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# Aging of Tissues: The Necessity for Research

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THE DESIGNATION OF A BIOLOGICAL and certainly of a sociological process as aging is perhaps unfortunate. In many minds it at once indicates a concern not in the change and readjustments in tissues and in human relationships chronologically regulated by time but in an irreversible state, senility, that finds its end reaction in the naturalness of death. Such a finality of biological and social adventures, while deserving both interest and care, of their nature fail to lend themselves to investigation with the hope of acquiring information that may be applied in a usable and constructive fashion. To prolong senility and the unhappiness usually associated with it would, in truth, be a vivisection. The statement which is to follow is therefore not concerned with senility as an age entity but with acquiring information about those processes which develop in all animal and plant tissue as a result of such tissue as organism being subjected to a life through time which may ultimately lead to senility and, if such be possible, to a termination in senile, physiological death.

The influence of the age of tissues in modifying, if not in determining, types of disease processes in the animal organism has been recognized for centuries, and yet these observations in general have certainly been treated in a superficial, if not an incidental, fashion. The phenomena of tissue resistance as well as susceptibility, in which the factor of age either influences or in a large measure determines these states as the individual as organism advances through different segments of the life span, have not been assigned the importance which they would appear to deserve. This does not imply that the advent of certain specific diseases and tissue modifications of a degenerative order has not been associated in the minds of investigators with such age segments. It does mean that observations of such an order have usually been made in a casual fashion without attempting to disclose the basic nature of chemical cell modifications, the products of aging which may be the factors determining the advent of degenerative alterations in tissues and which regulate, in a measure, their susceptibility or resistance to certain outside agencies, or the cause for specific disease states.

The influence of the age of tissues in terms of their susceptibility is shown very early in the life span by our recognition of a group of disease processes as specific pathological entities designated as the diseases of infancy and childhood. Such states may develop in adulthood or at even more advanced age periods, but they are predominatingly more frequent in younger tissues and in such tissues of specific cell types. Certain of these diseases have been shown to be due to viruses which prefer an intracellular order of existence. At such an age period intracellular material would appear to afford a properly chemically constituted culture medium for these living agencies of disease, and as the aging process develops it may well be that this living medium so changes in its composition that it becomes less appropriate for the life and multiplication of these bodies. Age as a modification in intracellular chemistry with or without a change in morphology (*3*) may have imparted to such cells and the tissues which they constitute an element of resistance to invasions by disease-producing entities. Why do we speak of anterior poliomyelitis as infantile paralysis unless it is due to the likelihood that in the infant and young child motor anterior horn cells of the spinal cord are more susceptible to the invasion and proliferation of the virus of this disease than is the case for these cells at more advanced years or in senility? It is possible that as these cells live into more advanced age segments they may become protected against the virus by the individual forming specific antibodies. These bodies, however, cannot be demonstrated in such advanced age segments of maturity or in senility in a sufficient percentage of incidence as to explain the decrease in the likelihood of infantile paralysis appearing in such periods of the life span. In reasoning of a reverse order, in the influenza epidemic of 1917 infants and young children were relatively notably spared the development of this virus disease, while adults who chronologically had

been afforded the time factor in which to acquire, by mild infections, an immunity of an extracellular chemical order were especially susceptible to it; and in this age segment of adulthood the mortality percentage rose to its height, again declining in the senescent and senile age groups.

The same order of inquiry applies to malignant disease (*4*). If such tissue developments have as their exciting cause the action of specific viruses, why is it that such bodies find in the cells, especially of certain organs as they pass their peak of maturity and into senescence, a favorable environment for their existence and express such an adaptation in a wildness of cell growth and an associated intoxication of the organism as a whole, designated as malignant disease? The occurrence of such states in infancy and early childhood and in senility is less frequent than in the mature and senescent individual. If such tissue growths come about from a lack of chemical tissue restraint or the advent of a tissue stimulus other than a living invading organism, it would appear equally important that knowledge of a highly complex, difficult-to-obtain, and exact order should be searched for in tissues at various age segments in order to explain modifications in tissue susceptibility or resistance to the development of such states of malignancy. Such states favorable to virus growth, to a lack of tissue restraint, or to tissue stimulation cannot be ascertained until we possess biochemical and biophysical information of cell life at various periods in the life of the organism as a whole, in order to contrast chemically through these data periods in the life span of tissues characterized by relative resistance as susceptibility to changes of a malignant order.

At the present time diseases of the heart and blood vessels, especially the latter, take the highest toll of life. Such terminal events, in all likelihood commencing years before the finality of the blood vessel accident or episode, certainly show themselves in a much higher percentage in adult and late adult life. The occurrence of coronary artery disease with occlusion in youth has recently been emphasized (*1, 2*). These heart and blood vessels changes are usually seen as tissue changes in the process of repair, as indicated by the laying down of fibrous tissue in the place of a protective endothelium and functional muscle tissue. The familial incidence and, of more significance, the age incidence in the development of such disease cannot be questioned. Basic research of a chemical order in an attempt to learn the nature of those chemical changes, the modifications in blood vessel tissue metabolism, and tissue metabolism in general, in which such vessels that are associated with aging share, has certainly lagged in its applied interest. The older microscopic type of investigation, perhaps for want of an adequate chemical technique, continues to dominate investigations concerning the causes of heart and blood vessel disease. This most important problem will be solved only with the discovery of the biochemical constitution of tissues as they advance from an age period of relative nonsusceptibility to vascular disease into that middle-age segment in which their susceptibility is marked and at which time such changes often terminate life. As a result of the rapidly increasing life span of the individual there will be a mounting number of human beings falling in that age segment in which vascular disease reaches such a state of development as to express itself either as incapacity or death.

Through certain illustrations used above, an attempt has been made to divest the minds of many individuals of an interpretation of the study of aging processes as a dominant interest in senility. Senility and the care of the senile deserve consideration both as biological end reactions and as an expression of the fineness of human feeling. The significance of an understanding of aging resides in the assumption that through such information the shifting, adapting, and nonadapting changes of a chemical order of life are to express themselves in determining those age areas in which tissue degenerations make their appearance, in which tissues exert their influence in the formation of new and abnormal tissue growths, or the advent of certain specific states of disease falling in the group of viruses which require an intracellular environment highly specific in its chemical constitution for their propagation.

### References

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## *Scanning Science—*

**From notices in the daily papers it appears that the registration at several universities is as follows: Yale, 2,515, an increase of 100 over last year; Columbia, 1,760, an increase of 130; Cornell, 1,720, an increase of 109; Chicago, 1,126, an increase of 17; Massachusetts Institute of Technology, 1,184, an increase of 12.**

*—30 October 1896*