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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.

Neo-Darwinian explanations of evolution since the genetics level have been proven wrong by geneticists at least 40 years ago — and still almost all American biologists adhere to these ideas and ignore the cytogenetical explanations. Also, the Freudian explanations of the inheritance of schizophrenia have been proven wrong, but although the genetical explanations have is the only plausible one especially from the point of view of those who want to see healed by aid of chemicals, almost all research in the genetics of mental diseases is influenced by those who live on adhering to the Freudian concept. Likewise, intelligence is clearly based upon genes, and I have the feeling these are rather simple gene combinations and no polygenes or other phenomena that prevent — proper analysis, but support for such studies are not forthcoming for the simple reason that our political system is believed, though wrongly so, to require that all families, all nations, and all races are equal, which they actually are not. We can be sure that even simple genetical studies will prove your heretical ideas to be even more correct than you have dared to dream of — so all studies of human genetics must be prevented even by putting a microscopist like Lysenko in a position of a human geneticist!

Doubts — human genetics are plagued with — by non-human geneticists are based on none or limited experiments, of course. And they put emphasis on wrong essentials —

Those few who are really interested in finding the understood truth on which we may base our lives, our eugenics, our understanding of our differences . . . ought to get together in a good and secure institute of human genetics. But such a place is not available anywhere at present —

The Lysenko method —

If I have been asked to tell you about polyploidy in a few words. Since the literature about this subject fills several volumes, you should not expect to learn every detail of the theory this evening, and not even to get a thorough understanding of the significance of polyploidy for the phenomena which I will select to discuss. But perhaps those of you, who want to know more, may find here some guidance to further studies.

2/ I realize that some of you know a good deal about polyploidy already, whereas others may be hearing the terms the first time. I will try to explain it's background for the latter, in the hope that the former will not feel that I am spending their time for nothing.

3/ Polyploidy has to do with chromosomes, or perhaps more correctly, with their numbers or rather multiples.

Chromosomes are small bodies in the cell nucleus which carry the genes, or the DNA, or the material that decides, about inheritance. Because of this they are the most important constituent of the cell not only basic for life, but for all processes of evolution of living matter.

4/ The genes of the chromosomes are visible in the so-called interphase between cell divisions, whereas the chromosomes are visible only during cell divisions.

Cell divisions are of two different kinds, mitotic and meiotic. The former have to do with the division of the body cells, which must get exactly the same number and type of chromosomes every generation and in all parts of the body. Mitosis goes through prophase, metaphase, anaphase and telophase, although the chromosomes are visible in all stages, they are shortest and most easily studied in metaphase, when they lie in a plane in the middle of the cell and each divides into two. That is the stage where we prefer to count them, and such divisions are most easily found in the meristem close to the root tip, although they are not within in every growing organ. We say that the chromosomes in such cells are three in the diploid number, which we also call the 2n-number.

5/ The meiotic kind of cell division has to do with the formation of sex cells. Since sex cells carry a complete complement of genes or DNA molecules for each parent to the progeny, this division must see to that every new sex cell gets such a complement, at the same time as it must guarantee that the chromosome number in each sex cell becomes reduced to the haploid number, which we call n, in order to prevent that the chromosome number in the body cells becomes higher than the 2n of the parents.

This is done through a complicated mechanism of pairing of so-called homologous chromosomes in the prophase, resulting in conjugations of paired couples in the metaphase which results in that in anaphase only a single chromosome from each pair goes to either pole. The pairing is significant, because if it breaks down as it does in hybrids between related species, it prevents the formation of viable sex cells and, thus, causes reproductive isolation and sterility. Let us speak about that later.

6/ Since we will hardly discuss reproductive isolation between species with the same chromosome number this summer, I ought to mention, that disturbances of the pairing of homologous chromosomes is caused by various kinds of morphological changes or rearrangements within or between the individual chromosomes. Also, never more than two homologous parts of the chromosomes can pair at any one point.

7/ That leads us to the problem of polyploidy.

Although it is general, in plants and animals, that somatic cells have 2n, diploid chromosomes and sex cells only n, haploid it was discovered early this century that within many genera chromosome numbers occur that are the multiple of the same low number, frequently 3, 4, 5, 6, 7 or 9. The lowest haploid number in such a polyploid series, say n = 7, is then said to be monoploid, the lowest somatic number is diploid, whereas all other numbers are polyploid. For instance,

in the genus of sharp-scarred, or Aesculus, the lowest haploid, or monoploid number, which we also call the basic number, is X = 7, the lowest diploid number is 2 = 14, whereas other species have the diploid numbers 2 = 28, 42 and 56.

We do not have time to discuss how such a polyploid series may be formed, but when a polyploid has once been produced in nature, it has gained certain attributes that distinguish it from its diploid relatives or from its relatives at other polyploid levels. It [illegible]

is evident that a polyploid has its genes in a polyploid ratio so that instead of having two genes of each kind, it has, four, six, eight or ten more of it. This immediately affects its morphological and physiological characteristics, which we will look at later. But it also has more than two chromosomes of each kind, so its meiotic pairing is somewhat more complicated than that of normal diploids. [illegible] But the most important evolutionary most important feature is,

that when a polyploid, [illegible] tetraploid level which has just twice the original diploid number, tries to hybridize with the diploid, the different chromosome numbers of the parents either prevent all hybridization or result in a number that cannot be evenly divided into the new [illegible] cells. Therefore, polyploidy creates what is called reproductive isolation, which is the most characteristic attribute of a biological species. With other words, a [illegible] of a polyploid series

results in the creation of [illegible], each of which characterized by its own chromosome number.

Since we are here concerned with biogeography, another characteristic of polyploids is of no less interest than their reproductive isolation. This has to do with the morphological and physiological differences which are connected with their higher number of genes.

a/ Polyploidy increases vegetative reproduction of plants, so that we will find a considerably higher frequency of agamosis, or parthenogenesis, and vivipary in polyploids than in their diploid relatives.

b/ Polyploidy ~~[illegible]~~ tends to change annual plants into perennial, probably because their larger cells slow down growth.

c/ Polyploidy seems to affect the photoperiodism, so that short-day plants become day-neutral or day-neutral become long-day plants.

d/ Whereas diploids tend to be self-incompatible, so that they require pollen of another plant for pollination, polyploids are frequently self-compatible, so that pollen does not need to come from another flower.

e/ Polyploids are, as a rule, hardier than diploids, at least in nature.

f/ Polyploids also can ~~[illegible]~~ live in soils that are extremely wet or extremely dry, whereas diploids tend to be found in too wet soils or dry ones in too dry soils.

There are several other physiological characteristics that separate polyploids from diploids, and most of these seem to be connected with the well documented observation, that ~~[illegible]~~ polyploids are able to live in climates considerably more severe than those favored by their diploid relatives.

When one goes from south to north on the globe, from the equator towards the pole, the size of the flora of each unit of land decreases at the same time as the frequency of polyploids increases, ~~[illegible]~~ from about 20% in the Tropics up to over 70% in the Arctic. The same holds true for alpine regions in the warm or temperate zones. The reason for this increase in the frequency of polyploids towards extreme conditions has been much discussed, although it is evidently caused by some of the physiological differences mentioned.

they are ~~[illegible]~~ in the caused by genes of general constitution, so that the explanation of the selective strength of polyploids as compared with diploids seems to be genetical rather than physiological. With other words, polyploids do not survive in the northern because they are harder than their diploid relatives, but they survive and are harder, because of a superior genetical constitution.

Let me explain this a little closer, by using a simple genetical example. Naturally, the real explanation is more complicated, but let us claim that the greater adaptability of polyploids to ~~[illegible]~~ arctic or alpine climate is connected with hardiness, which could be conditioned by as few as two pairs of genes, F and f and H and h.

~~[illegible]~~

~~[illegible]~~

The gene H is assumed to increase the hardiness with 1°C and to be slightly dominant, but H is assumed to decrease the hardiness with 1°C. According to this assumption, diploid plants with the genetical constitution HHhh or FFHH are hardy at 0°C, whereas Fhhh is hardy at −1°C, FFhh at −2°C, and FFHh at −1°C.

A great difference is observable already in a tetraploid derivative of this system. In the first generation, HHHhhhh — FFFFHHHH will show no difference in hardiness from the original diploids HHhh and FFHH and selection by cold will make no difference. The difference is evident in other lines:

FFFFhhhh = +4°C (reduction of −2)
no selective effect within it seems by chance

HHHHHH = +4°C (decrease of HHH +2)
no selective effect.

FFHh −1°C. → FFFFHHhh −2°C.
selective effect: FFFFhhhh −4°C.
etc.

Most striking results in FfHh = 0°C.
FFffHHhh = 0°C, no difference,
but in later generation FFFFhhhh individuals will predominate = −4°C.

Perhaps I ought to summarize some of the points that I have mentioned:

1/ Polyploidy is a significant factor of evolution, which isolates gene pools through the creation of strong reproductive isolation.

2/ Polyploidy increases the genetical variability on which morphological and physiological characters are based.

3/ Because of this, polyploids have a greater adaptability than diploids, making it possible for them to withstand greater climatical extremes.

4/ It follows, that the increased frequency of polyploids in arctic and alpine floras is a direct function of this increased genetical adaptability (survivability).

5/ I may add that polyploids are also superior to diploids from other points of view, for instance are the majority of cultivated plants polyploid derivatives of wild diploids, and plant breeders use polyploidy to increase the productivity of various plants.

Polyploidy frequency — can be used as a method of study of biogeographical phenomena: diploids in southern montane, polyploids in the Arctic.

Pleistocene-glacial high age groups.

We present this system not as the final evolutionary classification of the wheatgrasses but as a step towards such a classification, since we are aware that future hybridization between taxa that at present are rudimentarily known may reveal new facts that require new consideration. We do not expect that all our colleagues accept our logic or even agree with our basic conclusions. But we trust, as did Linnaeus (1753) as expressed in the forward to his classical Species plantarum, that this system will fare well when it is judged by the generation of our grandchildren, who are the ultimate judges of all scientific conclusions.

[illegible insertion: "They may be found to be lighter, as have previous [illegible]"]

[illegible margin note]

This is how I write 1986, three years later, when I try to write clearly, but my [illegible] [illegible] is almost invisible.

And this is written on February 22, slowly and with difficulty. Áskell Löve 5/3'86

Proc. Dt. Soc. Brit. Isles VIII, 1
p. 60:

Slastenenko, E. P. 1963: Species
and speciation. - Bijl. Jaarb. 31,
pp. 158-168:

"Species is an aggregate of
the similar individuals or groups of
individuals of common origin,
which structurally and biologically
are incompatible with other species."

A disciple who does not
surpass his master,
fails his master.

Leonardo da Vinci.

It is not in the power of nature to
produce another such man.

Phylogeny:

A question of evolution — but all
characters used by secondary importance —
why not those of primary importance for
specific & higher evolution: the characters?
There have been entirely ignored or only
mentioned as additional characters that
the authors have not understood: cf Evergreen.
Other primary characters ignored: embryos growth points. —

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as H.G. Wells put it:

"the restoration of the past is an
[illegible] of human mind."

(continued)

(George Sand)

Diogenes:

There is only one good thing, namely knowledge
and only one evil thing, namely ignorance.

Einstein: (Science p. 509, 1967):

"A theory is the more impressive the greater the simplicity of its premises is, the more different kinds of things it relates, and the more extended its area of applicability. Therefore the deep impression that classical thermodynamics made upon me. It is the only physical theory of universal content concerning which I am convinced that, within the framework of applicability of its basic concepts, it will never be overthrown."

This last remark is for the special attention of those who are skeptics on principle.

Einstein, A. - Autobiographical notes, 1, p. 32.
in "Albert Einstein: Philosopher-Scientist"
P. A. Schilpp (ed.) - Library of Living Philosophers, Evanston, Ill. 1949.

För [illegible]?:

Stebbins' (1970) påstående, att öfloror har högre polyploidifrekvens, är utan grund; de har samma frekvens som landet närmast där floran bildades, utom om starkt annat klimat skett utan nya tillägg.

Expl.: Azores, söderut (flera?), Island norrut.

In his ~~text~~ philosophical work on "Creative Evolution" (French title:), Henri Bergson (1907) posited a theory of ~~duration~~ time and duration in which the reality of life and evolution was contingent on, not a series of gradual Darwinian changes, but a movement through what he called a cinematographically perceptible ~~changes~~ states of change, in which past merges with present. Life was a constantly redefined process of change, evolution and metamorphosis in which each stage was directly modified by the preceding stage.

The full richness and complexity of which we are just beginning to understand.

Bergson, Henri, 1907: L'évolution créatrice. – Paris.

Adlai E. Stevenson, Center Dem. Inst. 1963 [: (Substitute "democracy" for "science" or "taxonomy" for [illegible] — [illegible])]

Democracy is not self-executing. We have to make it work, and to make it work we have to understand it. Sober thought and fearless criticism are impossible without critical thinkers and thinking critics. Such persons must be given the opportunity to come together, to see new facts in the light of old principles, to evaluate old principles in the light of new facts, and by deliberation, debate, and dialogue to hammer out the consensus that makes democracy possible. And this, as we all know well, though some of us forget from time to time, requires intellectual independence, impenitent speculation, and freedom from political pressure. In a word, it requires centers of the kind found on Eucalyptus Hill in Santa Barbara . . .

I hope the day may come when such centers are multiplied the world over. For democracy's need for wisdom will remain as perennial as its need for liberty.

The Gardener Magazine, Sept.-Oct. 1975:

(The Open University)

p. 12

We have strived towards explaining the main (teaching) points rather than to discuss conflicting conjuring details. Misleading statements and irrelevant scholastic displays are eliminated, and ~~that we hope~~ we hope we have succeeded in avoiding mistakes, non sequiturs (= does not follow), the fallacy of assuming ~~that~~ an unproved cause, jargon, or other defects in the argument. . . . . In the very act of imparting knowledge, the instructional material must explain why the knowledge is worth having & how it fits into the broader scheme of things.

Bot. Not. or New Phytol., Jan. Feb.?

Phytogeography is a science that requires many details, yet it is the field of botany in which the learned scientist and the interested layman have the same interest, same. —

The Natural Geography of Plants,
by Henry A. Gleason & Arthur Cronquist.
Columbia University Press, New York 1964,
420 pp. richly illustrated, Price $ 10.00

Colegrove Craighead:

There is only one book I know that can be compared with this one as to excellency in description of the vegetation of a whole country. The Schmitz The living Landscape in Sweden. But neither book is better than the other, since they are as different as night and day in their approach, and as filled with beauty in knowledge of description as are the different times of the diurnal cycle.

The living landscape, the plants of the country, is what makes the land interesting and inviting. The forms of the mountains, the mirrors of the lakes and the width of the plains all are views we want to enjoy, but in our memory we add to them the green color of the grass and the forests, and the variations in color of the individual flowers, before we think of them as something inviting, a landscape in which we want to walk ~~or sit or ride~~ rest or study. Although it is the ultimate aim of any phytogeographer to describe for us these landscapes in such a way that we can see them even far away, many of us are lost

in the details, and only a few seem to have got the gift to describe the ~~whole (habit) in~~ ~~feature~~ details in such a way as to make the whole better visible and better understood.

Watsonia 6, 1 (1964): 36-38.

Chromosome numbers of Parnassia

The genus Parnassia is often included in the family Saxifragaceae, though there seem to be good reasons to regard it as the sole genus in a family of its own, Parnassiaceae (cf. . . . Hutchinson, Fl. Europ.).

It is a genus of less than 50 species of boreal distribution. Though some authors (cf. Willis 1931; Hayata, Tutin & Warburg 1956), accept as many as 45 species, which are restricted chiefly to boreal or alpine bogs, it seems more reasonable

names.
to classify these taxa into
since most of the widespread species
distinctly lower number of species.
Of these, only two occur in
Europe, whereas

~~Botany has~~

Many people still seem to consider a pre-occupation with flowers a sentimental rather than a scientific interest.

It may be disputed if studies of plants began as a result of gathering of food or ~~as~~ of admiration of the ~~fact~~ beauty of nature, but many people still seem to consider a pre-occupation with flowers as having a sentimental rather than a scientific interest. ~~In actual fact~~ In actual fact, ~~systematic~~ ~~but~~ studies of plants are now the leading ~~science~~ of branches of biological research, notably in regard to species formation and related evolutionary problems, to ~~ecology~~ growth and physiology, disposal, to the study of populations ~~and~~ and ~~ecology~~ and to the extension or contraction of geographical range.

The geobotanical significance of polyploidy.
II. Polyploidy and altitude. —

The genus *Rumex*. A cytotaxonomical review.

Sex determination in dioecious *Rumex*
I. ~~Previous investigations.~~
Evaluation of present knowledge.

Íslenzkar jurtir, 2. útgáfa.

Íslenzk grasafræði. Yfirlit yfir (íslenzkar) sólar og grasa um íslenzkar jurtir.

Speciation mechanisms ~~in apomict~~ and viviparous.

Polyploidy on Mt. Washington.

Chromosome numbers of plants of the St. Lawrence estuaries.

Chromosome numbers of Laurentian plants.

The American Acorus.
Some Carex chromosome numbers.

Chrysosplenium alternifolium in Parnassia.

Rosa Sagii – acicularis.

Anthoxanthum alpinum – – synonym.

Cytotaxonomy of the Carex sabulosa complex.

The boreal-arctic circumpolar ~~complex~~ taxon Carex sabulosa seems to be one of the ~~puzzling~~ confused species, the area of which might be better classified as quasi-circumpolar because some of its ~~so-called~~ so-called variations are in fact good species. Especially in North America there has been so little consistency in the treatment of these variations, that whereas some authors regard them all as varieties only, e.g. var. sabulosa, var. major Gleason, v. miliaris (Michx.) Dailey, v. rhomalea Fern. (cf. Porsild 1957,

(4) ~~[illegible]~~

The C. saxatilis complex ~~[illegible]~~ in America has long been a matter of taxonomical dispute, ~~and~~ the taxa of which have been separated at the species level by some students, but accepted as varieties only by others. Löve (1954) showed that while C. saxatilis s. str. is characterized by 2n = 80 chromosomes, the eastern North American C. miliaris Michx. (= C. saxatilis v. miliaris (Michx.) Bailey) is clearly distinct with its 2n = 40 chromosomes. The ^Amerasian-Arctic^ species C. physocarpa Presl, which often is classified as C. saxatilis var. major Olney or i~~ncluded by Hultén (1961)~~) ~~included by~~ Hultén (1962) in ~~in C. saxatilis or its ssp. laxa~~ C. saxatilis ssp. laxa (Trautv.) Kalela by ~~Kalela (1940) and Hultén (1962)~~, has never been found to have the chromosome number 2n = 60. Therefore, it is apparently a species in its own right, ~~distinct~~ ~~and~~ clearly distinct from C. saxatilis.

~~It was suggested by Hultén (1962), that the ~~American~~ eastern North American C. *saxatilis* var. *rhomalea* Fernald might be the hybrid C. *miliaris* x *vesicaria*.~~

The suggestion, by Hultén (1962), that the eastern American C. *saxatilis* var. *rhomalea* Fernald might be the hybrid C. *miliaris* x *vesicaria*, ~~needs~~ ~~waits~~ needs cytological verification ~~or rejection~~.

(5) [illegible] ???

(5) ~~It is remarkable that even Hultén (1962)~~ ~~The two species~~ The genus *Lysiella* differs from *Platanthera* and *Habenaria* in the shape of its chromosomes, in addition to morphological characters pointed out by 1943, Rydberg ( ) and Nevski ( ). Hultén (1962), who placed it in *Platanthera*, regarded the Eurasiatic and North American taxa as conspecific, despite distinct morphological, ecological and geographical differences, ~~that they~~

Rhodora:

Carex sakatilis sensu Clinton.

The Carex sakatilis complex in North America has long been in a state of confusion, as shown by the fact that whereas some authors regard it as a single species including four or more varieties, others have ~~rejected~~ distinguished these as ~~so~~ independent species, or lifted some to the subspecific levels and ignored others. The confusion is evident if ~~two recent~~ the two most recent treatments are compared, i.e. that of Fernald (1950) and Hultén (1962), since the former accepts the species in its widest sense, whereas the latter segregates one of its varieties as an unrelated species, another as a subspecies, and the third is regarded as of hybrid origin only.

Michaux 19. mars 1803, cf. Richard 2
St. Jlen 1980, p. 117.

Wallenberg 1803, sannolikt tidigare på 2 ex.
cf. Krok, p. 742.

Carex rotundata Wg. 2n = 90 (92).
ssp. miliaris (Michx.) L. 2 R.?

Carex physocarpa 2n = 60

C. sextilis 2n = 80

C. v. rhomalea 2n = 80

C. sextilis
ssp. sextilis
ssp. rhomalea } 2n = 80

C. physocarpa 2n = 60

C. rotundata Wg
ssp. miliaris } 2n = 90 (92)