

Character and Origin of Species Created by Nature

An abstract of new experimental results

By

Herbert LAMPRECHT

Introduction

A glance on biological phenomena shows an enormous, nearly incomprehensible manifoldness. However, the following two of the seemingly unlimited number of biological problems have overtopped all others at all times. The first is how organisations with vitality could origin from organic-chemical substances. The second relates to the origin of species and higher categories.

At this time, no answer can be given upon the first question, and can perhaps never be given. The second problem seems to be elucidated by the results of my experiments made during more than three decades.

The following paper gives a short survey of the genetic, plasmatic and cytological basis of the course of evolution, demonstrated by the results of crossing experiments. This involves both species and higher categories. The results in question are published in a greater number of papers during the years 1940 to 1966. Especially may be mentioned "Der Artbegriff" (Agri Hort. Genet. 17, 1959), and "Die Entstehung der Arten und höheren Kategorien", Springer Verlag, Wien and New York, 1966. These papers also give an index of literature belonging to this problem.

The effect of interspecific genes

The first experimental statement of importance for all phenomena discussed below was that the genes are to be divided into two distinctly different groups: *i n t r a*- and *i n t e r*-specific ones. The alleles of the first group of genes are as a rule to be found together with fertility in each species, whereas the alleles of the interspecific genes always are distributed on different species. In connexion herewith the *i n t r a*-specific genes show in species-crosses the Mendelian segregation ratio $1 AA : 2 Aa : 1 aa$ or $3 A : 1 a$. In contrario hereto, the interspecific genes segregate into $1 AA : 2 Aa : 0 aa$ (or sterile).

This implies that a species-foreign allele introduced by crossing (or after mutation) in its homozygous state never can be found in a plant together with fertility. This phenomenon causes an absolute species barriere. With regard to the species-foreign characters of plants with recessive and homozygous interspecific genes the terminus *e x m u t a n t* is used.

Real species are always characterized and differentiated from

another by the alleles of interspecific genes, whereas categories under the species but represent different combinations of the alleles of intraspecific genes. The occurrence of a species-foreign allele, equal if it is the result of a mutation or introduced by crosses causes always a very distinct change of the manifestation of a number of intraspecific genes. The effect of interspecific genes as mentioned above is valid both for the differences between species and higher categories.

Thus, there exists but one systematic category created by nature, and this is the species. The categories lower than the species are exclusively caused by different combinations of intraspecific genes. The categories of higher level than the species are created by man for attaining a clearly systematic grouping, which may — so long a possible — indicate their natural relationships.

Evidence and effect of progenes

What is the reason of the above mentioned 1 : 2 : 0 segregation of interspecific genes? The species-foreign allele is always introduced by the paternal kernel, which nearly exclusively contains the chromosomes. The hybrid is heterozygous in the interspecific genes. The hybrid-plants always show a normal development, demonstrating that both alleles of an interspecific gene, thus, also the species-foreign alleles, become undisturbed reproduced from celldivision to celldivision. This means that heterozygosity in interspecific genes does not inhibit the reproduction of species-foreign alleles.

But when gametes of the hybrid with recessivity in the species-foreign alleles produce zygotes with homozygosity in these alleles, they either develop to quite sterile and from the species morphologically very deviating plants or to no plants at all. With regard to this phenomenon the conclusion is to be drawn that substances absolutely necessary for the reproduction of species-foreign alleles are missing in such homozygous plants. These substances, introduced in the hybrid by the paternal kernel, are called *progenes*. The sum of all *progenes* is called the *progenom*.

Naturally, the presence of *progenes* is necessary both for intra- and inter-specific. The enormous enrichment of certain substances (i. e. the *progenes*) during the division of cells and nuclei in the haploid state, which lead to the origin of the ovum, gives evidence for this (c. *Agri Hort. Genet.*, 6, 1948: 142). By the assumption that the quantity of *progenes* in each haploid state (there are six) increases to the fifty-fold, the ovum should contain a quantity of about 15.000 milliontimes that of the original diploid cell. And, this quantity should be sufficient for the reproduction of genes during the whole life of an organism.

The experiments have shown that the reproduction of the progenes takes place but once during life, i. e. at the reduction division. The progenom is a *conditio sine qua non* for the synthesis of genes from celldivision to celldivision. As life is going on, the progenom is increasingly reduced. In connexion herewith is the wellknown phenomenon that celldivisions with increasing age become slower and slower. Thus, the decreasing of the quantity of the progenom causes the aging and the death of the organisms. As evident, the progene is characterized by the same reality as the gene.

The mutation of species-foreign to species-own alleles

This phenomén is to be observed in all exmutants. It takes place in the somatic tissue during the ontogenesis, especially in the inflorescences of the uppermost region of the plant. Here, the species-foreign characters change more and more to species-own, and in many cases fructification is to be found.

As expected, depending of either homo- or heterozygosity in the species-own alleles, seeds of such plants develop to maternal plants only, or they are segregating again in accordance with the above mentioned ratio $1 AA : 2 Aa : 0 aa$ (or sterile). The backmutation of species-foreign to species-own alleles in the somatic tissue is herewith clearly demonstrated.

The manifestation of this course of backmutation is in a high degree dependent on the rhythm of the ontogenesis. Sometimes the backmutations appear already in the lower situated inflorescences, in other cases they are to be found but in the latest developed parts of the plant and also here in a very slight degree.

The effect of the species-specific plasma

Already the above discussed effect of species-foreign alleles of interspecific genes and the dependence of these genes of specific progenes, which are introduced with the paternal kernel, demonstrate clearly that the reproduction of genes from celldivision to celldivision can only be effectuated by the progenes, when the plasma support the substances hereto necessary. In connexion herewith the question is of greatest interest if this synthesis can be demonstrated experimentally.

The cross *Phaseolus vulgaris* \times *P. coccineus* has given evidence for the correctness of this supposed synthesis. The pollengrain of *coccineus* has an about 60 per cent greater volume than that of *vulgaris*. In connexion herewith in crosses with *vulgaris* as mather always some *coccineus*-plasma is introduced in the embryo sac and also in the zygote

of the hybrid. This causes that among the descendants of the hybrid-plants individuals are to be found which show the species-foreign characters of the paternal parent and which sometimes also produce a few seeds. However, plants developed from such seeds were never fertile and with *coccineus*-type. They were either of *vulgaris*- or again of the mentioned parent- or hybridtype.

By crossing such hybridplants with one another or by backcrossing them with *coccineus* the quantity of the *coccineus*-plasma could be increased until it reached a greater quantity than that of the maternal *vulgaris*-plasma. Then, suddenly a separation of the two plasmatypes takes place, which was demonstrated by the segregation of the descendants into 1 *coccineus* : 2 hybrids : 0 *vulgaris*, instead of in the generation before into 1 *vulgaris* : 2 hybrids : 0 *coccineus*. The change from *vulgaris* to *coccineus* was herewith a fact and, moreover, it was controlled by marker genes, before only present in *vulgaris*. Thus, the result was a *Phaseolus coccineus artificialis*. Crosses of this new type with *vulgaris* in both directions has shown that it behaves like common *coccineus*.

The change from *vulgaris* to *coccineus* has clearly demonstrated that the plasma furnish the progenes with substances necessary for the synthesis of the genes. This demonstrates also that the origin of new species can take place only in connexion with the origin of a new plasmatype together with alleles of new interspecific genes. This represents also the course of evolution, the origin of new species in nature, where longtime influences of the surrounding conditions can give rise to new plasmatypes together with corresponding new interspecific genes. The extraordinarily good accomodations of organisms to the different surrounding ecological conditions give evidence for this. Which of the new-created species will survive, is dependent on their possibility to compete in the struggle of life.

The importance of cytological conditions for the species barrier

The taxa of *Pisum*, of which several by taxonomists still are considered as good species, give very good elucidation regarding the importance of different structures of the chromosomes for the barrier between species. Of the different taxa of *Pisum*, described as *abyssinicum*, *arvense*, *elatius*, *fulvum*, *humile*, *Jomardi*, *sativum* and *transcaasicum*, exist at least 30 different structures of the chromosomes. For 15 or 16 of these the translocations together with involved genes could be demonstrated in crosses. Of all seven chromosomes of *Pisum* exist different types of structure. In the most extrem cases all seven chromosomes have a from the normal deviating structure.

In crosses with such types, as f. i. the ecotype *fulvum*, a F_1 -sterility of about 97 per cent could be stated. Quite clearly could be demonstrated that whatever the deviations of the structure of the chromosomes may be, no influence on the barrier between species could be proved without differences in interspecific genes. Seemingly differences of this kind could always be eliminated by means of crosses. Thus, a change of the chromosome structure alone never can be of importance for the origin of species.

The species concept, species of primary and secondary origin

With regard to the above discussed results of crosses the following both clear and simple definition of a species can be given: To a species belong all individuals which are characterized by the same alleles of interspecific genes. A species originated by the creation of a new type of plasma with corresponding alleles of interspecific genes is called a primary species. To the mentioned definition of a species belong a further group of species, the allopolyploids. These are of secondary origin. Allopolyploids arise by the addition of the plasma and the genome of two primary species. With regard to this origin they are significantly called addospecies, or secondary species. Thus, compared with primary species, they are not characterized by new originated interspecific genes.

The importance of microelements

The following discussion of microelements in their relation to the synthesis of genes is not based on experimental results. The development of different plants is seemingly always dependent on the presence of several microelements, which all may be present in certain minimal quantities. With regard to the single plantspecies, some microelements have as a rule a more or less dominant influence. The same seem to be valid for animals. Different organs of men are f. i. characterized by a very varying content of certain microelements. One of these can be present in a certain organ, whereas an other microelement can be lacking in this organ. In an other organ the contrary can be the case. Here, microelements are as a rule present in high molecular substances as ferments, hormones, vitamins and proteins.

I consider the microelements as indirectly engaged in the synthesis of genes. They seems to be present in substances which of the plasma are transferred to the progenes for the synthesis of the genes. Indicating this phenomenon is the possibility to eliminate the lack of a microelement in a plant by spraying the leaves with a solution of the substance in question.

As the content of microelements and their quantitative distribution in the soil is a condition of life for the organisms, a change of this content can be of great importance both for the origin of new species as for the extinction of them. Quite clear seems to be, that a species, the development of which is dependent on the presence of a certain microelement, never can originate in a territory not containing a sufficient quantity of this substance. A species originated in such a territory could never propagate.

A study of the relations between the genotypical constitution and microelements would in several respects give informations of great value. Thus, f. i., the accommodation of species to different surrounding conditions, which could solve many kinds of problems of geographical distribution. In some cases light could probably be thrown on the extinction of species. Changed climatic conditions can cause an emigration of species into other territories, characterized by a lack of microelements necessary for their normal development. This can cause a more or less marked sterility and an extinction step by step could be the result.

The course of evolution

Summarizing, the course of evolution, i. e. the origin of new species and higher categories, can be described in the following way. The surrounding conditions, as edafic, climatic and other factors, have repeatedly changed during geological periods. The effect of their influence is to be found in the plasma, where they become magazined as substantial changes. These changes are to be considered as a kind of memory of the organisms, equal if it is the question of plants or animals.

The first answer of an organism as an accomodation to changed surrounding conditions will be new combinations of intra-specific genes, inclusive mutations of such genes. When these possibilities do not more exist with regard to the genotypic constitution of the organism, a differentiation of the plasma can occur. Two new types of plasma with corresponding interspecific genalleles arise with the result of two new species or higher categories. What will survive is dependent on the possibility to resist in the struggle of life. In connexion herewith also the present genotypical constitution and the possibility to fast accomodation are of great importance. With regard to the possibility of a fast and successfull accomodation to the surrounding conditions an explosive propagation and distribution can be the consequence, but in unfortunate cases also an extinction of new organisms can take place.

In the course of evolution it may be observed that it always has to origin from the present constitution in interspecific genes. Thus,

this constitution decides the direction in which the evolution can take place. For this phenomenon, the already since long time, but in a some other sense used term, *orthogenesis* can be accepted.

Biochemical results

Finally it may be mentioned that the results of chemical investigations of substances which participate in the process of heredity, as desoxyribonucleic acid a. o., have absolutely to be brought into connexion with the above described species barrier and the course of evolution. The sometimes used term "molecular genetic" is misleading and may not be used for these biochemical results.

It is a command of our time that the above summarized facts may be evaluated for an conscious understanding of all life on earth.

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Zeitschrift/Journal: [Phyton, Annales Rei Botanicae, Horn](#)

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Autor(en)/Author(s): Lamprecht Herbert Anton Karl

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