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THE GENOTYPE CONCEPTION OF HEREDITY¹

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BIOLOGY has evidently borrowed the terms "heredity" and "inheritance" from every-day language, in which the meaning of these words is the "*transmission*" of money or things, rights or duties—or even ideas and knowledge—from one person to another or to some others: the "heirs" or "inheritors."

The *transmission* of properties—these may be things owned or peculiar qualities—from parents to their children, or from more or less remote ancestors to their descendants, has been regarded as the essential point in the discussion of heredity, in biology as in jurisprudence. Here we have nothing to do with the latter: as to biology, the students of this science have again and again tried to conceive or "explain" the presumed *transmission* of general or peculiar characters and qualities "inherited" from parents or more remote ancestors. The view of natural inheritance as realized by an act of transmission, viz., the transmission of the parent's (or ancestor's) *personal qualities* to the progeny, is the most naïve and oldest conception of heredity. We find it clearly developed by Hippocrates, who suggested that the different parts of the body may produce substances which join in the sexual organs, where reproductive matter is formed.

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Darwin's hypothesis of "pangenesis" is in this point very consistent with the Hippocratic view, the *personal* qualities of the parent or the ancestor in question being the heritage.

Also the Lamarckian view as to the heredity of "acquired characters" is in accordance with those old conceptions. The current popular definition of heredity as a certain degree of resemblance between parents and offspring, or, generally speaking, between ancestors and descendants, bears the stamp of the same conceptions, and so do the modern "biometrical" definitions of heredity, *e. g.*, as "the degree of correlation between the abmodality of parent and offspring." In all these cases we meet with the conception that the personal qualities of any individual organism are the true heritable elements or traits!

This may be characterized as the "transmission-conception" of heredity or as the view of *apparent* heredity. Only superficial instruction can be gained by working on this basis. Certainly, medical and biological statisticians have in modern times been able to make elaborate statements of great interest for insurance purposes, for the "eugenics-movement" and so on. But no profound insight into the biological problem of heredity can be gained on this basis, for the transmission-conception of heredity represents exactly the reverse of the real facts, just as the famous Stahlian theory of "phlogiston" was an expression diametrically opposite to the chemical reality. The *personal qualities* of any individual organism do not at all cause the qualities of its offspring; but the qualities of both ancestor and descendant are in quite the same manner determined by the nature of the "sexual substances"—*i. e.*, the gametes—from which they have developed. Personal qualities are then *the reactions of the gametes* joining to form a zygote; but the nature of the gametes is not determined by the personal qualities of the parents or ancestors in question. This is the modern view of heredity.

The main result of all true analytical experiments in questions concerning genetics is the upsetting of the transmission-conception of heredity, and the two different ways of genetic research: pure line breeding as well as hybridization after Mendel's model, have in that respect led to the same point of view, the "*genotype-conception*" as we may call the conception of heredity just now sketched.