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THE EXPERIMENTAL SYSTEMATIC METHOD.

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(With a genealogical tree.)

1) The Experimental Systematic Method deals with sero-diagnosis. It represents an inductive and objektive method for the recognition of the natural, i.e. genetical affinity of organisms.

2) Sero-diagnosis was found out by medical investigators in the process of the extension of the science of immunization; the phenomenon, that many diseases for a long or a short period after recovery afford immunity from re-infection by the same morbific agents, led to the discovery, that after the cure had been begun, substances ("antitoxines") which had not been present there before, circulate in the blood; with the help of these the viruses of the respective morbific agents ("toxines") can be neutralized. By this, the "specific" character of the antitoxines was proved.

3) With the aid of the specific character of the antitoxines medical research was enabled to identify both diseases in doubtful cases (WIDAL-Reaction), and proteinous substances of uncertain origin (blood-tests etc.). For forensic medicine especially, this discovery is of very great importance.

4) It was, however discovered by UHLENHUT, that human blood cannot be distinguished from that of the higher primates in this way, that consequently human beings, gorillas and chimpanzees possess peculiarities of blood very similar to each other and considerably different from those of the lower monkeys. Through this the first reaction for a blood-relationship which extended beyond the species, was discovered.

5) In the application of the sero-diagnosic method to vegetable objects, MAGNUS and FRIEDENTHAL succeeded in establishing that here also, reactions showing relationship can be obtained. The proof of the existence of albumen relationship between *Saccharomyces* and *Tuber* already touched on a question which had conside-

rable interest for systematic botany.

6) This recognition of the applicability of sero-diagnosis to botany, however, continued to be without further importance for our knowledge of the historical development of the plant-kingdom until MEZ, starting from the highest dicotyle-families, began working through the whole plant-system in a collective research carried out in collaboration with his students in the Botanical Institute at Königsberg from 1911 onwards. By means of it, the Experimental Systematical Method was produced as a special branch of Science. The results of this research that have been gained up to the present are submitted in the "Königsberger Stammbaum des Pflanzenreiches".

7) The method of examination was at first the one taken from medical science. Rabbits were employed for immunization; they were inoculated with the extracts of plants, after attaining sufficient immunity, were killed. The blood-serum was taken and mixed with extracts of the plants which were to be tested for their relationship. Existing relationship shows itself through the appearence of specific precipitates. These serums are called natural serums; they are now frequently replaced by the artificial serums discovered by us, which are quite identical as regards their effect.

8) While medical research in general presumes even to-day that the "immunity-substances" are produced as the reaction of the body of the living animal on the foreign proteinous substances injected, that they are substances which are produced by the animal body, we have shown that living animals are unnecessary for its production and that the immunity serums can be produced just as well or better by digestion in vitro of the proteinous substances with serum of animals which have been killed (artificial serums). The dead blood-serum has also the property of to take down the proteinous substances by fermentation, during the production [redacted] specific immunity substances.

[redacted] It was shown by us that all living organs of every species yield the same specific immunity substances in all stages of their development (youth and age, Haploid- and Diploid-Phase); consequently the "specific" character of the immunity-substances is settled by the specific character of the "specific-cell" ("Art-Zelle" O. HERTWIG).

10) As parts of animals, free of nuclei as well as chromatinous substances yield no immunity-substances which are typical for species, it is extremely probable that the property of yielding immunity-substances for specifying relationship belongs to the substances of the nuclei. Through this proposition the Experimental Systematical Method gains accession to the views of the investigators of heredity and represents a branch of Genetics which concerns the whole system.

11) Just as genetics assume with certainty that all the properties of the organisms are handed down to posteriority by physical transmission of the hereditary substances in the process of propagation, it is also the logical basis of the Experimental Systematical Method that the proteinous substances (which are apparently localised in the nucleus) and their properties (Idioplasma) are the cause of all morphological and physiological shapes of the organisms.

12) From similar or dissimilar characteristics, it is generally concluded whether the organisms are related or not. The same conclusion must also be admitted with regard to the similarities and dissimilarities which appear in the protein-reactions.

13) These accords and divergences of the reactions established by sero-diagnosis have led to a system obtained by experiment, which agrees with the broad outlines of historical-phylogenetical research (Palaeontology, History of development) in every connection, and coincides with the views of the best, though not always recognised investigators of Morphology. There does not exist a single statement of the "Koenigsberger Stammbaum", for which evidence cannot be produced from the great morphological literature.

14) The objection that the exclusive use of proteinous qualities in the Experimental Systematical Method would create an artificial system is groundless, because in process of the examination of the proteinous qualities, all proper-

ties of the organisms, the nature of which is settled by the proteinous substances of the Idioplasma, receive consideration (11).

15) The important difference, which the "Königsberger Stammbaum" shows when compared with all systems of the vegetable kingdom which have existed up to now arises from the fact that all its statements, resting as they do on an experimental basis, are made absolutely certain and unambiguous. The great uncertainty of the hitherto existing phylogenetical deductions from morphological facts has disappeared.

16) The Experimental Systematical Method is based on the Law of Irreversibility inductively deduced by DOLLO from a large collection of geological-palaeontological data. This Law was further based on HAECKELs biogenetical fundamental Law by KARNY; it was established by MEZ, who drew his conclusions deductively from theoretical opinions about the variation. The Law of Irreversibility states that no step made in the development of Ontogeny and Phylogeny is ever retraced.

17) According to the Law of Irreversibility the Idioplasma, as basis and cause of all morphological phenomena (v. supra 11) can never return again to a condition in which it has previously existed. KARNY rightly states: "If it were possible for an more highly specialised form to return to an earlier phyletical stage in the course of its further development ..... every examination of the phylogenetical History would be made a logical impossibility". By far the most convincing evidence for the correctness of the Law of Irreversibility is brought forward by the "Königsberger Stammbaum", the lines of which show, it is true, divergent developments everywhere in the evolutions, but on the other hand no anastomoses in any single place.

18) According to the Law of Irreversibility, by its evidence formulated in the "Königsberger Stammbaum", and further by the evidence of frequent comparative sero-diagnostic investigations of form-groups which are morphologically very strongly convergent and reduced, it is fully established that the Experimental Systematical Methode is not affected by convergence and reduction which are the two great uncertainities in morphological research. Compared with morphology the assertations of sero-diagnosis have not relative but absolute importance, assuming fault-less application of method. The results of the Experimental Systematical Method can serve as a referential system, apart from morphology, which enables us to decide which morphological trains of trought are correct and which are incorrect.

19) It is, however, absolutely erroneous when opponents of sero-diagnosis affirm that this new branch of knowledge neglects morphology. This is beside the point for the following reason alone, namely because it is only through the morphological corroborations that the results of sero-diagnosis gain their intelligibility and, as it were, comprehensible form. - On the other hand it is correct that the Experimental Systematical Methode does not accept as a matter of course the assertions of morphology, which are relativated by convergence and reduction, and according to its research methods always uncertain and indemonstrable, but compares them with its own results. No one will find this unauthorized, who knows that not one of the existing morphological systems agrees with the other; that not one of them has remained constant even all the way through the editions of the same book; that the morphological systems are diametrally opposed in just their most important points, namely in their views on the starts of development; that they, as the results of abstractive trains of throught and therefore as constructions of the systematical feeling, often bear a subjective character.

20) In contrast to this the "Königsberger Stammbaum" with its perfectly precise statements has remained quite stabile from the very first, i.e. for 16 years. Each new reaction has consistently followed those already in existence. Its elaboration is to be compared with the reconstruction of a mosaic picture by means of the surrendered stones, in which it is at once evident from the whole whether one stone has been rightly or wrongly put in. All the data obtained by many different investigators using the same method agree in every respect and mutually confirm each other. This is a convincing proof of the objektive correctness of the construction in its entirety.

21) The "Königsberger Stammbaum" is in complete accordance with the great theories of phylogeny; it corroborates them, just as, vice versa, it is corroborated by them. These theories are: The "Biogenetisches Grundgesetz" (HAECKEL), the Law of Irreversibility (DOLLO), the Law of the Unspecified (COPE). - In the other hand the enunciation of the Progressive Reduction of Variability (ROSA) and the Age- and Area-Hypothesis (WILLIS) are refuted by the Königsberger Stammbaum.

22) The "Königsberger Stammbaum" brings all the forms of the whole vegetable kingdom, which have been examined up to now, into genetical association beginning with the autotrophical bacteria and ending with the composites; it affords a clear, unequivocal and relatively simple survey of the vast abundance of forms in the vegetable kingdom.

23) Through this, the monophyletic "Königsberger Stammbaum", in that it proves with certainty that the *Euglenoideae* (which are established by PASCHER and DOFLEIN as the basis of the animal kingdom) are phylogenetically derived from the planogamets of the *Heterocontae* as neotenic formations, also, presents the family history of the animal kingdom in its lower orders (*Bacteria*, *Chroococcaceae*, *Palmellaceae*, *Protococcaceae*, *Ulotrichaceae* and *Heterocontae*) and proves the Unity of Life.

All botanical work dealing with the Experimental Systematical Method is contained in the "Botanisches Archiv" (Vol. I - XVI) edited by MEZ; this periodical sums up and criticises in its supplement, the "Botanisches Echo" all other investigations relating to sero-diagnosis in detail. - The Königsberger Stammbaum has appeared in large size (1,5 x 2 metre) as a demonstration table for lecture purposes and is obtainable from the editor of the "Botanisches Archiv".

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