy being added in 1862, and a research laboratory for agricultural chemistry in 1868. The direction of the latter was taken over by his son, Dr. Henry Fresenius, in 1881. Fresenius received the title of Geheim Rath of the Duchy of Nassau in 1855. His best-known works are his "Qualitative Analysis" (first published in 1841) and his "Quantitative Analysis" (published in 1846); both have passed through very numerous editions, and have been translated into almost every European language. His numerous original memoirs (there are 163 titles in the Royal Society's Catalogue between the years 1842 and 1883) deal almost exclusively with analytical chemistry. One of his earliest papers (1843) deals with the composition of a mineral water from Java, and this was a subject to which he frequently returned. A series of papers on the mineral waters of Nassau (1864-68) are well known. Many of his later papers are published in the *Zeitschrift für Analytische Chemie*, which he founded in 1862, and which he continued to edit until his death.

T. E.

Nature June 97

PROF. J. A. HARPER'S paper "On Nuclear Division and Free Cell-formation in the Ascus," reprinted from Pringsheim's *Jahrbücher*, completes a valuable series of observations on the obscure process of nuclear fusion which takes place immediately before the formation of the spores in many of the Ascomycetes. The author does not take the view of several French observers, that this fusion of nuclei is of a sexual character.

THE *Bulletin of Miscellaneous Information*, issued by the Superintendent of the Botanic Garden, Trinidad, mentions the very interesting circumstance that in that island a species of *Bauhinia* (*B. magalandra*, n. sp.), belonging to the Leguminosæ, is pollinated by the agency of bats, the first instance recorded of a "mammalophilous" flower. On visiting a flower the bat alights upon and holds fast to the protruded stamens, and attacks the erect and curved petals. The object of the visit of the bats appears to be not any nectar secreted by the flower, but the insects which are attracted to it by its odour. The flowers open only in the evening.

Dickson & Jameson Students Handbook of British Mosses Coloured plates 2nd hand
Berkeley Brit. Mosses.
Braithwaite Brit. Moss Flora Coloured plates
Tripp Brit. Mosses 2 vols 1874
Illustrations of Brit. Fungi ((Hymenomycetes) Cooke. Only plates 8 vols
Handbook of Brit Fungi Cooke 1871 Text 2 vols
Uredineae & Ustilagineae Plowright
Diseases of Trees Hartig (trans. by Somerville & Marshall Ward)
~~Flowr~~ Diseases of Plants Tubeuf t. by Smith [Rusham Library]
Newmans Brit. Ferns 1854. uncoloured illustrations
Johnson & Sowerby Ferns of Gt Britain " " 1858
Nisbet Brit. Forest Trees 1 vol

The <u>Forester</u>. Brown & Nisbet 1894 Vol I
<u>Engler & Prantl</u> Wheat & refs (Newnham Library)
Brit Mus. Catalogue of Fungi
Wheat. Agricultural Expt. Station Bulletin No. 62
Divn. of agriculture Hays Press.

SEAWEED.

By Sir EDWIN ARNOLD.

I have been struck lately by the rich information and sterling good sense of an article in the May number of "Good Words" upon the subject of Seaweed, written by Mr. W. C. Mackenzie. It would be difficult to find any brief paper more attractively illustrating two great facts—the first, that nothing in the world is without its usefulness, and the next, that there exists a romance of industry and of commerce as full of incident and vicissitude as any novel of social life. In one of his Epistles Horace talks of "inutilis alga," the "useless seaweed"—and probably, to the Romans there could be and was no apparent object in the creation of that grass of the ocean which is so salt and sodden and unlovely in hue and aspect. The classic poets, if they noticed it at all, looked upon it as casual and bitter fodder for the marine herds of Proteus and Neptune—sea-wreaths of sombre yellow and black for the brows and loins of Tritons and Nereids. Not that seaweed is really destitute of its own peculiar beauty. The children love to rescue, for the sake of colour and freshness, the long glassy stems and great bronzed fronds of the "tangle-top" from the outgoing waves, and to stamp with naked rosy feet on the bladder-wrack, to hear its berried vesicles pop. The sailor likes to see the sinuous coils of weed curling and writhing down the slope of the spray-laced billow, for it is a sign to him that land is near; and the yachtsman and lover of the deep would miss from the bosom, or from the brink, of his favourite element that giant and fragrant herbage of the blue and green waters which only grows where they are salt and fresh and free.

But seaweed is much more important than merely to be dried on specimen cards or wreathed round the golden curls of water-babies. From time beyond reckoning it has been a chief source for potash or soda, which goes to make glass; and it is quite possibly true that glass was discovered, as is said, by some Phœnician sailors, who, lighting a fire on the seashore with kelp, melted the flinty sand and soda together, and so created that common marvel which we have forgotten to admire and be grateful for. Kelp has been for generations past a mainstay of the islanders of the Hebrides and elsewhere, and the story of this industry is full of strangest ups and downs. From 1720 it helped to manufacture glass and soap at Newcastle, and alum at Whitby; but trade was poor, a ton of kelp only then fetching 25s. Afterwards matters mended, as Mr. Mackenzie tells us. During the latter half of the eighteenth century the average price was between £4 and £6; at the beginning of the present century it realised £11 per ton. From this point the price rose rapidly to £22 per ton, and the yield of kelp in the Hebrides alone was as much as 20,000 tons per annum, the resultant of about 400,000 tons of seaweed. This stands the high-water mark reached. Since that period kelp has undergone extraordinary vicissitudes. The introduction of barilla from Spain reduced in twenty years its price to £10 10s, and the subsequent removal of the high import duty on barilla further lowered the value to £8 10s. When, in 1823, the duty on salt was repealed, enabling soda chemically extracted from salt to compete with the soda obtained from kelp, it looked as if the end had come, for the price of kelp fell to £3. These adverse circumstances culminated in the competition of potash salts from Saxony, which almost entirely shut out from the market the same substance recovered from kelp. The price of kelp, which had been gradually dwindling with each successive blow at its supremacy, suffered a further relapse, until, in 1831, it reached as low a value as £2 per ton.

The discovery of iodine saved the kelp trade from extinction. That wonderful and subtle drug, named from its lovely violet fumes when burned, rendered the despised sea-wrack momentous, for Nature had hidden in it one of her most potent medicaments, and something indispensable for the new art of photography. Again the islanders went bravely and hopefully to work, raking up on beaches the dark harvest of the sea, and burning it when dry into ash or solid blocks, from which chemists readily extracted the purple flakes of their iodine. Kelp-making flourished again, and kept hundreds of poor toilers in bannocks and milk, until a new stroke of evil luck fell, twenty-five years ago, on the Orkneys and Hebrides. Chili and Peru unkindly proved that they could produce out of their bird-droppings and nitrates of soda as much iodine as the world would ever use, and nobody now can prudently invest in the "sea-violet," for there is always a five-years' store of it accumulated.

Must, then, the honest islanders despair? Must they mournfully agree with Horace henceforward to

the boiled rice, as we use mint in pea-soup; or soaks and boils the hijiki as a legume, or to enrich gravy. There are rarer and choicer kinds, but I remember none at the price named by Mr. Mackenzie. Egg and rice spiced, and rolled up with fish-crumbs, in a cover of soft wave-salted seaweed, is called "norimaki," and was, as I have said, one of the delicacies on the Emperor's hospitable manœuvre table.

Yet, of course, the sturdy coastmen of the Orkneys and Hebrides, and such places where there occurs this ocean-harvest, cannot be expected to live wholly on seaweed. It would be advice to them as vain as that of Mr. Toots, who, when someone asked "what could be done if Russia cast her raw products upon our ports?" answered, "Cook 'em!" A little sea-grass as diet goes a long way, and there has arisen a far better chance than this for the "kelpers." A substance named "algin" has been discovered by chemical analysts of seaweed, which promises to do all that iodine ever wrought for this decaying industry, and even more. Algin is a glutinous, colourless substance which seaweed contains in large proportions. The weed is steeped in sodium carbonate for twenty-four hours, and becomes a mass fourteen times more viscous than starch and thirty-seven times than gum-arabic. It is then filtered and pressed, forming a compact cake resembling new cheese, and can be so stored for any length of time in a cool drying-room. It can be used for sizing fabrics, and as a mordant in dyeing, and in these directions, more than in any other, a great commercial future is predicted for it. Perhaps its most interesting use to the general public consists, after all, in its value as an article of food. Algin will make splendid thickening for soup, capital puddings, famous jellies and gelatine, and better jujubes for boys and girls than any gum-arabic. How should it not, when 90 per cent. consists of carbon and oxygen in almost equal proportions, there being also nitrogen present. And, besides this, it will prevent the incrustation of boilers, act as a good non-conducting cover to them in the shape of "carbon cement," while as cellulose hardened and whitened it makes a fine vegetable ivory, turns out an admirable paper which is fibreless, answers well in electric machines as an insulator, and in the form of "alginate of iron" is being warmly taken up by medical men for the cure of anæmia and chlorosis. After this we need not mind what the Latin poet wrote about the uselessness of seaweed, and we may hope that those honest islanders of the North may yet again reap golden harvests from the "pastures of the deep."

of their bird-droppings and nitrates of soda as much iodine as the world would ever use, and nobody now can prudently invest in the "sea-violet," for there is always a five-years' store of it accumulated.

Must, then, the honest islanders despair? Must they mournfully agree with Horace henceforward to dub seaweed "inutilis"? The supply of it on their coasts is enormous, comprising the black-knobbed bladder-wrack Fucus, and the red drift-weed Laminaria, and "tangle," which last the waves throw up. A certain limited employment may be made of all these for field manures, but they will not pay for distant carriage. Considerable economy might also be effected by improved methods of burning kelp, for in this respect Hebrideans are too unskilful and conservative. You can distil tangle so as to obtain considerably larger percentages of iodine and salts than are yielded by merely burnt kelp. The residuum of charcoal is useful for sanitary and other purposes. Ammonia, acetic acid, and tar are also obtained from the distillate. Such works have proved of great service to the islanders; but the output is limited in consequence of the large stocks of iodine in the market, and, for the most part, the shore-people go on roasting their sea-wrack in the kilns, the yellow flames at evening making them look like gnomes moulded out of amber as the kelpers push their iron "clauts" into the mass, above which dance wildly pungent, briny smoke and the gilded tongues of fire.

There is one thing more which you can do with seaweed, and that to an extent greatly undervalued—I mean to say, you can eat it. Mr. Mackenzie's charming paper would have been incomplete if he had not touched on this part of the topic. He justly observes that green and pink laver are used in soups, and murlins eaten in Ireland. In Wales, seaweed fried in oil is a common article of diet; while even in London it finds its way to some tables boiled as greens. Dulse, even in its raw state, is far from being unpalatable; nay, Highlanders will say that a dish of dulse, boiled in milk, is fit for a king. Every Hebridean is a connoisseur of the edible properties of tangle; preference being usually shown for the root of the plant, as sweeter than the stem. In China and Japan seaweed is largely used for food, and for special varieties very large prices are obtainable. Two of these edible seaweeds, green and pink laver, both British species, are said by Mr. Mackenzie to be worth in Yokohama no less than 4s per lb. It may here be noted that, unlike the fungi, there are no poisonous species of seaweed. The gelatinous principle in certain kinds of ware is of special value in making jelly. Irish moss, which is exported from Ireland to this country and Germany, belongs to the dulse species, and from another variety is obtained the substance known as gelose, or Japanese isinglass.

Mr. Mackenzie is quite right about the popularity of seaweed as an article of diet in Japan. Often and often I have eaten it myself there; and at fashionable banquets, too, notably at the Emperor's own summer palace at Nara, where his Imperial Majesty's 3,000 guests had, among other delicacies, "norimaki" for supper, after the military manœuvres. There are numerous names for seaweed in Japanese, such as aosa, funori, hijiki, kajime, mozuka, miru, and kobu, or kombu, &c. Aosa is the green, filmy sea-leaf; hijiki is the "systoseira," very edible; so is funori and miru, the latter resembling Iceland moss. And kombu is the Laminaria japonica, excellent in flavour and highly nourishing, though the taste for it has to be acquired. The vegetable dealers' shops in Tokyo and Yokohama and elsewhere expose these and other varieties as regularly as salads with us. You see them neatly prepared in brown, or black, or dark olive green slabs or leaves, fluted and crinkled by the sea. The Japanese housewife either dries and crumbles them to make tasty

Darwin's "Insectivorous plants"

Drosera rotundifolia

Living dragon fly recorded with its body firmly held by two leaves.

Sticky buds of horsechestnut cause the death of insects without thereby receiving any advantage.

The drosera secretion seems to possess like the gastric juice of the higher animals some antiseptic power. Very warm weather, equal sized bits of raw meat one on leaf of drosera, other surrounded by wet moss. 48 hours. Bit in moss swarmed with infusoria & was much decayed. Bit on leaf partly dissolved, but undissolved part quite undecayed.

When tentacles which have been closely inflected for several days begin to reexpand their glands are left dry for a little time, which is useful ∴ the remains of the insects can be blown away

Drosera plants collected in June & planted in 6 ordinary soup plates. Each plate divided by a low partition into 2 sets, the least flourishing half of each culture selected to be fed. Plants prevented from catching insects by a covering of fine gauze. The "fed" plants given minute pieces of roast meat. Difference visible in 10 days, & went on increasing. Fed plants produced much more seed &

It is remarkable that the leaves of Drosera rotundifolia, which flourishes on bleak upland moors in Arctic circle, should be able to withstand 145° Fahr = 62.7°C

Handbuch
der
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Von

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Professor an der Universität Wien.

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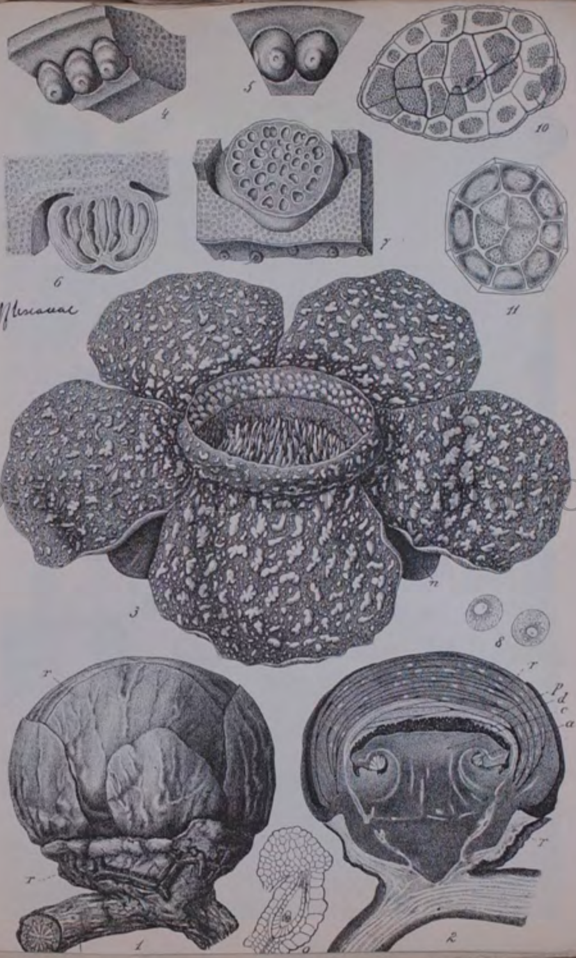
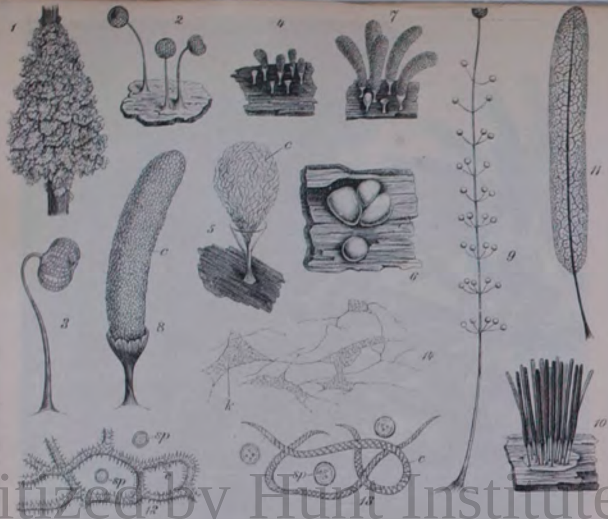
Rafflesiaceae



Befruchtungsvorgang von Ginkgo.

Cocos nucifera und Nipa fruticans.



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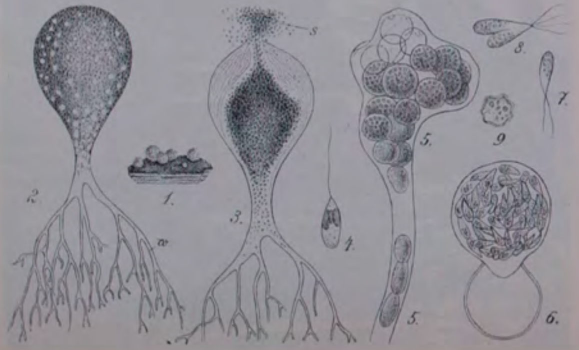

Botrydium.

At E. S's request & with heartiest greetings:

In Lancs:

Urtica dioica†: young shoots gathered in spring by the children & afterwards cooked for table as we cook spinach.

Agrimonia Eupatoria
Gathered on the sunlit sand hills when in full bloom – when it has its apricot-like fragrance – & Agrimony Tea made from it:

In Oxon:
Taraxacum – regularly gathered for Dandelion tea.

Alliaria officinalis – used occasionally to flavour when – a cottager is short of Garlic.

†: fibres v. strong. used in Germany to make the earliest form of Brussels net hence its name "nessel tuch."

A Taylor.

91. Ave: Rd N.W.

Botrydium.

Shamrock

Some few years ago several of these wise people were asked to collect specimens of what they considered was the genuine plant, and to permit them to flower, by which the identity might be established beyond doubt. Curiously enough, there proved to be two varieties, one of which is the yellow suckling and the other is white, or Dutch clover. Further consultation among the "wearers of the green" showed that the counties of Cork, Derry, Wicklow, Wexford, Clare, and Queen's County accepted the yellow suckling, while white clover was chosen by Antrim, Mayo, and Roscommon. Armagh and Carlow were divided on the question. In England, the wood-sorrel, which has a pretty and delicate pearly white flower, is often erroneously regarded as the shamrock, but its foliage is larger and of much paler green than either of the two varieties recognised in Ireland.

Brown, C. Barrington. 1876. Canoe & Camp Life in British Guiana.
Chap XIII pp 348 – 351. Account of

Brazil nuts

"Upon the borders of the New River & main Corentyne, above the last-mentioned fall, we met with large groves of Brazil-nut trees, & on the ground beneath them obtained numbers of their nuts. I was fortunate enough to find some of the nut-cases containing nuts that had commenced to germinate, each nut sending out long roots from one end & young plants from the other. The roots were all twisted & matted together, in the case around the nuts; the cavities with filling up yet the ~~nut-case~~ nut-case was hard, & showed no signs of decay, & that it is difficult to say how the young plants free themselves. There is a small aperture where the fruit-stalk was once attached, but in only one instance did I find a case in which one of the young plants had found its way out through this & sent forth leaves. It seems to me that – when this happens, one plant alone survives of the twelve or fifteen that commenced to grow, & that its matted roots gradually filling the nut-case eventually burst it, when the plant is free to take root in the earth. The strong cover of the growing nut is a necessary protection to the young plant, for without it such seeds would be devoured by one of the host of animals that are ready to eat it. I planted some of the sprouting nuts, cut out of their covering, on my way up river, but on returning found that they had all been dug up & eaten by rats or other small vermin."

He explains that even terrible monkeys will take in their claws (paws) & break the nut case.

in the development of the Zoological Park and of the serious work of the society, all concerned are to be heartily congratulated on the progress that has been made up to date, and the promise of rapid advance in the near future. A gratifying feature in the year's record was the transference of the New York Aquarium to the management of the society, since, as we are told in the report, this was made spontaneously by the municipality without any suggestion on the part of the governing body. The society has organised the administration of the aquarium on practically the same basis which has been found so effective in the case of the Zoological Park, with a director and council who secure the best expert advice obtainable. As regards the general progress of the park, the report records the completion of a lion house, and the issue of a contract for a building devoted to the exhibition of antelopes. The executive committee states, however, that if the menagerie is to equal the best European institutions of a like nature, even, greater efforts in the way of new buildings must be made in the future.

Judging from the excellent reproductions of photographs with which the report is illustrated, the larger mammals are allotted ample space, and enjoy, whenever practicable, surroundings suitable to their particular requirements. This is well exemplified in the annexed illustration of a group of Barbary wild sheep in the collection.

FIG. 1.—A group of Aoudad, or Barbary wild sheep. (From Report of the New York Zoological Society.)

Perhaps the most important part of the society's work, so far, at any rate, as menagerie administration is concerned, is the establishment of a medical department on what it is hoped may be a permanent basis. In the words of the report, "the object of this service is, by systematic observation and record, and by experimental treatment, to extend our knowledge of the care and health of wild animals in captivity, the causes of various diseases, and the means which should be taken for their prevention. This is both humane and part of an economic administration." The establishment includes a well-known medical pathologist, a trained veterinarian, and an expert in microscopic investigation and the preparation of pathological cultures. To the report before us the last-named official contributes two communications of prime importance in regard to menageries, namely, one on the modes of tubercular infection in wild animals in captivity, and a second on cysticerci in wild ruminants. The work of the department in question is therefore already in full swing, and its investigations will doubtless be found of the highest value to menagerie authorities throughout the world. None of us can fail to be pained at the large percentage of ailing animals to be seen in every menagerie, and all will therefore welcome anything that can be done to render such cases less common in the future.

In addition to the aforesaid special papers and the reports of various officials, the volume before us contains other articles of interest. In one of these, for instance, Mr. R. H. Beck gives a graphic account of hunting for giant tortoises in the Galapagos Islands, illustrated by a photograph of these reptiles coming to a pool to drink, and by a second of the mode in which their empty shells are carried on mule-back to the coast. The psychology of birds forms the subject of a communication by Mr. C. W. Beebe, while Mr. R. L. Ditmars discourses on the method of feeding reptiles in captivity, with especial reference to the somewhat forcible measures adopted in the case of a recalcitrant python.

To those who make the study of mammals a speciality, as well as to big game hunters and sportsmen generally, a paper by the secretary, Mr. M. Grant, on caribou, or reindeer, will be of special interest, not only from the excellent account of the various local forms, but from the numerous illustrations by which their distinctive features are displayed. One of these we herewith reproduce, on account of its being taken from an animal in the wild state. Mr. Grant considers that all the American caribou may be divided into two groups, the large and light antlered barren ground group, and the woodland group, distinguished by the short, heavy, and much-branched antlers. The distribution of the various members of these two groups is illustrated in a coloured map.

R. L.

FIG. 2.—Wild Newfoundland Caribou. (From Report of the New York Zoological Society.)

THE ORIGIN OF SEED-BEARING PLANTS.[1]

WHEN Linnæus, in 1735, brought out his famous sexual system of classification, which for so long dominated systematic botany, twenty-three out of his twenty-four classes were occupied by flowering plants, and one only was left for the flowerless plants or Cryptogamia.

As the name "Cryptogamia" indicated, a thick veil of mystery still hung over the reproductive processes of these flowerless plants. When this obscurity became gradually dissipated, with the aid of improved microscopes, by the brilliant researches of Hedwig, Mirbel, Nägeli, Pringsheim, Cohn, Thuret, and above all Hofmeister, and the "Crypto-

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[1] Discourse delivered at the Royal Institution on Friday, May 15, by Dr. D. H. Scott, F.R.S.

Brit. As. Glasgow 1901

Mr. A. C. Seward, the recorder of the section, contributed two papers, the first entitled "A Chapter of Plant Evolution: Jurassic Floras" and the second "The Structure and Origin of Jet."

In the course of the second paper he said that the hard jet of Whitby appeared to have been used in Britain in pre-Roman days. It was alluded to by Cædmon, and mentioned in 1350 in the records of St. Hilda's Abbey. It was formerly extensively mined in the cliffs of the Yorkshire coast, near Whitby and elsewhere, in Eskdale, Danby Dale, and in several of the dales that intersected the East Yorkshire moorlands. Parkinson in his "Organic Remains of a Former World" (1811) spoke of jet, in some cases, as pure bitumenized vegetable matter, and the majority of writers regarded it as having been found as a product of the alteration of plant tissues. On the other hand, it had been described as the result of the segregation of the bitumen in the intervals of the jet shales, which had sometimes formed pseudomorphs after blocks of wood. He had himself recently examined several sections of Yorkshire jet in the British Museum, which, he believed, demonstrated the origin of this substance from the alteration of coniferous wood and, in part at least, of wood of the araucarian type. Sections cut from specimens which consisted in part of petrified wood and in part of jet showed a gradual passage from well-preserved araucarian wood to pure jet, which afforded little or no evidence of the ligneous origin.

Two other papers were read by Mr. G. P. HUGHES on Government plantings in the Isle of Man, and by Mr. T. BARKER, on spore-formation in yeasts, before the proceedings of the section were closed, two other papers being unavoidably left unread.

EVENING LECTURE.

At St. Andrew's-hall, in the evening, Mr. Francis Darwin gave a discourse on the movements of plants.

He introduced his subject by some general illustrations, instancing especially the streaming movements of protoplasm which were visible only with the microscope, and the easily seen nutation of the scarlet-runner, the circling movements by which, like other twining plants, it sought a support up which to climb. He then attacked the main subject of the lecture—the power possessed by plants of growing along vertical lines, straight up like a pine tree or straight towards the centre of the earth like a tap root. This power depended on the sensitiveness of the plant to the force of gravity, a perceptive power which enabled it to correct its line of growth by appropriate curvatures whenever it deviated from the vertical. Mr. Darwin's contention was that gravity did not act directly but indirectly; he compared it to a sign-post or signal which the plant interpreted as best suited to its needs in the struggle for life. The curvatures of plants in relation to gravity were, in fact, of the same type as the reflex or instinctive actions of animals; and, as in animals so in plants, there were special organs adapted for the perception of the stimulus of gravitation, or light, as the case might be, and other regions for the performance of the appropriate curvatures. This part of the subject was illustrated by Pfeffer's and Czapek's experiments on roots and Mr. Darwin's own researches on *Setaria*, a grass with remarkable sensitiveness both to light and gravitation. The lecture concluded with a discussion of the question whether in plants there were any indications of the qualities known as mental, anything like desire or memory, any faint rudiments, in fact, of consciousness. The lecturer allowed that it would be his wiser course to rest contented with classing plants as vegetable automata, just as Huxley made an automaton of man. Nevertheless, he was inclined to believe with Dr. James Ward that mind was always implicated in life, and that with a fuller knowledge of consciousness we should admit that the rudiments of the psychic element existed even in plants.

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SECTION E.—GEOGRAPHY.

This section met at 11 o'clock on Friday, in the Humanity Theatre, but there was no paper of engrossing importance read during the day, and consequently the attendance fell off somewhat. The first three papers in the morning related to certain geographical features of the home country. Dr. Mill, the president, occupied the chair throughout the day.

MR. G. F. SCOTT ELLIOT opened the proceedings with a paper on the effect of vegetation in the valley and plains of the Clyde. He began with a description of the general characteristics of the valley from what he described as the sub-Alpine portion, passing through the heather and peat into the sheep pastures and arable districts, over the Falls of Clyde, into the valley below, and the flat alluvial plains about Renfrew. An excellent series of lantern slides showed the changes in the valley from the broad ravine to the gentle slope and afterwards to the flat alluvial land, as well as the effect of vegetation in preventing the wearing away of the land and the manner in which the flat lands were formed with the assistance of vegetation. A perfect series of transitions were shown from the vertical cliff or scaur left by the river to the continuous steep slope which was characteristic of the valley sides throughout this neighbourhood, and it was demonstrated that the vegetation controlled this slope formation throughout. The vegetation covering the space at the base of the cliff formed very rapidly, the annual formation of wood and other tissues being very great in this sheltered and moist situation. Falls of stones, rock, earth, and vegetable matter from above accumulated at the base of the scaur, and were at once covered with vegetation. Thus a steep sloping surface was formed, which gradually extended up the side of the cliff until, eventually, the characteristic V shape of the ravine was produced. Mr. Scott Elliot went on to discuss the character of the flatlands, and to show that their formation depended chiefly on the work of certain marsh plants. He also discussed the effect of vegetation on the shingle beds.

MISS MARION NEWBIGIN followed with a description of the Scottish Natural History Society's scheme for the investigation of the Forth valley. She said that the society proposed (1) to arrange, in a readily available form, references to papers already published on the natural history of the Forth valley, including its botany, zoology, and geology; (2) to utilize its various sections and the labours of its individual members in the acquisition of a mass of detail in regard to the existing organic conditions in the valley of the Forth, with the primary object of providing a basis of fact upon which conclusions may be later established, although the opportunities of the work as a means of training observers would not be lost sight of. It was hoped that the work might be carried out in such a way that the conditions of existence of the most important organisms within the area might be readily ascertained by reference to the society's records.

PROFESSOR W. G. SMITH dealt with the botanical survey of Scotland. He said that until recently it was practically admitted that the distribution of plants was so general that it could only be represented in small scale maps over large areas of country. In the botanic survey of Scotland the 1-inch maps of the Ordnance Survey had been used for the full work, but for smaller areas it was advisable to use the 6-inch maps. The present attempt was the work of the late Robert Smith of University College, Dundee, and was the outcome of recent progress in cartography and also in botany. The vegetation of the country was divided into associations and these associations were recorded on maps. A plant association was a group of plants, and each association had a dominant species after which it was named. There were also the sub-dominant species and the dependent species in each association, the latter including plants which grew upon the carpet and were dependent on the dominant and sub-dominant species for shade or moisture or on the leaf mould formed by the fall of their foliage. After carefully examining the area to be surveyed it was necessary to fix on certain associations, though if a large survey was to be made only the chief associations could be recorded. If, however, only a small area, such, for instance, as a river basin, a larger number could be recorded. In choosing a series of associations it was necessary to choose enough to account for the whole of the vegetation. Three features were already well recorded in the maps of the Ordnance Survey, namely, land in cultivation, moorland, and woodlands. Professor Smith proceeded to say that tests of association of plants had been made for a number of years, the first being made in Northern Perthshire and the neighbourhood of Edinburgh. Surveys had also been made from the North Sea into about Loch Lomond and from a little south of the Dee down to Dumfriesshire. An area of Yorkshire, extending over about 1,700 square miles, and a portion of Somerset, had also been surveyed. Another survey went from Lochnagar on Dee Side to the North Sea, a distance of 40 miles. On the sea-level was the maritime or littoral association. Then came the cultivated land, which was rather difficult to deal with being too much under the influence of man. It was divided into two classes, a better class on which wheat was grown, and the poorer class where wheat did not enter into the rotation. The vegetation on the arable land was marked, and the woodlands were also recorded—oak, pine, and on Scotch maps larch. The heather moorlands were recorded by a different colour and the grasses again by another. above the 2,000ft. line the heather gave out and the blaeberry association became dominant. Above the 3,000ft. line was the Alpine plateau, on which it was difficult to say what was the dominant species.

DR. HERBERTSON moved a vote of thanks to the readers of the three papers, and in the course of a short discussion which followed,

MAJOR CRAIGIE, of the Board of Agriculture, said he had come specially to hear Mr. Smith's paper as he was very much interested in it. If such a survey was put on a definite basis, the Board of Agriculture were willing to assist in the way of giving details.

The PRESIDENT pointed out that by the study of plants which resisted erosion and the movement of sand dunes the Emperor Napoleon hit upon the idea of binding together a part of the coast of France with the result that had had enormous practical value. Some years ago, too, a British general, when visiting a newly-erected fortress on the coast, asked the officer in command why the mound was so bare. He was told that grass had been tried upon it but would not grow. He replied, "Sow no more grass, but go along the coast and find out what plants are growing there naturally. Get them and plant them."

Brit Ass 1901

SECTION K.—BOTANY.

The Botanical Section met in the Botany Lecture Theatre to hear the address of the president, Professor I. Bayley Balfour, who chose for his subject the group of Angiosperms.

In the course of his remarks he said that no fact of the construction of the plant body that had been established within recent years was of greater importance than that of the continuity of protoplasm in pluricellular plants. As has been the case with so many epoch-making discoveries, we owed our first knowledge of this to the work of a British botanist. The demonstration by Gardiner of the existence of intercellular protoplasmic connexions was the foundation of our modern notion of the constitution of the pluricellular plant-body and of the far-reaching conception of the communal organization of Angiosperms and of all other Metaphyta. It had settled, once and for all, phytomeric hypotheses. We now realized that in an Angiosperm the living plurinucleated protoplasm was spread over a skeletal support furnished by the cell-chambers of shoot and root. The energid of each living cell was connected with the adjacent energids by the protoplasmic threads piercing the separating cell-membrane. The protoplasm thus formed a continuous whole in the plant. According to their position in the organism the energids became devoted to the formation of special tissues for the building up of the various organs. Each one of them, however, whilst its actual destiny was ultimately determined by its relationships to the others, was, so long as its fate as a permanent element was not fixed, a potential protophyte, having within it all the capacities of the plant-organism to which it belonged. Their construction out of this assemblage of protophytes—this colonial, or perhaps better communal, organization—gave to Angiosperms their power of discarding effete and old parts of the plant-body without mutilation, of allowing these to pass out of the region of active life yet to remain without damage to the organism as part of the body, of renewing and replacing members as required. The response of the plant to the various horticultural operations of pruning, propagation by cuttings, and so forth was an outcome of this constitution. Another outcome of this organization of the Angiosperm was its power of extension and its longevity. It was potentially immortal. It was this feature of the life of Angiosperms which marked them out sharply in contrast with the higher members of the animal kingdom. The root-difference between plants and animals was one of nutrition. Plants are autotrophic, animals heterotrophic. Whatever had been the origin of the two kingdoms, we must trace the differentiation of plants to their acquisition of chlorophyll as a medium for the absorption of the energy of the sun. The vegetative mechanism of the plant had been elaborated upon lines enabling it to obtain the materials of its food from gases and liquids which it absorbed from its environment. For the plant the primary requisite had been a sufficient surface of exposure in the medium whence it could obtain energy along with the gases and liquids of its food. To this end the fixed habit was an obvious advantage, for the question of bulk within the limits of nutrition became thereby not a matter of moment; and an upward and a downward extension gave opportunity for the creation of a larger expanse of absorptive surface. The nutritive mechanism of animals, on the other hand, had become one for the ingestion of solids obtained by preying upon the bodies of plants and other animals. The exigencies of its feeding had compelled the adoption by the animal of the habit of locomotion, the development of an apparatus for the capture of its prey, and of an alimentary canal for its introduction to the body, for its digestion, and for the final ejection of the unused matter along with the waste of the body.

ORIGIN AND DOMINANCE OF THE ANGIOSPERMOUS TYPE.

It was now usually admitted that all plants, like all animals, had been derived from aquatic ancestors, and that the trend of evolution had been in the direction of the establishment of a vegetation adapted to a life on land. Of this evolution the Angiosperms as we saw them to-day were the highest expression. Could we say anything about the origin of the angiospermous type? As the problem presented itself to him we could only mark time at present. From the geological record we obtained no help. The appeal to ontogeny likewise gave little information. But we were on surer ground when we endeavoured to fix upon characters which had enabled the group to become established as the dominant vegetation of our epoch. Hordes of distinct forms and whole classes have disappeared, giving place to plants of the angiospermous type. In considering this point we must bear in mind the well-known climatic differences—particularly in the distribution of water—that distinguished our epoch from those in which these extinct plants throve. The factors which determined the success or otherwise of an organism or group of organisms at any period must always be complex, and no exception can be claimed for plants in their struggle for mastery. But looking at the succession of plant-life in the world in relation to the known diminution of water-surface and increase of land-area, and the consequent differentiation of climates, we could not but be convinced that of these factors water was one which had had supreme influence upon the evolution of the facies of the plant-life that we saw to-day. He thought the statement was warranted that the Angiosperms had become dominant in great measure because in their construction the problem of the plant's relationship to water on a land-area had been solved more satisfactorily than in the case of the groups that preceded them. Two prominent risks in its relation to water attached to the process of sexual reproduction in a plant of the type of heterosporous Pteridophytes :—(1) That of failure of moisture on the soil sufficient to promote germination of the spores ; and (2) that of failure of moisture on the soil sufficient for the passage of the spermatozoid to the ovum. In addition there was the risk of failure of the fall of microspores and megaspores together upon the soil. In the Angiosperms such risks were practically abolished in the formation of flower. The stigmatic surface of the style itself provided a secretion—the more copious in a dry and sunny atmosphere—to moisten the pollen-grain and stimulate germination, and for the spontaneous movement of the spermatozoid was substituted the passive carriage of the male gamete to the ovum by the agency of the pollen-tube. Possible failure of pollination was too provided against by the complex mechanism of the flower in the highest forms in relation to insect visits. But if this flower mechanism relieved the Angiosperm from these risks in the performance of the sexual act, it imposed a new duty upon the plant, that of nursing the embryo within the sporangium. This involved a water-supply of a kind not demanded in the Pteridophytes, and we might gain some idea of the importance of this by a comparison of the trivial vascular system required to supply through the stamen the pollen grain, with the copious system that traverses the gynæceum for the ovules. It is, however, to the ovule—the immediate nursery of the embryo—that we must look for special indications of this water relationship.

CLASSES OF ANGIOSPERMS.

There had been for long a general recognition of two classes amongst the Angiosperms—Dicotyledones and Monocotyledones. Recently, however, we had seen an attempt made by Van Tieghem to establish another class—that of Liorhizal Dicotyledones—for which was claimed a rank equal to that of the Dicotyledones and Monocotyledones. Were this valid it would be a matter of supreme importance, for whatever be the relationship between Dicotyledones and Monocotyledones there could be no doubt of their having developed as distinct groups within the whole period of which we had knowledge of them, and the existence of a third class intermediate or outside of them might lead to interesting conclusions. But it appeared to him that this third class of Angiosperms had no sound foundation, no more, perhaps less, than Dictyogens and Rhizogens which appeared as parallel groups with Endogens and Exogens in Lindley's old classification. Our present knowledge allowed the recognition of only two classes of the angiospermous type—the Dicotyledones and the Monocotyledones. The relationship of these two groups was involved in the origin of the angiospermous type. They might have had a common origin or might have arisen separately ; and if the former the Dicotyledones might have been a subsequent offshoot from the Monocotyledones, or the reverse might have been the case. Were he to maintain an opinion it would be that the two classes had arisen on separate lines of descent. The embryo-characters, as well as those of the epicotyl, could, he thought, be shown to be fundamentally different and to afford no basis for an assumed phyletic connexion. As to the groups within the Dicotyledones and Monocotyledones, whilst there was a wonderful concurrence in the opinion of botanists as to the natural groups—real phyla, whether termed cohorts, alliances, or series—into which many of the families of both Dicotyledones and Monocotyledones fell, there was irreconcilable divergence of view as to their genetic sequence or sequences. This was not surprising when we remembered that we knew nothing of the starting point or points of the classes themselves, and had, moreover, no critical mark by which to diagnose a primitive from a reduced feature in many of the flower constructions to which, as characteristic of Angiosperms, importance was attached. The desire to establish a monophyletic sequence of these phyla was natural, but all such attempts appeared to him, in the present state of our knowledge, to be in vain. We saw in the phyla, as we knew them, sequent offshoot from the Monocotyledones, or the reverse might have been the case. Were he to maintain an opinion it would be that the two classes had arisen on separate lines of descent. The embryo-characters, as well as those of the epicotyl, could, he thought, be shown to be fundamentally different and to afford no basis for an assumed phyletic connexion. As to the groups within the Dicotyledones and Monocotyledones, whilst there was a wonderful concurrence in the opinion of botanists as to the natural groups—real phyla, whether termed cohorts, alliances, or series—into which many of the families of both Dicotyledones and Monocotyledones fell, there was irreconcilable divergence of view as to their genetic sequence or sequences. This was not surprising when we remembered that we knew nothing of the starting point or points of the classes themselves, and had, moreover, no critical mark by which to diagnose a primitive from a reduced feature in many of the flower constructions to which, as characteristic of Angiosperms, importance was attached. The desire to establish a monophyletic sequence of these phyla was natural, but all such attempts appeared to him, in the present state of our knowledge, to be in vain. We saw in the phyla, as we knew them, culminating series in our epoch in lines of descent; some, for instance Myrtales or Lamiales, progressive; others, like Primulales or Pandales, apparently not so. We also recognized that these series grouped themselves in many cases as branches of broader lines of descent; for example, in the Bicarpellatæ of Gamopetalæ, in the Helobieæ of Monocotyledones. To a greater or less degree such relationships were traceable now, and as we obtained more knowledge of the angiospermous plant-life of the world they would be widened. But this was a different thing from the carrying back the pedigree of every phylum of dicotylous and monocotylous plants to one or other of the existing ones, which might possess what were taken to be elementary characters. We had, so far as he knew, no evidence to sanction the belief, or even the expectation, that there was extant any family of Dicotyledones or Monocotyledones which represented, even approximately, a primitive type in either class. The stem in each had gone. We had the twigs upon a few broken branches. Amongst the phyla we could not discern any one type that could be described as the dominant one. The multifarious adaptability of the angiospermous type had given us diverse forms, suited, as far as we could discern, no less well to the various environments of our epoch. Yet we were able to differentiate certain of them which took precedence alike in point of number of species and in area of distribution. If we sought for some general character that marked these advanced groups we found it in the tendency to greater investiture of the ovule, both in Dicotyledones and Monocotyledones. This was brought about in different ways. That this feature must give greater security to the embryo in relation to its water-supply was obvious, although it had evidently also direct connexion with seed-dispersal. Another general character observed in these higher groups was the greater security for economical pollination afforded by the adaptations in relation to insect-visits. At the same time the case of the Gramineæ showed that other adaptations in this respect were not incompatible with prominence. He would not dwell upon the influence of water upon the vegetative organs in Dicotyledones and Monocotyledones. Of all the factors of environment its effects were best known because most easily seen. The examination of plants from the standpoint of their relation to water—bearing in mind that this was physiological, and not merely physical—had already thrown a flood of light upon their forms and upon their distribution, and offered a fertile field of investigation for the future.

Students Handbook of British Mosses
Dixon & Jameson
Wheldon 58 Gt. Queen St.
1896
Price 18/6

The same figures as Jamesons book.
Looks very good.

Aug. 11

Dear Miss Robertson

I have taken some time in answering your letter because I wanted to look at one of the books you mention, & to think whether I had other suggestions to make, but your list is so long already that I doubt whether I shall assist by adding to it. Perhaps I might note down a few that occurred to me (in addition to yours) & then make a few remarks on the whole – the selection however depends so much on whether you have any preference for a particular line;

Wilson The Cell. latest edition 1901
Campbell Mosses & Ferns 1895 5/6
Warming Lehrbuch der Ökologischen Pflanzengeographie 1896

Schimper Indo Malayische Strandflora 1891
De Bary Fungi
Von Tavel. Vergleichende Morphologie der Pilze

Tubeuf Pflanzenkrankheiten (There is an English translation)

Thanks for remarks.

I am ~~not~~ hardly in a position to give an opinion about the two Fossil Botany books, but I should expect them to be good, & that you will want to know what is in them, but are they not Elementary Textbooks -- will you not be familiar with the one or other? but

the same time it is time that one constantly wants to refer to textbooks

Schimper's Pflanzengeographie I have been looking through since I got your letter. I think it seems very good & most interesting & I should feel inclined to put it at the head of the list; especially as geographical distribution is difficult to get except piecemeal, & a good general book [illegible] a very useful. In that case I should cut out Warming which is something on the same lines, & the 'Strandflora' which no doubt is summarised in the 'Geographie'. Campbell is good & ~~can be~~ could (probably can) be got very cheaply for 5/- or 5/6 though published at 12/- or 14/-. It ~~details~~ deals in detail with anatomy & development & discusses the relationship of phylogeny of the different groups

De Bary is classic, & perhaps one ought to possess it.

Haberlandt I should get if you want to specialise in detailed histology.

Pfeffer's Physiology is tiresome in that it is so long drawn out, & I do not like it — but confessedly there is no other Physiology. Vol 2 is just out in the German but I have not really looked at it yet. Vol 1 is of course already translated.

Schenk? I should not advise; it seems to me it would take a large share of the Grant & on many of the sections more recent work has been done.

A book on Seaweeds is difficult — Harvey costs £3.10.0 & mere keys for identification without illustrations or general principles are somewhat dull & that I think is what the smaller books mostly are.

Marshall Ward's Grasses is I believe good, & enables one to identify by

vegetative & morphological characters which is useful. [Have you by the way seen his 'Conditions of Disease' also out this year?]

Have you any books on Fungi? De Bary's Fungi is almost as necessary for reference as the Comparative Anatomy. Von Tavel is good & his classificatory tree gives the more modern views with regard to the Basidiomycetes Æcidiomycetes & Ascomycetes, & I think is well worth having.

Tubeuf is a good textbook of genera & species causing disease but is merely classificatory with a short paragraph to each genus giving the structure & life history. Wilson I daresay is your daily companion already.

I hope these somewhat disconnected remarks may be of use, but as I said earlier, the choice depends so much on your preference for any special line. The only book which I personally think is perhaps not worth so large a share of the sum to be expended is Schenk.

I am sorry to learn that your visit to Scotland has been postponed through Mrs Robertson's illness. I hope that she will soon be better & that you will have an enjoyable time before next term.

Yours very sincerely
Edith R. Saunders

Schimper's Pflanzengeographie 30/-

De Bary's Comp. Anat.	16/-
~~Scott's Studies. Struct Bot~~	~~7/6~~
Geikie's Scenery of Scot	10/6
Haberlandt's Phys. Pflanzenan	18/-
V. Tavel's Vergleichende Morphologie der Pilze	7/6
De Bary Fungi Myc. Bac	18/-
	109/~~8~~6

Ap. 17. 02.

Dear Miss Robertson,

I only know that "museum cases & cabinets" are rather expensive things & that £10 wont go very far.

At U.C.L. our own carpenter makes everything, so I have never had to purchase.

In Miss Aitken's position I think I sh'd. go to Stevens's sale rooms & ask the people there if they had anything

at the Nat Hist Mus. they recommend
Sage
Grays Inn Rd
for inexpensive new cabinets
& Stevens
Auction Rooms.
King St –
Covent Garden
for 2nd hand

If I can't at
the London Means
for 1 std. have
been glad to
have really
helped, as
Miss Aitken
deserves well
of us all.

likely or at any rate get from them ~~the~~ information as to the whereabouts of dealers with this class of goods (second hand).

The Town Clerk of Manchester was here when your letter arrived - He says it is quite right to get these things over here.

I have heard that occasionally at the British

Museum (Bloomsbury) they have old cases stored in the cellars wh. they part with for a consideration. But all I know abt. that is that serviceable cabinets, &c. have been obtained cheap — odd ones being weeded out I suppose.

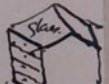
As the lady who is writing to you lives near Manchester she cd. run over to Liverpool & see the new Botanical department wh. is fitted

at the Nat.
Hist. Mus.
they recommend
Sage
Grays Inn Rd
for new cases
new cabinets
& Stevens
Auction Rooms
King St
Covent Garden
for 2d hand

in a modern way throughout.

Prof. Harvey Gibson wd. give her informatn willingly & Miss Aitken's name wd. be sufficient introductn. Or if Manchester is more convenient Prof. Weiss (at Owens) who is my former assistant wd. do the same.

But the fittings of the Manchester museum are rather ~~t~~ magnificent & would make a £10 note look foolish! I suppose what they want is a wall cupboard with glazed doors & movable shelves, & a penthouse shaped thing like this with drawers below



The perspective ought I suppose to run the other way

Yrs. sincerely
F. W. Oliver.

a herbarium case, &c. shd. be kicked up if knocking about. They will want to collect the week, Hon

at the Nat Hist Mus. they recommend
Sage
Grays Inn Rd
for inexpensive new cabinets
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Covent Garden
for 2nd hand

Photograph of Bird's nest
fungus W. Hastings
nov: 1903

MAKING FIVE-LEAF CLOVER.

A PROFESSOR'S EXPERIMENTS.

According to a writer in "The Holborn" an extra leaf or so to a clover does not seem at the first an episode of great sensational moment. We can find four-leaved clover if we look for them. Still, they are rare, for they are monstrosities. So, when it comes to putting on another leaf as a regular thing, and growing clover till the ordinary three-leaf is the exception, that is an achievement seemingly magical. Yet it counts only as an instance among many wrought by a certain eminent Dutch naturalist, Hugo de Vries, Professor of Botany in the University of Amsterdam.

The manner in which Professor de Vries developed his four-leafed variety of clover, illustrates his system of experimenting. Near Amsterdam, in 1886, Professor de Vries found a plant bearing six or seven four-leaved clovers. This he set out anew in his garden, where it did not bear seeds till 1889. These he sowed, and since then he has had a new generation each year. Each time he chose his seeds from one-fourth of the best plants; that is from those which had the most four and five-leaved clovers. It was the third generation, however, in 1891, that began to be rich in the desired forms of leaves, but only with four and five leaflets, and these only in the adult plants. Still, during August and September of the same year, he remarked a very few with seven leaflets. At this point he reduced his selection (or choosing his seeds from the best specimens) to a severe standard. That is, he chose for progenitors only those plants which had two-thirds of all its leaves with four or more leaflets.

Meantime, he had discovered a curious fact, which much simplified his selecting from then on. In sowing clover you may observe that the first leaf of each young plant has but one leaflet, and that the second and subsequent leaves have regularly three leaflets. But in his variety some of the young plants made the very first leaf compound; that is, with two or three leaflets. This knowledge enabled him to make his selections much more quickly. He had only to choose the young clovers with compound leaves, and transplant them from his glasshouse into his garden, leaving the others to perish. Thus he did not need so many hundreds of individuals as before, though each year he still selected some thousands of seedlings from their sowing pots. In 1894 the new variety of clover had come into existence. Of this crop, nearly all the young plants had their first leaf compound, and all of them, with few exceptions, were five-leaved. In among the five-leaved there were some with four and three, and others with six or seven leaflets. He saw none, however, with more than seven. Each year he can pick four-leaved clovers at will for mementoes, and, as he says, they have brought him good luck. The five-leaved clovers, however, are now the normal product. He has given its seeds for practical experimenting purposes to a professor of the Minnesota Agricultural College, but as to the results, he has not yet heard. Providing that a rich soil and good culture be maintained, he holds that his five-leaved clover will keep constant, that is, it will not go back to the three-leaved. Such being the case, the cultivation of this new variety should have a high value over the ordinary clover, not only as "cow grass," but as a more energetic enricher of the soil.

SYMONS'S

METEOROLOGICAL MAGAZINE.

No. CCCCXXIII.] APRIL, 1901. Vol. XXXVI.

THE BLOOD-RAIN PLANT AT CAMDEN SQUARE.

By a curious coincidence, while the red rains of African dust are exciting attention and alarm in the south of Italy, the head quarters of the British Rainfall Organization have been invaded by the microscopic water-plant which was responsible for many of the "rains of blood" recorded in history. Speaking accurately, the coincidence is less curious than it appears, for it was the report of the occurrence of red rain in Italy that led us to look more critically into the phenomenon at Camden Square, which had been noticed before, although not investigated. It has nothing in common with the red sand-rains of the Continent except the colour.

About the beginning of March the water in the large evaporation-tank (6 feet square and 2 feet deep) assumed a chocolate colour, which might have been due to the accumulation of ordinary London dust, and attracted little attention; but when the last ice disappeared from the surface, and the long spell of cloudy weather gave place to sunshine, the red colour of the water was intensified to a rich deep crimson, offering a most effective contrast to the green of the surrounding grass. On stirring the water the presence of clouds of a deep red floating substance became apparent, and a glass dipped into the thickest part of one of these clouds and held up to the light was seen to be full of minute bright red points just visible to the eye. Believing that these were due to some sort of living organism, we reported the matter to the Botanical Department of the British Museum, and on April 3rd Mr. V. H. Blackman kindly visited Camden Square and took away specimens of the water. On subjecting them to microscopical examination, he at once found that the red colour was due to the presence of swarms of a minute moving water-plant—in technical language a motile alga—now called *Sphaerella pluvialis*, but formerly known as *Haematococcus pluvialis*, literally "the blood-plant of rain." It is closely allied to the better known *Sphaerella nivalis*, the microscopic plant which gives its colour to red snow. This organism is usually found in small pools, where it makes its home; its occurrence in rain is a

ONE PENNY.

GOOSEBERRIES AND BIRDS.

How many of the multitudes of people who enjoy fruit ever give a thought to the question how we come to have grapes or gooseberries? Yet it seems an obvious question, and it certainly is a very interesting inquiry. Our fruits—our apples, pears, peaches, &c.—are the consequence of a long line of developments, some of which have been made by human art in comparatively recent time, some of which were made through ages before man had anything to do with the business. Fruits begin in the care which plants take for the dispersal of their seeds. In the hurly burly of the struggle for existence, it is not enough that plants should produce and mature seeds and let them fall. Seeds left to such a fate would be overshadowed by the parent plant, and would drop on soil already impoverished. If the future plants are to come to prosperity, they must have a better chance than that. In fact, a plant has to do for its progeny what a human parent must do for his offspring—place them out in the world as advantageously as possible. The schemes and devices employed by plants for this purpose are numerous and ingenious. The sycamore furnishes its seeds with wings wherewith it may be carried by the wind until it finds a suitable spot in which to anchor and root itself. The gorse discharges its seeds as by a catapult, so that on a hot summer day there is a continuous popping like that of miniature artillery among the gorse bushes. Some plants provide their seeds with hooks which catch the wool of sheep and are carried away adhering to the animal's fleece. Some equip their seeds with a substitute for pick and shovel, that they may dig a hole for themselves in the ground.

Other plants, like the gooseberry, arranged to secure the assistance of birds. Evidently, if a bird can be induced to take up a few seeds, and to retain them for a short time, there is a strong probability that the seeds will be deposited in some distant, and possibly suitable place. How is that desirable end to be gained? By enveloping the seeds in a substance which may please the bird palate, and giving the seeds a coat strong enough to resist the bird's digestive power. In that way the seeds may pass through the alimentary canal uninjured, and may be placed in material favourable to their germination and growth. That is the genesis of the wild gooseberry. The plant has solved a problem of no small difficulty, and solved it most cleverly. The bird does not know that it is being utilised, but only that it has found a juicy and tasty morsel. In bird philosophy it may be an axiom that berry-producing trees and shrubs have as their final cause the pleasant satisfaction of the hunger of birds, but the plant knows better, and might be imagined to chuckle over the conclusions of bird philosophers. Plants have laid themselves out to gratify the taste of birds; they have spared no pains to offer attractively coloured and agreeably flavoured wares for bird consumption, but they have done so for their own purpose—the dispersion of their seeds. The result has been satisfactory to both parties, and so continued for an indefinite period, until a new comer interfered.

Long ago, some one of the human species, who had often enjoyed the sweet and cooling berries of the wild gooseberry, took into his head (if it was not a woman) that there would be a saving of time and trouble if he dug up the bush and planted it near his home. The plant had no objection to removal probably, but the birds, its previous frequenters and friends, would not approve the change, because the man threw stones at them when they visited the bush to feed on the ripening fruit. That is, in brief, the history of fruit culture by men, a history of interference and annexation by force. To-day, we net the fruit trees against birds; we invent horrible things to scare them away; we shoot them; we use strong language when the robins devour red currants, or the blackbirds strip the cherry trees, but we are the real robbers. We have appropriated what was grown for the birds. Our right to the fruit is little more than right of seizure. It is a little more in most cases, because we have improved pose—the dispersion of their seeds. The result has been satisfactory to both parties, and so continued for an indefinite period, until a new comer interfered.

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It has probably occurred to the reader that when the gooseberry prepared a pleasant fruit for the birds it was putting temptation in the way of other animals, small mammals like mice, for instance, and the greedy hordes of slugs and snails. These creatures enjoy sweet and juicy things as much, if not more than do the birds. And, since such consumers are altogether unproductive and unprofitable from the plant's point of view, it became necessary to circumvent them in some way. Here again the devices adopted in the world of plants are many. Near relations of the gooseberry, the black and red currants hang their fruit on a long and slender stalk, which affords no foothold for a mouse, and scarcely for a snail. The gooseberry, as everyone who has gathered its berries knows quite well, has gone in for protection in the shape of stout and strong prickles, so cunningly placed that it is not easy for the human hand to avoid them in plucking the fruit.

one
the possible confusion about the ceremony, among those who did not know the facts." Daily News 22.6.03

It is magnificent news, if true, and at all events a hopeful rumour if not strictly accurate, that a new rubber-bearing plant has been discovered. "Country Life" seems inclined to credit the rumour; and it points out that all through life, from the days of infancy and the bottle, through the catapult-shooting time of boyhood, up to the mature years of bicycle and motor riding, and of sending cablegrams, we are confessing practically our indebtedness to india-rubber in some form or other. But whilst the demand grew the supply of rubber threatened extinction. It is the old tale—that something new alway comes out of Africa. It is from West Africa thi time. The new plant, or the plant whose rubber giving qualities have been newly found, is th Landolphia thralloni, growing in the Frenc Congo, Lower Congo, Lower Guinea, and Norther Nigeria.

Unlike other plants that give us rubber, this has its rubber in its roots, like potatoes. Since all the world now plays golf with the india-rubber-filled ball, the find becomes the more important. Our contemporary suggests that with care we might cultivate it to grow tubers of Haskell balls ready made—a great convenience; and since it is said to thrive in sandy places, we might plant our golf links with them and pull them as required. The prospect is alluring.

Mr. Eduardo Higginson, the Peruvian Consul at Southam

Westminster Gazette 30:6:03

"Job's Tears."

An interesting experiment, which bids fair to develop into a remunerative industry, is being carried on in various districts of South Kerry in the hope of acclimatising to Irish soil the plant, so common in France, the berries of which are used for rosary beads. These berries are commonly known as "Job's Tears," and are imported into Ireland in large quantities. Mr. John Boland, the member for South Kerry, is interesting himself in this new cottage industry, which, if successful, will do away with the necessity of importing an article for which there is always a large and constant demand.

GEOGRAPHY.

THE DISTRIBUTION OF PLANT FORMS.

The Geographical Section meeting in the Temperance Institute, under the presidency of Captain Creak, was really concerned with botanical subjects at the morning sitting.

Dr. Otto V. Darbishire read a paper on the relation and importance of botany to geographical science. Plants, he showed, played a very important part in the composition of the scenery of our earth, and botany and geography met on common ground in three branches of botany, viz., the geographical distribution of plant species, the geographical distribution of plant forms, or ecology, and the influence of the plant world on the earth's surface. A knowledge of ecology should be considered a most necessary part of the scientific equipment of any professional traveller.

Dr. W. G. Smith, going on much the same lines, read a paper on the observation of features of vegetation in geographical exploration.

Dr. Smith afterwards read a paper by Mr. F. J. Lewis, F.L.S., University College, Liverpool, on a botanical survey of the basins of the rivers Eden, Tees, Tyne, and Wear.

THE PENNINE MOORS.

Mr. C. E. Moss, B.Sc., Manchester, read a paper on the peat moors of the Southern Pennines, their age and origin. His conclusions as to these peat moors were that they were post glacial; that they were certainly of a later date than the Britons; that they were certainly of an earlier date than the Saxon and Danish period; and that they probably date from the Roman conquest, probably originating in morasses formed as a result of the sudden destruction of a primitive Pennine forest. In his opinion the peat moors of the Pennines could not be more than 2,000 years old. At the present time the Pennine peat moors represented a most valuable asset, which was turned to little or no account. Grouse were driven and shot over them it was true, and of late years town and city corporations had utilised them as gathering grounds for reservoirs, but that the most was made of them no one could truthfully affirm. There was not a single peat factory, to his knowledge, on any part of the Pennine chain. Certainly there was no such factory on the Southern Pennines. Formerly the farm labourers on the moor edges possessed turf cutting rights, but those seemed in nearly all cases to have been lost. Putting aside the enormous value of products manufactured from peat, there was fuel enough on the Pennine peat moors to last the whole hillside population a thousand years. Again, the whole of the grassy edges of the moors were fit, with the smallest possible amount of preparation, to be at once reafforested, and as the peat was cleared from the higher altitudes, as to some extent it would be in the near future, the surface thus laid bare might be reafforested also. In these days, when a timber famine was approaching, which would be seriously felt in less than half a century by the whole civilised world, the question of the afforestation of waste lands was one that would engage the attention of practical men, and succeeding generations would undoubtedly see, what the Britons and the Romans in their times saw, the Pennine Hills clothed with trees.

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STUDY OF BOTANY.

SYSTEMATIC TEACHING IN SCHOOLS.

In this section Professor A. C. Seward, F.R.S., Fellow and Tutor of Emmanuel College, presided, and delivered his Presidential address.

Dealing first with the "Floras of the past: their composition and distribution," he remarked that in endeavouring to take a comprehensive survey of the records of plant life they should aim at a wider view of the limits of species, and look for evidence of close relationship rather than for slight differences, which might justify the adoption of a distinctive name. Their object, in short, was not only to reduce to a common language the diverse designations founded on personal idiosyncracies, but to group closely allied forms under one central type. They must boldly class together plants that they believed to be nearly allied, and resist the undue influence of consideration based on supposed specific distinctions. They must decide upon the most convenient means of expressing the facts of geographical distribution in a concise form. The recognised botanical regions of the world did not serve their purpose; they were not concerned with the present position of mountain chains or wide-stretching plains that constituted natural boundaries between one existing flora and another, but simply with the relative geographical position of localities from which records of ancient floras had been obtained. With regard to pre-Devonian floras, the scanty records from pre-Devonian rocks afforded but little information as to the nature of the vegetation that existed during the period in which were deposited the Cambrian, Ordovician, and Silurian strata that now formed the greater portion of the Welsh and Cumberland hills. Dealing with Devonian and lower carboniferous floras, he said the earliest plants that had been found in sufficient number and in a state of preservation, were those of Devonian rocks. From Bear Island, within the Arctic Circle, the late Professor Heer described several Devonian plants. The Devonian and lower carboniferous plants led them away from the present along converging lines of evolution to a remote stage in the history of life; they brought them face to face with proofs of common origins. From the lower carboniferous formation they passed on to the wealth of material afforded by the upper carboniferous and Permian rocks. He urged the importance of taking stock of their accumulated facts, and of so recording their observations that they might be safely laid under contribution as aids to broad generalisations.

The report of the committee on the teaching of botany in schools was submitted by Professor Wager. The committee pointed out that the teacher should have a relative importance of facts, and not spend too much time on topics which demanded much mental effort, and which were of relatively little importance—such topics as getting off by heart the names of the different shapes of leaves, or the characteristics of the orders of British flora. Then the pupil must work for himself. The lecture as a mode of instruction in schools was, the committee thought, absolutely bad. Book work should take as small a part as possible in the instruction in botany—they should rather pay attention to the inculcation of personal inquiry on the part of the pupils. The committee had a feeling that it was the method of attacking scientific problems that was wanted, and not merely information about botanical facts. As the pupil became older the committee suggested that plant physiology was one of the most important means by which the methods of botanical science could be inculcated, including the study of seedlings, elementary nutrition of plants, &c. Reference was made to the usefulness of school gardens, excursions into the country, in the instruction of botanical science, &c.

During the discussion several suggestions were made as to the teaching of systematic botany to children, one of the difficulties being the size of the class.

Reports were presented of other committees, and papers on "Fungi" were read by Mr. B. T. P. Barker, Mr. E. S. Salmon, and Professor T. Johnson. At the afternoon session Ecological papers were read by Professors Letts and J. S. Totton, Miss M. C. Stopes (with lantern illustrations), and Mr. A. W. Hill (with lantern illustrations).

BOTANICAL DISCOVERIES.

The morning session in this section was devoted to "Heredity," three valuable papers being read on this subject. The first paper read was by Mr. W. Bateson, F.R.S., on "New discoveries in heredity."

Mr. Bateson explained that they proposed to deal with the aims, the methods, and results that had been achieved by the study of heredity by experimental science. Only a very few years ago the subject of heredity was practically in confusion. The only guide they had as to whether an organism would reproduce itself truly was the previous history of the organism and some knowledge of the ancestry from which it was descended. Such a criterion as that was, however, extremely difficult to apply and uncertain in its application, but owing to the work that had been done lately, and especially to the discovery of Mendel, that period of confusion was passing away, and the results that had been already obtained showed beyond question that they were now beginning to have methods which would enable them to obtain a proper study of heredity and make the problems of heredity solvable problems. In the matter of the art of the breeder a knowledge of heredity was his stock-in-trade. Apart from the economical aspects, there was another aspect, which must be a personal one. They were all of them limited in their operations by the laws of heredity. To everyone it was a personal question—what had he got from his forbears? how much was he likely to imitate the qualities of his parents? The means they had of solving this problem were based on the discovery that Mendel made. That discovery was, in the cases of the crossing of bees, that each germ cell would carry, not whole characters of the parent that produced it, but some of them. The first problem was—What were the laws that governed the segregation of characters? The second was—What would happen when these different types met each other in fertilisation? Mr. Bateson then displayed on the limelight screen slides showing peas, maize, poultry, wheat, sweet peas, &c., and which, he explained, went to show the formation of pure types as the result of breeding crossbred organisms together. It often happened, he added, that hybrids produced, instead of two parental types, a whole series of types, and that each had a different behaviour in heredity. These were for the most part forms with which the practical breeder was concerned, and by knowledge of their properties he would be able to fix such types as he needed with certainty.

Miss Edith Saunders spoke on the results of some cross-breeding experiments with plants. The results, she explained, were in many cases in perfect accordance with the Mendelian theory, and those which at first sight appeared not to be so were on examination found to be reconcilable with the theory. Miss Saunders exhibited diagrams dealing with the stock and the salvia.

Mr. Charles H. Hurst, F.L.S., treated with "Recent experiments in the hybridisation of orchids." Speaking first of the recent progress in orchid hybridisation, he said the first hybrid was raised in 1856, and there were 1,300 distinct crosses in 1903. The majority of hybrids were fertile. Orchid hybrids offered a wide field to the student of inheritance. Intermediate, dominant, and false hybrids were then dealt with in detail; and, as regards the last-named, further experiments into the nature of one-sided inheritance were, he said, urgently needed.

During the discussion the question was asked as to whether there were grades in the characters mentioned—whether they were sharply marked. It was stated in reply that they were always practically sharply marked.

Professor Ward (Cambridge) thought that further financial assistance should be given by the Association to the experimenters, and he was pleased that they were going to apply for it.

Dr. Otto V. Darbyshire, of Owens College, Manchester, gave a paper upon "The sandhill-vegetation of Birkdale." The sandhills, he said, were formed by the wind blowing inland the sand which is supplied by the sea. There was plenty of sunlight and heat in the day, and a cooling down at night, with heavy dew. Generally there were strong sea winds during the day, with land-winds a little at night, and these had a drying effect. The sand was not very salty, and water soaked in rapidly, whilst there was ready evaporation. An outside layer of hot, dry sand kept the interior cool and moist. The common features of the vegetation were underground rootstocks, types of Psamma protected against sand, small plants, the trees reduced in size, and plants in the form of dunes, and generally in tufts.

This sec resumed its sitting with a paper f Miss Ethel Sargent and Miss Agnes Robert-on upon "Some anatomical features of the Scutellum in Zea Mais," followed by Mr. Harold Wager with "Experiments in the staminal basis of Tradescantia," and Mr. J. Pargin on "The localisation of anthrocyan (red cell sap) in foliage leaves."

FOREST RESOURCES OF AUSTRALIA.

Mr. E. T. Scammell, F.R.G.S., brought forward an interesting subject in "The forest resources of Australia available for British Commerce." He said that one of the most important duties requiring the early attention of the Federal Government of Australia was that of dealing with the forest resources of the Commonwealth. At present the forest laws and regulations in force, according to the judgment of the Victorian Royal Commission on Forestry (1901), are "weak, unsystematic, and inefficient." This has been acknowledged at different times by the various Governments of the Australian States, and desultory efforts to introduce some scheme of State regulation have been made, but no scientific and comprehensive plan, on the lines laid down by France, Germany, or India, has, apparenlty, been seriously considered or, at any rate, attempted.

The magnitude and importance of the interests involved could be judged by the fact that the forest areas of Australia comprised 107,037,000 acres of marketable timber, or nearly half the areas of the forest lands of Europe, excluding Russia. Of these areas Queensland possesses about forty million acres, New South Wales twenty million, Victoria twelve million, South Australia four million, Western Australia twenty million, and Tasmania eleven million. To this should be added considerable areas in Queensland (over 100 million acres) and in Western Australia (over 70 million acres) covered with inferior timber, which has a local value for building and for general purposes.

Most of the important forests of Australia are fairly accessible from the sea.

The timbers of the Commonwealth are of many varieties, and some of them are of high commercial value. The chief of these are the eucalypts. Of this valuable timber alone there are over 150 species. Besides the eucalypts there are many kinds of casuarinas (the Australian oak), some conifers (the Moreton Bay pine, the cypress pine, the brown pine, or colonial deal, and others), many acacias (the Australian wattle), Banksias, and numerous other varieties.

At present, however, the range of Australian wood available for British commerce is limited. Western Australia and Tasmania are the only States that have seriously dealt with the question of exporting timber or of using their forest resources as a valuable commercial asset.

An interesting discussion followed, in which Mr. C. C. Lance, commercial representative of New South Wales, said they were doing something there in forestry matters, and were beginning to export largely.

PRESERVATION OF TIMBER.

Mr. W. Powell, of Liverpool, dealt with the preservation, seasoning, and strengthening of timber. After dwelling upon the importance of timber to man, he said he might show how some kinds of timber at present valueless may become exceedingly useful; how timber used for structural purposes may be so strengthened as to bear a much greater load or strain; how our streets may be cheaply paved with sanitary wood blocks, which will neither absorb surface water nor give out disagreeable effluvia; how we may combat the ravages of dry rot; and, finally, do all this simply, naturally, and at comparatively small cost. He found that by boiling timber in a thin saccharine solution until most of the air in the timber was exhausted, and then by leaving the wood in the syrup to cool, a certain amount of sugar was absorbed by the timber, in some cases as much as to cause the timber to sink. After the wood has become sufficiently saturated it is put into a drying stove and the moisture driven off at a fairly high temperature, until the wood is thoroughly dry and ready for immediate use. That process differed from others mainly in the fact that before drying is attempted the interstices of the timber are filled in with a viscid glutinous solution, which takes the place of the natural sap and air which the wood has been forced to part with, and so, when the moisture is driven off by stoving, the sugar which remains in the wood acts like a strong binder and holds the fibres together, just as cement or mortar binds the stones or bricks in a wall. There are thousands of square miles of land in the States and Canada covered with timber which at present is of little commercial value. This class of timber is especially amenable to the Powellizing process, and the results are somewhat astounding. Very remarkable results had recently been brought out at Silvertown, where some timber processed at Messrs. Burt, Boulton and Haywood's works showed the following results in increased strength:—Pitchpine, from 14 to 32 per cent.; white pine, from 29 to 39 per cent.; yellow pine, from 56 to 107 per cent. If this simple process could increase the strength of yellow pine from 56 to 100 per cent., then it follows that such timber would be able to bear a corresponding greater strain, or that 25 to 50 per cent. less timber would be required to bear the same strain. The question as to the effect of the process on the flammability of wood—especially of such wood as the pines—has naturally arisen, for many persons imagine that because sugar is introduced into the timber it would become more inflammable. A little reflection, however, will show that

the reverse should be the case, which, indeed, is borne out by facts. Timber properly powellised will stand very high temperature in drying, and be all the better for it; and each class of timber naturally requires its and treatment

timber it would become more inflammable. A little reflection, however, will show that the reverse should be the case, which, indeed, is borne out by tests. Timber properly processed will stand very high temperature in drying, and be all the better for it; but each class of timber naturally requires modified treatment in each stage of the process. In all timber, and especially in walnut, oak, beech, birch, maple, mahogany, &c., where there is a feather or grain, the process brings out the ornamental character of the wood more distinctly, and thus even some of the commoner woods may be used for ornamental purposes, as the appearances when cut and polished are so much improved. By this simple and inexpensive process it is probable (1) that some varieties of timber not at present merchantable, especially some kinds growing in Canada and the United States, may be made of considerable commercial value, and thus an important addition be made to the world's stock of useful timber. (2) That such timber may possibly furnish us with an ideal paving block, at once cheap, tough, and sanitary. (3) That the lighter timbers used for structural purposes my be made to bear much greater strain without increasing their weight appreciably, and at the same time be rendered less inflammable and impervious to the attacks of dry rot. (4) That hard woods, such as beech, birch, elm, ash, maple, mahogany, &c., have their valuable qualities enhanced, their liability to split or crack diminished, their appearance when polished or varnished much improved; and (5) that timber may be rapidly dried and seasoned, and thus an enormous amount of capital now locked up may be released.

After some discussion, Mr. W. Wilson pro-

MAN WITH PANDANUS FRUIT, KONDUL.

From "IN THE ANDAMANS AND NICOBARS." 34

Hope, "providing his expenses do not exceed £200 a year," and he brought back 400 species of new plants. This collection, being entirely new to Europe, placed Kew Gardens above the then celebrated botanic gardens of Trianon, Paris, and Upsala, which up to then had simply vied with each other for pre-eminence, without admitting even competition from any English garden. Afterwards collectors were sent out at the expense of the Government to India, China, Brazil, Fiji, Australia, and the Philippines.

WILLIAM COBBETT AS A KEW GARDENER.

Few people are aware that William Cobbett at one time assisted in the gardening work at Kew. He tells the story in his own homely English:

"At eleven years of age my employment was clipping of box hedge and weeding beds of flowers in the garden of the Bishop of Winchester, at the Castle of Farnham, my native town. I had always been fond of beautiful flowers; and a gardener who had just come from the King's Gardens at Kew gave me such a description of them as to make me instantly resolve to work in these gardens. The next morning, without saying a word to anyone, off I set, with no clothes except those above my back, and with thirteen half-pence in my pocket. I found I must go to Richmond, and I accordingly went on from place to place, inquiring my way thither. . . . . The singularity of my dress, the simplicity of my manner, my confidence and lively air, and doubtless his own compassion besides, induced the gardener, who was a Scotsman, to give me victuals, find me lodgings, and set me to work. And it was during this period that I was at Kew that the present King (William IV.) laughed at the oddness of my dress while I was sweeping the grass plot round the foot of the Pagoda."

After the Georges, Kew ceased to be a Royal palace, and the interest of the public grew in the beautiful grounds. As early as 1819, the public were admitted free on certain days, but it was not until 11th March, 1840, that the gardens were handed over to the Office of Works as a public possession. After 62 years' excellent stewardship, the Office of Works now hands over the control to the Board of Agriculture.

Daily News

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In Evelyn's Diary it is recorded, under date August 30, 1678: "I went to my worthy friend, Sir Henry Capel (at Kew), brother to the Earle of Essex; it is an old timber house, but his garden has the largest fruit of any plantation in England, as he is the most industrious and understanding in it." Again, Evelyn makes this entry: "From thence we went to Kew, to visit Sir Henry Capel's, whose orangery and myrtetum are most beautiful, and perfectly well kept. He was contriving very high palisades of reeds to shade his oranges during the summer." It may be stated here that the orange trees were removed to the grounds of Kensington Palace in 1841.

PRINCESS AUGUSTA'S HOBBY.

About the year 1730 Frederick, Prince of Wales, obtained a long lease of Kew House from the Capel Family, and he also began to improve the grounds of the Royal Palace adjoining. Princess Augusta, Princess of Wales, who survived her husband twenty-two years, made gardening at Kew one of her greatest hobbies. The Princess gave to Kew Gardens the definite scientific character which they have ever since retained. She engaged in 1759 William Aiton, who had been a pupil at the Chelsea Physic Garden, to establish a properly-equipped botanic garden at Kew.

The Princess, at her own personal expense, also engaged Sir William Chambers, the architect of Somerset House, to erect many of the temples, and to prepare an elaborate book on the gardens.

THE PAGODA DRAGONS.

Among the fanciful buildings which Sir William erected in the grounds were the Alhambra and the Mosque, both frail structures, which long since disappeared. Of the buildings that remain, the Orangery, constructed in 1761, is now Museum III. The initials of the Princess Augusta were affixed to the building by William IV., "in grateful remembrance of her who laid the foundation of the surrounding scenes." The Pagoda was put up in 1762. All the angles of the roofs and the stories were at the time adorned with large dragons, eighty in number, covered with a kind of thin glass of various colours, which produced a most dazzling reflection. Everybody knows the dragons are no longer there.

It was not until 177

Daily News
August 1902

KEW GARDENS CHANGE HANDS.

HOW WILL THE PUBLIC BE AFFECTED?

A PRINCESS'S HOBBY.

Simultaneously with yesterday's statement that 55,000 people went to Kew Gardens on Bank Holiday came the announcement that the gardens were to be placed under new control.

In the interest of the 55,000 a "Daily News" representative set out to learn how the public will be affected by the change. First he went to the Board of Agriculture, which is to be the new controlling body in place of the Office of Works. It was not much they knew there. No details had been settled yet, but it was believed—nay, it was regarded as certain—that the rights of the public would in no way be tampered with as a result of the transfer. And the reason for changing the masters? That was easily explained. The Office of Works having charge of the Royal parks had been entrusted with the management of Kew as a matter of course when that delightful spot was placed at the free service of the people over sixty years ago. The Kew authorities have always acted as technical advisers to the Board of Agriculture on subjects of botany, and the Government has at last deemed it well that the Board is the more fitting body to manage the gardens.

A PEOPLE'S TREASURY.

Crossing St. James's Park our representative next called at the Office of Works. Here, again, little was known and details were meagre. The one definite thing that could be said was that the public would lose nothing by the passing of control from one Government Department to another. Then he went to Kew itself. Perhaps on the spot they would know more. Alas! the curator was away, and his courteous assistants only knew what appeared in the morning's papers. But they readily put our representative in the way of gleaning a harvest of good things about the famous gardens—how they came to be founded, and how Kings and Queens and Princes and Princesses assisted in creating what has now become a people's treasury. The story has double interest just now, for as a Parliamentary Committee is to be appointed to carry out the details of the transfer, the subject of Kew Gardens will for some time to come be more than ordinarily before the public mind.

FROM A DESERT TO AN EDEN.

The 55,000 holiday-makers who rejoiced in the beauties of Kew Gardens on Monday—and, by the way, it is generally a reverent, nature-loving Bank Holiday crowd that goes to Kew—little thought that the luxurious lawns and smiling flowers and rare exotics bloomed over what was originally a swamp. The gardens are not very large, nor is their situation very advantageous. It is low, and has no prospect save occasional glimpses across the river of uninviting Brentford. At one time the ground was one continued dead flat, with barren soil bearing neither wood nor water. This does not refer to prehistoric times, but no further back than the days of the Stuarts.

It was a Princess of Wales who succeeded in converting this desert into an Eden, but many other people, of course, contributed. The gardens as they exist to-day are the result of the labours of so many hands as the taste of each successive possessor modified what had been done before that it is not easy to say now whose influence is most predominant. To judge from old prints, the aspect of the gardens in the middle of the eighteenth century must have been much more formal than it is at present. It recalls more the style which obtained at Versailles and other Continental gardens of the time. Gradually the gardens at Kew seem to have given way to a less artificial treatment, and to that kind of landscape gardening which is distinctively known as English. Even now, however, with all the richness and beauty of the plants the barrenness of the sandy and gravelly soil remains one of the great obstacles in the successful maintenance of the gardens.

PICTURED IN EVELYN'S DIARY.

The old [illegible] at one time adjoined by a smaller mansion called Kew House, to which the botanical character of the grounds owes its small beginnings. Here about the middle of the seventeenth century lived Sir Henry Capel, who was much attached to the culture of plants, and his collection is regarded as the actual starting point in the botanical history of Kew.

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was not until 1772

Standard
April 16. 1904

GARDEN NOTES.

An addition has recently been made to the plants which may be grown in the room of an invalid or recluse, and bring a new interest where pleasurable things are all too few. The plant is called botanically Sauromatum Guttatum. Its importers have christened it "The Monarch of the East." Its interest largely consists in its character of a mystery plant. It will grow and develope leaves and flowers without requiring soil or moisture, and without attempting to form roots. The plants, as imported, are dry bulbs, about four inches in diameter. The shape is not unlike that of a Spanish onion. The bulbs are brown, rough, and woody looking. They feel heavy in the hand, and this, perhaps, is the key to the secret of their puzzling power. Placed in a dry vase on the mantelpiece or other warm position in a room, a bulb of Sauromatum Guttatum will quickly be seen to throw up a light green spike like the first growth of a hyacinth. This spike lengthens itself at a rapid rate, gradually deepening in colour at the top point and thickening at the base until the diameter of the stoutest part of the stem is about an inch across. This mysterious growth obtains a height of a foot in about three or four weeks' time. Its taper top then turns ruddy brown, and ejects a flower stem bright red in colour, like a thin stick of round red sealing wax. The plant also unfolds leaves which have formed themselves as tight-fitting coverings down the stem whilst it grow. The cultivator possesses at length a completely developed plant grown without any apparent aid of moisture or outside nourishment of any kind. The plants are stated to be importations from Central Asia, and cultivators are recommended to plant them in soil kept amply supplied with moisture after they have fulfilled their first life period of growing in dryness. It is stated that they will renew their vitality if so treated, and will again go through the interesting process of unaided development from the dry bulb next year. We are growing them ourselves for the first time this season, and our experience is limited to the formation of twelve-inch spikes ejecting tongues of scarlet at the tips. Assuming the after treatment to be equally successful with our first experience, it is not difficult to guess at the explanation of the phenomenon. These must be plants fitted by nature to flourish under the conditions which exist in parts of Asia where perfect drought in Summer is succeeded by a rainy deluge in Autumn and Winter. Such plants will need the power possessed by the South American cacti of storing up moisture for their own use. The dry bulbs of Sauromatum Guttatum which feel weighty in the hand must possess a sufficient store of moisture to produce in turns the long-spiked stem, the tongue-like flower, and the outer leaves. Afterwards they need providing with a British substitute for the rainy season they would enjoy in their Asiatic homes. The bulbs are being sold at very reasonable prices by nurserymen and seedsmen, considering their novelty, usually a reason for charging high prices.

Lovers of violas will just now be regar ith

N.R.R. grew a bulb
in 1904. Bought
by AMC for
Carter.

[See next
page]

Note by Marian Clark on rate of growth of Sauromatum guttatum

1903

Dear Uncle Harry.

You were so interested about my strange bulb that I *must* send you the measurements I have taken since last Sunday mg. I only regret I did not start a record [illegible] sooner. I enclose a paper about it that Carter sent with it. I don't want it again as I have another copy. Its home is in Central Asia apparently.

Much love

A.M.C. - over

April 15th from 7-8 inches

April 26.

9. a. m	$25\frac{1}{4}$ inches	
3.45 p.m	$26\frac{1}{8}$	..
8.30 p.m	27	..

Ap. 27

8.45 a. m	$28\frac{7}{8}$	..
1. p.m	$29\frac{1}{2}$	..
5 p.m	30	..
9.45 p.m	$31\frac{1}{16}$	..

Ap. 28.

9.20 a. m	33	..
1.30 p.m	$33\frac{7}{8}$	..
10. ..	$35\frac{1}{2}$	..

Ap. 29.

9 a. m	$37\frac{1}{16}$	..
5. p. m	$38\frac{5}{8}$	..
10 ..	$39\frac{5}{8}$	..

Ap. 30.

9. a. m	$41\frac{1}{2}$ inches	
1.45 p.m	42	..

May. 1.

10. a. m.	$44\frac{1}{4}$	..
9.30 p.m	45	..

May 2.

9. a. m	$46\frac{1}{8}$	..
9.45 p.m	$47\frac{1}{4}$	.

May. 3.

2 p.m.	$48\frac{3}{4}$	..

N.B. These measurements are taken from the surface of the Earth in the pot in which it is growing to the tip of the leaf. The leaf itself is now only $9\frac{1}{2}$ inches long. So the stalk is enormously long.

A Curious Floral Novelty from Central Asia.

MONARCH OF THE EAST.

This remarkable plant, as shown in the illustration, exhibits one of those extraordinary traits in nature that few are able to understand, for the magnificent flowers, as depicted, actually come out of the dry bulb without being placed in soil and water.

The flower sheath sometimes reaches a length of nearly two feet, is of a red-brown colour, tipped with red and yellow, whilst the inner parts of the flower are equally as brilliant. The bulb of this extraordinary plant needs only to be placed in some fancy receptacle, *without water*, in a warm room, or on the mantelshelf, when, without showing either leaves or roots, the flower makes its appearance, usually early in the year, thriving entirely upon the nourishment contained within the bulb.

Directly after the flower fades and a growth appears to be coming from the bulb, it should be potted in a large pot in good soil and freely watered. Later on an umbrella-shaped leaf will be formed on a stout stalk spotted with a granite-like colour, and sometimes reaching a height of three feet. In autumn this leaf fades, when water should be lessened, and as soon as it has died off, the bulb is lifted out of the soil, cleaned up, and placed in a dry condition in a warm room, when the previous year's display may be repeated.

A PHOTOGRAPH ABOUT ONE-HALF NATURAL SIZE.

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Sarracenia
D R Boyd Thomson
Toronto
1905

SHOWY LADY'S SLIPPER (*Cypripedium spectabile*).

such as starch, and then stored up to supply energy for the rapid development of the next spring.

Picking the flowers of the bloodroot destroys the only possible chance of those particular flowers producing seed which may be able to survive and reproduce their kind. Destroying the leaves or the rootstock interferes with subsequent growth of the plant.

Herbaceous perennials, that is soft-stemmed plants which live on and produce flowers season after season, die down to the ground each fall and in the spring send forth shoots from the buds which are just under the surface. Those which blossom earliest have the largest

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American Flowers
Pop Sci Monthly Feb 1903

protection are wanting in an appeal for the plants. Birds, high in the scale of animal life, with power to feel pain and pleasure, with food-seeking, home-making and young-protecting instincts, demand, as fellow creatures, freedom from cruelty. Efforts were first made to protect them as individuals, while the prevention of the destruction of species was a secondary consideration. Through the agricultural department of our government, knowledge of the great economic value of birds was disseminated, and this was a most effective means of insuring their protection. Through the same department people learned of the vast value of our trees to preserve which a public sentiment was created. Laws were then passed for their protection, and we now have a distinct forestry policy.

GOLDEN-ROD (*Solidago serotina*).

To most persons our wild plants are only things of beauty, common property to be admired or destroyed at will and, therefore, can not be preserved by the same petitions as were made in behalf of the birds. The appeal for the plants is much more difficult and must be at first not a thoughtfulness for the plant, less it degenerate into an unhealthy sentiment, but a request that consideration be given to the rights of other people, that common property be protected for com-

TWINFLOWER (*Linnæa borealis*).

mon enjoyment. Efforts to create reforms through calling upon higher altruistic motives require a long time for their process of evolu-

GREAT LAUREL (*Rhododendron maximum*).

tion, and demand most strenuous work in order that the 'influence of the enlightened few' may be felt by the 'unenlightened many.' Permanent reform is best assured by positive rather than negative means, and this particular one can be easily, though slowly, accomplished through nature study.

The increasing interest in the study of nature and the publication of numerous illustrated popular books on the subject have been much feared by the friends of the wild flowers, who feel that wanton destruction will follow in the path of the enthusiastic young student. This fear has been somewhat justified in towns and cities where, in their eagerness to get specimens for the class, the thoughtless pupils have robbed the parks and gardens. Perhaps, too, in the country, the nature study program has been the means of reducing the numbers of our most attractive wild flowers. This was a natural result of the first step in a movement which will develop into a more carefully directed study. The popular teaching of ornithology in America has advanced farther than botany. In its early days collecting 'sets of eggs' and skins of birds were prominent features of the work and the extinction of the great auk was one of the results. But now, partly through nature study and partly through the influence of the Audubon Society, studying the habits of birds, naming them without a gun, photographing eggs in the nest and birds in the bush are the most popular aspects of the study.

ASTER (*A. spectabilis*).

SABBATIA (*S. stellaris*).

The gathering of plants to be used in schools as specimens for class instruction can be obviated by school authorities arranging to purchase such supplies from botanic gardens or nurseries where they have been raised in large numbers for the purpose. Such an arrangement has been made between a few teachers of botany in Boston, and the directors of the Bussey Institute of Harvard University. Well might a portion of city parks and public gardens be devoted to the raising of such plants as are in demand for botanical instruction. The farmer's


BIRD-FOOT VIOLET (*Viola pedata*).


PLYMOUTH MAYFLOWER, TRAILING ARBUTUS (*Epigæa repens*).

boy or girl, having at his disposal various kinds of land and being able to gain intimate knowledge of the conditions best suited to the different wild flowers which would not flourish in a city park, can experiment with their cultivation, and in time find the raising of native plants a useful and fascinating employment. The instilling of a love of flowers will help to protect them, but this must be united with scientific knowledge of their structure and relation to their environment in order that the necessity for restricting the manner in which they are gathered and the number that are collected will be evident.

The epigæa perhaps has suffered more from inroads upon it than any other New England plant. Its sweet odor and delicate beauty were in themselves attractive. Its connection with the Plymouth settlement created for it a patriotic sentiment which unfortunately was not united with a knowledge of the office of its underground rootstock and its slow manner of growth. Bryant's poem drew to the fringed gentian the attention of those who never knew before of its intrinsic beauty and interesting botanical structure. It is now being gathered for flower markets and becoming scarcer in meadows.

MOUNTAIN LAUREL (*Kalmia latifolia*).

The epigæa, the gentian and other fast disappearing flowers, though difficult of cultivation, should be choicely guarded in wild flower reservations, which should be to the plants of America what the large country estates are to those of England. The Sharon Biological

Purple Fringed-orchis (*Habenaria psycodes*).

Observatory controls three hundred acres of land in Massachusetts which serves as a preserve for native plants and animals. All the deciduous trees of the state and also the native flowering plants are now growing there under protection. As people become more and more devoted to nature study; when they see how much more beautiful the plants are in their haunts than in a wilted bouquet; when they gain more knowledge of botany and know the plants intimately, learning in what ways they struggle for existence; they will not need to be asked not to destroy the plants needlessly, but will unite themselves with the 'enlightened few' until they become the enlightened many. Then the gentian, the sabbatia, the epigæa, the orchids and other delicate plants, ill fitted to struggle for existence, but not necessarily unworthy to survive, will be protected and mutual aid will become a factor in their evolution.

Plant preservation depends partly upon the natural adaptation of plants to their environment and partly upon the attitude of people toward them. The very absence of beauty in some plants

Swamp Rose-mallow (*Hibiscus Moscheutos*).

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renders them unlikely to be destroyed by too much picking, while the strikingly beautiful ones fall prey to thoughtless collectors. Others, on account of their protective coloration, escape the notice of wild flower gatherers or browsing cattle. The disagreeable odor of the skunk cabbage, the bitter taste of the crowfoots, the poisonous properties of various members of the parsley and nightshade families, and the stinging glands of the nettles prevent animals from repeating unpleasant experiences with them.

The power to produce, through a long season, many flowers, bearing many seeds, well adapted for dissemination and germination, under ordinary conditions, is the height of plant differentiation for preservation of species. A consideration of some New England wild flowers will serve as specific illustrations of the way in which plants are self protected and the reasons why they require other aid in order that preservation may be insured.

FLOWERING DOGWOOD (*Cornus florida*).

In the early days of April the bloodroot pushes itself through the ground, each flower-bud rolled in a green leaf. The leaf unrolls somewhat; the flower pushes itself through it up into the air. The delicate calyx drops off and the corolla of pure white petals spreads itself out surrounding a cluster of golden yellow stamens, in the center of which is the pistil. After a few days the stamens wither up, the petals drop off and the pistil, if fertilized, remains, growing larger and larger until the ovules within it are matured. Then the work of the plant, along the line of perpetuation of its kind, is over for a year. The unfolded leaves expand more and more on their lengthened petioles and spread themselves out into the light and air. They then continue to act as organs of great activity in the vegetative work of the plant. Through them carbon dioxide and oxygen are taken in from the air and united, in the green cells, with water and nitrogenous matter absorbed from the soil by the root hairs. The carbon dioxide and water unite to form carbohydrates such a starch and sugar, and oxygen which is given off as a waste product. The carbohydrates and other food products, proteids manufactured in the leaves, are transported to regions of growth, such as buds, or places of storage, like underground stems. Before being transported to growing points, the insoluble products are digested or changed to soluble forms, starch being changed to sugar and then transformed into various plant tissues. If carried to storage regions they are first converted back into insoluble forms, such as starch, and then stored up to supply energy for the rapid development of the next spring.

SHOWY LADY'S SLIPPER (*Cypripedium spectabile*).

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Brit. Assn. 1904.

extent for the disappointment.

Mr. A. W. Hill, in a description of a journey around Lake Titicaca, said that the lake was situated at an elevation of 12,500ft. above sea level between the eastern and western ridges of the Cordillera of the Andes. His journey was made during the spring of 1903, which was the rainy season on the plateau. From La Paz, the capital of Bolivia, the route lay along the southern shore of the lake to Tiahuanaco, where there existed some of the finest and most ancient stone monuments in South America; thence to the Desaguadero, the only stream flowing out of the lake, and across this, going eastward to Copacabana. Here some stay was made, and the sacred island of Titicaca, with its Inca temples and palaces, was visited. The ancient terracing of the hillsides for cultivation was very marked in this region, and the terraces were still in use. The crops usually grown were barley, potatoes, quinoa (*Chenopodium*), ocas (*Oxalis*), and beans; wheat and maize could only be grown in sheltered spots at this elevation. On returning to Copacabana an interesting Indian festival was found to be in progress, which, though avowedly Christian, showed strong resemblances to some early pagan ceremony. The narrow straits of Tiquina were crossed and the journey continued along the north-eastern shore of the lake, with digressions into the eastern mountains, and plants were collected up to about 16,500ft. The majority of the plants showed a striking uniformity as regards their vegetative habit, and grew usually in rosettes or mounds; they had long tap roots, which enabled them to absorb water from the warmer soil at a considerable distance below the surface, and their leaves were usually linear and often hairy. These peculiarities were induced by the climatic conditions, since the plants had to endure a burning sun during the day, followed by frost at night, with cold, cutting winds; there was often a difference in temperature of as much as 70deg. F. in a few hours. The journey was continued round the northern end of the lake, where the Indian huts were built of mud bricks in the shape of beehives, and was terminated at the Peruvian port of Puno. Some capital maps and lanternslides were shown to illustrate the paper.

Quarry Hill
July 14. 1905.

Dear Miss Robertson

Many thanks for your paper which is interesting & suggestive. I can't help feeling that to include all the processes taking place within the ~~megaspore~~ embryo-sac at the time of fertilisation under the term cytology, is stretching its meaning a little. Such processes are observed of course by cytological methods.

Your recent appeal failed to induce me to read Allen's paper, I regret to say, but Dr Scott made a second which did the trick. I have read it - very carefully - and it is a good paper. The observations are very carefully carried out I should say, and I am quite prepared to believe that where we differ I am wrong. But accepting, for the sake of argument, the facts as he states them - I think his theory open to criticism. His fundamental ~~axiom~~ statement is that chromosomes persist, retain their individuality from one division to the next. Now look at his own drawings, Pl. VI, figs 1-10. If the chromosomes of the preheterotypic division are permanent, they must exist as segments of a fine network on which masses of more or less amorphous chromatic matter is deposited. You may explain it in two ways:

1. That the only essential part of the chromosome is the skeleton thread to which the chromatic substance adheres: in other words that the hereditary qualities are inherent in the thread only, and that the chromatic matter is of the nature of food.

2. That the chromatic substance is in the end deposited on the thread in such a way as to exactly reproduce the chromosomes of

the previous division.

Now (2) is all but incredible. If so much depended on an exact reproduction of previous chromosomes, the process would take place in more regular fashion.

With regard to (1) it is difficult to regard the process as one of feeding. The thread does not thicken slowly + regularly with a corresponding lessening of the spare chromatic material. On the contrary that material overlays the thread & conceals it.

Allen however demands that the ~~permanence~~ individuality of the chromosomes shall be so exactly maintained that those of the preheterotypic division shall be divisible into 12 male + 12 female; reproducing the original 24 chromosomes of the fertilised ovum from which the plant originated. These male and female chromosomes are first to unite in the prophases of the heterotypic division.

The kernel of the whole matter is this. We have on one hand the facts recorded as to the inheritance of characters: on the other the facts observed concerning the division of nuclei and their union in fertilization.

All analogy leads to the

assumption that the inheritance of parental characters is due to a transference of material particles ~~both~~ from the male + from the female stock to their offspring. These material particles are pangenes or ids, + so far are purely ideal.

The next step is to observe the processes of nuclear division + of fertilization in order if possible to discover (a) whether any

transference of material from the male to the female parent takes place: (b) if so, whether all the material so transferred or only part of it can be considered as bearing hereditary qualities: c) How these qualities are distributed in the offspring.

(a) Of course the male parent transfers a nucleus accompanied ~~to~~ by more or less cytoplasm to the female: the nucleus unites with a single nucleus of the female stock and the male cytoplasm mingles with the female cytoplasm surrounding the selected or egg nucleus.

(b) Since the child shows no more tendency to resemble the mother than the father it is clear that an equal number of male and female ids must exist in the fertilised ovum.

Now a small male nucleus commonly unites with a large female nucleus while the female cytoplasm is often many times the bulk of the male cytoplasm.

But the small male nucleus is densely packed with chromatin while the larger female nucleus has thinner chromatic contents. Before complete fusion the male nucleus swells to about the same size as the egg nucleus & then the amount of chromatin appears about equal in both. Hence the chromatin has been identified with the hereditary substance.

(c) In the first division of the fused nuclei 2n rods appear in which all the chromatic substance of the fused nuclei is contained. These are divided longitudinally: 2n halves going to one daughter nucleus, 2n to the other. And this process is repeated in every subsequent division up to the appearance of the male + female nuclei of the younger generation, but at one point in the life cycle the number of rods is reduced from 2n to n

The machinery which secures an equal division of chromatin between daughter nuclei is elaborate and its existence strengthens the presumption that the chromatin carries hereditary qualities. It is clearly divided into at least 2n rods, which may each be regarded as an id or a collection of ids.

Now Allen is perfectly justified in proceeding to define the necessary qualities of ids according to Mendel's or any other well established law of heredity, but when he talks of chromatin or chromosomes he ought to refer only to cytological facts. So far the evidence is against the general permanence of chromosomes. Their individuality is commonly completely lost to the eye during the resting-stage; and we have no right to assume that it is retained because theory demands that the individuality of ids or groups of ids should be retained. We may of course experiment & observe in the full belief that facts will be found to bear out our belief in the individuality of each chromosome & its persistence through many generations.

But Allen – in very good company – seems to argue in a vicious circle. Chromosomes must be ordered groups of *ids* because they alone in the cell fulfil certain conditions which must be true of *ids*. And if chromosomes are groups of *ids* then they must obey further laws which cannot be evaded by *ids* on our theory. Therefore chromosomes do behave in such & such a way — while his own observations show that they don't obviously do so!

Almost everyone argues like this but it is vain.

Yours Ethel Sargant.

hardly be classed as a mere subdivision of the
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Strawberries.

SIDE by side in our English hedgerows in early springtime there grow two sister plants, almost exactly alike in foliage, flower, and all other points except the fruit, but differing widely from one another in that solitary, and to us essential, particular. One of these plants is the wild strawberry, the other is the little three-leaved, white potentilla. It is not often that a parent species

GRANT ALLEN.

advanced and developed descendant.

Strawberries.

SIDE by side in our English hedgerows in early springtime there grow two sister plants, almost exactly alike in foliage, flower, and all other points except the fruit, but differing widely from one another in that solitary, and to us essential, particular. One of these plants is the wild strawberry, the other is the little three-leaved, white potentilla. It is not often that a parent species and its more developed offspring survive together in the same district, but this is almost certainly the case with these two small English wayside flowers. Indeed, the similarity between them is so close that even the most unobservant passers-by have been greatly struck with it; and the common native English name of the white potentilla—'barren strawberry'—bears witness to the striking character of the family likeness. Perhaps one ought rather to go a step further, and to say that, while the most unobservant have perceived the relationship, only the more observant have ever discovered the distinctness of the two plants. Nothing is more ordinary than to hear casual townsfolk exclaim that though there were lots of strawberry blossoms a little while ago in such-and-such a spot, there are no ripe strawberries to be seen now that the time has come for picking the fruit. In such cases, careful examination will generally show that the spot is really covered by white potentilla plants, whose little starry flowers were easily mistaken by the world at large for true strawberry blossom. Though there are some marked distinctive features even in the

flower, to which I shall presently recur, it is in the fruit alone that the two plants really differ sufficiently to attract the attention of an unbotanical eye. But here the difference is one which touches humanity on a very keen point indeed, for the strawberry blossom sets at last into a sweet and pulpy berry, while the potentilla blossom sets only into a small head of dry and unpalatable nutlets. How the edible fruit has been developed from the inedible seeds is the question which I propose briefly to investigate in the present paper.

To get properly at the ancestry of the strawberry, we ought first to begin with the potentillas at large, for a most important part of our evidence consists in the fact that the white potentilla varies from the central type of its race in nearly all the same particulars as the strawberry plant. In other words, we have to show that the ancestors of the strawberry had already acquired most of their existing peculiarities while they were still white potentillas, and that they have only then varied so far as to have added to that white potentilla type the one extra peculiarity of a red and juicy berry. Our systematic botanists, indeed, will tell us that while the one plant belongs to the genus *Potentilla*, the other plant belongs to the totally distinct genus *Fragaria*; and they imply, therefore, that the differences between the real strawberry and the barren strawberry are far greater than the differences between the barren strawberry and the other potentillas. I hope in the sequel to show, however, that it would be far easier to develop a strawberry out of a white potentilla than to develop a white potentilla itself out of any one among its yellow allies; and therefore that the systematic classification is a faulty one, and the popular classification a correct stroke of half-unconscious scientific intuition.

The potentillas are a group of very lowly and primitive roses, the earliest and simplest surviving members of the great and world-wide rose family. Our common English cinquefoil may be accepted as a good typical instance of the whole group. Cinquefoil is a pretty tufted creeping plant, whose small golden flowers, like yellow roses in miniature, star the waste grass-plots by the side of lanes and highways everywhere in Britain during the summer and autumn months. Its leaves, as the very name denotes, consist of five separate spreading leaflets, all springing from a common point, and radiating round it as a centre like the fingers of a hand. The flowers, as usual in most very simple and primitive plants, are bright golden yellow, and they closely resemble the equally early blossoms of the buttercup, which similarly form the starting-point of another

great and varied family. Originally, there is good reason for believing all flowers were of this same bright golden yellow hue; and those of them that have since progressed to other colours, under stress of special insect selection, have passed through regular gradations of white, pink, red, crimson, purple, and finally blue. Some flowers still remain at the ancestral yellow stage; others have got on as far as white or pink; yet others have attained the stage of crimson or purple; and a very few, the most advanced of all, have even reached the culminating glory of deep blue.

We have several other yellow potentillas in England besides the cinquefoil, and some of these have varied a good deal in foliage or other points from the central form. Nearest of all to it stands the small tormentil, so frequent upon heaths or other moors and uplands; for the main distinction between them lies in the fact that the cinquefoil has usually five large petals, while the tormentil has usually only four. This difference, however, is by no means always constant, for on the one hand it is easy to find stray flowers of cinquefoil with only four petals, while on the other hand the first flower on each stalk of tormentil has often five. There is an intermediate form, too, which exactly splits the difference between the two plants in every respect; and one can hardly doubt that tormentil is in reality only a very slightly altered form of cinquefoil, grown woodier and more dwarfish from its peculiar upland situation, and with one of its petals suppressed through gradual failure of constitutional vigour. The frequency with which the first flower on each stem recurs to the original five-petalled form, while the material to spare remains abundant, is very significant: the later flowers, as the material for their formation runs short, have generally to be content with only four petals each.

More divergent types of potentilla than these are the forms which have their leaves (to use the technical term) pinnately, not digitately, divided—that is to say, with the separate leaflets arranged along two sides of a central leaf-stalk instead of radiating from a common point; and though the white potentilla and the strawberry belong rather to the latter or digitate division, I shall yet enter briefly into the nature of the pinnate section, for the sake of the light which it throws by analogy upon the evolution of our own proper subject. Commonest among the potentillas of this divergent group in northern Europe is the trailing silverweed or gooseweed of our English roadsides, a pretty, long-leaved plant, with a silvery underside, and bright golden flowers springing from rooted joints on its creeping runners. A rarer plant is the shrubby potentilla, which grows in bushy or stony places, especially on mountain sides, and has accommodated itself to its special situation by acquiring a stout woody stem. This species also has a yellow flower. But there are two other pinnate-leaved English potentillas whose blossoms have long since changed colour under the selective influence of their insect fertilisers. One of these is the marshy comarum, a perennial which grows in peaty or boggy places, and has assumed a dingy purplish-yellow hue, to suit the eyes of marshland insects. It is very noticeable that waterside flies do not seem to care for yellow, and most waterside flowers are therefore pinkish, purplish, or white. Thus the water-crowfoot and the mud-haunting ivy-leaved crowfoot have become white, while all our other native buttercups remain yellow. In the group of bennets or *Geums*, closely allied to the potentillas, we find a still closer analogy, for the roadside herb-bennet or common avens is yellow like cinquefoil, but the marshy water-avens has exactly the same dusky purplish-yellow tint as the marshy comarum. The other pinnate English potentilla, found wild with us only among the clefts of the Breiddin Hills in Montgomeryshire, is a mountain species with handsome and conspicuous white blossoms; and this also is in striking analogy with similar facts elsewhere, for mountain species usually rise higher than their neighbours in the scale of colour, owing to the keen competition between the flowers for the visits of those rare fertilisers, the butterflies, which sail further up mountain heights than the bees and other meadow honeysuckers. For example, some Alpine buttercups are snowy-white, while most of their lowland congeners are simply yellow.

With the side light thus cast upon our subject by the analogy of the pinnate potentillas, let us hark back to the digitate cinquefoil once more, and ask by what steps some such early ancestral form gave origin to the common predecessor of the true strawberry and its barren sister. The cinquefoil, we saw, had five leaflets to each leaf, but the strawberry and the white potentilla have three only. This is one of the marked points wherein these two plants differ from the other potentillas, and agree with one another. But though the trefoil leaf is a matter of some importance, as indicating community of origin, it is not difficult to understand how it has been developed from the primitive cinquefoil. The exact number of leaflets in a leaf is always rather variable, depending partly on the mode of growth of the plant, and partly on the amount of available material. Thus, in the allied tormentil the lower leaves have five leaflets, but the upper ones have usually three only. In the spring potentilla, a rare English species, the lower leaves have seven or five, and the upper ones five or three. Again, where a species creeps along the ground, it is apt to have long pinnate leaves with many leaflets, as happens, for example, with silverweed and many similar plants. But where the leaves grow habitually among tall grass or choking wayside weeds, the number of leaflets is very apt to be reduced to three, as happens, for example, with clover and lotus among the peaflower tribe, and with wood-sorrel among the geranium tribe, many of whose allies have long pinnate leaves with numerous leaflets. Now, the strawberry and the barren strawberry differ conspicuously in habitat from the other potentillas in the fact that they grow mainly among grass, on banks, or in hedgerow thickets. Hence it suits them best to raise their trefoil leaves on tall stalks above the neighbouring herbage, and thus to get at the light and air which they require for their proper growth. Natural selection has easily brought about this result, because in such situations those potentillas which raised their leaves highest would best survive, while those which trailed or crept closely along the ground would soon be starved out for want of carbonic acid (the raw material of growth) by their surrounding competitors.

In another direction the ancestors of the strawberry and of the barren strawberry also diverged from their cinquefoil predecessors, and that was in the peculiar colour of their flowers. For some reason rather difficult to decide, the petals have changed from yellow to white. Difficult to decide, I say, because we do not exactly know what are the insects which the strawberries set themselves out especially to please, or what is the peculiar nature of their specific taste. But, as a rule, this change from yellow to white petals is an ordinary concomitant of higher development, and it probably accompanies some change in the insects to which fertilisation is generally due. Our own native species have got no further in the upward course of development than white; but two allied East Indian forms with digitate leaves, cultivated in our flower-gardens, the Nepaul potentilla, and the purple potentilla, have risen as far in the scale of coloration as crimson and deep red.

One may sum up the common points of the strawberry and the barren strawberry somewhat as follows: Both have tall leaves of three leaflets, raised on an elevated leaf-stalk, whereas most of their other congeners have many leaflets. Both have white flowers, whereas most of their other congeners have them yellow. Both have short tufted stems; in both the leaves are clothed with silky down; and in both the leaflets are regularly toothed at the edge in the self-same manner. On the other hand, they differ from one another almost exclusively in the matter of their fruit. Now, as we shall proceed to see, it is comparatively easy to produce the change whereby a dry fruit becomes a succulent one, and it is also comparatively easy to produce any one single change, unaccompanied by others; but it is comparatively difficult to produce the whole set of changes whereby the two strawberries differ alike from all their congeners. So, if we are going to make a new genus, *Fragaria*, with a Latin name at all, we ought to make it include both the true strawberry and the barren strawberry, while we relegate to the genus *Potentilla* all the other less closely related kinds. But perhaps we shall do better if we lump them all together in a single genus, considering that, after all, the barren strawberry does not differ more from the remainder of the potentillas than many of these differ from one another among themselves.

And now, how did the edible strawberry get developed from its barren ally? Well, if we take the fruit of any potentilla, we shall find that it consists of several small, dry, one-seeded nuts, so tiny that they look themselves like seeds, crowded on a thick receptacle or flower-stalk, without any signs of redness or succulence. In some potentillas, however, as the fruit ripens, this receptacle becomes a little spongy, something like the hull of a raspberry, only without its pulpy character. It is a common tendency of fruits to develop such pulpiness, and sometimes they do so quite suddenly by apparently spontaneous variation, as when an almond tree has been known to produce peach-like fruits. But no fruit will permanently acquire such a succulent character unless it derives some benefit by doing so; the change, once set up, will only be perpetuated by natural selection if it proves of advantage to the plants which happen to display it. Has it done so in the case of the strawberry?

A strawberry, as we all know, consists of a swollen red receptacle or end of the flower-stalk, dotted over with little seed-like nuts, which answer to the tiny dry fruits of the potentilla.

Suppose any ancestral potentilla ever to have shown any marked tendency towards fleshiness in the berry, what would have happened? It would probably be eaten by small hedgerow birds, who would swallow and digest the pulp, but would not digest the seed-like nuts embedded in its midst. Hence the nuts would get carried about from place to place and dropped by the birds in hedgerows or woods, under circumstances admirably adapted for their proper germination. Supposing this to happen often, the juiciest berries would get most frequently eaten, and so would produce hearty young plants oftener than those among their neighbours which simply trusted to dropping off casually among the herbage. Again, the birds like sweetness as well as pulpiness, and those berries which grew most full of sugary juices would be most likely to attract their attention. Once more, the brightest-coloured fruits would be most easily seen among the tall foliage of the hedgerows, and so those berries which showed any tendency towards redness of flesh would be sure to gain a point in attractiveness over their greener rivals. Thus at last the strawberry has grown into the fruit that we know so well, by constant unconscious selection of the little hedgerow birds, exerted at once in favour of the pulpiest, the sweetest, and the ruddiest berries.

It is noticeable, too, that in all these particulars what happens to the strawberry happens also in a hundred other independent cases. Wherever animals are to be enticed by plants, sugar is sure to be developed to entice them. It is so developed in the honey of flowers, in the extra-floral nectaries used for attracting ants, and in the sweet secretion by which the pitcher plants allure flies into their murderous vessels. So, too, bright colour is commonly employed to advertise the sweet material, as in the petals of flowers, the skin of fruits, and the pink or purple patches on the lips of the pitcher plants. On the other hand, the particular way in which these allurements are displayed by the strawberry is very different from that adopted by almost all other fruits. In the closely allied raspberry, the pulpiness and colour are produced in the outer coat of the little nutlets themselves, and the receptacle assumes the form of the hull, which we pull out of the fruit and throw away. In the plum, there is only one such berry, enclosing a single seed. But in the strawberry, the separate fruits remain always hard and dry, and it is only the receptacle which holds them that swells out into the bright-coloured and juicy edible portion.

It very seldom happens, however, that a plant which has diverged from another in one point remains constant in all other points. In the strawberry this is almost the case, for it hardly differs at all in any particular, save its fruit, from its ancestor, the white potentilla; and that is good evidence, it seems to me, that the two plants cannot very long have separated from one another. Yet even here there are a few inconspicuous lateral differences. Most notable of these are the variations in the flower. Though to a casual observer the two blossoms look almost identical, and the plants can only readily be identified when in fruit, a botanical eye has never any difficulty in distinguishing the one from the other. The petals of the barren strawberry are usually rather short and narrow, the flowers scarcely open into more than a cup-shape, and there is a good deal of yellowish or reddish colour about the receptacle and the base of the stamens. In the true wild strawberry, on the other hand, the petals are usually larger, rounder, and purer white, the flowers open into a wide saucer-shape, and there is no yellow or red in the centre of the blossom. Perhaps one may best account for these changes by supposing that the true strawberry has still further progressed in insect fertilisation. This would sufficiently explain the purer white of the petals and the loss of such relics of the primitive yellow hue as still remained in the barren strawberry. But it is also probable, I think, that the barren strawberries represent the remnants of the old ancestral race which have not yet been lived down by the newer strawberry type, but which are gradually undergoing progressive degradation; hence their half-opened flowers—often self-fertilised—their smaller and degenerate petals, and their general unattractiveness of outward appearance. It is difficult to compare the blossom of a true wild strawberry with that of a barren strawberry without immediately catching the obvious suggestion that the one is going upward towards higher development and the other downward towards general degeneracy.

In some other respects the strawberry plant equally shows itself the nobler species of the two. Its leaves are usually larger and more erect, its stem taller and straighter, its root-stock less fluffy and not so creeping. Moreover, if it is really descended from the white potentilla, or from some closely-allied common ancestor, it has certainly far outstripped its progenitor in the race for the possession of the world, for the white potentilla, or barren strawberry, is apparently a strictly European species, found from Sweden and Ireland to the Crimea and the Caucasus, but the true strawberry is a much more cosmopolitan plant, being found in almost all the temperate regions of the world, from Siberia and Scotland to Vancouver's Land, and from the Arctic Regions to the Andes of Chili. This is quite what one would expect under the circumstances, for while the seed-like fruits of the white potentilla could only fall out on the ground close to the mother plant, and so could disperse themselves very slowly over a single continent, the little nuts of the strawberry could be carried by birds from land to land, across the severing ocean or the intervening tropical region. Thus the old degenerate type is now apparently dying out in northern and western Europe; but the progressive and advancing strawberry is making its way steadily, like a colonising race, round the entire girdle of the two temperate regions.

The strawberries are, as yet, it would seem, a relatively new race, and so they have not, so far, split up into any very marked or distinctive separate species. Still they have even now assumed several minor forms, worthy at least to be distinguished as nameable varieties. The most divergent of these, as might be expected, is the Chilian pine strawberry, for in the southern hemisphere the imported strawberry, carried over at first, no doubt, by some weather-driven bird, has found itself in the midst of a very different environment from that which surrounds it in the hedgerows and meadows of its European home, and to this environment it has had to adapt itself in several minor but obvious particulars. An almost equally distinct variety is the white Alpine strawberry, which has quite lost the native blushing ruddiness of the lowland fruit. Curiously different in another way is the hautboy, a taller plant, with fewer and larger blossoms and a richer flavour, chiefly distinguished by the separation of its sexes on distinct plants, for here the stamens grow on one vine, and the pistils, or embryo fruits, on another. In order to make the berries swell and ripen, it is necessary to plant both sorts together, and then the fertilising insects unconsciously carry the pollen from the staminate flowers to the sensitive surface of their pistillate neighbours, and so assist the efforts of the gardener in setting the fruit. In the great American market-gardens it is usual to plant one row of 'barren' flowers for every three rows of 'fertile' ones, leaving the insects to do the rest. At present none of these varieties can be said to have developed into what old-fashioned botanists used to call 'a good species,' for fertile cross-breeds can still be readily produced between them all by artificially fertilising the pistils of one sort with pollen taken on a camels'-hair brush from the stamens of another. The possibility of fertile hybridisation in such a manner shows that the plants have not long diverged from the common central stock. But after they have long been exposed to varying circumstances and acted upon by natural selection, they will probably become so different from one another in a variety of small particulars that the hybrids will no longer prove fertile, owing to the want of sufficient similarity between the respective ancestral lines. Perfect fertility is only possible between individuals which still retain all the principal traits of a common ancestral form.

On the other hand, if the strawberries ever really live down the white potentillas, so that the latter race dies out altogether, then the distance between the genus *Fragaria* and the genus *Potentilla* will be far greater than it is at the present day. We are lucky enough at this moment to be able to trace the close connection between one rather abnormal potentilla (the barren strawberry) and the true strawberry itself. But if the barren strawberry were to disappear we should have no link between the yellow-flowered, five-leaved, dry-fruited cinquefoil and the white-flowered, three-leaved, succulent-fruited strawberry. In nature, as it now stands, this 'missing link' is fortunately not yet missing. Though still essentially a potentilla in all important points, it yet approaches so nearly to the true strawberry that only rather close observation enables us to perceive their differences in certain stages of their existence. What thus happens now with the strawberry has doubtless happened at one time or another with every new species of plant or animal; but the special interest of this case consists in the fact that here, in all probability, we still have the parent type living on in a degraded form side by side with its more advanced and developed descendant.

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