A Biologic Basis for an Holistic Philosophy in Medicine[1]

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The idea of wholeness, of indivisibility of the human body, the interdependence of its parts is old. Alfred Adler carried this concept into psychology and it is now applied to the totality of man, body and mind. However, though this holistic approach is almost self-evident, or probably because it is self-evident, most physicians pay only lip service to this philosophy. It may well be that it is a point of view too general and too abstract to be easily translated into concrete terms. It is even more difficult for many to understand the old statement that the whole is more than the sum of its parts.

It seems, therefore, appropriate to attempt to show on a concrete example the inevitability of an holistic approach to living organisms from the simplest forms to man. Such an example is furnished by our modern concepts on heredity and embryology.

It is a well established fact that the genes are the carriers of heredity. They are contained in the chromosomes of the cell nucleus and are in all probability protein molecules of high complexity and of high molecular weight. Their most important characteristic is their ability to reproduce themselves. It is now believed on good evidence that genes are enzymes or that they produce enzymes, that is, organic catalysts. An enzyme is a highly specific agent, responsible for a specific chemical change, be it the combination of molecules to a higher unit or the breaking up of a molecule into two or more constituents. Thus we see that an enzyme acts only upon the appropriate chemical substance or substances that are termed substrates. Chemical changes of the substrate are practically impossible without the specific enzyme, while, of course, an enzyme is inactive in the absence of the specific substrate.

A most important step forward in our understanding of gene action and thus of heredity and ontogenesis was achieved when the old idea of direct relation between gene and any one somatic character was abolished. At first it was believed that each gene was responsible for the development of a specific character, for instance, color of hair,

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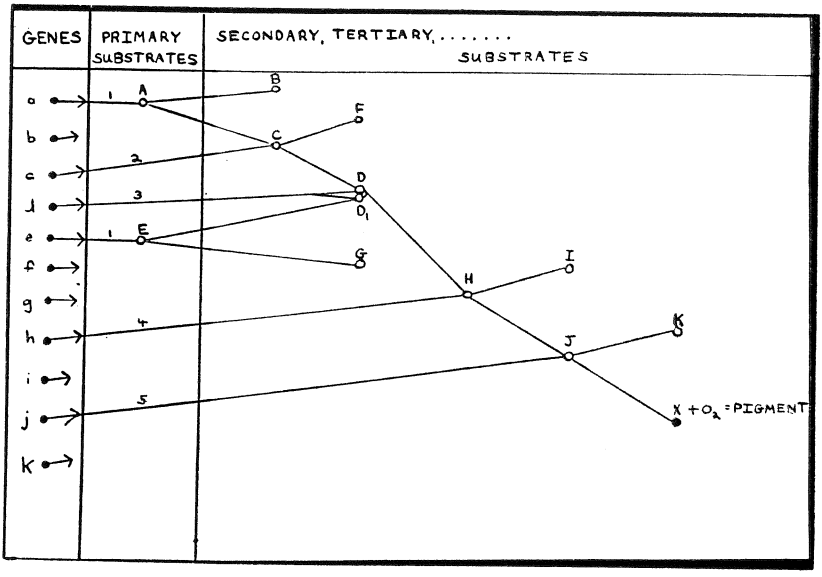
color of eyes, morphology of each tooth and so on. The body was then thought as a mosaic of parts, represented in the fertilized egg by a mosaic of genes. Today we know this concept to be wrong. It is believed that the single character develops by the interaction of many genes and, as a corollary, that a single gene influences many structures of the body. A physiologic and, therefore, dynamic theory of gene action emerged to replace the old "billiard ball" theory.

In order to gain at least a basic insight into this concept we have to understand one more fact. Evidence from many sources permits us to estimate, though only roughly, the number of genes in the human fertilized egg cell. This number is in the range of about 30,000 to 40,000. It must be remembered that each one of these 30,000 genes is a specific enzyme (or responsible and indispensable for the formation of a specific enzyme) that can act only upon a specific substrate. 30,000 genes thus "need" 30,000 different substrates. It is easily understood that the protoplasm of a single cell can contain only a minute fraction of this number of different chemical compounds. How, then, can the many thousands of genes that are at first inactive because of a lack of their substrate, be activated? The following astronomically oversimplified diagram may show the basic principles.



In this diagram it is assumed that genes *are* enzymes. Of the 30,000 to 40,000 genes present, eleven, a to k, are taken as a sample. Likewise of the 10 to 20 primary substrates, i.e., the different chemical compounds present in the fertilized egg, two, A and E, are represented. In the action 1 gene (enzyme) a causes the substrate A to split into substrates B and C, while gene (enzyme) e effects a breaking of substrate E into substrates D_1 and G. Now new, secondary substrates have made their appearance so that new genes (enzymes) have been activated. Let us follow the action 2 in which gene c, splitting the secondary substrate C, effects the appearance of substrates F and D. Action 3: gene d combines D and D_1 to the compound H. Action 4: H is split, by the activity of h, into I and J. Action 5: enzyme j splits J into K and X and the latter, finally, by simple oxydation forms a pigment. It is now clear that this pigment could not form without the coordinated and *timed* action of six genes, (a,c,d,e,h,j) and besides that now all the eleven genes are activated, substrates being present for their specific activity.

If one were able to unravel the lines of action and interaction of all the 30 to 40 thousand genes of a human egg cell it would be possible to show that organs and their parts are not only interdependent in their life and function, but also in their very development. That the brain cannot survive and function if it is not supplied with blood by a pumping heart, is commonplace knowledge. But now we see that a normal brain could never develop if not a thousand other things happen in the development of other—possibly all other—organs. We see now that the interdependence of all the parts of the body begins with the first steps in an orderly development, *ordered* in space as well as in time. And this is the secret meaning of the knowledge that the whole is more than the sum total of its parts. One thing has been added in this pattern of things—order or organization. This invisible addition to the sum of the parts is responsible for an organized whole to be more than the sum of its parts.

You may pile up all the differently colored threads of wool that are needed to weave a beautiful carpet. They do not mean anything before they are woven into a pattern. Then they may show the beautiful picture of a Flemish tapestry, or let you read the saying of a wise man, or simply delect your eye by the beauty of abstract colorful patterns.

This is life: