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A study of senescence

William T. Sanger

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Important note.

I wish to make the following explanations:

1. Time has not permitted us to work out some of the sections of this the **A STUDY OF SENESCENCE** owed to do later. This is particularly true of chapters 2, 3, and to some degree, chapter 4.
2. The bibliography is not quite complete and has not been proof read. The numbers of the bibliography will be filled in the body of the text later when revision is made.
3. I regret that the typing is not neater. I could not have the same stenographer for the whole job.
4. I hope numerous suggestions will be made for the revising of the manuscript, both as to condensation and elaboration.

William T. Sanger

accepted by Dr. Ball

June 4, 1915

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2. Normal Sources.

- (1) Muscles.
- (2) Psychia Patardabilis.
- (3) Memory.
- (4) Attention.
- (5) Imagination.
- (6) Attention.
- (7) Consciousness.
- (8) The Mind.
- (9) The Mind.
- (10) Observation.
- (11) Observation.
- (12) Memory.
- (13) Observation.

(14) Obstinacy.

(15) Dominating.

(16) Later Sex Life and Celibacy.

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(6) Affection. *the mind.*

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I. INTRODUCTION.

- (14) Obstinacy.
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I. INTRODUCTION.

(1) The Problem.— A complete study of senescence would involve, not only a consideration of man, but of lower organisms, animal and plant, as well as institutions, races, nations, even the cosmos itself; for assuredly the phenomena of decay are as universal and intricate as those of genesis. In the present study, however, it will be attempted merely to indicate, first, the best that has already been done upon human senescence; second, to add further findings; and, third, to set more definitely a number of new problems for future investigation. While the writer feels that there ought to be a treatment of senescence different for brain workers and hand workers, because the former retain their youth and their youthful productiveness longer, in our present state of knowledge it is impossible to make such a nice differentiation of the problem. It is to be hoped, however, that the future will recognize this distinction, and make ample provision for it in adequate individual and comparative study.

Speaking of senescence, Clouston (, p. 230) says, "Its full psychology has yet to be written." Likewise, Chamberlain maintains that, "We are in need of just such an investigation of old age and its phenomena, as the child study movement, an investigation that shall put old age in its true phylogenetic and ontogenetic setting, and emphasize its role in the individual and social life of man" (, p. 130). President Hall, in a public lecture, has remarked, "We ought to study old age and death and develop a gerontology and thanatology." Years ago, Humphry, () now well known as a fruitful worker in the field of senescence, lamented that there was such little attention given to old age. Recently, Thompson () has spoken for the medical profession, urging that— "If one considers the balance of medical literature from the point of view of the age of patients, it is very noticeable that with an enormous output of works relating to infants

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and childhood the opposite extreme has met with comparatively little exact study, even when the disproportionate number of survivors to extreme old age be reckoned with" (p. 277). In quite the same fashion one could appeal to numerous specialists, both in psychology and medicine, who are convinced that senescence has long been a neglected field of investigation. Saleeby () goes so far as to conclude that the psychical needs of old age are greater now than they used to be; that we need to give more attention to the problem of old age, because science has lengthened life; that we less tolerate and sympathize with the foibles of old age; ^t that old age differs from earlier age; that we need more teaching on the care and regard for the aged; and, withal, that there is need of more teaching concerning how to live in preparation for happy old age. Finally it might be said that a recent demand and justification for the study of old age is to be found in the decrease of the birth rate, especially among the higher social groups. This makes it more than ever necessary to prolong life, efficient life, that those best fitted to serve may make the fullest contribution to social evolution. For the wisest and best to die early is an irreparable social loss.

(2) What is Senescence ?- This term is used quite vaguely in the literature for manifestly good reasons; just as chronological and physiological age are not identical in many instances in young life, quite the same is noted in decadence. In fact, it may be that in senescence the greatest disparity between chronological and physiological age is to be found. Some writers as Saundby () make a distinction between senility and old age, holding, as indeed one may well do, that it is quite possible to be old without being senile. Saundby remarks that "Old age implies merely the lapse of time, but senility indicates deterioration of structure"(p.9). The American Text-Book of Physiology reports: "In the more restricted sense senescence or old age comprises the period from about fifty years (in women from the climacterium) onward, during which there is a noticeable progressive waning of the vital powers"(Vol. II. p. 490).

In this study senescence is taken to mean a process involving physical and mental decline, which for some individuals sets in early, while for others not until advanced years. In either case it may or it may not advance rapidly to the end. Moreover, old age is used as synonymous with senescence, referring not to the attainment of years, but of structural and functional weakness. This is done to give a greater variety in terminology-for literary reasons and to conform to the usage of many authorities whose studies are considered in the present one.

workers and the aged workers. Unfortunately in this study there

(3) The Method.- If this study can be said to have a method, it was hit upon after a number of aged individuals were observed for a considerable time and after the literature had been gone over in part. Then it seemed evident that certain facts ought to be determined, if possible. Consequently, a set of about fifty questions, some of them having several parts, were made out,- questions, which if answered, would bring out the characteristics, especially of the senile psyche. These questions were committed to memory, and when in conversation with the aged an opportunity opened to ask one of these questions, an answer to it was sought without the knowledge of the one questioned. At one sitting, perhaps four or five or a dozen questions might thus be answered. These answers were written out with great care later, or at the time in several cases. All of the questions were not put to all of the individuals observed. It seemed to the writer that the answer to some of these questions by some of those observed would be of little value. These question may have influenced the writer in his reading, but he sought always to be open to points not covered by the questions. The writer is convinced that the facts of old age will never be determined by merely questioning these folk, for it is probable that the aged do not realize their shortcomings and, therefore, may not give valid answers to many of the questions. Whenever possible, the friends or care-takers of the aged have been asked concerning the latter, in order to secure as full and accurate data as possible. In some instances the facts of this study have been derived chiefly from the friends or caretakers of the aged, for their data promised the greater accuracy. A complete study of senescence will only be written when a large number of subjects have been observed, and if possible, experimented upon for years,-subjects representing various ages and social strata, among them both the hand

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II. THEORIES OF SENESCENCE.

workers and the brain workers. Unfortunately in this study there has not been an opportunity for such an extended investigation though the observations have extended over several years in some instances. Wherever possible the observations of others have been taken advantage of, also.

The questions asked of the aged are so fully represented in topics of Chapter 4, The Psycho-Physical Aspect of Senescence, that they are not given here. As to the amount of data the writer's personal observations have yielded, it should be said there are in hand six detailed and a score of less complete observations.

Summarizing Hufland's book, Lankester points out that he says the length of life is dependent in general upon the quantity of vital force contained in the body and that life consumes and destroys, not only this vital force, but even the bodily organs. In consequence, the destruction of life occurs later in a body endowed with vigorous organs than in one with more delicate organs. The consumption of the vital force and of the organs progresses more or less rapidly in consequence of which life may be short or long. The duration of life is then dependent upon the sum of vital forces which it possesses, and on the greater or less consistence of its organs, and upon the rapidity or slowness of its consumption and finally upon the perfection or imperfection of regeneration.

Speaking for himself Lankester continues:

"By 'specific longevity' we mean the average longevity of the individuals born. . . ." (p. 30). By potential longevity Lankester means the longevity of the groups of

of the species, that is, the average duration of life of all the individuals born.

II. THEORIES OF SENESCENCE.

While experimental data regarding the nature of senility are accumulating, theory still holds much of the field and will probably do so for some time. It is beyond the limits of the study to give a complete survey of theories and experiments; only those will be referred to which have primal historic or present-day worth, to indicate something of the complexity of the problem.

Regarding an old theorist, Lankester, (1870) says();

"The work of the Prussian physician, C. F. Hufland, entitled 'The Art of Prolonging the Life of Man', published in the beginning of this century is to a great extent founded on Bacon's work, from whom most of his facts are derived. The advance in science during a century and a half, enabled him to treat the subject in a less metaphysical style than Bacon could; at the same time, his philosophy which has now in its turn become antiquated" (p. 5).

Summarizing Hufland's book, Lankester points out that he says the length of life is dependent in general upon the quantity of vital force contained in the body and that life consumes and destroys, not only this vital force, but even the bodily organs. In consequence, the destruction of life occurs later in a body endowed with vigorous organs than in one with more delicate organs. The consumption of the vital force and of the organs progresses more or less rapidly in consequence of which life may be short or long. The duration of life is then dependent upon the sum of vital forces which it possesses, and on the greater or less consistence of its organs, and upon the rapidity or slowness of its consumption and finally upon the perfection or imperfection of regeneration.

Speaking for himself Lankester continues:

"By 'specific longevity' we mean the average longevity of the individuals ~~born~~....." (p. 20). By potential longevity Lankester means the longevity of the groups of

of the species, that is, the average duration of life of all the individuals born.

beings or the lease of life unaffected by disease and accident. In other words, the potential longevity of a species is its possible span of life unbroken by accidents or disease.

Lankester maintains that high individuation or high evolution, that is, complex structure and large bulk, favor longevity. Expenditure is of two kinds, that involved in the wear and tear in obtaining and assimilating food and the general carrying on of life, and that involved in the propagation of the species by the elaboration or separation of living forces of the parent organism. These may be named, the former, personal, and the latter, generative expenditure. The diminution or the increasing of either of these favors or antagonizes longevity. The adaptive power of man's brain makes the essential conditions of living, and hence longevity, more uniform, despite variations in habitat, total expenditure in securing heat, food and safety, despite, too, variations in race, climate and latitude.

Lankester arrives at these, along with other conclusions concerning longevity: That the most degraded races have a shortened life; that most nations speak of the ages from sixty to one hundred years in a way which indicates the same opinion in regard to the duration of life; that females have at all ages, especially in advanced life, a better expectation of longevity than ^{males;} the less distinguished members of professions; that married persons are longer lived than unmarried; and finally that the clergy, medical men and lawyers have a longevity in the order stated.

are less long lived than

Life, according to Buffon, (1749) (), is believed to be six or seven times as long as that of the period of growth. He places this period at about fourteen years, thus making the span of life from ninety to a hundred years.

Flourens (1855)() maintains that the period of growth ends when the epiphyses of the long bones unite with the bones themselves and he makes the span of life five times the length of the period of growth.

Oustelet(1900)() is unable to arrive at any definite conclusion concerning the relation of the duration of life and the size, the rate of growth, the period of gestation, etc., among animals.

Bunge (1903)() takes the period required for the new born to double its weight (among mammals) as an index of the rapidity of growth, which is in definite relation to the possible duration of life.

Excepting "some fish and reptiles and possibly whales, it is certain that a man enjoys the longest average duration of life and that centenarians occur more frequently amongst men than amongst most of the lower animals," is the view of Mitchell, given in the Encyclopaedia Britannica, 11th edition.

Sajous (1912)() reports adrenal degeneration with advancing age. He concludes, "It is quite probable, in fact, that centenarians owe their prolonged longevity ^{to the integrity} of their adrenals" (Vol. 1, 89).

Mitchell (1911)() has studied over 20,000 mammals and birds in captivity. Following Lankester, he distinguishes average and potential longevity, the former referring to the average age to which animals attain under the natural conditions to which the species has become adapted, the latter to the limit of age to which the species could attain under most favorable circumstances. He considers broadly that large animals can be expected to live longer than smaller ones, as it may be said Weismann long ago pointed out. Mitchell thinks this is in part associated with the effect of

accumulated waste. Larger animals, too, can adjust themselves better to temperature changes. Birds form a notable exception to this principal, for in proportion to their size, they have a greater longevity than mammals.

Mitchell maintains that Weismann, Lankester and Metchnikoff have advanced the best theories concerning longevity. He thinks, however, that Weismann's correlation between longevity and reproduction must be reversed. "It is not longevity that has become adapted to reproduction, but the rate of reproduction has been adapted not to potential longevity, but average specific longevity." (p 548).

Mitchell contends that the higher races of men have a greater viability than the lower ones, that the former have greater power of resistance to adverse conditions, to changed conditions, to disease, (though not necessarily to any particular disease) than the lower races. He finds that apes and monkeys have a still lower viability, possessing an amazingly poor power of resistance to the adverse conditions. Furthermore, Mitchell believes that the human life is perhaps greater in length than any other mammal except the whale. It will be remembered that Weismann held that the elephant as well as the whale possessed greater length of life than man.

Following Rubner, (1908) () who has experimented upon the growth of man and eight other types of mammalia, Howell () thinks that

"In some way the processes of growth contain the very source of the maintenance of life. The injurious by-products which accompany simple metabolism in the living matter are in some way obviated or neutralized by the growth changes. On this bases Rubner suggests, somewhat in the line of Darwin's theory of pangenesis and of Weismann's theory of the cause of death in the somatoplasm, that the body-cells give off certain molecular complexes which are necessary to the growth processes, and these complexes are taken up by the reproductive

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cells. After the animal has reached the period of puberty, of reproductive power, and provision is thus made for the perpetuation of the species, the individual organism is depleted of the power of growth, and senescence and death become inevitable" (987).

Benedict objects to drawing conclusions that senility results from the accumulation of waste products in the tissues—from the success of the method of prolonging the life of tissues grown in plasma, the method devised in the laboratory of Dr. Carrel. Such and similar extravagant claims are not made in the published work of Dr. Carrel. Others have drawn these conclusions themselves. "The accumulation of waste products may be one of the results of the primary cause of senility, but even this much is not proved by these experiments." (p. 790)

To Haeckel () senility is the result of decay of the organs and the dwindling of their function. He says:

"The cause of this senility and the ensuing natural death is determined for each species of the organism by the specific nature of their plasm. As Cassowitz has lately pointed out, the senility of individuals consists in the decay of protoplasm and the metaplasmic parts of the body which this produces. Each metaplasm in the body favors the inactive break up of protoplasm, and so also the formation of new metaplasm. The death of the cell follows because the chemical energy of the plasm gradually falls off from a certain height, the acme of life. The plasm loses more and more the power to replace by regeneration the losses it sustains by the vital functions. As in the mental life, the receptivity of the brain and the acuteness of the senses gradually decay, so the muscles lose their energy, the bones become fragile, the skin dry and withered, the elasticity and endurance of the movements decrease. All the other normal processes of senile decay are caused by chemical changes in the plasm, in which the dissimulation gains constantly on the assimilation. In the end they inevitably lead to normal death" (p. 106).

A cytological explanation of senescence is offered by Minot (). He holds that to determine the cause of senescence it is necessary to first make out certain laws of growth, and certain changes in cells and tissues during development. To this end he has conducted careful experimentation upon guinea pigs, chicks, rabbits, and studied the development of prenatal life. In brief, his conclusion from work upon guinea pigs is that the decline in rate of power of growth is most rapid in the young animals, and less so in the older individuals. For chicks, he concludes, that the younger the individual the higher its percentage of increment of daily growth. In general the same holds for rabbits as for guinea pigs and chicks. While the study of the foetal life has not yielded complete data, it is evident that the farther one goes back in the history of the individual, the more rapid is the rate of growth. From the foregoing considerations Minot concludes that

"if we are to regard the loss of growth power, as we have always hitherto done, as one of the most characteristic marks of old age, then it becomes probable we shall find more favorable opportunities for determining the cause of the loss of growth by studying the foetus than by studying the old individual, since it is during the foetal period that nearly the whole of the loss of growth power is effected. We then arrive at the somewhat paradoxical conclusion that in order to investigate the fundamental phenomena of old age we must specially investigate the very earliest stages of the individual" (pp. 241-42)

Minot maps the stages of cytomorphosis, finding two types of differentiation. He also notes nuclear changes in growth and development, maintaining that they are as important as those of the cytoplasm. Broadly speaking, it is his conclusion that as the amount of cytoplasm increases in proportion to the nucleus (the nucleus is barely clothed by cytoplasm in undifferentiated tissues), the power of growth diminishes, indicating that the increase and differentiation of the protoplasm is the cause of the decline of growth. Ageing, therefore, consists primarily in the increase in the proportion of cytoplasm to

nucleus. According to this view, then, the individual ages most rapidly at the period of greatest differentiation or growth, which appears to be at the very beginning of the life impulse, from which time it declines more and more slowly to the end of life.

Minot's four laws of age() are:

- "First, rejuvenation depends on the increase of the nuclei.
 - "Second, senescence depends on the increase of the protoplasm, and on the differentiation of the cells.
 - "Third, the rate of growth depends on the degree of senescence.
 - "Fourth, senescence is at its maximum in the very young stages, and the rate of senescence diminishes with age.
- As the corollary from these, we have this--natural death is the consequence of cellular differentiation"(p.250).

are certain phagocytes which when the organism is young consume the nobler elements of the organism, consume them, which in turn permits the substitution of lower structural elements. In this way the elements produced in the large intestine play an important role. The changes of old age are pathological, due to a preponderance of the inferior or conjunctive elements of organic tissue which increase in amount with age and produce sclerosis and like phenomena. These are various which cannot be eliminated. These inferior elements find a place in the body tissue, because certain organisms called macrophages (one form of phagocyte) devour the weaker parts of the body, thus making room for them. In old age the macrophages thrive increasingly. Thus the nobler elements of the system are no longer supplied the protective secretion that stays the voracity of the macrophages in sufficient amounts. In fact, the protective secretion becomes diminished or ceases entirely from a variety of causes, chief of which are those given off by the bacteria of the large intestine. In this case the protective solution is completely absorbed. It is, therefore, necessary to reduce the intestinal flora.

Views upon old age coming from Metchnikoff() have had wide circulation. While it may take a century or more to completely establish or modify his hypothesis, nevertheless, it has to be considered. It is worthy of note, too, that this hypothesis is open to experimental attack, and already such data are being piled up in the laboratories. Metchnikoff and his students have written so voluminously upon senescence that one is at a loss to know just how to fairly present their case in a few words. Briefly, ^{the} Metchnikoffian view is that the individual carries within himself from the first the factors which finally mean decline and death. These factors are certain phagocytes which when the moment is ripe pounce upon the nobler elements of the organism, consume them, which in turn permits the substitution of lower structural elements. In this work toxins produced in the large intestine play an important role. The causes of old age are pathological, due to a preponderance of the inferior or conjunctive elements of organic tissue which increase in amount with age and produce sclerosis and like phenomena. They are wastes which cannot be eliminated. These inferior elements find a place in the bodily tissue, because certain organisms called macrophages (one form of phagocyte) devour the weaker cells of the soma, thus making room for them. In old age the macrophages thrive increasingly. Then the nobler elements of the system can no longer supply the protective secretion that stays the voracity of the macrophages in sufficient amounts. In fact, the protective secretion becomes diminished or ceases entirely from a variety of causes, chief of which are poisons given off by the bacteria of the large intestine. At this point the protective solution is completely absorbed. It is, therefore, important to reduce the intestinal flora.

Since phagocytes are in the end so deadly, what are they and

what is their function? They are of two kinds, microphages and macrophages. The former are small and active, produced in the bone marrow, they circulate freely in the blood and occur as some of the white blood corpuscles, the leucocytes. They are distinguished by their oval shape and have the power to pass through the small blood vessels. They often form around microbes, thus arresting infection. The macrophages, on the other hand, absorb blood clots, and play a role in the healing of wounds. In general, microphages rid us of microbes, while macrophages heal mechanical injuries as wounds, hemorrhages, etc., unless stimulated by toxins to devour weakened organic elements.

Putrefactive material, especially from protein diet, favors the development, in the large intestine, of a bacterial flora which produces toxins, causing, when absorbed by the soma, not only many distresses, but the weakening of the higher, nobler structural elements, but as well stimulating the macrophages to set upon and devour the weakened elements. In consequence the large intestine has been acquired at the expense of longevity. It is held, however, to have a survival function as a reservoir of waste material which makes possible prolonged flight without defecation. This contention has led to the study of animals without a large intestine, as numerous birds, whose striking longevity is thus explained as due to the absence of colon.

It is difficult to define the characteristic features of senile decay. We know, however, that the flesh of old animals grows tough, the liver and kidneys harder; cellular elements disappear gradually, their place being taken by connective tissue. Arterio-sclerosis is due to the increase of connective tissue, also, but all the ills of old age are not to be traced to arterio-sclerosis.. The frame grows

ossify. Merkel, according to Metchnikoff, thinks that the skin and mucous membrane retain their youth to the end. "In senile atrophy the same condition is always present; the atrophy of the higher and specific cells of the tissue and their replacement by hypertrophied connective tissue." For example, neuroglia cells replace the higher brain cells. In the liver hepatic cells yield to connective tissue, while in the kidneys connective tissue blocks up the tubes. In other words, old age represents a conflict between the simpler or primitive elements and the higher elements of the organism in which the former turn out victorious. Gray hair is held to be due to the consumption of its pigment by the chromophages, a kind of macrophage. At a given moment they get active in the central cylinder of a hair and devour the pigment cells, and at length find their way to the skin or quit the body. The brittleness of the bones of the body is likewise due to the destructive action of the macrophages.

What, then, can be done to reduce the bacterial flora of the large intestines, and thus reduce the number and quantity of the toxins so destructive in weakening the higher organic elements and, at the same time, stimulating phagocytosis. Theoretically there are many possible ways, but after study, Metchnikoff has concluded that the most economical method is to introduce into the large intestine a bacillus which will prove in its secretions antagonistic to the putrefactive bacterial flora, always present there unless systematically combated. The bacillus most effective for this work has been found to be the bacillus Bulgaricus. It has the power of maintaining itself in the large intestine, there producing large quantities of lactic acid, which forms a medium destructive to the bacterial flora that thrive upon the alkaline products of putrefaction and cannot exist in an acid medium. The best form of introducing the

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Bacillus Bulgaricus into the alimentary tract is found to be a certain specially prepared tablet, liquid, or scientifically soured milk, each of which can now be readily obtained, as a later discussion(Chapter7) of this study shows.

Says Metchnikoff();

"Contrary to what many journalists have made me say, I have never, in any of my publications on the subject, asserted that curdled milk is able to prolong life. This is the thesis I have developed—in our premature old age intestinal microbes play a considerable part; and I have proposed the administering of lactic microbes in order to modify the intestinal flora and diminish intestinal putrefaction"(p.58).

Indol, phenol, katol, paracresol, etc., are among the putrefactive products of the colon. These the Metchnikoffian school are introducing into laboratory animals, to determine what lesions, if any, will develop. By comparing any such with those of old age it is hoped to be able to contribute towards an experimental determination of the role of putrefactive products in senescence. Salimbeni and Gery() are among those who have taken for their program, first the study of the lesions found in the aged, and, second, the study of similar lesions produced experimentally by diverse factors capable of affecting the organism and of producing senile degeneracy. Up to the present time the experimental phase of this program is perhaps better worked out than the anatomical study of senility. Lesions have been produced in animals which are considered similar to those in the aged according to Salimbeni and Gery. Metchnikoff has demonstrated that fatty degeneration of the aorta, cirrhosis of the liver, and chronic interstitial nephritis can be produced in animals by injecting a small dosage daily for some months of paracresol. Okhubo, and more lately Drachinsky, have produced pronounced organic lesions in the same cells as those found in the aged by injecting small doses of indol in rabbits, guinea pigs and monkeys. Salimbenie and Gery

themselves have made an important contribution of data upon the exact anatomic-pathology of a woman aged ninety-three, dying after thirty-six hour's illness. The post-mortem examination was made about four hours after death. The following is Saundby's (, pp. 46-47) excellent summary of their findings:

"Apart from the lesions of the fatal disease they found many and complex changes; sclerosis, mono-nuclear and macrophagic infiltration, hypoplasia, cellular degeneration and calcification, of which the most widespread and striking was sclerosis, the consequence of the leucocytic infiltration. Hypoplasia showed itself in the glandular organs, whose volume, weight, and histological condition concurred to show that their functions were depressed, but were not abolished. The cellular lesions were least marked and least common. The pituitary body and thyroid showed signs of diminished function, while the suprarenal capsules were hypertrophied. Calcification was very common and involved the vessels, the choroid plexuses, and the spinal marrow. The authors consider that the hypothesis of Metchnikoff as to the effect of intestinal poisons of the aromatic series may explain the widespread vascular lesions, the greater part of the scleroses and infiltration, as well as some of the cell degeneration, but does not explain the involution of certain organs, such as those of the female generative system, which occur at a fixed date independently of the previous condition of the individual or of her mode of life; nor can all the lesions of cells be explained by it, for while the hypertrophy of the adrenals may be a reaction against intoxication, this cannot account for the diminished function of the thyroid and pituitary body. There is, too, no resemblance between the cell necrosis of the lymphatic glands and the cell

degenerations observed in the liver and pancreas." (p. 46)

Lorand(), as it comes out later (Chapter 7), makes insufficiency of the ductless glands, especially the thyroid, the causal factor in senescence; and advocates hygienic care and the taking of glandular extracts, if necessary, to defer old age.

Thompson () rejects the theories of Metchinkoff and Lorand to account for old age, contending that no one theory appears applicable to a majority of cases. "In many persons the attainment of nonagenarian age appears to be due chiefly to favorable environment and freedom from harassing worries and poverty"(p. 280). Thompson thinks he finds longevity about equally distributed among all classes of society. To him moreover, heredity is a primal factor:

"A majority of nonagenarians give a history of long-lived ancestry, and there are many families remarkable for this characteristic, but it is not an essential one, by any means, for a line of such ancestry may be broken by intervention of infectious diseases or by the unhygienic or irrational habits of individuals.

"All things considered, however, heredity appears to be a much stronger factor in producing nonagenarians than any special habits, as of diet or hygiene, for the latter are found to present the greatest variety in different cases—hence extreme longevity is largely a matter of natural selection.

"That the aged very often exhibit no predominating symptoms of any one disease to which their death is attributable, is a striking fact, may become so universally sclerosed and atrophic that a general weakness is their only complaint, and although they may have marked arteriosclerosis, nephritis, or myocardial change, the more active symptoms which characterize such diseases early in life may be entirely wanting. They rarely show marked edema, for example, and the typical picture of the last stages of failing compensation of the heart, so familiar in early life, the orthopnea cyanosis and general anasarca, etc., is very rarely met with. They die suddenly and peacefully—it is as if the clock had run down. Hence in the mortality statistics 'senility' is so often given as the cause of death and accepted by health authorities without further question.

"In the group of cases in 1910 this was the final diagnosis in 26 per cent. of the nonagenarians and in 40 per cent. of the centenarians. Fortunate it is, indeed, that the reward of a long life well spent should so often be a peaceful ending without the long drawn out sufferings so common in the middle decades" (p.280).

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Several of Weismann's well-known views follow here, () as introductory to later considerations, chiefly those of Jennings, Woodruff, and Conklin.

Weismann maintains that it is not important to the species whether the individual is short or long lived, but it is important ~~that~~ that the individual should do its work toward the perpetuity of the species (p.10). Though all mammals and birds outlive the reproductive period, this is not true of insects, except those species which tend their young (p.10). The origin of death cannot be sought in the waste of single cells, but in the limitation of their powers of reproduction. "Death takes place because a worn-out tissue cannot forever renew itself, and because a capacity for increase by means of cell-division is not everlasting, but finite (p.21). The immediate cause of death, however, does not lie in the imperfect renewal of cells "for death, would in all cases occur long before the reproductive power of the cells had been completely exhausted" (p.21). Functional disturbances set in as soon as the rate of renewing worn-out cells becomes slow and inefficient. If the higher animals possessed immortality, their efficiency for the species would be reduced by injuries that would come to their organisms from time and in consequence they would come to be a burden to their species, but "Worn out individuals are not only valueless to the species, but they are even harmful, for they take the place of those which are sound" (p. 24). "I consider that death is not a primary necessity, but that it has been secondarily acquired as an adaptation" (p.24). Protozoa are potentially immortal (p.27). In the differentiation of cells into reproductive and somatic, the latter lost their potential immortality. Among multicellular animals at this point, normal death became possible (p.28). The inequality of length of life between male and female is frequently found among insects (p.28).

Old age is of use to man, "for it enables the old to care for their children, and is also advantageous in enabling the older individuals to participate in human affairs and to exercise an influence upon the advancement of intellectual powers, and thus to influence indirectly the maintenance of the race" (p. 158).

In one of his early famous essays, as just mentioned, Weissman held that death is not necessarily involved in living; that death did not originally exist; and does not now exist in lower organisms, that is, infusoria are potentially ^{immortal}. Different investigators have attacked this problem experimentally. A resume of the findings to 1912 follows, taken from the careful survey of Jennings (), himself a notable worker in this field. Maupas, acting upon Weismann's speculation in a set of epochal experiments, 1883 to 1888, found that after about 100 generations Stylonychia became sickly until the death of all occurred in the 215th generation. He was able to secure survival in another series to the end of the 316th generation. From this he concluded that these organisms do get old and die; that Weismann was mistaken in affirming potential immortality in protozoa. Further he held that death is inherent in life and thought his experiments proved that conjugation prevented extinction. That is, conjugation between unrelated individuals. Maupas' conclusions held for many years. Calkins opened the question anew (1901-1904). He cultivated paramecium for 200 generations, when he found them depressed and their division rate decreased, many of them dying. By changing the diet at these periods he kept them alive for 742 generations (twenty-three months). His conclusion in part was that the depression is due to the uniform food or to conditions not adapted to the animal. He further raised the question whether multiplication

without conjugation results in degeneration, senility and death and further whether this degeneration is remedied by conjugation. An affirmative answer was generally assumed. Enriques(1903-1908) concluded that degeneration resulted from bacteria and that when foods are changed everyday or oftener no degeneration takes place, provided there is protection from bacteria, *etc.* He is in error, however, in making bacterial action the sole cause of degeneration. Woodruff, believing that the degeneration observed by Maupas and Calkins may have been due to too great uniformities in cultural conditions or to the fact that the conditions employed lacked something necessary to the continued health of the animal, set about to establish the facts. He used controls. At the time Jennings wrote this article(1912) Woodruff had the progeny of a single individual flourishing in the generation subsequent to the 2,500th, after four years and three months, without conjugation. (Since this time the investigation has gone into more than three thousand generations). There is no indication of the degeneration. It seems that if only the culture medium be properly selected, no degeneration takes place, even if conditions are kept uniform. Weismann is right in his assumption of the potential immortality of protozoa. Jennings, after an investigation with paramecium covering five years, found no ill results even when conjugation was permitted among related individuals. Consequently, Maupas is wrong in holding that conjugation must take place with unrelated individuals. Inbreeding is not injurious. There may be a difference, however, among different types of infusoria, as with higher organisms. Concerning conjugation Jennings(here epitomized) concludes; 1, that animals when ready to conjugate are by no means in a depressed state, or degenerated condition, unable to multiply

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farther. They multiply vigorously, if prevented from conjugating; 2, that those allowed to conjugate multiply less rapidly than those not allowed to conjugate. Multiplication is slower for a month or two after conjugation; 3, that many more of those allowed to conjugate die or are abnormal than the others; 4, that usually a considerable number of the conjugants never divide after conjugation, while the others do; 5, that greater variation is seen among the progeny of those that have conjugated-(1) in the rate of multiplication and, (2) in their dimensions. There is no evidence that conjugation causes rejuvenation. It is a dangerous ordeal. Regarding its functions:

"Conjugation does not rejuvenate in any simple, direct way. What it does is to produce variation; to produce a great number of different combinations, having different properties. Some of these are more vigorous, others less vigorous. The latter die, the former survive. This happens equally, whether the animals which conjugate are at the beginning vigorous or weak. If they are vigorous, then one of the most striking effects of conjugation is to produce some lines that are less vigorous than the original ones, so that they die out. If the animals which enter conjugation are weak, then one of the most striking effects of conjugation is to produce certain combinations that are more vigorous than the original ones, so that they survive, while those that did not conjugate die out. In a short time the entire race is replaced by the descendants of a few of those that conjugated"(p. 573).

Likewise in higher animals inter-crossing is to produce variation. Conjugation is necessary to produce bi-parental inheritance. It is interesting to note that conjugation is usually induced when survival is threatened. Some of the variants stand a better chance of survival. Death is not a necessary accompaniment of infusorial life. Again Weissmann's position is shown to be correct. Age and death follow upon differentiation as Minot and others hold, for, then, the metabolic balance is not so well maintained. Jennings questions Minot's cytormorphosis. Jennings says,

"The recent important paper of Conklin has shown that in

the cleaving of many animals this increase of nuclear material relative to the cytoplasm does not occur. Conklin's results will apparently go far in rendering untenable or modifying all theories in which great significance is attached to the precise quantitative relations between nucleus bearing on the fundamental feature of the theory that ageing and death are due to differentiation. The grafting of the theory that the quantitative relation between nuclear and cytoplasmic material is an essential point upon this general theory was unfortunate from the beginning" (p.577).

Prevention of death, since it is the price of differentiation, would prevent the attainment of a higher organism.

Woodruff found longevity in Paramecium dependent upon right environmental conditions. With higher animals, however, the situation is more complex.

While Weismann pointed out an inverse relation between the rate of reproduction and longevity-undoubtedly true in many cases- he has not proved that longevity is the result of slow reproduction. Says Conklin, "It may well be that both length of life and rate of reproduction are dependent upon the duration and rate of assimilation and dissimilation in somatic and germinal cells"(p. 370).

"There is also an undoubted relation between longevity and adaptability, or the power of regulation. If life is a continuous adjustment of internal conditions to external conditions, length of life may be said to depend upon the duration and perfection of such adjustment. The power of regulation is much less perfect in some animals than in others, and at certain stages of the life cycle than at other stages. But in all animals this power is greatest where the relative relation of protoplasm to metaplasm, or differentiation products, is greatest, and where the protoplasm is most labile" (p.370-371).

Many are the hypotheses advanced () to explain the running down of the vital machine. The potential immortality of protozoa and of the germ cells of metazoan man is clear that death is not a necessary corollary of life. "Senescence, like all other processes occurring in organisms is primarily a cellular phenomenon" (p.371). "Throughout the entire life of any organism every cell has

Professor Edwin G. Conklin () has brought together valuable evidence, structural and functional, concerning longevity, senility and rejuvenescence in his Harvey Lecture for 1913. Barring death by accident, "longevity is determined by the duration of the excess of anabolism"(p. 269). Woodruff has shown this in Paramecium, rearing more than three thousand generations without conjugation and without loss of vitality; thus, along with other experiments, demonstrating the essential truth of Weismann's contention that protozoa are potentially immortal. Woodruff found longevity in Paramecium dependent upon right environmental conditions. With higher animals, however, the situation is more complex.

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"Throughout the mature life of any metazoan many cells are

continually growing old and dying while others take their places. Even in the oldest organisms certain types of cells are still young enough to grow old and divide and there is no reason to doubt that such cells are immortal, and if saved from the general death by isolation, might live indefinitely. Cells which continue to grow and divide throughout life apparently never grow old. It is customary to speak of the germ plasma as potentially immortal, but it is not generally recognized that other kinds of plasma may also be immortal. Indeed all kinds of protoplasm may be regarded as potentially immortal, except when processes of constructive metabolism are prevented in one way or another. In most cases the power of cell division is lost before that of growth, and the presence or absence of cell division is therefore indicative of youthful or senile conditions in the cells concerned. Measured by this standard, certain cells grow old at a very early stage in the life cycle, whereas others remain young until overwhelmed by general death of the organism. Senescence then is not a uniform process for the entire organism; it begins in certain cells at a very early stage of development, while it may not appear at all in other cells" (pp. 272-273).

Though not mutually exclusive senescence and rejuvenescence may be regarded as having both a structural and functional basis (). It is probable that both structure and function are involved in these processes. Different students, however, have placed emphasis more or less exclusively on one point of view or the other. Minot has proposed a structural hypothesis to account for old age. It is his view that senescence is caused by an increase in the amount of cytoplasm with a corresponding decrease in the size of the nucleus. Hertwig on the other hand has proposed a view apparently diametrically opposite that of Minot's. "He finds that senescence or rather 'depression' and 'physiological degeneration', in Actinospherium and Infusoria are accompanied by an enormous growth of the nucleus" (p. 274).

Conklin finds himself in agreement with Minot's latest formulation of the causes of senescence, namely, that differentiation is to be considered as the real cause of ageing. Yet Minot still holds that the essential basis of differentiation is the greater growth of protoplasm, relative to the nucleus; and that early in the history

of the organism there is a prepondering growth of the nucleus while later there is a longer and slower growth of the protoplasm, the former making for rejuvenescence, the latter for senescence. On the other hand Conklin has shown in his study of Crepidula that during early cleavage the growth of nuclear material is not greater than that of protoplasm, and that in general nuclear size is directly proportional to the general protoplasmic mass, and to the length of the resting period.

Conklin holds that

"By all odds the most important structural peculiarity of senescence is the increase of metaplasm of differentiation products at the expense of the general protoplasm. This change of general protoplasm in the products of differentiation and of metabolism is an essential feature of embryonic differentiation, and it continues in many types of cells until the entire cell is almost filled with such products. Since nuclei depend upon the general protoplasm for their growth, they also become small in such cells. If this process of the transformation of protoplasm into differentiation products continues long enough it necessarily leads to the death of the cell since the continued life of the cell depends upon the interaction of the general protoplasm and the nucleus. In cells laden with the products of differentiation, the power of regulation is first lost, then the power of division, and finally the power of assimilation; and this is normally followed by the senescence and death of the cell" (p.275).

A dedifferentiation process is also found by Conklin in which the metaplasm is dissolved and converted back into the general protoplasm at which the protoplasm and nuclei increase in size. At this the cells begin to divide and may become capable of regulation. Rejuvenation of cells is the result.

Of the functional causes of senescence Conklin mentions the hypothesis of Metchnikoff, the slow poisoning of the organism by its own toxic wastes and accentuated phagocytosis. Child also proposes a functional cause of senescence in the decreased power of constructive metabolism. He concludes

"that anything which decreases the rate of metabolism, such as 'decrease in permeability, increase in density, accumulation of relatively inactive substances, and so on,' will lead to senescence. On the other hand, 'rejuvenescence consists physiologically in an increase in the rate of metabolism and is brought about by nature by the removal in one way or another of structural obstacles to metabolism'" (p.277).

"It is well known that constructive metabolism cannot take place in the absence of a nucleus, and I have shown elsewhere that the inner change between nucleus and protoplasm is a condition of assimilation. I have likewise shown that only the general protoplasm can enter the nucleus and that the products of differentiation are excluded from it. The progressive increase of such products and the corresponding decrease in the general protoplasm lessen this interchange between the nucleus and the cell body, and thus decrease the power of constructive metabolism"(p. 277).

Progressive differentiation then is the chief factor in senescence(). Potential immortality is dependent mainly ^{upon} stopping or reversing this differentiation. In protozoa dedifferentiation usually precedes or accompanies division, and where this is long delayed even these show signs of old age.

"The same is true of germ cells; the mature egg and sperm are senile cells not because the one has a very large nucleus and the other a very small one, but because both are loaded with products of differentiation which interfere with constructive metabolism. When the sperm enters the egg and either leaves behind its old cell body or dissolves it, and its nucleus gets a new protoplasmic body, it is rejuvenated; likewise, when the egg begins to dissolve the yolk and other products of differentiation with which it has been loaded, it begins to live anew"(pp. 277-78).

Any plant or animal capable of dedifferentiation is indeed capable of rejuvenescence(). Long ago it was known that encystment and accompanying loss of differentiation results in rejuvenation. Jacobs has found that when the rotifer, Philodina, grows senescent rejuvenation results if it is completely dried up and later put into water. This evidently produces dedifferentiation().

Child(Conklin,) determined that youth returned to planarians though apparently extremely senescent after starving them for some time. Starving seemed to use up a part of the structural substance

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which made against rapid metabolism. Similarly renewed vigor comes to many animals after hibernation.

"The great breeding activity of many animals, such as frogs, so soon after their winter sleep, may find a physiological explanation in this using up of metabolic products during hibernation and the consequent increase in vitality" (, p.287).

Likewise new tissue formed in regeneration comes from undifferentiated or dedifferentiated cells.

"In the latter case also there is a rejuvenescence, due to the loss of differentiation products. In this case dedifferentiation is evidently due, in the first instance, to the injury. It is at least possible that the failure to regenerate lost parts, which many animals show, is due to the inability of the cells to undergo dedifferentiation and subsequent rejuvenation.

"In conclusion, we find that the life of a cell is dependent upon the continued interaction of nucleus and protoplasm; that as the protoplasm is transformed into products of differentiation this interaction of nucleus and protoplasm is reduced and constructive metabolism is diminished; that when the quantity of protoplasm present has been reduced beyond a certain point, either by its transformation into metaplasm, or by other means, constructive processes fail to compensate for destructive ones, and the cell grows old and finally dies. On the other hand, processes which lead to the increase of the general protoplasm in a cell, either by the growth of the protoplasm already present or by the conversion of metaplasm into protoplasm, we lead also to the growth of the nucleus, to increased interchange between nucleus and protoplasm, and hence to increased powers of assimilation, cell division and regulation. Anything which decreases the interchange between nucleus and protoplasm leads to senility; anything which increases this interchange renews youth" (, pp. 278-279).

Conklin has elsewhere () treated the matter of senescence similar to the foregoing discussion. In summarizing it, as set forth on pages 57 to 62, he makes this digest:

"My observations do not support the view that senescence is due to a decrease (Minot), or an increase (Hertwig) of nuclear, as compared with protoplasmic material; nor that rejuvenescence is accomplished during cleavage by the great increase of nuclear material relative to the protoplasm. On the other hand senescence seems to be associated with a decrease, rejuvenescence with an increase of metabolism (Child). Anything which decreases the interchange between nucleus and cytoplasm, such as products of differentiation and metabolism within the cell,

or a dense nuclear membrane, decreases metabolism and leads to senescence; anything which facilitates this inner change increases metabolism and leads to rejuvenescence. It is suggested that in early development increased oxidation is associated with fertilization and mitosis (Loeb, Lyon, Warburg)" (pp. 85-86).

different structural and functional changes, we shall here trace out the usual trend of these changes, in the so-called normal senescence. Obviously there are many individual differences. Few or all of these changes may come to the same individual, depending upon factors not clearly made out, but discussed elsewhere in this study.

Clouston () maintains that it is impossible to fix the age at which the physical ability begins. Some are older at fifty than others at seventy. Most congenital idiots and imbeciles grow old. Many die of old age at thirty. Moreover, certain races of men, as the Kalmucks and Hottentots, grow old early. With us we do not speak of a man as old until he is over sixty-five. Mental and bodily changes of old age are correlated with the deterioration of brain cells. The general shrinkage and change in the vascular system of the brain can be seen with the naked eye.

This general atrophy of from 4 to 6 percent, corresponds to the lessening of the mental force and the loss of memory. The cells become shrunken in outline at first. Then a number of them begin to show an irregular shape, and then finally disappear. The number of cells passing out from such cells is small, and, as it were, 'fall off', so that the compactness of each with its neighbor cells lessens" (pp. 225-227).

The first sign that the body has reached the full term of its normal development, according to Haeckel (7*), is the accumulation of superfluous fat, especially in the abdomen. This marks a diminution of metabolic activity.

The second sign of waning power is presbyopia, a change in the crystalline lens, consisting in the hardening of its structure and

The author is greatly indebted to Dr. Haeckel for data regarding mental details involved. Unable to summarize this last in brief, the author has given a more detailed account in his book.

III. THE SENILE BODY.

Since senescence is not marked by an inflexible span of years, but is rather a condition of body and mind determined by relatively different structural and functional changes, we shall here trace out the usual trend of these changes, in the so-called normal senescent. Obviously there are many individual differences. Few or all of these changes may come to the same individual, depending upon factors not clearly made out, but discussed elsewhere in this study.

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"This general atrophy of from 4 to 6 ounces, corresponds to the lessening of the mental force and the loss of memory. The cells become blurred in outline at first. Then a number of them begin to waste and look like 'ghost cells', and then finally disappear. The numbers of fibers passing out from each cell lessen, and, as it were, 'fall off', so that the connections of each with its neighbor cells lessen" (pp. 236-237).

"The first sign that the body has reached the full term of its active development, according to Saundby ()*, is the accumulation of superfluous fat, especially in the abdomen. This marks a diminution of metabolic activity".....(p. 32).

The second sign of waning power is presbyopia, a change in the crystalline lens, consisting in the hardening of its structure and

* The writer is greatly indebted to Dr. Saundby for data regarding normal senile involution. Unable to acknowledge this debt in every instance throughout the present chapter, he wishes to do so here.

flattening of its surface, causing lengthened focus and necessitating spectacles. This change usually sets in at about forty-five years. In short-sighted people this lengthening of focus may be beneficial and permit laying aside of spectacles. "The date at which it occurs, whether preceding forty-five or postponed to a later period, may be taken as a sign that the onset of decay is either premature or retarded" (, p. 33).

Whitening of the hair is a much less certain sign of age, as it depends on factors or agencies which are not yet definitely made out. In some it occurs earlier than others, without being accompanied by other evidences of decay, " and there is no reason to believe that the lives of such persons are shorter than the average" (, p. 33). Jet black, coarse hair is prone to premature grayness. While in many centenarians grayness has not been noted, yet it nevertheless portends decay.

Baldness is even a less trustworthy sign of old age than whiteness, for it is often hereditary and may occur even before adolescence is lived through. "It occurs more often to persons with light than persons with dark hair, and is almost confined to the male sex" (, p. 34). Apart from exceptions, as a rule after fifty years the hair grows thin on the vertex, individual hairs become stiff and brittle, scalp dry, necessitating the use of some unguent to prevent the hair from looking rough. The hair covering the body becomes scanty, thin and weak, white or light in color, ceases to curl and in places disappears entirely, leaving the skin smooth, pale and polished, especially over the fronts of the legs. On the other hand, in women there is an increased growth of hair on the face.

"The nails become brittle and dry and show longitudinal ridges; they split easily...." (, p. 34).

Dryness of the skin results from the diminished activity of the sebaceous glands. The epidermis shows disposition to crack or become rough. The sweat glands grow less active, particularly the odoriferous glands in the axilla, genitals and feet. The skin becomes wrinkled from the disappearance of the sub-cutaneous fat, together with less of its elasticity. The atrophy of the malpighian layer of the skin causes the skin to fade, but with advancing age brown patches or freckles often form on the dorsal surface of forearms and hands, on neck and cheeks.

"Small stellate veins disfigure the cheeks and nose, backs of the hands, and the skin of the lower extremities, while minute vascular naevi, the size of a pin's head or larger, form in the skin of the abdomen and trunk. The skin of the feet is dry, and on the soles is thickened and scaly" (, p. 35).

Normally hearing undergoes changes comparable to vision.

"According to Patenostre (Examen fonctionnel du Labyrinthe Chez le Vieillard. These de Paris. 1911), who has made a special study of the subject, the labrynth of a man of sixty is never like that of the normal adult. He finds that the anterior labrynth is diminished to three-fifths of its normal function, while aerial-audition is modified by changes in the middle ear. Bone conduction is diminished on account of changes in the bones. The posterior labrynth is diminished in its function by one-half, as tested by the production of nystagmus and vertigo, the latter symptom being diminished in the rapidity of its appearance, its duration and intensity, the diminution varying from one-third to one-half. It may be parenthetically asked here whether this diminished tendency to vertigo explains the disappearance to liability to seasickness, which is one of the advantages of advancing years. In addition to the labrynthine change there is distinct diminution in the distance at which the voice is heard, although conversation may be followed quite well. The diminution is less marked in women than in men, and the left ear is as a rule better than the right. Thus three-fourths of the male subjects heard a whisper better with the left ear, while a third heard it six metres or more, one-third from four and five-tenths to six metres, and one-third below four and five-tenths metres. In women half the cases examined could hear a whisper at more than six metres, and two only below four and five-tenths metres. Examination with the watch gave similar results; only a sixth of the elderly people could hear the watch over the temporal mastoid or pre-auricular regions; five-sixths could not hear it. A tuning fork is heard by a young man from seventy-five to eighty seconds, but in old age this duration is sensibly diminished, being from forty to seventy seconds on the average, the fork being held at 2 cm. from the pinna. Bone conduction of the tuning fork showed in all cases reduction of

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more than eight seconds, and there were great variations in the two years, a condition which is not observed in the young" (, pp. 35-36).

Loewenburg has observed in old age complete insensibility to high tone with slight deafness to low notes.

Muscles become wasted, pale, and suffer simple or fatty atrophy or fatty infiltration. These changes result in great loss of weight which is likely to begin at sixty and reach a considerable degree by eighty. Rigidity of structure is accompanied by lessened contractibility and considerable loss of response to stimuli. The tendons tend to ossify and the fluid in their sheaths is diminished.

In old age the bones of the skull become denser, while bones of the rest of the skeleton grow lighter, thinner and more porous. Diminution of blood supply causes the cancellous tissue of the bone to become yellow(fatty).

"The spaces in the spongy portions of the bone become large, the nutrient canals are obliterated while the medullary cavity grows wider and longer, reaching right up to the epiphysis. (Sappey)" (, p. 37).

Extreme fragility of the bones in old age is termed osteoporosis. With an increase of organic matter there is a corresponding decrease of lime salts in the bone. The skull shows gradual disappearance of sutures, beginning on the inner table and in the posterior sutures. The bone becomes wasted and thin, and may be really perforated. The female shows this disease more markedly. Facial bones are altered, resulting chiefly from the loss of teeth; the glenoid cavities become shallower. The spine shows kyphosis, resulting from absorption of the inner vertebral discs and osteoporosis of the bodies of the vertebrae. "There may be ankylosis of several vertebrae soldering of their bodies together; this is seen most often in the atlas and axis and the sacrum and coccyx, but it may effect the entire spine" (, p. 38). These processes result in loss of height in men, an inch on the average; in

women, an inch and one-half, but it may amount to three inches. This begins at fifty and may continue to the eighty-fifth year. The sternum also shows ankylosis of the manubrium and xiphoid with the body of the bone.

"The pelvis tends to atrophy; the iliac bones assume a transverse attitude under the pressure of the viscera, while the pubic and sacro-iliac sutures become ankylosed; the cotyloid cavities become widened, the bones fragile and predisposed to fracture" (; p. 38).

Functional changes of bones and muscles show themselves chiefly in greater difficulty in locomotion, Walking and movement in general becomes slower, more uncertain, sometimes painful and stiff. Occasionally a tremor is present. The reaction of muscles to electrical stimulation is diminished. Senile ectropion is due to the wasting of the orbicularis muscle. This results in deviation of the lachrymal duct, causing tears to flow on the cheek.

Cartilages generally grow yellow, fatty, calcified, particularly those of lids, larynx, trachea and bronchi.

Joints showed deficiency of synovia, erosion of their articular surfaces with outgrowths of bone. These changes are observed especially in the knees, and ^{are} not gouty or rheumatic, but senile.

The lungs suffer loss of elasticity, grow soft, often emphysematous and pigmented. In extreme old age they are reduced in size, fibrosed with dilated alveoli from senile emphysema, resulting from the wasting of blood-vessels. The pleura frequently shows milk spots and patches of cartilaginous degeneration. Adhesions at the apices of the lungs are common. These by the older anatomists were called ligamenta pulmonum and thought to be normal structures.

Chief among the functional changes in the respiratory system

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are dyspnoea and cyanosis.

"They are ^{caused} by the alterations in the thoracic wall, the loss of elasticity in the lungs, the weakness of the respiratory muscles, and the diminished respiratory capacity which shrinks from three and fifteen-hundredths litres to two and sixty-five-hundredths. The average respiration per minute in old people is twenty, showing a slight increase. Expiration is forced. According to Andral and Gavarret, the amount of expired carbon dioxide is 808.80 grms, instead of 1072.80" (p. 39)

Organic heart changes in old age are constant and may be considered normal, though they vary in degree and may impair the functional capacity of the organ when they are pathological. The old heart shows increase in size and weight with muscles wasted, their fibres showing brown atrophy or fatty degeneration, while there is an increase of the interstitial connective tissue. The last is a fibroid degeneration which may not impair due performance of functions whereas brown atrophy and excessive fatty degeneration, lead to weakening and finally to death from heart failure. Fever, especially fever due to infectious disease, tends to rapidly increase fatty degeneration, which makes such diseases specially fatal to the aged. Based upon analysis of 409 cases over sixty years of age Dr. T. D. Savill (Senile Decay, its pathology and Treatment, Trans. Med. Soc. Lond. Vol. XX), gave as the normal symptoms of old age muscular weakness, senile changes in heart and circulation, vertigo, epilepsy and high arterial tension. He attributed all of these to hypermyotrophy of the arteries occurring independently of renal disease. The changes begin by loss of elasticity in the large vessels long before any similar signs appear in the smaller ones; the changes in the latter are due to the direct transmission of the shock of the blood caused by the loss of elasticity of the large vessels, and also to previous long periods of high blood pressure. Thus he attributes senile decay generally to altered blood pressure and advocates the prophylactic use of small doses of nitro-glycerine to prevent its ill effects.

The pericardial sac frequently shows on its inner surface patches of thickening of its endothelium called milk spots. Fibrous layers of the membrane are thickened and are often the seat of deposits of fat and lime salts. Occasionally extensive infiltrations of calcareous matter may cause it to be converted into a box of stucco.

"The visceral layer of the pericardium shows similar thickening and milk spots.....The endocardium tends to become opaque, thickened, and calcified, these changes involving the valves which are stiffened, but not necessarily incompetent" (,p. 41).

The aorta shows dilatation, its intima exhibiting widespread yellow patches of fatty degeneration or raised areas of fibroid endarteritis, with deposits of fatty and calcareous degeneration, more or less widely distributed. There is loss of elasticity in the vessel, its fibres and muscular coats thin, resulting in dilation, the walls yielding to blood pressure. Similar changes are found in the arteries with thickening of the adventitia, while the capillaries are also thickened. The veins lose their elasticity, resulting in varicose dilatation, their coats weakened and easily ruptured.

In the blood there is reduction of erythrocytes to about three million, six-hundred thousand. The haemoglobin is proportionately diminished, while the polynuclear leucocytes are relatively increased. There is an increase in the amount of urea from 0.017 to 0.019 per liter. The functional consequences of a weakened heart are dyspnoea on exertion, slight oedema of the ankles, and increased sensitiveness to external cold. The pulse grows more frequent and variable, registering more sensitively the influence of exercise, rest and position. The pulse, too, is more full than in earlier life. Coldness and cyanosis of the extremities are usually present.

The lymphatic glands are usually atrophied. The salivary glands become hardened, likewise, and decrease in bulk. Saliva is sometimes

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secreted in large quantities ("dribbling"), due probably to central inhibition; or there is a lack of secretion, hardly keeping the mouth moist. changes probably play some part in the alterations of the voice

The spleen is generally found reduced in size, but occasionally enlarged and hard, with cartilaginous plaques, encrusted with lime salts in its capsule. These changes, however, may not be due to old age, but result from some antecedent attack of perisplenitis. A cross-section of the organ shows it to be paler than the normal with some wasting of malpighian corpuscles.

Some find the thyroid gland reduced in size, dark in color, with an increase of connective tissue and a decrease in colloid material. Weinburg, however, reports a normal thyroid in a man of eighty years, examined by him at the Pasteur Institute.

According to some the cortex of the suprarenal capsules is diminished with fatty nodules imbedded in it, and also small adenomata.

"On the other hand, Sabrazes and Husnot (1906) have described these glands as hypertrophied, and Josue has based on this his explanation of the increased arterial tension of old age as the consequences of the heightened activities of these organs" (p. 42).

Changes in the respiratory mechanism in old age depend upon alterations in the thoracic cage, the calcification of the cartilages of the ribs (not found universally in old age, but very common) the thinning of the bones, soldering of the sternal articulations, drawing up of the posterior costal angle, giving a more horizontal direction to the ribs, raising the sternum and enlarging the arterio-posterior diameter of the thorax. The wasting of the inter-vertebral discs, causing diminished length of the spinal column, narrowing the inter-costal spaces and curving the spine. These changes result in loss of elasticity and play in the movements of the thorax with diminished haematosi.

The rings of the trachea ossify as do the cartilages of the larynx. There is also atrophy of the lining of the mucous membrane. These changes probably play some part in the alterations of the voice characteristic of old age. "The mucuous secretion of the larynx is scanty, thick, colorless, and there is atrophy of the submucuous muscular coat" (, p. 43).

With few exceptions the teeth are lost from different complex causes. Dr. Marcel Baudouin,* the General Secretary of the French Prehistoric Society says,

"That there is not a single well-authenticated instance of caries in the teeth of palaeolithic man, and that this disease makes its first appearance in neolighic times, that is to say, with agricultural and polished stone implements, although with a frequency ten times less than at the present time" (, pp. 43-44).

The oesophegus shows slight atrophy of its muscular coat.

According to the amount of food taken, the stomach may be dialated or reduced in size. The peptic glands undergo atrophy. The mucuous membrane becomes thinner. The muscular coat wastes, while the submucuous connective tissue increases. The mucuous glands become enlarged and often cystic.

The loss of weight in old age is probably due to the defective absorption of food and assimilation, especially of fats.

"Constipation is so frequent as to be almost constant. It is due to diminution of the digestive juices, of mucus and of muscular power. It leads to colic and haemorrhoids. It is usually of the atonic form, involving the whole length of the colon.

"Faecal incontinence from weakness of the sphincter may occur in extreme old age or where from any other cause the muscle has lost its tone.

* Baudouin, Dr. M. La polyarthrite alveolaire a l'epoque pal-eolithique. Le Semain Med. 1912. p. 504.

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"In old age the bowel often drops into the pelvis, its mucous membrane is pale, its coat thin, the villi wasted and the glands atrophied. In the colon small hernial pouches are often formed in which masses of faeces are retained" (p. 45).

The kidneys are diminished in size and weight, the surfaces irregular, lobulated and presenting cysts. "Their capsules are thickened and adherent, the surface of the organs being pale and granular" (p. 45). Numerous other complex changes also take place. The ureters are thickened, their lining membrane slate colored, sometimes granular.

The bladder often shows muscular and fibrous hypertrophy, or it may simply be dilated.

The quantity of urine is generally diminished in old age, its density normal, its acidity slight, with diminished urea, uric acid variable in amount, with diminution of phosphoric acid and maintenance or chlorides to a normal amount. There is general diminution of solids, consequent upon incomplete assimilation and defective metabolism. In old age the toxicity of the urine is diminished.

Glycosuria occurs frequently in old age, due to inability to assimilate carbohydrates. Such cases may be mistaken for diabetes.

"The senile changes in the genital organs require separate description in the two sexes. In the male the penis is retracted, the scrotum flaccid and wrinkled, the testicles lose their firmness, and are reduced in size, while the epididymis feels hard and nodular, and the scrotal veins are dilated. The dartos muscle wastes, the tunica vaginalis becomes thickened, its two surfaces may be adherent in places, and the serous fluid increased. The vas deferens is usually permeable, but occasionally becomes obliterated; the spermatic veins are dilated, and their walls atrophied; the seminal canals show thickening of their walls with consequent narrowing of their lumina; their intertubular connective tissue is increased, while their nutrient vessels are sclerosed. The spermatozoa are few in number or absent, but they have been found active in very old persons, as in a man aged ninety-four (Demange), and in one of ninety-six (Casper); the semen is more gelatinous than normal, and if it contains no spermatozoa is coloured brownish. The retrogression of the testicle begins at about the age of fifty; at the same time the genital activity diminishes, and the cremasteric reflex weakens or disappears. Loss of desire does not always keep pace with loss of power, but pleasure is lessened, and the act

is often followed by nervous prostration. Sterility is not always a necessary consequence of old age, as is proved by the relatively large number of old men who have been found to possess living spermatozoa, while there are many examples of old men who have procreated children.

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"In the female the external changes are similar to those in the male, while the vagina becomes relaxed, easily dilatable, or sometimes contracted. The ovaries are shrunken, scarred, and their ovigenous superficial layer disappears shortly after the menopause; there are often cysts on the surface. The tubes lose their ciliated epithelium and are sometimes obliterated. [The uterus becomes rounded, diminished in size and weight and denser, while its cavity assumes a cylindrical shape; the cervical canal is often obliterated.] The uterus becomes rounded, diminished in size and weight and denser, while its cavity assumes a cylindrical shape; the cervical canal is often obliterated, generally at the internal opening, when the cavity contains a small quantity, from a few drops to 1 c.c., of coloured fluid. Its lining is covered with viscid yellowish-white mucus, and is thickened, scarred, and marked with haemorrhagic patches; it often shows small cysts or little polypi. The ciliated epithelium disappears, the muscles atrophy, the blood-vessels show endo- and periarteritis, while there is a general infiltration of leucocytes, which are the agents by whose means the senile involution is produced (Weinberg and Arval).

"At the menopause the chief symptom is the cessation of the menstrual flow, but with this are associated loss of sexual desire, flushings, increase of subcutaneous and abdominal fat, lowering of the pitch of the voice, growth of down or hair on the lips and chin, and predisposition to or loss of resistance to disease. The thyroid gland may be atrophied or in some cases hypertrophied, with the appearance of some of the symptoms of Graves' disease. The age at which these changes supervene is generally between forty-five and fifty, but they may occur earlier (thirty-five) or later, fifty-five, sixty, sixty-five (Courty); in warm climates, just as puberty is attained earlier so does the menopause take place sooner. Repeated pregnancies are believed by some to retard it. Loss of fertility generally accompanies the cessation of menstruation, but this is not an invariable rule" (pp. 48, 49, 50).

The metabolism of old age does not appear to be essentially different to that of earlier life. There is probably merely a slackening of the process. "This slowing of metabolism is not wholly due to diminished activity, as even during rest less heat is generated.." (, p. 51).

"There is an increased excretion of phosphates and lime owing to the gradual atrophy of the bone. The evaporation of water from the skin is lessened; the absorption of food in the intestine seems to be about normal" (, p. 52).

Donaldson () says that for old age "The bodily temperature

falls from 0.1-0.5 C. below that found in the prime of life"(p. 324).

"The crystalline lens, says Parsons, (), normally possesses a slightly amber-yellow hue, which is inappreciable in youth, but increases as age advances. In elderly people the colour of the lense causes an appreciable absorption of the more refrangible rays (green, blue and violet). This fact must be borne in mind in estimating the visual sensations of such people"(p. 8).

There is a thickening of the membranes of the cerebrum, the pia-arachnoid often being adherent to the dura mater. Calcareous deposits appear in it with an increase of the pacchionan bodies. Convolutions are wasted, sulci widened, the corresponding increase of subarachnoid fluid. The Pia mater is more or less adherent to the brain substance. Microscopic examination of the convolutions shows the nerve cells to have undergone pigmentary degeneration, appear rounded and to have lost their poles, while the perivascular spaces are widened, loaded with pigment and the vessels themselves dilated and tortuous. Sections often show vacuoles, due to the destructive action of the macrophages(). The cerebellum shows changes similar to those of the cerebrum, but minor in extent.

The neuroglia cells are proliferated, with an increase of round cells, while miliary haemorrhages, aneurisms and softenings are often observed.

"The spinal cord is rarely atrophied, its consistence is often increased, its membranes may be thickened or calcareous, but any increase of any cerebro-spinal fluid is rare. The central canal is frequently obliterated, and the vessels show periarteritis with thickened sheaths, and there may be miliary softenings"(, p. 51).

According to Bischoff, quoted by Donaldson(), the weight of the encephalon begins to decrease in men at about fifty-five years, while with women perhaps at ten years earlier. Among eminent men this decline is deferred until after sixty-five years. With the heavier and better organized brains, eminent men are longer in attaining brain growth, a condition which tends to postpone senescence.

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"The thickness of the cerebral cortex diminishes in harmony with the shrinkage of the entire system. In large measure this must depend upon the loss of volume in the various fibre systems....."(, p. 328).

Donaldson follows the finding of Engel that the branches of the arbor vitae of the human cerebellum decrease in size and number in old age.

Donaldson further believes that the condition of the organism in fatigue and in old age is closely similar. The fatigued cell possesses the power of recuperation; the senile cell on the other hand has lost this power.

"Even in youth," says Donaldson, "extreme fatigue brings with it the bodily expression of age and the feeling of decrepitude, and in many ways the two conditions thus approximate, although it is recognized that fatigue depends upon the exhaustion of stored material and senility upon the failure of the power to restore it in full measure, but how the one stage passes over to the other, or why, are problems still untouched" (p. 335).

The classical work of Hodge() upon the brain of a man dying of normal old age at 92 years, upon material taken from a male foetus killed by accident of birth, upon that of a man killed by accident at 47 years and upon the brains from twenty-one old and twenty-one young honey-bees, led him to conclude that if the nucleus be the source of rejuvenation, then "age is of the nature of final fatigue, final, because the source of the energy for the nerve has dried up at the fountain head"(p. 133). In extreme age the protoplasm was found vacuolated in bees, pigmented in man, nucleus shrunken, but not dense, as in fatigue and the nucleolus absent from a large proportion of the cells in man.

Dolley conducted experiments upon twelve dogs, exercised in a tread mill to determine the recuperation of nerve cells after functional activity. These animals were of different ages. In addition three brains from senile dogs were used. His results are interesting

as they throw light upon the condition of cell senility and cell death.

He finds that a cell may die natural death, from the point of view of the whole cell, may happen independently of any extraneous

"come down to a point without Karyosome, without nucleus and without extra-nuclear chromatin, and be left as a formless mass of faintly staining reddish and bluish substance, whose principal claim to notice rests on the fact that it lies along the line of other Purkinje cells with the now hyaline-like remains of its dendrite process attached"(p. 328).

While Dolley is not able to state a final conclusion on this point, he tentatively and with certainty holds that the number of Purkinje cells both in prematurely and naturally senile animals is considerably less as compared with very young animals. Functional processes not only lead to cell death, but as well to severe alterations in the old dog. Moderate irregularity of form in otherwise normally appearing cells is found to a considerable extent. The finding of the actual loss of cells corroborates the work of Hodge mentioned elsewhere.

Dolley points out that "the fact that his(Hodge's) detailed work was done on this most resistant and least specialized type of nerve cells (spinal ganglion) explains why he did not trace the cell to the end."

Both Dolley and Hodge conceive of old age as of the nature of final fatigue. In the literature of the subject there is other confirmation of senile changes in cellular structure. Robertson and Orr found in the case of a senile woman dying at the age of ninety "that in no less than sixty per cent of the pyramidal cells of the cortex there are disintegrative changes in the nucleus leading to its disappearance, a scantiness of Nissl substance, and atrophy of the cell body. They say further there is an 'evident paucity of nerve cells in the cortex!'"

(p. 330). Dolley moreover gives Ferrier's description of senile neural structure in the "progressive diminution of the cell volume, its deformity, the irregularity of the nucleus and the final disappearance of both nucleolus and nucleus"(p. 330).

From the present study Dolley comes to interesting conclusions concerning old age and death.

"Natural senescence and natural death, from the point of view of the nerve cell, may happen independently of any extraneous cause whatsoever, and are the inevitable final result of its natural activities. The morphological price of activity is age."

Again, "Premature senility is the certain outcome of the injudicious and extravagant expenditure of energy without adequate chance for rest and recuperation"(p. 340).

To say where senescence begins in point of years is a discussion inherited from antiquity and will not be rehearsed here. Viewing senile involution as a reversal of psychophysical processes, one must recall, by way of orientation, the developmental phase of the life-span. Just as physical maturity comes earlier than mental maturity, it should not be surprising to find physical decay manifesting itself earlier than mental decay, particularly where it is remembered that though the nervous system, which conditions mental function, is carried farther in growth during the foetal stage than any other organ of the body, yet as regards minute structure development the nervous system reaches middle life and brain shrinkage for the intellectual process not set in until about the sixty-fifth year (Ladd and Woodworth, p. 68). It is a common practice to speak of physical maturity as correlated with sexual maturity, and, within wide variations, about the twenty-fifth year. At the other end of life may be in place to accept tentatively that physical involution begins with the waning or cessation of sex life, followed later by more marked mental involution. This, of course, is at variance with

IV. THE PSYCHO-PHYSICAL ASPECT OF SENESCENCE.

Except for the field of senile dementia, which has long been the province of psychiatry, the psycho-physical aspect of senescence remains the most chaotic. One finds nowhere in the literature a serious attempt at a complete picture, ^{of it} perhaps in part explained by the supposedly impracticable nature of the undertaking. It will be shown later, however, that even for education the psychology of senescence promises something.

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Minot's view, given above, that senescence progresses inversely as the age of the individual. Nevertheless, the fact remains that there are marked changes with women at the climacteric hardly less noticeable than at pubescence and evidence is growing to the effect that much the same condition obtains with some men. In the treatment of adolescent phenomena, it should be recalled moreover that the discussion is predominantly concerning the earlier years of adolescence. They are apparently the most unique years. In obverse fashion, again, one must expect to find the later years of ~~involution~~, rather than the earlier, to present the most unique phenomena of senescence. But just as the later years of adolescence require some consideration, so do the earlier years of senescence. Assuming, then, that development is correlated with expanding sex life and decline with reverse processes, it seems expedient to begin the present section of this inquiry with a brief survey of the facts of sexual abatement.

1. The Climacterium.

As is well known sexual potency has, in point of years, an ill-defined termination, even for woman. Tilt, (), speaking of this, says,

"Sexual involution has an ill-defined beginning and end, and only one fixed date, that of cessation" (p. 25).

Studying over 1,000 cases (female), Dr. Tilt found cessation varying from the twenty-first to the sixty-first year (p. 25).

Summarizing the American Text-Book of Physiology (v. II, p.)

on this point one notes that in women sexual potency lasts from thirty to thirty-five years, ending definitely between the ages of forty-four and forty-seven in temperate climates, while earlier in warmer, and later in colder countries. Among laboring

classes this change occurs earlier, and later where menstruation has first appeared early. Nagel () finds the climacterium in women falling between the fortieth and fiftieth year of life on the average, marking not only the termination of the *vita sexualis*; but soon thereafter the beginning of the senile involution of the whole organism. As a rule the climacteric itself extends over a period of from one to three years, following usually about thirty years of sexual potency (Zweiter Band; pp. 197-198).

With man the situation is somewhat, but not totally, different. The American Text-Book of Physiology () gives only a short paragraph:

"At the sixtieth year the power of producing spermatazoa, and, therefore, the reproductive power of mankind begins to wane. It continues, however, in a diminishing degree, even to extreme old age, and there is no recognized period of ending of the male sexual life" (v. II, p. 490).

This is doubtless true on the whole. But Church () finds a climacterium in men between the fiftieth and sixty-fifth years, lasting from eighteen months to three years. During this time one may find in the individual headaches, oppressed feelings in the chest, sudden sensations of an alarming nature, especially vertigoes, cold extremities, and heat in the head, loss of weight, easy fatigue, indigestion, and tendency to neuresthenia. Periodic migraine shows a falling off. Among other symptoms one may find an onset of anxiety, and increased blood pressure. As treatment he prescribes travel and attention to the general health. Freud () has made a similar observation: "There are men who show a climacterium-like women and merge into an anxiety and neurosis at the same time when their potency diminishes" (p. 143).

Mendel () in a long discussion adds confirmatory evidence. Clouston (, pp. 218-230) gives a detailed analysis of the psyche during the stress period of the climacterium, which is here presented in resume. During this time, he begins, the reproductive instinct weakens and dies, then a greater intensity of affection is shown for the progeny, shifting from the mate. Poetry and love tales do not stimulate as once; action is less pleasurable for its own sake. While the reasoning power does not necessarily lessen it often indeed grows stronger until the decay and atrophy of the brain cells in senile years. "The wisdom of age" has often impressed mankind. At this time, the society of the opposite sex is less over-mastering and electric. Life seems slower both mentally and physically. A genial contentment replaces ambition. Courage grows weaker and an indefinable sadness sometimes settles down upon the individual.

These mental changes, no doubt, have affected historical events. Changes, however, are more marked when later old age sets in, but these climacteric changes show alterations in face, eye, gesture, walk, appetite, while the form, especially in women, suffers marked change.

There are certain mental dangers incident to the climacterium. Sometimes there is an almost imperceptible loss of the will to live. Death grows less abhorrent under these circumstances. One becomes stoical, deeming death as much a part of life as birth. Energizing the self is no longer felt to be so necessary. This is often accompanied by a lowering in desires and ideals. The pleasures that cost little are now preferred. At this time the well-to-do often take to the pleasures of the table. They are easily attained, requiring little exertion. For the same reason alcohol may be indulged in for it reverses former intentions and

deadens regrets.

At this time, furthermore, obsessional feelings of all sorts and kinds steal oftentimes upon the individual. There are many cases of this on record. Women sometimes think that certain gentlemen are paying them marked attention. They have been known even to take houses in the name of imaginary lovers and to buy groceries, furniture, etc.

The emotional life during the climacteric is lowered in intensity. There is less conscious affection between husband and wife which often causes sensitive women much unhappiness. Lessened emotion seeks to find compensation in an increased tendency to be with one's mate. Maternal affection, on the other hand, is apparently unlesened, even at this time. At this period previous close friendships of the same sex are less cultivated. Monthly visits and casual meetings at the club may take the place of the customary daily or weekly meetings. Men frequently feel it necessary to spend more time than formerly on whist in order to make life more tolerable. After the climacterium new intimate friendships are less likely to be formed than before. Then there is a lowered intensity of the social instinct; social functions become a bore; the gregarious instinct grows weaker likewise.

The failure of memory shows itself at the climacterium. Names are forgotten and the things of yesterday do not make the former deep impressions. Slight acquaintances are not so readily recognized.

Will power, too, suffers loss at this critical period; the originating faculty is lessened. Great deeds involved in persistent will power are less frequently undertaken. Pleasure

to command others is less keen, while purposes are more easily departed from. One sees a marked tendency of these individuals to ask younger men's advice and to act upon it. On the other hand, obstinacy is sometimes noticeably increased. Speech may be diminished, more being expressed with fewer words.

Imagination and poetic feelings undergo great changes. It has been said that no poetry is written by those past fifty, but to this there are notable exceptions, as Wordsworth and Tennyson. Now vague feelings of a bodily origin arise, hard to analyze and impossible to name. Something interferes with the whole enjoyment of life. The cause of this may be found in lowered nutrition; decreased function of body organs; less keen appetite for food; and constipation.

Less sleep is now required. It is not so deep and is disturbed by dreams and often wakefulness, especially in the early morning.

During the climacterium chronic grumbling may develop, especially among the better off, for there is a lack of power to respond in the terms of pleasure and the like. Neighbors are likely to be mere citizens, while previously good managers are not able to get anything done right for them. Previous cynicism is now accentuated.

Most serious of all the changes is the general depression of the mind. "Vain regrets", deadened emotion, with brain seemingly defunct, sleeplessness, loss of appetite, loss of flesh, bad color, darkening of the skin in tint, with loss of freshness of complexion.

2. The Post-Climacterium.

This term will be used to designate the period between the climacterium and senescence proper or the uniquely senescent years.

Noting in the foregoing pages that the reproductive power in women fails earlier and more definitely than in man, two questions arise for answer, first, what is the phylogenetic meaning of the climacterium in woman and, second why is it apparently much less definite in man? The writer desires to set forth several hypotheses, which he does not know to have been proposed before. Reproduction is generally recognized to be more exhaustive to the female than to the male. If, then, potency were indeterminate in woman her energies might too largely go to procreation, unfitting her for the important office of conservator of social heredity and teacher of the immature. There is evidence that the post-climacterium brings, especially to woman, a marked expansion of the mental horizon and this must have survival value--as the nature provided a time when children and maidens especially should receive the social heritage from those who, profiting by the tempering process of years, are fittest to give it. Support for this view is to be found, first in Taylor's (p. 413) contention that the climacteric is in no sense pathologic, but is rather "a conservative process of nature to provide for a higher and more stable phase of development, an economic lopping off of a function no longer needed, preparing the individual for a different form of activity." Again, Shaler's () observation is in point here:

"Those who are in the habit of carefully observing people may have noticed in women who have passed the climacteric, or between the forty-fifth and fiftieth year, a considerable enlargement of the intellectual

interest. So general does this appear to be that it may be regarded as normal, and as indicating a natural tendency of the mind to claim its rights in the peculiar human period of old age. Among men, perhaps because there is no distinct change in the work of the body or the load of care, this enfranchisement of the spirit is less often and less clearly seen; yet there too, I am satisfied from the instances I have observed, it tends also to occur, and needs but a little fostering to become normal" (p. 282). Finally, summarizing Clouston, (p. 230), we have a similar finding: Between the crisis of the climacterium and old age nature provides a time of mental peace, calm, and health, especially in the female. With the latter many have better health than for the last twenty or thirty years. The dangers and excitements of life are passed, and passions evaded, while judgment and control have asserted themselves over emotion and impulse. Much good work, especially of the judicial and benevolent sort is done at this period of life. If strenuousness is not too great, caution is enormously increased, former experiences being applied effectively.

While the whole matter of the phylogenetic meaning of the climacterium may be much too complex to be explained, as suggested, yet the post-climacterium it would seem is unmistakably a period of new possibilities for the race, at least vicariating for the loss of procreation; it should be utilized to the uttermost, and not made a time for resignation and consequent early loss of social efficiency.

As to the second question raised above, namely, why has man a later and less distinct climacterium than woman, it has occurred to the writer that since, in the nature of the division of labor between man and woman, the former's chance of survival is less, as even present-day statistics show, race survival depended upon prolonged male procreative powers. Moreover, while females only slightly outnumber males at present, once this difference might have been greater.

In rather sharp contrast to the expansion of the self in the post-climacterium, especially in woman, as previously considered, is the so-called "dead line", prominent in the fifth decade of life, in the pre-climacteric period. Sanford () points out several aspects of this period. He notes that the "dead line" for clergymen comes at forty years, beyond which there are a few flattering calls to the large cities. At forty man seems suddenly to grow old. Chicago is said to be made up of men under forty, for young manhood is the time for action.

Drunkards, it is said, are more easily reformed in middle life, say at forty-five, for then they begin to see the results of excesses, metabolism being less active and repairs slower. After forty individuals commonly realize that ideals and ambitions of early years have not been attained; that their powers are inadequate to the original plan. This discovery brings pain. Then it is that children are often looked to as a means of compensation, and this may result in taking a greater interest in them--forwarding their success.

Other data could be given, but sufficient has been said to suggest that this so-called "dead line" is a factor to be reckoned with. To the writer it appears, first, that contemporary society is prone to underestimate the powers of the individual in the forties, over-stressing the dynamic phase of personality and, second, that civilization is imposing greater tasks than many can successfully carry through and that perhaps maximal positive results are in the future to be further found in artificial stimuli, in honors and rewards, as provided by imperial Europe, and suggested by President Hall to advance the interests of scientific research in American educational institutions.

3. Normal Senescence.

While some workers are unwilling to grant the existence of normal senescence, nevertheless this term will be used here to cover such data as are not unmistakably those of senile dementia.

As insisted before senility is not a matter of years, but is a condition of structure and function. Naturally enough, since all do not possess identical initial endowments and are not subjected to identical stress and strain thru life, living in diverse environments and of dissimilar occupations, one can not expect involution to set in at the same age for all or advance at the same rate towards the end. To emphasize this further, one need only recall that loss of brain weight comes to the mentally superior by perhaps ten years later and, withal, that maximum physical efficiency is lost before mental efficiency.

Upon asking the elderly to name the first sign of decline noticed by them, one is likely to receive one of two responses: either that of a perceptible loss of muscular power or loss of memory, especially memory for proper names and infrequently used nouns. These changes may come early, and may, along with others, advance so gradually that they are scarcely noticeable, even to those given to self-observation. Likewise it is merciful that the senses fail so imperceptibly. Some individuals apparently fear old age worse than death. With these consciousness that old age has claimed them is usually prepared for so gradually that they accept the inevitable with fine stoical resignation. Ageing is a process, not an event, and most persons seem not to be aware of anything like final senescence--only senescence in certain particular respects. Just as we are scarcely certain on a given day of maturity, the same can be said of senescence. An anonymous writer () gives her experience as follows:

"There was a time when I was more of a comrade than a mother to my daughters; when I was advisor of my sons. Now I am not. I do not know when the change came, nor do they, if they indeed realize it at all. There was a time when I was of their generation. Now I am not. I cannot put my finger on a time when old age finally claimed me. But there came a moment when my boys were more thoughtful of me, when they didn't come to me any more with their perplexities, not because I had what is called 'failed', but because they felt that the time had come when I ought to be 'spared' every possible worry. So there is a conspiracy of silence against me in my household" (p. 10).

"The cares and responsibilities of life are shut out by loved ones more and more until ~~the~~^{the} world is artificial, smiling, divested of the big interests of life. If there are sickness or mishaps ~~I do not~~^{they are not} know them until they are past. "So the great silence enfolds me more and more. I live more alone and solitary among those I love, groping in the silence, watching the faces of my children to find out what is passing in their lives" (p. 11).

This same writer in another way realized that old age had claimed her. When attempting to do some work her daughter forbade it, saying that the hired girl would look after that. Furthermore, her loved ones insist that she will not take care of herself, and this is the grievous charge brought against her, to neighbors and friends. It is quite impossible to say just when old age comes upon us, but, says the author, "This first touch of age comes when our children begin to dictate to us" (p. 26). Our children alter our world, "and one day you will wake up in a new world, an unhomelike place to which you must adjust yourself as a baby must adjust himself to his surroundings, but with the difference that every day the baby makes progress, whereas

every day you will find a new condition harder to understand, as I have, and as your mother has" (p. 28).

(1) Muscles.--The lessened activity in physical effort, the shortened breath and finally the shuffle gait usually steal upon the aging most slowly. Altho preserved to a remarkable degree, one person questioned said he notices a shortening of breath in case of the more violent exercise, as hill climbing. Too, tho he cannot explain it, he observes less tendency to run for a car, with a sort of feeling that he shouldn't; he seems to be settling into an easier, slower pace. Another (male, age 78) reports:

"I must walk more slowly, especially up hill; this is not so much a matter of getting out of breath as of the sense of muscular effort and of the corporeal weight. In recent years I am not so steady on my legs; it is becoming more difficult to stand in a moving street car. I must lean against something; hold a strap; or get a seat when the car is standing still. *Getting to be tottery! I tell my family."

The shortness of breath upon exertion characteristic of advancing years, Taylor () explains as due more chiefly to defects in circulation and of the vaso-motor nerves than in the lungs (p. 407). The general reduction in muscular powers is no doubt similarly best accounted for through the failure of coordination of the muscular mechanism from a slowing down of neural association. Later in life there are structural and functional changes in the muscles themselves that likely complicate the matter.

Another interesting topic involving the muscles has been suggested to the writer by a careful observer in the seventh decade of life. He thinks he can develop efficiency in a given physical task, as the sawing of wood, as quickly as in earlier life, but that upon discontinuing practice the developed skill does not persist so long. This should be given

experimental investigation.

(2) Psychic retardation.— Analogous to the neuro-muscular slowing-up with years, we have general mental retardation. This phenomenon is patent on every hand. An eminent alienist rounding out the eighth decade and enjoying an unusually normal "physiological" old age, has reported detailed introspection and observation to the writer, some of which will follow here. With him, as one would expect, retardation is not uniformly present in all mental tasks. From long practice and familiarity with his subject, he accounts for not being aware of retardation in lecturing. "But in writing," he discovers,

Hand(?)

"while there is, at times when I am rested, apparent normal facility; yet at other times, (in work which I wish to do carefully and with a particular purpose,) I am conscious of a decided slowing of the association processes. With persistence, the mechanism will work. I become more inclined to read over and amend the 'work' the next day. I made confession to a friend not long ago, of being conscious of some disability in this regard, especially with respect to a subject in which I am deeply interested."

In a word, then, the conclusion of this observer is,

"that in my case there is some reduction of essential functional capacity in mental work, but the work can be done quite as well as ever, though more slowly."

His explanation of this retardation is that the neural structures are still intact, but show functional infirmity because of poorer metabolism. His words are:

"The mechanism is still there, and may accomplish even better results under prolonged and persistent effort; in many cases, no doubt, the cortical mechanism may not really lack functional capacity, but some degree of arterio-sclerosis may cause more or less shortage of blood supply and nutrition to the essentially normal cortex, and hence the phenomena of functional weakness."

Summarizing Clouston (pp. 234-236) one gets a general view of the progress of retardation in psychic retrenchment, as follows:

*Memory is first to show signs of diminution, especially memory for the recent, for the brain cells are impressed less easily. The old memories are often vivid enough.

There is diminished power of attention. Things are not seen by the 'inner ego' as formerly. The next faculty to fail is originating power, of which there is a far greater failing than during the climacterium. It is natural for it to abate since it requires much effort and output of nervous energy. There is a growing tendency to put off doing and thinking about things. In fact, the effort to originate is often painful. Next the strong exercise of the will power goes, though not always so, as in cases of negative obstinacy. Later it may be, and often is, increased. Self-control, also, is naturally lessened. Mental and bodily self-control are the greatest things in man, and must be expected to go with brain shrinkage. Emotion abates at the same time with inhibition. It does not carry one with as strong an irresistible wave as once. The old rarely feel the loss of loved ones as keenly as the younger. Control over the expression of emotion, however, may be lessened. For this reason the aged are often thought to feel more than they really do. It is notorious that the very old will weep and laugh over a trifling. This, to be sure, is a sign of advanced age or it may be a sign of changes accompanying softening of the brain. The intellect is the last to weaken and to go. It calmly outlasts most of the other faculties. The highest and most difficult forms of reasoning upon abstract subjects may wane, but a man of seventy-five or eighty will often come to the soundest conclusions from facts put before him, when memory is far gone and energizing power much impaired.

Thus far broad, striking considerations chiefly have been taken up. It is now necessary to attempt to particularize,

notwithstanding the fact that the self is conceived as a unit.

(3) Memory.- Based upon laboratory experiments in the field of memory, Meumann concludes that at about the age of forty years "it seems probable that a retrogression of memory occurs even under conditions of maximum practice" (p. 359). If this be true, it is not remarkable that all observers place the failure of memory as a first sign of mental decline. An anonymous writer () says:

"When I look at the young girls chattering in the street, I can only wonder about what they are talking; I knew once, now I have forgotten, and there is nothing that can make me remember" (p. 197).

Further, she is convinced that elderly people experience a sort of embarrassment at the failure of memory and the like akin to that of adolescence when there was some failure of adjustment to a given situation, but there is this difference: In old age one can laugh off mortification and in adolescence it is washed away with tears.

Later it will be pointed out again that while memory for the recent in senescence may fail utterly, thru lost plasticity, usually recall of earlier experiences is unique. It appears that childhood data are stamped in most effectively of all and persist while life lasts, due, we are sometimes told, to the tendency of childhood to dwell upon each datum with interest. But the writer is skeptical about the reputed accuracy of senescent memory for early years. It is common to find the elderly add to and subtract from their memorial material in an extravagant fashion. This comes out when they are asked to repeat a given experience with a considerable lapse of time between repetitions. Moreover, the friends and children of these persons can often testify to the purely imaginary

character of these reports. To be sure, there are many individual differences.

(4) Attention.— Possibly the best index of the degree of senility attained is power of attention. When one observes a person heavy with years conversing, he often sees with what strain the topic is pursued, how extraneous data are likely to come in or the topic to be lost altogether, as with children. Thus psychic retardation can be very roughly measured. Three considerations may be said to account reasonably well for the diminished attention of old age: First, with the greater apperceptive background there is more conflict of imagery upon reaction to a given stimulus, followed by a seemingly less efficient degree of attention. Second, slower metabolism or easier fatigue may explain it. Third, a defective sensorium may be ^a significant feature. When hearing grows bad, for example, and it does so with a surprising difficulty of detection, this may be mistaken for a lack of attention. Something similar may be said for the other sense departments. That attention tires, as it is naively reported, from reading when vision is impaired is frequently met with.

(5) Imagination.— Definite data are hard to get at here. On the one hand, one is told (Clouston) there is lowered imagination, which is the natural expectation upon the onset of enfeeblement and retardation. This is one element in the loss of enthusiasm, power to originate, little courage for new undertakings and consequent procrastination, as well as inability to view the present sympathetically. It may be this that led Miss Paine (, p. 168) to believe that the young can sympathize with the aged more fully and effectively than the aged with the young, and that both are too different to realize complete

sympathy.

Perhaps the reason that old people think the younger generation giddy, silly and irresponsible, bent so largely on pleasure, lies in the fact that the senescent cannot longer image the desires and cravings of adolescence. Among the aged there is no small number who confess a feeble remembrance of these earlier, giddy years, at least, this phase of the earlier years. Not longer having the old desires and incapable of imagining them, the new generation is charged with irrational inclinations and perversities.

On the other hand elderly persons sometimes show fine imaginative powers in their ability to picture the older times, especially with themselves playing the role of hero--in true childish fashion. Akin to this is the tendency for senescence to exaggerate its waning abilities. This last topic comes up for treatment later.

The writer is inclined, from observation, to the notion that generally speaking feeling and emotion tend to weaken markedly with age, particularly advanced age; that instances to the contrary represent reduced inhibition and control and must not be mistaken for depth of feeling. One frequently hears an elderly person say that he hasn't life enough for such and such a task or diversion, that he can't work up to it any more. This to me means that he has, among other things, been de-sensitized.

The fears of old age have been studied somewhat. Many of the fears appear to be senile delusions and are aside the purpose of this study. It is to be noted that the aged are disturbed by fear or anxiety by reason of organic and nervous

(6) Affection.— Of the feeling life of senescents next to nothing is positively known— quite the same as with earlier life. If it be true that there comes to the sex life in advanced years a sort of Indian Summer, as President Hall has reason to believe, then one can be fairly sure that the affective processes glow in a new way once more; this is shown best no doubt in a reawakened interest in children and at times in marriage.

Acute and chronic disease in senility must give consciousness a displeasurable or maybe painful affective toning, tending often to pathological states. Yet definite data are not available. The view of Stumpf and similarly of Wolley that affection is really organic sensation or as modified by Watson(, p. 23ff.) to be sensation referable to the reproductive organs and related erogenous zones—these considerations a priori speak for a profoundly changed affective life in old age. Moreover, the present-day tendency to correlate feeling and emotion with subtle physiological, especially glandular, changes, indicates something of what must be the qualitative and quantitative changes in affection when structures, including glands, atrophy.

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The fears of old age have been studied somewhat. Many of the cases belong to senile dementia and are aside the purpose of this study. Bazelaire de Ruppierre() concludes that the aged are disposed to one form of fear or another by reason of organic and psychic

changes and that these fears should be prevented or combatted by general hygiene and psychoterapeutic treatment.

Many persons past middle life feel that the last enemy to be overcome is old age, not death. Stekel() makes every fear in last analysis a fear of death. Death is for us the absolutely new and unknown. We can only die once. Man can endure anything but the unknown, whose symbol is darkenss. President Hall has suggested to the writer that the bivalent element of the will to live, that is, the will to die, gets in its first good work in adolescence, when the race life dawns and the individual realizes he must live for others. Hence, at this time, the curve of suicide rises. Dr. Hall further holds that should man live out his hopes, desires, ambitions, etc., the will to die would by degrees be substituted for the will to live and in the end death would be more welcome than life.

As an illustration of how the will to live may weaken and die, Metchnikoff() cites an instance from a Russian authority, who observed a woman, at the age of one hundred, longing for death. She is reported as saying, "If you come to live as long as I have lived, you will understand not only that it is possible not to fear death, but to feel the same need for death as for sleep"(p. 279). Perhaps it may be said, that the will to live is in direct proportion to interest in life and things to live for, as, for example, a man's family or business. There are many observations to support this thesis, which President Hall has affirmed. Scott() points out that the tables of suicide show the greatest number at the time of the climacteric or later, indicating, as he thinks, the relation between the sex life and the will to live. He says, "Old men who still desire to live, are those who have preserved the upper irradiations of the reproductive life in love and sympathy for their fellows"(p. 119). To Hutchinson()

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"Every process in nature is tolerable, and even enjoyable when it comes, except, perhaps, birth"(p. 405).

We all dread death, yet it is met by ninety-nine percent. with less out-cry than birth. There is abundant testimony that death is easy. "Death is as natural and painless as the fading of a flower, or the falling of a leaf, and as welcome as sleep to the weary"(,p. 406).

"As in youth there is an instinct for life, in old age there is an instinct for death; and all develop it who live long enough... Work-worn and pain-weary-men and women stretch out their arms to the Great-Rest-Bringer and long for death, as little children cry for sleep at eventide"(,p. 436).

Abraham () has made a psychoanalytic study of the Italian painter, Giovanni Segantini, who in his work gave technique minor emphasis, and painted from his heart. His themes were work, love, motherliness, and death, according to the Freudians. The secret of this artist's life, like every life, is to be found in his childhood. His mother died when he was of tender years. Later he established a cult to her. The sight of a rose would incite love for his mother, until the tears came. He had visions of his mother. Abraham thinks that Segantini must have gone through the incest stage, as Leonardi de Vinci, otherwise he could not have made these idealizations of her. His mother figured in everything, in both his art and his love. It may be said that he idealized his mother; that his mother-love went over into his love for nature; that at thirty-one years of age he experience a turning away from the aggressive life to the more passive life, and hence finally he developed a cult of death. Thus, his will to live passed into the will to die. Death came to be longed for as persistently as life was once held to.

Jean Finot() gives the following interesting summary of his Philosophy:

"Our life is nothing but a long and implacable battle with

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death. The thought of the inevitable end fills the mysterious background of our being. However much we mock or fear it, we cannot free ourselves from its dominion. The human consciousness is impregnated with it, from its awakening until its last act. We can smother this preoccupation like a drunkard who drowns his sorrows in wine. It is useless. Our mind, delivered from the passing whirl of life, will infallibly bring us back to the spectacle of death. The philosophy of the end remains, and will remain, the supreme philosophy of races, religions, and civilizations. Today, as thousands of years before us, we might define the mentality and the morality of men by their relations with death" (p. 279).

In this vein Finot speculates that the fear of death ever with us tends to end the span of life before its natural time, and pleads for a new attitude toward death, believing that it will make both for the efficiency and length of life. Though not denying the immortality of the soul, he affirms the immortality of the body and asks that we change our view of death as conceived as a repugnant nothingness and consider it as a change of life. This will tend to build up in the individual a love for death when by nature death should be expected. By the immortality of the body, Finot means the transmutation of human form into other life forms. With fine imagination he pictures the processes of both disintegration and integration going on in the grave, in the body yielding its molecular elements to constitute vital tissue in other organisms, plant and animal.

(7) Control.— With the lowering of the vital processes as age creeps on, it many times happens that there is not only incapacity to execute or, as it may be, even to desire to launch into action, but also there may develop inability to control one's self when action is initiated. In this respect there are many individual differences. Many observers note that what may seem to be a deep senescent emotional life is merely a lack of control of the feelings, a sort of return to first childhood, in which the individual gives free vent to each passing emotional state. Indeed, this disposition may run so far that tears succeed laughter and vice versa in quick succession. Of course, if this tendency is pronounced, it is indicative of the onset of abnormal senile decay.

Furthermore, lack of control is seen in muscular inefficiency, which is held to be central quite as much as muscular per se. This is but another instance of general neural retrenchment which age brings.

On the contrary, there are individuals who show, even as non-agenarians, remarkable powers of mental and physical control, persons who keep right on working and living. Slight retardation in general is the chief stigma of their senility.

(8) Thought life.— Years bring remarkable increase in synthesizing powers of mind; rich wealth of experience provides apperceptive data that have a facile way of getting together effectively. To one individual who has been a hard student all his life and an author, arranging reading notes and writing them out is easier than once, whereas the taking of notes has grown more difficult. Ideas tend to shoot together now in an unusual way, illustrating the synthetic character of consciousness. Indeed, while this individual does not contemplate writing out his Weltanschauung, yet if he chose to do so, the task would be easier than in any previous years. Other parallel cases could be cited, as von Ranke writing his Welt Geschichte during the last five years of his life, beginning at eighty-five. It is in normal old age, the earlier years in special, that the intellectual fruitage of a life can often be expected. This should be prepared for and seriously realized.

elderly hold most of the property and want most of the world's power (p. 38). Similarly Robert Louis Stevenson () speculated that perhaps what of power has more to do with the will resolutions of old than we know, and holds that it would be an instructive experiment to rejuvenate an old man and yet leave him all his wisdom.

"I scarcely think," Stevenson says, "he would put his money in the Savings Bank after all; I doubt if he would be such an admirable son as we are led to expect; and as for his conduct in love, I believe firmly he would out-hered Herod, and put the whole of his new powers to the blush" (p. 93).

the retardation and impoverishment of intellectual processes and activities is well illustrated in an experimental investigation by Binet and Simon (1908) in their study of the qualitative and quantitative changes in

Perhaps Clouston () brings out best the general consensus in the literature of senescence that thought is the last process to go in decadence. As given above, he goes so far as to say that even after memory functions most poorly and energizing power is low, the elderly individual may come to sound conclusions from facts put before him. My observations confirm this in part. It will take a special investigation to prove it, however.

The wisdom of old age has a worthy reputation from times remote. Both folk lore and cultural literature abound in references to it. The meaning and value of this comes out in a later chapter. Here I wish only to register a suggestion that it is necessary to take the wisdom of old age with reservation. There are numerous differences. No doubt there is truth in Brinton's contention that old age as synonymous with wisdom is a deception resulting from the fact that by law and custom the elderly hold most of the property and want most of the world's power (p. 35). Similarly Robert Louis Stevenson () speculates that perhaps want of power has more to do with the wise resolutions of old than we know, and holds that it would be an instructive experiment to rejuvenate an old man and yet leave him all his wisdom. "

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The retardation and impoverishment of ideational processes in involution is well illustrated in an experimental investigation by Ranschburg and Balint (1899) in their () study concerning the quantitative and qualitative changes in

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mental processes in advanced old age. They used as subjects twelve men from sixty-one to eighty years in age, healthy and vigorous in body with no noticable symptoms of dementia. The intelligence of these subjects was not considerable, but high as compared with their schooling. As controls ten individuals between the ages of twenty and thirty-nine were used as similar in intelligence and training to the aged subjects as it was possible to determine. The tests were made in simple and complex reaction time with auditory and optical stimuli including simple judgment reactions, addition reactions and reactions of the free association of ideas. The results show in an interesting way that the reactions of the aged individuals are without exception retarded decidedly. This is especially true in the free association reactions, simple judgment and discrimination. In the former the retardation was extremely marked. The per-centage of errors was found roughly proportionate to the retardation and was very greatly in excess of the per-centages of the normal adult. Qualitatively the free associations revealed an impoverishment of ideas. Moreover, it is rather surprising to find that associations were almost invariably determined by the sense of the words rather than by rhythms or similarity of sound. The averages of the six tests follow, expressed in 1/1000 of a second: 1, simple auditory reaction, young subjects-152, old subjects-193; 2, simple auditory choice reaction, young subjects-249; old subjects-368; 3, optical (ward) reaction, young subjects-757, old subjects- 924; 4, judgment reactions, young subjects-1047, old subjects-1278; 5, free idea association reaction, young subjects-1457, old subjects-2447; 6, addition reaction, young subjects-1138, old subjects-1307.

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The harking back of senescence to the noetic life of early years is well known. An anonymous writer () illustrates this from her own experience:

"Lately I find myself returning to certain opinions and prejudices of my girlhood, that I had long forgotten. Time, after all, has not obliterated them nor have I walked away from them. It is rather as though I had gone in a circle, and as I come to the completion of it I find my old thoughts and opinions, changed and grown older, waiting for me" (p. 2).

St. John in his study of senescence based upon a careful survey of the life and works of four distinguished men, Auguste Comte, Emanuel Swedenborg, Leo Tolstoy and Gustav Theodor Fechner, found that for these men the beliefs of earlier years were readopted and lived by in old age. He thinks that early ideas take a position in the fringe of consciousness, where through life they may play some uncertain role; and trip back again into the focus of attention in old age, and hold sway or tend to do so once more. In senescence the individual grows less critical which allows the revival of early superstitions and beliefs which possessed a decided emotional tone or which had in early years a prominent place in mental life. In cases where the early mental data are not in conflict with the later there is not such a marked reversion to the early point of view as is discovered in taking cross sections of the mental life at different ages. Reversion to the mentality of early years, St. John thinks, ^{is} correlated with a departure from the ^aposteriori to an a priori attitude of mind. **B**ecoming subjective the individual tends to accept feeling and belief as criteria with of course as much logical consistency as possible. Fears and other emotions or physical ills accentuate this diathesis. For Tolstoy it was found to be the fear of death; for Fechner, loss of sight.

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"Before the final loss of affectivity", St. John notes, "there seems to come a period of greater affectivity, which should rather be spoken of as a time of less control, when old feelings, and beliefs grounded in them, rise unrestrained and dominate thought, rather than submit to its rule. The discipline of a calmer and more critical judgment is removed, and a deeper feeling of consciousness holds sway. It seems a reversion to a more primitive type, to an earlier stage of mentality. We should say, not with Scott, that in old age one passes 'from the protecting shadow of the phylogenetic life and becomes more ontogenetic and individual,' but rather that one descends the phyletic ladder-it is a dissolution downward to a deeper strata" (pp. 180-181).

Reversion to an earlier psychic level, it might be said, is not restricted to senility. In day dreams especially, persons of middle life often return to a lower childhood level and live over days long past. These experiences indicate correlation with fatigue conditions, showing, it may be, that the first structures to function in the life-span work with the least energizing. Perhaps this is the explanation of reversion. Made more subjective by failure of the senses and suffering general reduction of functional capacity, the senescent falls back upon the level that works best. That the childhood level reveals striking persistence is brought out by Dr. Jones () experiences under anaesthetics. He submitted to three ministrations of chloroform, at as many different times, under controlled conditions to determine what happens in the blocking out of consciousness. He found that after the function of the sense organs had failed he could still think and reports lingering ideas, the first ones gained in life. A memory of his boyhood home, parents, brothers, sisters, playmates almost forgotten, religious conceptions long since discarded, and a few aesthetic feelings of early childhood. His last ideas were vague and indistinct, and then he remembered nothing.

(9) The Senses.— Experimental findings in regard to the exact status of the senses in senescence are few. Sensitivity to touch is lessened (). The writer has found nothing definite regarding the temperature sense or pain modality, however, Taste and smell often lose acuity, tho when and to what degree we are not told. There must be profound change in kinaesthesia with the stiffening of the muscles. With the failing of sight and hearing the individual is made more auto-centric than ever. The structural changes of eye and ear are enumerated elsewhere () in this study. The influence of the failure of the senses, furthermore, has been touched upon in the discussion of attention. As mentioned before, it is an inestimable blessing that the senses fail gradually, driving the self "inward" by degrees. One can only fancy what the loss of contact with the outside world thru the onset of deafness means. Confidences can no longer be heard as confidences. The tender whispers and finer tones of friendship are forever past. At last, childish prattle, once the delight of parenthood, falls upon unresponsive ears. Just as failing audition brings isolation, so does failing vision; and we may attach greater significance to deafness and think it more prevalent than failing sight because deafness is a greater inconvenience to those caring for the aged.

The characteristic narrowing of interest in advanced years finds partial explanation in a defective sensorium. One observation made for the writer by a medical specialist (age 78) will make this clear:

"I am aware that I am more and more inclined to enjoy staying at home, and to be content with my immediate associations—with a few people and things. I enjoy meeting a few of my old friends; my occasional

visits to B. and W. and a medical consultation stir the old fever of interest in the blood of age. But allowance must be made for any inability to hear papers read, and discussions. I measure this as a great deprivation by which I am shut out from keeping up with the current of new things. I do deliberately avoid situations of embarrassments to my friends and others and to myself which put them to the trouble of making me hear. This is a common experience in kind with those whose length of days goes beyond the allotted term of three score years and ten."

and ways of doing things often preclude change of opinion and habit. Illustrations of this are numerous. The writer once sought to present a given point of view to a rather studious gentleman in the seventh decade of life. This point of view was new to the latter and different from his own: The old gentleman could warm up to the new position after an evening's discussion and liked it quite well, but curiously enough the next morning he was unable to agree to it and began the argument for his old view again. This experience was repeated a number of times and I doubt whether the person in question could ever have acquired a reasonably good permanent grasp of the new point of view. It should be said that the argument involved a religious belief contrary to the one held to from childhood by the old gentleman.

Again, it is noted that aged persons come to use certain chairs, take certain walks, specialize on certain topics of conversation, etc. They dislike "new fangled things", as they call them, and these are many. They like to have the same old furniture, carpets, hangings, etc. retained, though they say be long out of vogue. They employ the gardener, gardener, butler long accustomed to serve the family, though quite inefficient by reason of age. Younger

(10) Conservatism.—Conservatism, used in this section in a broad sense, is both achieved by and thrust upon senescents. On the one hand, it comes naturally through the fixation of habit, manifold limitations of mind and body, and consequent loss of adaptability. Fixed modes of thinking, the so-called "thought ruts", and ways of doing things often preclude change of opinion and habit. Illustrations of this are numberless. The writer once sought to present a given point of view to a rather studious gentleman in the seventh decade of life. This point of view was new to the latter and different from his own: The old gentleman could warm up to the new position after an evening's discussion and liked it quite well, but curiously enough the next morning he was unable to agree to it and began the argument for his old view again. This experience was repeated a number of times and I doubt whether the person in question could ever have acquired a reasonably good permanent grasp of the new point of view. It should be said that the argument involved a religious belief contrary to the one held to from childhood by the old gentleman.

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men seem unable to render the right quality of service.

Speaking of this common senile disposition one writer (), herself aged, says:

"I do not think I am exaggerating when I say that there is no class of society so bound down by conventions and for no good reason, as are the oldest of all" (p. 51).

It should, also, be said that sometimes conservatism develops into a veritable phobia for the new, as in one old lady who had a sort of horror of post-cards.

While it is well known that conservatism is a common characteristic of the later years of life, just when this tends to begin to increase rapidly is hard to say. Common observation seems to show that among scientists and educators in middle life, say at forty-five to sixty, begin to show a fine satisfaction in older explanation of all sorts of facts in contrast to the younger men, who seem more anxious to investigate and manifest a tendency to accept the newer views. If this be true, it but confirms the old saying that young men are rash, that theirs is the sphere of action and not of judicial weighing.

From another standpoint conservatism is foisted upon the elderly thru the expectation that they shall wear certain styles of clothes, be and do certain things. This is the decree of social convention. Of it one old lady says:

"Another convention that shackles my life is the insistence of my children that I always take a carriage when I go out. My children are continually insisting upon similar conventions."

Senescents sometimes refuse to submit to conventions and prohibitions placed upon them by their children. This leads the latter to continually report all sorts of rash deeds of their mothers and fathers.

Accepting that conservatism may be said to result from an

to dwell upon the past, following sentiment rather than judgment, the degrees of retrospection might be measured and ^{made} a relative index of the degree of conservatism. Perhaps retrospection might be measured by asking elderly persons to write down for a given period of time their most profitable and pleasant mental experiences and analyzing these. grandmothers will agree that there is a certain emotion at the sight of your first grandchild that is a little different from any other. Your son who was your baby of only yesterday has a little son of his own" (pp. 161-163).

Summarizing the same author () we learn that grandmothers are often exasperated because their children will not permit them to take an active part in the upbringing of the grandchildren. The old way of rearing the child will not suffice in the new generation. It is really difficult to learn the function of a grandmother. Either the nurse or the parents of the new-born child is bound to interfere with the wishes of the grandmother. Frequently it turns out that the grandparent is allowed to interfere with the rearing of the grandchild only after the new methods of child-care have proved less effective than they were dreamed to be. The grandmother often finds herself singing the first time for many years the same nonsense jingles that were sung for her own offspring. This seems almost an unconscious experience.

Grandparents and grandchildren show many similarities. Their limitations, faults, whims, tastes, prejudices, etc. are akin. This comes out in detail in a later chapter of this study. Here, however, it is only necessary to point out that the natural kinship of first and second childhood cause them to get on so well together. While the old incline to get and spoil the child, the latter compensates from its point of view in being a worshipper of grandparents. The aged often find comfort in the expectation that the young generation will

() Grandparenthood.--The business of being a grandparent, especially for the grandmother, is not easily learned. This would ~~make~~ make a topic of interesting study. One highly intelligent grandmother () in advanced years confesses that;

"I think all grandmothers will agree that there is a certain emotion at the sight of your first grandchild that is a little different from any other. Your son who was your baby of only yesterday has a little son of his own" (pp. 161-162).

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Speaking of this an anonymous autobiographer () has this to say:

I suppose it is because we are so alike that the sympathy between old people and little children is as old as the world. As I was telling stories to Betty, I could but think how, all the world over, there were grandparents rejoicing in their grandchildren, tending to them, playing with them, teaching them the old baby games that go back to the beginning of time. Very often I echo in different words some observation of Betty's,—the ignorance of childhood and the wisdom of age touch each other at more points than one" (pp. 155-156).

While old age inclines to pet and spoil the child, the latter compensates from its point of view in being a worshipper of grandparents. The aged often find comfort in the appreciation that the young grandchildren show in their singing, though the voice has grown thin and wavering. Further, old people are flattered by their grandchildren's company; both often like the same thing. To the child the aged seems witty, accomplished and gifted. The grandchild treats the grandparent as an equal. For this the compensation to the child is indulgence; ~~To~~ the aged, love, trust, and pseudo-flattery. That grandparents beg-off well merited punishment from grandchildren is prevalent, but perhaps not harmful. Curiously enough, too, grandparents accuse others constantly of spoiling the children as tho they were jealous of this privilege themselves. The situation is even worse if two aged grandparents of different families happen to be visiting their children at the same time. Each seems to find his prerogative invaded and shows a jealous hovering over the young wards. The situation may grow amusing.

The value and meaning of grandparent to grandchild and vice versa is treated elsewhere in this study. Nevertheless, it might be said here that childhood keeps old age occupied helpfully and old age brings priceless benefit to childhood

from the past and prevents a social break between generations. An illustration of the happy comradeship between the young and old follows:

K. went to live with her grandmother at seven. Her grandmother is now between seventy and seventy-five and K. is eighteen. The bond of love has grown very strong, and there seems to be no great gap of age between them that would cause them to have very different ideas and tastes. K. is a very normal eighteen-year-old girl, beautiful of character, full of life and fun. The grandmother seems young in her ways, having remained youthful with K., instead of aging and growing fixed of idea and habit. She plans K.'s dresses, even embroiders them and does fine handwork on them, and K. is always dressed in extreme good taste. One would take the grandmother for a woman of fifty-five or sixty.

When Socrates (Plato, The Republic, Book 1, pp. 1-6) asks of Cephalus whether life is harder toward its end, Cephalus replies that his acquaintances complain that they cannot eat or drink; that the pleasures of youth and love have fled; that the good old times are gone; that life indeed is no longer life. They complain, too, against the restraints put upon them by relatives; that they are slighted on every hand. Cephalus, however, thinks that they do not blame what is really at fault, for he does not have these experiences. He and others of his aged friends do not make such complaints. Cephalus when old was glad to escape the master of love. Cephalus agrees,

for certainly old age has a great sense of calm and freedom; when the passions relax their hold, then as Socrates says, we are freed from the grasp of not one master only, but of many. (p. 4)

() Worry.— If there is little that the senescent can or wants to do, worry is likely to hold sway. This simplified life busies itself with trifles. Narrowed in interests, it is likely to grow fretful, peevish, selfish and vindictive, a mark of second childhood. Perhaps this is the type of decline that led Burton () to write this accusation:

"Old age is a disease of itself, loathsome, full of suspicion and fear" (p. 632).

This same author goes to pains to make melancholy inseparable from old age, coming in an instant upon those who have resigned from great affairs suddenly. That this is many times true, chiefly with individuals who have cultivated few interests in life, no one can dispute; and it is doubtless the principal source of the descriptions of repulsive senescence found in much literature.

Whether worry consumes old age or not must depend in great measure upon disposition and manner of life, even from the first. When Socrates (Plato, The Republic, Book 1, pp. 1-6) () asks of Cephalus whether life is harder toward its end, Cephalus replies that his acquaintances complain that they cannot eat or drink; that the pleasures of youth and love have fled; that the good old times are gone; that life indeed is no longer life. They complain, too, against the restraints put upon them by relatives; that they are slighted on every hand. Cephalus, however, thinks that they do not blame what is really at fault, for he does not have these experiences. He and others of his aged friends do not make such complaints. Sophocles when old was glad to escape the master ~~of~~ love. Cephalus agrees,

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Cephalus maintains that the complaints and regrets of the aged against their relatives are not to be charged to old age but to men's characters and tempers. A "calm and happy nature will hardly feel the pressure of age, but to him who is of an obstinate disposition youth and age are equally a burden" (p.4).

Salisbury sets forth pointed observations upon worry in old age in one of his chapters, the fourteenth (), which follows in resume: Like the worry of childhood and of womankind over domestic affairs, that of old age shows special characteristics, also. While in youth worry is anticipative, in old age it is retrospective. There is more worry in adult life than in youth, but worry is not maximum when health is good and time reasonably occupied.

"Years should bring the philosophic mind, an outlook calm, serene, not easily perturbed, and old age 'serene and bright'".

But the fact is that worry finds its chance as old age creeps on. Life today is "faster" than once, and when old age comes on with lessened power and ability, then worry comes to its own, and the individual becomes self-centered. Happy is the grandmother near her grandchildren, to spend her time with them. The man who in early years has used his mind hard finds it more difficult to protect himself against worry. Too, the young have become less tolerant of the foibles of old age. We live at higher speed and the slower pace of old age seems to be all the slower by reason of this.

"We were all contented with a job-trot formerly; now we must have the motor-car and old age would job-trot still" (p. 183).

Family ties, too, are weaker than once. We now undervalue the patriarch as compared with the past. Contrary to expectation, religious worry does not increase in old age.

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"Youth worries about the 'wrath to come'." "Old age is commonly merciful, and its religious outlook for itself sees less vengeance and more compassion than it used to" (p. 184).

One psychologist has found young children vindictive, harsh, merciless, This is like the old penal code. The aged seem to look for mercy in the next world and are willing to mete it out here.

"For the aged worry is retrospective—it is regret rather than apprehension or is fretfulness about present trifles. The worry of old age, then, is regret and fretfulness" (p. 184).

Legion are the objects, usually trifles, that old people will worry about. It is impossible to name them. A particular source of worry to some individuals is the things their children promise to do for them which their strength does not permit. This can and should be made minimal. Besides, it sometimes happens that worry grows apace thru the loss of a certain form of activity, which, too, may develop the braggard, substituting magnified words for a previous rather commonplace skill. Saleeby () illustrates this tendency, thus: A certain old man played cricket until he was sixty years old. Then he met an accident and could play no longer, but he had to go to the cricket ground, and there he found all manner of fault. He scornfully criticised the form of the "youngsters". His sad refrain was ever, "I was playing cricket two years ago." To him as to others a lack of occupation was distress, for contrary to the belief of many, freedom from work is not rest. Cowper wrote,

"Absence of occupation is not rest. The mind that's vacant is the mind distressed."

() Concealment of Infirmities.—One notices in the senescent a strong tendency to conceal the infirmities of age. One individual became nervous if one held his coat for him or resentful if a cane was given him as a present. Another old man founded an institution, after retirement from business, which became his life. Though palsied, he sought to disguise it and suffered deep mortification when infirmities obliged him to stop driving. Yet another old gentleman confessed that in order to eat heartily at the banquets of the club to which he belonged, he fasted all day. He took other means also to disguise his senectitude. In many cases, moreover, the aged make a remarkable effort to disguise their failing memory which comes to embarrass them in an extraordinary way. It many times happens, withal, that the aged do not mind being told by strangers that they look old, but it is painful to hear about their infirmities. This is only an aggravated sensitiveness, which most of us possess in some measure.

When, then, an individual begins to show a new independence in doing things and helping himself, age has already begun to claim him. This is probably a subconscious defense against retrenchment, indicating, it may be, that the will to live is yet strong. An observation in point has been reported to the writer: X is a man of high mental attainment who can go through the work of the thirty-third degree of Masonry finely. Recently he went to a barber shop to get some work done, was brushed down as usual, but refused to let the barber hold his coat, for he said he didn't need anybody to help him hold his coat; that he was able to help himself. The barber considered this a confession of old age, and mentioned it to his friends.

Another form of concealment of infirmity is exaggeration. Old people are fond of lauding their powers. A common expression is,

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"Don't you think I do well for one of my age? X down here --- can't do nearly so well and he is--- years younger." And then will follow a comparison of powers with X to the great disadvantage of the latter. If X later is called upon, he is likely to return the compliment.

One individual insisted, though in advanced years, that he was a perfectly good driver, and went round frequently to take out a friend to the occasional and growing annoyance of the latter. Although given a slow and trusted horse to drive, the old gentleman was unable to keep the middle of the road and would be now on one side and now on the other, yet he not infrequently spoke in an almost boastful way of his ability to handle a horse.

X The writer has a conviction that the aged in their writings, also, laud their powers far too extravagantly, for probably they are not conscious of their failures, except memory. It may be with them as with the fool or drunkard that they are not conscious of their condition. One suspects that Cornaro who has been so slavishly followed by many is wrong in his statement concerning his powers. X Infancy or childhood is well known to overestimate its powers and it is often with a shock that a child realizes that he cannot do what his father or older brother does. Even at the table, says an old adage, the child's eyes are often bigger than his stomach. Something similar to this may be said of second childhood as well.

One man observed, aged eighty-seven, thinks he is no mean writer and has lately had a short composition published in a daily paper. He is inclined to modesty about his ability until complimented or encouraged in his tasks; then, he is sure to wax warm in self-praise and lament that he is not truly valued. What he writes is really mediocre, done with the great effort of revising again and again. Lying in bed in the morning meditating (work is best after

the night's rest), when he "gets a thought", he jumps up hurriedly before he forgets it and jots it down. Do what he can, the same ideas are repeated many times in a single paper and come out subsequently in the other work. In common with others, this old man genuinely enjoys mention of his preservation and activities.

It not infrequently happens that the aged complain to their families of their infirmities, reminding them that years bring incapacity for old undertakings; and yet in the next instant resent an offered service, giving fling to the magnified ego in protest. Concealment is likely one factor in the disinclination of old people to use ear trumpets.

How medical men meet sensecent concealment and its relation to treatment may be illustrated from one of Thompson's cases ():

"A woman of ninety-two years, whom I had occasion to treat for various ailments, such as chronic bronchitis and attacks of indigestion, would never allow me to see her in bed, no matter how ill she was, for she acquired the notion that if a doctor once caught her there she would never get out of it again, so she would keep me waiting until she dressed and sat up, immediately going back to bed when I left! A fortnight before her death, however, she gave in, and, for the first time in her life, permitted a nurse to approach her. Such patients often suffer seriously from lack of attention to personal cleanliness. Originally of clean habits, physical or sometimes mental weakness renders them careless and forgetful, with the result that they may acquire considerable cutaneous irritation" (pp. 279-280).

seventy-three cases of obstinacy. Her discussion of the facts are here given in part:

"The obstinacy and contrariness which frequently characterize old age, and of which one hundred seventy-three cases were described, seems to be due, in large measure, to force of habit. Like the muscles, the mind seems to lose its flexibility with advancing years, and habitual ways of thinking or of doing things become so automatic that change is difficult or impossible. Fixed ways of doing a particular thing, habits of dress, preferences for certain kinds of food and adherence to opinions, largely because they have been held until they have become a part of the mental life, are characteristic of old age."

() Obstinacy.—Like concealment on the one hand, obstinacy or stubbornness is defensive, while on the other, it may be the result of waning comprehension and resultant inability to adjust to the given situation. Convinced they are able to do more than they can and anchored to the past, old people rebel against change, feeling their prerogatives have been invaded. Yielding to the new order and to conditions that age brings is hard for them. Besides, concealment may be involved. One old lady views it this way in substance: Old people are afraid they will have to give up for domestic peace certain long-cherished likes, as for instance, griddle cakes and syrup in the morning. While they will submit to certain demands of loved ones, they revolt at others. This woman has revolted against a trained nurse, for she takes too good care of her and places too many prohibitions upon the old lady. She grumbles a great deal about the too anxious care shown her by her family.

Not grasping the merits of a new point of view or practice must often be the reason for refusal to comply. This leads to friction and must be overlooked on the theory of positive loss of response to the present. Smith () reports one hundred and seventy-three cases of obstaincy. Her discussion of the facts *is* ~~are~~ here given in part:

* "The obstinacy and contrariness which frequently characterizes old age, and of which one hundred seventy-three cases were described, seems to be due, in large measure, to force of habit. Like the muscles, the mind seems to lose its flexibility with advancing years, and habitual ways of thinking or of doing things become so automatic that change is difficult or impossible. Fixed ways of doing a particular thing, habits of dress, preferences for certain kinds of food and adherence to opinions, simply because they have been held until they have become a part of the mental life, are characteristics that are too

well known to need description. The idea of advancing feebleness and a dread lest one's right of decision should be called into question often induce what appears to be an unreasonable contrariness in the old, and the greater the consciousness of failing powers, the more keenly is this felt. Old people are often extremely sensitive in regard to anything that seems in the slightest degree to threaten their independence. As memory begins to fail, early associations are recalled much more clearly than later ones and assume relatively greater importance. Hence the clinging to old familiar places and customs which seem inconvenient and uncomfortable to others, but which have a very real value to the old because they contribute to a feeling of the integrity of personality which is diminished by new surroundings and unfamiliar ways" (p. 38).

Doctors and nurses find obstinacy a problem in the care of senescents; they are often perfect rebels. Thompson () gives this testimony from his practice:

"One of the principal difficulties encountered in the treatment of very old patients is that of overcoming their prejudices and obstinacy in matters dietetic and hygienic, for, having lived so long, they naturally believe they know better than any one else what is best for themselves, and, with a certain irritability, resist interference. They resent the personal contact of administrations of a nurse, or refuse to take this or that remedy, so that much tact with firmness may be required in dealing with them"(p. 279).

() Domineering.—One of the evident characteristics of advanced senectitude is the disposition to domineer others, complacently denying any such tendency and charging others with it. To maintain domestic tranquility children often suffer great loss of individuality when their aged parents grow to using the "big stick" again. Many parents never seem to realize that their children ever grow up and always act accordingly, to the unhappiness and privation of the latter. Maybe it is these parents who most in old age rule their offspring and kinsfolk. This many times takes place, too, even when these parents give up their own homes and go to live with their children. The writer's own observations of this have been confirmed by others. Its explanation is found in a lack of occupation, of control and power to envisage the present.

() Later Sex Life and Crime.—To get at the facts of later sex life is difficult; one class of persons is reticent, the other, because of exaggerations, one cannot give full credence to. What to accept is, then, a problem. Furthermore, there are apparently distinct individual variations. It has already been shown that sexual functions persist longer with men than women. The former to retard abatement sometimes resort to artificial stimulation. There are many cases reported of potency lasting beyond three score and ten and several beyond the limits of a century. Thus it is evident that we need more exact findings; it is not enough to accept merely an old man's statement of his powers of sex. In fact, the writer suspects the aged is likely to exaggerate as much, if not more, in regard to this as in regard to other powers, for impotence is accepted as an unmistakable mark of failure.

While the evidence is not convincing, there is an indication that with the waning of sex life there is some passing of the sense of shame. This offers a difficult, but promising field for further study, either pathological or normal. In old men it seems probable that there is some disposition to harbor a mental sex life as though there is an effort to compensate in the mental field for the passing of the *vitaesexualis*. This may explain why old men (one case has come under the writer's observation) will lure young girls into reciting love tales to them and kissing them, gratifying a mental sex life, in which sublimation tends strongly to the pathologic.

When an old man shows a fondness for kissing his daughter-in-law and her young women friends and manifests practically no affection towards his own wife, how is this to be interpreted? Does it represent an effort to satisfy sex demands in the larger sense? One observation will make the question more definite:

At a summer home in the mountains two young people opened their home to their college friends, and a number of young women from eighteen to twenty years of age came to spend the summer there. At the same time the grandparents of these young people were there, the grandmother very feeble and the grandfather strong and well, able to travel by himself and in no way dependent upon others. He seemed to take a great fancy to the young ladies, and made very excuse to kiss them. When any one arrived or left, he insisted upon kissing her, because he always kissed his granddaughter. Most of the girls raised no objection, thinking he was old and should be humored and that it was only a whim. One girl always avoided these demonstrations, because it appeared to her an impropriety. He showed no attention whatever to his dear, old wife, who was, indeed, very lovable. He was over eighty years of age.

President Hall has called the writer's attention to a sort of Indian summer in the vita sexualis which comes no doubt just before final abatement of potency, as the phylogenetically it represents a warming up of the powers likely to go to a new interest in and care of the new generation. When survival was more difficult than now this might have been fundamental to it. At best, we know all too little about it.

What the life history of sexuality has been in a given individual may be a first factor of its status quo in old age. Concerning this Scott () concludes:

"When the sexual functions have been denied or insufficiently radiated (and their normal gratification is the easiest and most natural condition of their radiation), there is plenty of evidence to show that the danger of a recrudescence in old age of the sexual passion in morbid forms of the most unhealthy type" (pp. 120-121).

Senile exhibitionists, perverts, etc. come under this head.

Sexual promiscuity may last on into senescent years. This case has been reported to the writer: A rich, miserly old widower, living in a northern state, had lived an unrestrained life sexually. He had a housekeeper, a widow, ugly and decrepid, with whom he was sleeping when seen at eighty-four years of age. At this time when a young farmer and family came upon the older man's place to work, the latter called the young man's wife into his room one day, shut the door, and begged her to kiss him.

According to Aschaffenburg () advanced age is unfavorable to criminality. Of this he says:

"The weakening body becomes unfit for all those crimes in which physical strength and skill are necessary; there is less energy, and, finally, in advanced age, but little crime occurs" (p. 154).

Using delinquency and crime as practically synonymous terms throughout his work, Healy, () holds in regard to the offenses in old age that,

"Although directly due to mental aberration, the delinquency is properly chargeable to unfortunate features of physical involution of the individual" (p. 209).

Few offenses of old age are committed by those previously considered demented, but defective force of will power and ethical discrimination resulting from subnormal conditions of the blood vessels and brain cells in old age, often leads to childish misconduct, as that of a man cultured, of previously good reputation stealing flowers from a park at intervals, at the age of eighty ().

Concerning the types of old age offenses it is found (Healy) that few women beyond sixty years commit anti-social offenses and these are usually of petty stealing. At this period "most of the offenders are old men, and their delinquencies are nearly always sexual" (p. 210). Following Bresler () Healy points

There is seemingly a general agreement () that aged offenders out that after seventy years there is only one-fourth to one-eighth as much general crime as in the previous decade, while sexual offenses are one-half as numerous. Aschaffenburg () puts it differently. He says that grand larceny after the 70th year is only 1-150 part of what it is at 18 and 21, relating the delinquency to an equal number of persons of the given ages. But convictions for indecency and rape are almost $\frac{1}{4}$ as many, proportionately to the same number of persons ().

"Now this peculiarity of old age finds another social expression, which Bresler has delved out of national statistics. He shows that in the 5 years from 1900-1904 the marriages of girls 20 years and under runs as follows: 401 married men between 40 and 50; 1521 married men between 50 and 60; 1762 married men over 70. These figures must have increased significance in the light of the fact that there are considerably fewer men living over 70. But, of course, there are somewhat modifying circumstances, such as the increased number of widowers, and so on" (Healy, pp. 210-211).

It seems to the writer that the large number of marriages of girls of twenty years and under to aged men may be due less to the deliberate choice of the latter and more to the fact that it is only the more foolish young girl who is willing to marry an individual of such advanced years.

It is shown by Healy that many old men who commit sex offenses have never been in collision with the law before; that many of them, too, have been of previously high reputation. Breslery gives significant statistics on this point (). The maximum number of first offenders are punished between the years of 18 to 21. Of the offenders between 40 and 50 years, 49% are punished for the first time, while of those beyond seventy 67% are punished for the first time. It is shown that except between 19 and 21 the greatest percentage of first offenders among convicted criminals falls at 60 years and beyond.

There is seemingly general agreement () that aged offenders are suffering from mental changes, especially in the field of the will and ethical sense due to atrophic conditions. One eminent authority holds that every offender past sixty should be given a psychiatric examination.

These sexual offenses occur mostly after sixty when the sexual powers normally have waned or practically disappeared. To some senile brain degeneration does not satisfactorily explain the great increase in sexual stimulation. These attribute a considerable share of these unfortunate tendencies of old men sexually to a local irritative condition in the pelvis, especially as produced by the characteristic senile enlargement of the prostate gland. Percy () stresses this. Healy thinks a measure at least of the reported improvement following operation upon the prostate may be due to suggestion and stimulation of the will power and we need to be careful how we generalize here.

It is well known that old men show a morbid tendency to select children for their offenses. Says Healy, "

"More occasionally abnormal acts are indulged in, including exhibitionism, the latter representing the most impotent procedure. Krafft-Ebing suggests that the peculiar sex objects selected are indicative of weakened potency" (p. 212).

The writer would like to suggest that perhaps it is the natural innocence and trust of the child in the aged that invites and makes possible offenses of many old men which would otherwise not take place.

"It is undoubtedly true that in some cases," says Healy, "there is much actual sex stimulation and sex power in old men" (p. 212).

() Passing the Time.—Years bring the longed-for leisure of active life, but the problem of using it sometimes baffles satisfactory solution. This is the more true, if involution is rapid or if interests are few and narrow. Having outlived one's generation makes time hang heavy over many old people; lonesomeness engulfs them and life is a burden. This is the time to come back to early interests, to make hobbies of science, philosophy, literature, games, conversation, gardening, grandchildren, collecting all sorts of things, etc., etc. These promise contentment and fruitfulness. One individual took up biology, long his great wish; another, past eighty, learned more geography than when in school. X and his wife began to reread the classics, which press of professional duties prevented for years, and grew young over them. Smith () travelled around the world and rejuvenated himself remarkably. Old people report that when they become collectors, as of stamps or coins, it brings them in contact with younger collectors, which delays frigid involution. Beginning life over first with children and later with grandchildren keeps interests warm and maintains the continuity of life. A one-time highly skilled mechanic now devotes considerable time to making himself a set of teeth out of hard pine, trying to excell himself. He insists that his home-made teeth work better than those from the dentist. Many senescents, if sight is spared, spend time over the Bible and newspapers. In the latter local events are given the most notice. One man of eighty-seven says he is too old to get interested in foreign news. He read little about the recent Balkan struggles,

but he now seems more attentive to the European war, because we have more connection with it.

President Hall has called the writer's attention to a considerable prevalence among elderly persons of playing solitaire. A well-known banker between eighty and ninety years took eagerly to solitaire and several other games as the center of his interests, going about this way of passing time in a businesslike fashion. Further investigation shows a large number of individuals taking up solitaire in old age or resorting to it in earlier life at the close of a period of hard work to ease down upon in preparation for rest or sleep. It has the advantage of requiring only one participant and hence can be played when, and as long as, the individual cares. Old people play other games, also, but not so enthusiastically unless games were a part of life when younger. One person said he did not have life enough for games.

Talking to one's self is another way of passing time, characteristic even of some who are not particularly enfeebled. How is this well-known inclination to be explained? Does it result, as perhaps with children, from a lack of control? Is it a failure to inhibit the motor phase of consciousness? The writer notices that when he is enthusiastic certain ideas are likely to get themselves worked out more or less vocally and fancies that if mental decay increased the difficulty of control that this tendency might be accentuated. Another view would explain talking to one's self as due to an effort to make

ideas more distinct, seen particularly in the tendency of some to read aloud to clear up certain obscurities.

elderly writer (p.) reports:

"If we grow old wisely, we lay aside the senseless forms and meaningless conventions of society, and go back to a more primitive mode of social intercourse, picking our friends the way children do, because we like them, spending time enough with them to get some real good out of them" (pp. 103-104).

This same woman rejoices that being old she need not call upon any acquaintances that she does not care for, as once she used to do. Old age is an excuse for escaping conventional duties.

Often it comes to pass that it is difficult for the senescent to form friendships; and if he has outlived his earlier associates he is left alone socially. One man eighty-seven years old says he does not care to attend reunions any longer, for his generation is dead and he does not fit into the new one. Both talk and behaviour have changed. He has hardly a single friend but seems to enjoy the writer's visits greatly. Time and again one finds practically the same situation. The aged become so individualistic that if of different original environments, they utterly lack present social adjustments. In a certain home for old men the game boards had to be taken from the inmates because they "fell out" over them and were harder to reconcile than children. In this same home at times there is little real association among the men. They seem only to see the faults of each other and fail of getting on together. In fact, some see in the others falshood, egotism, selfishness, deceitfulness and other perversities. If friendships do develop, they are likely to be among those coming from

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() Friendships; Conversation.- In the choice and cultivation of friends age may bring advantages. One elderly writer (m) reports:

"If we grow old wisely, we lay aside the senseless forms and meaningless conventions of society, and go back to a more primitive mode of social intercourse, picking our friends the way children do,-because we like them,- spending time enough with them to get some real good out of them" (pp. 103-104).

This same woman rejoices that being old she ~~need~~ not call upon any acquaintances that she does not care for, as once she used to do. Old age is an excuse for escaping conventional duties.

Often it comes to pass that it is difficult for the senescent to form friendships; and if he has outlived his earlier associates he is left alone socially. One man eighty-seven years old says he does not care to attend reunions any longer, for his generation is dead and he does not fit into the new one. Both talk and behaviour have changed. He has hardly a single friend but seems to enjoy the writer's visits greatly. Time and again one finds practically the same situation. The aged become so individualistic that if of different original environments, they utterly lack present social adjustments. In a certain home for old men the game boards had to be taken from the inmates because they "fell out" over them and were harder to reconcile than children. In this same home at times there is little real association among the men. They seem only to see the faults of each other and fail of getting on together. In fact, some see in the others falsehood, egotism, selfishness, deceitfulness and other perversities. If friendships do develop, they are likely to be among those coming from

the same or similar neighborhoods.

When one travels in a strange or foreign land, it may turn out that chancing to meet there a person little known or even unknown but from home soon results in a friendship--one that may last for all the years. So it is in old age; those from the land of the same childhood often gravitate into a cherished friendship, altho hardly known to each other before. Mental interests cement the ties of good fellowship. An individual may form a strong attachment to a person held by his family to be socially below him, to the keen annoyance of the family. Quite the same happens among children, also.

With the coming of years there is a tendency for the individual to feel that he need not be so careful concerning the expression of his views. This comes out repeatedly. Life has already been made more or less. There is now no danger that certain opinions may cost the individual positions or honor. Suppose society should resent an expressed view. What would come of it? This is particularly true if the individual does not have to depend upon a salary for a livelihood. One individual reports that he has come to the stage where he is anxious to let himself go with abandon, to say what he now feels and thinks, which in earlier years might not have been expedient. Too, this same

individual feels more confident, better seasoned, with
 91 Another individual agrees that old age simplifies life.
 greater conviction that his views are tenable. ^ It is a
 time when one can express his opinions without being afraid
 of being misunderstood. A younger woman cannot speak
 so frankly, she thinks.

It has been held by some that old people are overfond of talking. One elderly person says her observations do not confirm this. Individuals must vary here just as they do in earlier years. But when one no longer participates in active affairs there may well be an accentuation of conversationalism. The testimony of Cephalus in Plato's Republic, Book 1, confirms this:

"The more the pleasures of the body fade away, the greater to me is the pleasure and charm of conversation."

figure and well-fitted dress of earlier years; at this age considered herself dressed up whenever she put on a better dress and a fresh white apron. It might be mentioned, too, that this lady could have dressed as she chose, being surrounded as she was by every possible comfort and convenience.

One person thinks a real compensation of old age is the privilege of dressing as one really cares to, escaping the undesirable and absurd extremes of fashion. The children are likely to be dictatorial regarding the dress of their aged parents. It sometimes happens that the aged have extravagant tastes in dress. There is seemingly a guilty joy in being extravagant, as once there was in younger life. One aged lady (a widow) wears certain laces and a certain brooch, because her son cares for them, certain colors because of her daughter, and is in a continual state of border warfare because her children insist upon her buying new things she does not need, and which are clearly beyond her pocketbook. Like herself, she knows other widows who will love fairly to fight their children not to use every penny they possess upon their wants. She rejects the

() Personal Appearance.-- It is a well-known fact that even among the most fastidious in dress, years with failing sight and decreased animation bring greater carelessness in dress. In fact, it is sometimes a matter of great difficulty to get old people to look their best. Even among the less old there is likely to be a reduced concern for personal appearance. One old lady, who at eighty-one took a marked delight in mentioning her perfect figure and well-fitted dresses of earlier years, at this age considered herself dressed-up whenever she put on a cotton dress and a fresh white apron. It might be mentioned, too, that this lady could have dressed as she chose, being surrounded as she was by every possible comfort and convenience.

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conventions of dress imposed upon old age. Why should the lighter colors be taboo. Pale pink to some is just as becoming as pale lavender. She knows one sweet woman who has always loved pink. It is hard for her to give it up with age and she still wears it, but not on the outside. She runs plenty of pink ribbon into things, and like others, takes secret comfort in pink garters. Indeed, old ladies often do not take kindly to the required conventional dress of old age.

Just what the personal appearance in senescence will be depends in great measure upon the degree of preservation or decay. Trembling hands and dim eyes, with the failing power of the looking glass, bent form, loss of fat, and wrinkles, tottering gait, uncleanliness of person, unkept whiskers, bodily odors,—these figure in matters of dress and appearance. Children (Scott, , p. 88 ff.) are known to pity old people for these among other reasons. While a child associated with a grandparent may think the latter good-looking, another child may so strongly dissent as to lead to blows to prove the issue. Undoubtedly those more advanced in years should be stimulated and helped to save themselves from repulsiveness.

The following is a detailed set of observations, one of the half dozen which will be included in this thesis later, if it is thought best. Material from these observations and the other minor ones has of course been used throughout the whole dissertation.

When she wears a high-waistline, she said something about it every time she wore it, that it didn't feel good, etc. When this was changed, she put the dress on and said nothing about it, for not feeling that it was uncomfortable, she forgot that once it didn't feel good. She had to be reminded of it. B. reminds her family rather often of her infirmities, but conceals them from others, and asks if they do not think she does well for one 80 years old. In the newspapers she reads the most sensational items, going into the greatest detail, usually deciding matters of guilt and right, etc. with great justice, as she believes. At home B. does not like to have things done for her, but accepts all courtesies when on the street or in the house of friends. She thinks she can do vastly better than she can. Once very neat and careful in dress, there is now a distinct let-down here. Her sight is good, but hearing quite defective. She enjoys a printed joke better than a spoken one, for she can understand it better. Once a most extraordinary cook, she has lately come to be careless and child-like, and tries to conceal from her daughter the lack of care in housekeeping, which now seems to be too great a burden. She eats less than formerly, she has a slight tendency to choke while eating, but resents any help that may be offered her. Lately she has come to confuse colors; has called a red, brown; bright yellow, white and insisted upon her position. Lately, too, she has come to insist upon having her daughter at the table, though the table is maintained by the latter. She did not do this until quite

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Case B. (female, age 80 years).

Her memory for the present is fast fading, and for the past, too, there is a distinct change, though her memory was never of the highest order. Recently when a dress was made with a high-waistline, she said something about it every time she wore it, that it didn't feel good, etc. When this was changed, she put the dress on and said nothing about it, for not feeling that it was uncomfortable, she forgot that once it didn't feel good. She had to be reminded of it. B. reminds her family rather often of her infirmities, but conceals them from others, and asks if they do not think she does well for one 80 years old. In the newspapers she reads the most sensational items, going into the greatest detail, usually deciding matters of guilt and right, etc. with great justice, as she believes. At home B does not like to have things done for her, but accepts all courtesies when on the street or in the homes of friends. She thinks she can do vastly better than she can. Once very neat and careful in dress, there is now a distinct let-down here. Her sight is good, but hearing quite defective. She enjoys a printed joke better than a spoken one, for she can understand it better. Once a most extraordinary cook, she has lately come to be careless and child-like, and tries to conceal from her daughter the lack of care in housekeeping, which now seems to be too great a burden. She eats less than formerly. she has a slight tendency to choke while eating, but resents any help that may be offered her. Lately she has come to confuse colors; has called a red, brown; bright yellow, white; and insisted upon her position. Lately, too, she has come to insist upon helping her daughter at the table, though the table is maintained by the latter. She did not do this until quite

recently. It seems to represent a drop back into her earlier life. Forgetting she has passed things at the table, she does it repeatedly. Almost any matter she will decide arbitrarily, often with very slight trace of reason. She thinks the old order of things superior in many respects. She does not show any increased religious interests which have always been reasonably strong. She maintains that she does not want the newspaper to say when she is gone that she died of old age, nor does she want any future birthday that she may have mentioned in print. Like many other old persons, she treats her daughter, now in middle life, as a girl. B's married son is named for her brother. Of late she has come to refer to him in mentioning him to her daughter as "your brother -----", not calling him by his name alone as formerly, and refers to his wife by the name of B's brother's wife, though it is not the same. She, too, refers to her son's children as her nephews instead of grandchildren, thinking of them as her brother's children. It might be mentioned that this brother has been dead for a number of years.

7. Herdier, Charles. Sanity and Insanity. Philadelphia, Pa. 1890. 393 p.

8. Psychology Normal and Abnormal. Wm. B. Eerdmans & Co., London, 1901. 516 pp. 2s. 6d.

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V. THE MEANING AND VALUE OF SENESCENCE.

4. Abnormal Senescence.

Dr. Hall:

It was my original plan to include at this point a short section on the above topic; time will not permit at present. If you suggest it, I shall work up this section later. My reading on abnormal senility has covered 'in the main' these authors:

1. Bianchi, Leonardo. A Text-Book of Psychiatry. (tr. J. H. MacDonald). William Wood & Co., N. Y., 1906. 904 p. Chap. XXXII
2. Craig, Maurice. Psychological Medicine, etc. 2nd ed. J. & A. Churchill, London, 1912. 475 p.
3. de Fursac, J. R. Manual of Psychiatry. (tr. A. J. Rosanoff). John Wiley & Sons, N. Y., 1908. 406 p.
4. Defendorf, A. Ross. Clinical Psychiatry. (adapted from Kraepelin) Macmillan, N. Y., 1904. 420 p.
5. Forel, August. Hygiene of Nerves and Mind in Health and Disease. (tr. H. A. Aikins). Putnam, N. Y., 1907. 342 p.
6. Kraepelin, Emil. Lectures on Clinical Psychiatry. (tr. Thos. Johnstone). Bailliere, Tindall & Cox, London, 1904. 305 p.
7. Mercier, Charles. Sanity and Insanity. Scribners, N. Y., 1890. 395 p.
8. -----. Psychology Normal and Morbid. Swan Sonnenschein & Co., London, 1901. 518 p. pp. 385 - 509.

V. THE MEANING AND VALUE OF SENESCENCE.

The function of senescence is distinctly not procreative, even when (for women) involution has merely set in. Says Healy:

"There seems to be good evidence that a child born of a mother long after she has had other children, and after she has begun her involutional period may be physically and mentally defective" (p. 206).
Involution seems to figure less in this way in the father.
There are functions, however, which those who have passed

the meridian of life can perform, and which, if not performed, involve distinct loss to the social group, especially to the new generation. It is now necessary to turn to some of these considerations.

(1) The Post-Climacterium.—As seen elsewhere (Chapter 4) in this study the post-climacterium (with women) is marked by an unusual expansion of intellectual powers and interests, the latter becoming more social in the larger sense. It is a time when the self is inclined to expression in ways humanitarian and philanthropic. This indicates a period in the life-span when it is natural to return to the professional activities and duties which the woman may have taken up before her marriage and is an unanswerable argument for the social and professional training of womanhood, for this training not only serves her family, including her offspring, but it may later serve the larger human family. This should be expected and looked forward to as definitely and seriously as any other aim in life. In case, then, the woman's family does not require all her attention in these post-climacteric years, it is but parasitism not to find larger fields of service. This is not only a way to keep young, but as well a program of usefulness for the young. Surely education must recognize these facts. Indeed, they ought to become a fixed part of educational philosophy

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much of importance goes with it" (pp. 267-68).

To illustrate the value of old age to the group, though a rude people, Shaler mentions the status of the senescent among the Jews. These showed a fine reverence for old age. With the coming of a literature or a body of traditions formed into an organized religion, then it is that old age tends to come to a dignified place in society.

Continuing, Shaler traces progress in the race to another plane of dignity and importance for the elderly. He says:

"As civilization advances to near its present state, another change comes over the treatment of old people. They are no longer regarded as a folk to be set apart from the active members of the society, to be looked up to as a class with a certain reverence and an obligation to maintain a fitting, dignified and solemn demeanour. They are, as it were, readopted into the association and are allowed to go along with the business of life in the manner of other men and women. This change of temper is probably due, in part at least, to the fact that modern skill, in the care of the body, has done a great deal to remedy the defects that age brings, especially those of the eyes and teeth, so that those of fourscore can still appear as and do the work of younger men. The generation which has seen an aged Gladstone guide an empire, a von Moltke at the threescore limit beat down France; and a Bismarck at more than threescore, readjusting the powers of Europe, has naturally given up the notion that a seat by the chimney-side was the only place for the elders.

"There is no reason to doubt that the present attitude of society toward old people is one that is greatly to the advantage alike to old, mature and young. It brings into the center of social life all the value which inheres in age; the broad view of life, the repose, the sense of relative values which is lacking in the immature and scarcely unattainable by those who are in the full tide of living. The change is indeed the complement of the introduction of the youth into the social relations of their people which has also come about in our time. It marks the modern passage from the earlier division of men into rank and occupations in which women, youths, and the old were separated from the active and militant class" (pp. 268-69).

Unquestionably the coming of the modern industrial and political system marks a new epoch for old age. Men are no longer valued merely for their skill in war and power to endure the

physical hardships of life. There comes to be a revaluation of powers in terms of service that they may render in other ways. Traditions, customs, the rich heritage of the past, with its folk-lore, religion, philosophy,—these are given greater value up the evolutionary scale and their best representatives are to be found in the oldest living generation. The wisdom of age, and the skill and council that years bring are the real gifts and prerogatives of many that have long since passed the time of effective muscular activity. Besides, when the conditions of life have become easier, survival is less difficult with expanding food supply and other means of subsistence, and it is not necessary to put the old to death; this, then, gives them a new chance to prove their worth. Withal, the most recent achievements in medicine and hygiene promise to make old age even more fruitful in the future than in the past. If it be true that the race is dying at the top one sees all the more need of extending the life span of the fit to the greatest possible extent of usefulness. President G. Stanley Hall, in one of his unpublished lectures, urges several noteworthy considerations. He, too, asserts that old age has had a hard, slow and therefore late development; that age is to serve youth and must develop to this end more effectively. He holds,

"It is our duty to ripen all we have to wisdom, and old age is essentially didactic. It is the teaching stage and should be respected directly in proportion to wisdom."

Dr. Hall believes we are in need of "collations of hygiene, body-keeping, regimen of this stage of life, which has a vast amount of medical wisdom if it can be gathered and condensed. Observant sages can tell what traits in youth bring success or failure later."

If it be true, as Dr. Hall thinks, that "the most essential

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need of true wisdom is a long range in time", old age which represents the summation of a constructive life is logically to be expected to make many contributions, unique and invaluable, to sane social advancement. To the aged we must look for those safeguards which will protect us against repeating the errors and follies of the past. Individuals should all along recognize this as their true function in later life and prepare assiduously to meet it.

If individuals will begin life anew with their offspring, grow and keep young with them and repeat the same again with their grandchildren, what can be expected of them in the future in manifold services is beyond estimate. One notices among the aged, even those who seem not to have consciously made it their business to serve in a larger way the new generation, nevertheless, a tendency to render at least some small service. One finds them every where teaching their grandchildren the old songs, ballads, and stories, customs, practices etc. It is also probably true that the simple hand-made toys and the more individualistic games are taught to the young by their grandparents, whereas the more competitive games are learned from older boys and girls. The influence of the grandparent comes into the young life at those most impressionable years, when all that is said and done is most carefully noted. Thus a pre-school education of this sort can be gained, one, too, in many respects superior to any other kind of training.

To determine the wisdom of an increasing tendency in this country of relegating the older and middle aged men to oblivion in order that the more progressive and aggressive young men may be advanced to the front rank, Dorland () has undertaken to determine at what period in the life of men of distinction they begin to show

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evidences of distinct ability to do original research, at what age they accomplish their magna opera and, withal, how long they continue productive in their chosen fields of activity. He carefully compiled and analyzed the records of four hundred eminent men of modern times to get at these facts. He found it convenient to divide these into workers and thinkers, meaning by the former those whose intellectual activities culminated in some practical and visible application of their thought and by the latter, those whose talent ran to more abstract and metaphysical considerations. The thinkers are possibly best typified by philosophers or natural scientists; the workers, by inventors or warriors. He found the initial age of activity to be for the workers, 22 years; for the thinkers, 26 years, a general average of 24 years. On the whole those to begin their distinctive work first are musical composers at seventeen years; those to begin it latest are the satirists and the humorists at 32 years. For the workers the age at which the masterpiece was performed falls at 47 years; for the thinkers, at 52 years, the average age being 50 years. The youngest to produce their magna opera are the chemists and physicists at 41 years, the oldest, naturalists and jurists at 58 years. This study puts the duration of mental activity for workers at 41 years; for thinkers, at 39 years, an average of 40 years. The extremes are represented by poets, satirists and humorists whose work continued on an average for 33 years, and inventors whose duration of mental activity was 49 years. Computing the ages at which these 400 men ceased their mental activities, 35 per cent. fall in the seventh decade; $22\frac{1}{2}$ per cent. in the eighth; $20\frac{3}{4}$ per cent. in the sixth; $10\frac{1}{4}$ per cent. in the fifth; 6 per cent. in the ninth; and $4\frac{1}{2}$ per cent. in the fourth. Of these distinguished men one ended his career in the second decade, three in the tenth and five in the third. Seventy-

eight and one-fourth per cent. closed their life work between fifty and eighty years, and 85 per cent. after the fiftieth year. When one glances over the table of thinkers and workers, he discovers that of the number who did not perform their magna opera until seventy years or later, among the two hundred and ninety thinkers there are twenty-one; among the one hundred and ten workers there are five. While it is manifestly difficult to decide upon what the masterpiece of a given individual is, Dorland seems to have gone to great pains to determine this as effectively as possible, and in his table of these four hundred eminent men he lists what he considers to be the masterpiece of each individual. As careful and interesting as this study is, one cannot generalize from it for it is too much to infer from men of distinction what those of less distinction can be expected to accomplish at the various decades of life. Nevertheless, this study does make definite the contention that the later years of life may be the best years for some individuals, and this is but a logical expectation, as already maintained by the writer. The later years should represent an expression of the accumulated training and wisdom of all the earlier years. This probably can be greatly accentuated by a better worked out program of life which includes the implications and possibilities at every stage in the full span. One is tempted in a final comment upon this study to propose that a reason for the balance of achievement falling in more advanced life may be due in considerable measure to the fact that only latterly has the younger individual had an unrestricted opportunity, particularly in some fields, to win eminence, an opportunity yet too recent to count in historical studies. If true, this indicates the need for the future of better recognizing the complementary nature of youth and age and making adjustments necessary for maximal returns from both.

(3) Some Negative Factors.- While it is no doubt true,

as Goodhard (, p. 14) concludes, after surveying in brief the progress in medicine, that

"all will, I suppose, admit that good old age is both more prevalent and enjoyable",

yet it is regretful to note that there are some factors which still make seriously against the best old age. We have not yet sufficiently begun to envisage life from birth to death in all of its aspects. The reasons for this are not far to seek. We know all too little about the life span and especially of senescence. Consequently the meaning and value of old age has hardly become a consideration of the social consciousness. Adequate preparations for an efficient old age must begin in the very first years of life and continue to the end. Many or most individuals not doing this means that in old age one cannot find there the happy summation of experience most fruitful in possibilities of service to the group.

Another negative factor is seen in the penury of old age. Squire () finds that in America one out of every wage earner in eighteen reaches sixty-five years in penury and the number seems to be on the increase. Two-thirds of our great industrial army is not provided for by present or prospective old age relief. The writer does not intend to raise the large problem of old age pensions, but it is evident from what has been said that many of the best fruits of advanced life are denied society because of poverty and lack of leisure, for leisure and philosophic calm are unquestionably essential grounds for the most efficient senectitude.

Moreover, probably it is true that for many old age comes prematurely, overtaking us before our time, as Sir James Crichton-Browne believes statistics show, which he explains as due to the "immoderate excitement and fatigue of our modern life". He has found for turners of buttons, weavers and potters that skill of

hand and arm increases from the teens to about the thirtieth year, then remains uniform until forty to forty-five years and afterwards declines. He holds that this failure is premature and due to the excessive demands made by the specialization of labor. Likewise, he reports, that a penknife maker in Sheffield has to deliver 28,000 strokes with his hammer daily to earn a living, and it is not to be wondered that untimely old age should overtake the hand and arm centers of such operatives. He contrasts with this situation the case of Michael Angelo who was drawing superb designs for St. Peter's Cathedral at Rome shortly before his death at eighty-nine. The attainment of old age is to be achieved through "steady obedience to the laws of health and prolonged by judicious regimen."

"The 'second childhood' of old age looks like a reversal of some processes associated with birth. It is as if, instead of expanding its realm and accreting new material, the soul retires from the world and gradually reduces its fear of action and influence. The loss of stature and weight which actually accompanies old age is an eloquent indication of the general tendency towards retrenchment, a tendency which, but for the stability of the more permanent tissues, would no doubt go much farther than it does" (p. 116).

Scott (p. 88) maps the span of life, making infancy and childhood ontogenetic or individualistic, finding at adolescence a marked reduction in individualism and a return to the philogenetic with an increase of this tendency in maturity and again after the grand climacteric a drop-back to the individualistic or ontogenetic. This last characteristic increases with the waning of the sex life. Thus old age is the test of life from the individual standpoint.

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VI . FIRST AND SECOND CHILDHOOD.

(1) General.— The conception of two childhoods has remote origin. Chamberlain has noted that:

"Most of the proverbs and folk sayings in which childhood and old age are compared assert a resemblance in the weakness, silliness, helplessness, etc., of these two periods of human existence. The saying, 'once a man and twice a child', common in some form or other to most languages, expresses a widespread belief in the similarity of the latter end of life to its first beginning" (p. 99).

The expectation of a return to childhood is only **natural**. If involution could go on harmoniously far enough the end would be the single cells from which the life sprang. Starvation experiments suggest this regression, at least; in them as in senile decline there is a definite predicable loss of each of the different somatic cell types and parts. d'Albe () sets forth a similar idea:

"The 'second childhood' of old age looks like a reversal of some processes associated with birth. It is as if, instead of expanding its realm and accreting new material, the soul retires from the world and gradually reduces its fear of action and influence. The loss of stature and weight which actually accompanies old age is an eloquent indication of the general tendency towards retrenchment, a tendency which, but for the stability of the more permanent tissues, would no doubt go much farther than it does" (p. 116).

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Whether senescence marks, in advanced stages, a return to childhood on an ontogenetic or phylogenetic level cannot now be affirmed positively. To the writer neither explanation is satisfactory, for second childhood shows both ontogenic and phyletic characteristics, of which all too little is known to enable one to speak with certainty.

Nordan () is convinced that even the pessimist believes in childhood and old age and thus amusingly continues:

"Persons who regard themselves as irreclaimable takers of the gloomy view of things, still feel a veneration for old age and a sympathy of childhood. The grey haired man arouses in them the idea of wisdom and experience, the suckling child that of a development full of promise. And yet the child during his early days is nothing else but an unreasoning little animal that dirties itself, squalls and annoys those who happen to be near it; while the grey-haired man, from the point of view of an unprejudiced observer, is physically an unattractive picture of decay, in disposition a blind inexorable selfishness, which has not even the ability to become interested in anything beyond itself, and spiritually an enfeebled and narrow intellect, the chief contents of which are exploded fallacies and prejudices, and which is closed to all advanced ideas. Why is it then that we nevertheless regard old age with veneration and pious care, and childhood with tenderness? Simply because we are so fortunate as to be able to create illusions for ourselves, and because the close of a life just as much as the beginning of a life, a last chapter just as much as a first, affords us the opportunity of composing the missing novel from our materials in the most charming and edifying manner possible. To the old man we allot the past, to the child the future of an ideal individual, and that although the chances may be one hundred to one that the venerable looking, grey-haired man was in the period of his youth and manhood but a commonplace simpleton, and in respect of accomplishments and bad qualities but an everyday sort of character, deserving no attention at all; or that the child which is the subject of such interest will become an unmitigated noodle in his character, a niggardly grocer by occupation, and will tell lies, do mean tricks, and slander the neighbors, just as nine-tenths of the people do whorswam about us, and who inspire us with neither respect nor sympathy" (pp. 24-25).

To begin more specifically the comparison and contrast of the first and last of the life span, one can well remind himself how helpless the newly born child is, how he grows and develops the first years, winning in time control of fundamental and accessory movement and of the senses: first a creature of

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his tiny bed, then of the room, the house, premises and finally the world, his mental data multiplying, physical strength increasing and mastery coming by leaps and bounds. All this represents expansion--of soul, interests, powers, abilities, and achievements, mental and physical. So often is the other picture quite the reverse. On the western slope of life contraction has dominion. Age steals on almost unsuspected. At length comes retirement from active pursuits. This crisis is followed by narrowing of interests, shrinkage of personality, progressive hold on life and events; occupations grow fewer and simpler, walks shorter, friends less numerous, living harder, muscles, senses, and powers mental and physical abate, driving the individual inward still farther; trifles are burdens, the weather seldom right; the house, then the room, at last the bed await this second child, waxing more and more feeble and helpless to the end.

(3) Biological.- When the first and last years of life are compared and contrasted in a broad way with regard to anatomical and physiological factors one notes striking differences and similarities, but of these we know all too little to speak except in a provisional manner. In childhood the bones are more pliable, while in old age, except the skull, they are lighter, thinner and more porous; fractures occur more easily and repair is slower and less perfect. With the ^{young} child there is a sort of shuffle gait, difficulty and characteristic noise in climbing the stairs, and flat-footedness before the muscles develop and coordination is secured. In old age coordination is lost and the shuffle gait returns. Muscular effort is tiring. As to the structure of the muscles themselves in childhood, we note elasticity; in old age in-

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elasticity. The nervous system for the child is plastic, the promise of what is to be; for the aged plasticity is gone forever, and the neural structure bears in some measure the record of a life. Besides, for the aged in the cerebro-spinal tract there is much wasting of cells and many other anatomical changes, especially in the atrophy of the blood vessels, thickening of the membranes, wasting of convolutions, widening of sulci and the increase in the subarachnoid fluid. Children fatigue easily, but recover easily. The aged fatigue easily and recover slowly. The voice of both sexes in old age tends to similarity with a suggestion of childish qualities. The senses increase in acuity and functional power for the first child. The order is reversed for the second childhood. Both first and second childhood is toothless. This, though a disadvantage to digestion with the latter, nevertheless, it protects against overeating. As they are in childhood, so in old age the sexes grow together, both mentally and physically through loss of definite vital functions. This observation is confirmed by many authorities (Church, , p. 301). In the number of meals per day and the amount of food consumed, in the frequency and feebleness of pulse and of respiration, and in the amount of oxygen absorbed and the quantity of carbon dioxide given off there are striking similarities when first and second childhood are compared. The former represents evolution at outlook; the latter involution.

(3) Psychological - In senectitude one often notices a return to the petty vices of childhood as stealing and lying. Fine mental powers seen in the elderly indicate that the brain is last to go as it is first to come in life. Both first and second childhood show pessimism, but there is a qualitative difference. Pessimism

with adolescents, not infrequently the concomitant of disillusionment, indicates greater hopelessness and despair, things are irreparably out of joint, beyond redemption. With the aged one is likely to discover a note of compromise, a lessening quality of bitterness. The first child is individual with socialization ahead; the second child is individual also, his socialization depending upon what it has been in early life. Whether the second child is able to adjust or not, then, depends upon what his previous abilities have been. Both ends of life show a retardation in reaction time, as pointed out by Gilbert (; p. 80 ff.) for children and by Ranschburg and Balint () for senescents. The child is prospective; the senescent retrospective, with a future outlook added as well. Youth is said to be phylogenetic; old age ontogenetic. Both the first and second child is selfish, the degree of selfishness depending upon, for the first child, environmental conditions; for the second child, what life has been. Both youth and old age usually have strong religious interests, the latter many times a return to the point of view held in youth. Childhood and youth, too, is a time of dreams, dreams of things to be. Senescence is filled with dreams, also, but dreams of other days. Both old age and childhood are under many prohibitions, - prohibitions imposed by nature, parents, guardians and friends. Numerous occupations of adults are equally meaningless to both, - the one has yet to learn; the other no longer remembers. Both ends of life show a curious strain of naive egotism, lack of self control, power and concentrated attention, and disposition to bully or domineer. Contrariness is a defensive mechanism both for the child and senescent. Neither would have his

inalienable rights infringed upon, or it may be that there is a lack of understanding or comprehension which inspires revolt. Both are given to exaggeration, picturing themselves as heroes and to recounting feats quite out of the ordinary. The one is wide awake to life and the new; the other, to the old, the past or the beyond. Embarrassment to the young, the adolescent, is overwhelming and often ends in tears; with the aged it may easily be laughed off. The youth is given to fear of the future, while with the elderly there develops a disposition of equanimity, for the many hardships of life before have been lived through and the future is usually welcomed. Even the fear of death many times grows to be a minor fear when death itself approaches. It is said of Dr. Johnson that he lost the great fear of death which had followed him through life as the hour of death grew near; and the great surgeon, John Hunter, wished for strength to write how easy and pleasant it is to die, as he lay upon his deathbed. Frequently the first years of life are filled with a strong tendency to antagonize others. This is likely to be lost in old age. One distinguished elderly gentleman has said to the writer,

"There has been a growing disposition to let pass avoidable contention and to cease to bother busy people".

Both young and old form friends for their intrinsic value, not infrequently among those socially inferior, but friends are so because they are real friends. The worries of youth and old age have been studied. These in old age have already been pointed out in chapter four. For the young, Saleeby (), given here in summary, sets forth the following considerations: The child does not project itself into the future or the past to anything like the degree of his elders. Consequently the child has no business to worry, but children do worry notwithstanding,

which is unnatural and pitiable. The causes for worry with the child are, first, hypersensitivity to ridicule at school, on the street, at home and elsewhere; from difference in name, appearance and abilities at play and in books. Second, religious worries that come with the religious consciousness at adolescence. Then the child takes to the terrible, the sinister, the devil in religion, at the encouragement of the adult, because he has no need of the adverse adult point of view, that of getting comfort, peace, consolation and happiness from religion. The terrible, the fear element in religion strikes the child's keen imagination. This means worry. Puberty and religion are so closely connected that early religiousness will hasten puberty and vice-versa, which is in itself unfortunate. There are reported numerous suicides among children from religious fear.

Probably second childhood has no where in all literature been better and more beautifully characterised than in Ecclesiastes 12: 3-7. This represents the second child when he has become a veritable child. Slightly varying interpretations of this famous selection are given, the one which follows below is from Evans (, p. 226):

"In the day when the keepers of the house (the hands) shall tremble, and the strong men (the legs) shall bow themselves, and the grinders cease, because they are few; (the teeth be loosened and drop out) and those that look out of the windows be darkened, (the sight be decayed) and the door shall be shut in the streets, (when the mouth can be hardly opened to eat or speak) when the sound of the grinding is low, (the digestion is weak and disordered) and he shall rise up at the voice of the bird, (be easily awakened at every little noise) and all the daughters of music shall be brought low; (the ear and voice shall fail, so that he can neither sing himself, nor take pleasure in the music of others) also when they shall be afraid of that which is high, and fears shall be in the way, and the almond tree shall flourish, (the hair grow white) and the grasshopper shall be a burden, (if it but leap on them it shall put them in a fright) and the desire shall fail, (all appetite

or relish for former pleasures be lost) because man
goeth to his long home, and the mourners go about the
streets."

Yet like many others cannot sense where it lies. Generally there
is no one limited regimen indispensable for all; there are too many
initial individual variations and too much difference in habits
from life to warrant designation of its class. The ideal regimen of
moderation begins in practice with the early years and forms a
studious attitude towards personal idiosyncrasies and habits,
continues to make right living to the end a conscious purpose.

The literature records many cases of death among the apparently
healthy and robust in middle life. It would seem that those who
many delicate persons, by diet and careful regimen might be able
and live to old age, that this way of living if followed by the
seemingly robust would work wonders for them. It may be over-
wondered whether the causes for longevity in many instances may
not be attributed to careful hygiene, as in the case of persons
and many others.

While Brinley () believes that longevity is partly
hereditary, he holds that "it is still more a question of nutri-
tion, mode of life, and personal hygiene" (p. 20). He states
that

"The Jews of Frankfurt averaged ten years more of life than
the non-Jewish citizens, because they avoid unwholesome
amusements and observe wiser rules of diet" (p. 75).

Kellogg () thinks that our hygiene is essential, that
it simply preserves the unfit doing little to cure their unfitness.
This is shown in the decrease in the proportion of
centenarians to the whole population which appears in all
civilized countries. He says:

"The real measure of the physical vigor of the race is not
the number of years the average man lives, but the proportion

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VII. THE HYGIENE OF SENESCENCE.

(1) Introductory.— This is a favorite field for faddists, yet like many others common sense serves it best. Assuredly there is no one limited regimen indispensable for all; there are too many initial individual variations and too much difference in habitation thru life to warrant dogmatism at its close. The ideal hygiene of senescence begins in practice with the early years and from a studious attitude towards personal idiosyncrasies and needs, continues to make right living to the end a conscious business.

The literature records many cases of death among the apparently healthy and robust in middle life. It would seem that since so many delicate persons, by diet and careful regimen regain health and live to old age, that this way of living if followed by the seemingly robust would work wonders for them. It may be even wondered whether the causes for longevity in many instances may not be attributed to careful hygiene, as in the case of Cornaro and many others.

While Brinton () believes that longevity is partly hereditary, he holds that "it is still more a question of occupation, mode of life, and personal hygiene" (p. 76). He states that "

"The Jews of Frankfurt averaged ten years more of life than the non-Jewish citizens, because they avoid unsanitary avocations and observe wiser rules of diet" (p. 76).

Kellogg () thinks that our hygiene is one-sided, that it simply preserves the unfit doing little to cure their unfitness. This is shown in the decrease in the proportion of centenarians to the whole populations which appears in all civilized countries. He says,

"The real measure of the physical vigor of the race is not the age at which the average man dies, but the proportion

← of individuals who attain great age" (p. 11).

Various epidemics once weeded out the weaklings which now survive, kept alive through quarantine and public sanitation, etc. The average longevity is increased, although both the number together with the proportion of centenarians has decreased. This means that the race is dying at the top, while we deceive ourselves by believing that it is flourishing because the average length of life is greater. He quotes statistics to show a steady falling off in the number of centenarians. America has less than 4,000 centenarians, or one in 25,000 of our 100,000,000; while Bulgaria in a population of 3,000,000 has 3,000 centenarians or one in every thousand. France shows the proportion of centenarians to be one in 190,000; England, one in 200,000; and Germany, one in 700,000 of the population. Dr. Kellogg in consequence maintains that

"Senility and youth are approaching each other, and the time seems not far distant when the normal interval between youth and second childhood will disappear, and childhood will be met by second childhood" (p. 12).

Senility, he thinks, is coming earlier to a vast number of men and women.

Among the efforts, municipal and private, and through schools and colleges, to lengthen life, those of the life insurance companies are good examples of constructive hygiene. Through bulletins, nurses and periodic medical examinations attention is being directed to the significance of health. Numerous welfare foundations are doing similarly valuable work of varied types. All this points to a time when the relation between hygiene and efficiency will be adequately recognized and profited by.

Senescence has come to be vastly more tolerable even among the poorer classes than in other days. It may find rejuvenation in travel, change of scene and of climate; besides, there are spectacles and ear trumpets to supplement the senses. The printed

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page is accessible, too, as a means of passing time. The comforts of life have multiplied; and medical attention, hygiene, perhaps even an accentuated respect for the aged, are among the more recent factors that tend to make old age more tolerable.

Though general, Matthews () offers a bit of excellent philosophy for the ageing, who should modify their conduct, to grow more self-sufficient, less dependent upon social sympathies. They should show broad sympathy themselves, an interest in essentials, in broad generalities. All this makes for peace of mind. By all means avoid hurry which begets fussiness. Cultivate broad interests, so as to be able to escape from professional minutiae when the proper time arrives. To say that it is better to wear out than rust out is not apropos in America, for here the race is too great. It is better to retire than to be retired by business or profession. It is too great a strain in the last years of life to keep the pace of younger years. Those with careers, however, are loath to step from the arena of achievement and applause. This is not true with those who have achieved something which is sure to live.

"A little work and a great deal of play may keep the mind elastic, the heart young, and the spirits buoyant for a long period; while the opposite policy, and the dread of rusting out or the ambition to wear out ~~in it~~ instead may drive the overwrought brain to suicide or, as we have said, to enforced ambicility. (. . .). In a word, a man ought not voluntarily to slide into his last decade stooping under the load of a young man's cares and anxieties. He should rather approach it calmly and light of heart-with a dignified and graceful bearing of one completely master of the situation, well knowing what is near at hand, yet neither wishing to hasten its coming nor dreading its arrival-always ready to welcome the final embrace of Nature when she shall say, 'The end has come; thou art mine'" (p. 396).

Hutchinson () maintains that the ills of old age are based on self-created superstitions; a healthy, honorable old age is one of the happiest things that can happen to us-"the crown and reward of a well-spent life". Old age is largely what we make it.

Overwork in old age is the cause of more unhappiness than overplay. Infectious diseases and bad hygienic habits cause most of the dreaded senile degeneration. The beginning of this may be in ^{the} diseases and common colds in childhood.

"A healthy first childhood is the best possible insurance for a best second one" (p. 480).

Hutchinson connects the ills of later life with those of early life. He maintains that common colds affect the hearing of the aged. Man dies faster and has more diseases during babyhood than during his second childhood. Many of the ills of old age are grossly imaginary. The old man outgrows childhood diseases. He is less liable to die of tuberculosis, typhoid, syphilis, disentary or any acute or infectious disease except pneumonia and influenza. Arteriosclerosis is attributed to overwork and infectious disease largely. Hutchinson advocates playing out of doors, holding on to one's hobbies, etc., maintaining that the only thing in old age to fear is poverty and disease.

recommended a temperate and orderly life. He was sad at the thought of dying early and resolved to escape death by embracing the orderly life. He began to partake of foods prescribed for invalids in small quantities and never broke over. At the end of the first year he was entirely cured and comfortable, he says. He tested the foods that were good for him and found the old saying, "follow your palate" to be false for him. This manner of living freed him from a yearly recurring fever, to his great satisfaction. He avoided excesses in heat, cold and fatigue and resorted to regular sleep and ventilation. Moreover, he banished melancholy, hatred and other passions of the soul. In his work regimen he was inspired by Galen's temperate life. The latter warned against excessive eating and drinking and was not strict

(2) Records of Longevity thru Hygiene.- From the numerous authenticated cases of prolonged life several will follow, to suggest in a concrete way something of the possibilities of hygiene, in confirmation of the view that heredity is only one factor, perhaps not the largest one, in longevity.

The four discourses on The Temperate Life () by the renowned Cornaro, a Venetian nobleman (1464-1566), written at the ages of eighty-three, eighty-six, ninety-one and ninety-five respectively, have had profound influence upon the literature of old age to the present. It is remarkable how one can trace this influence, sometimes apparently almost unconsciously, through literature, both popular and technical. Cornaro takes up the task of writing because the young have asked him how he has attained such an extraordinary old age. In his youth he was intemperate. Between the ages of thirty-five and forty he was in wretched health. Every known means of cure was tried. His constitution was not natively robust and his physicians recommended a temperate and orderly life. He was sad at the thought of dying early and resolved to escape death by embracing the orderly life. He began to partake of foods prescribed for invalids in small quantities and never broke over. At the end of the first year he was entirely cured and comfortable, he says. He tested the foods that were good for him and found the old saying, "follow your palate" to be false for him. This manner of living freed him from a yearly recurring fever, to his great satisfaction. He avoided excesses in heat, cold and fatigue and resorted to regular sleep and ventilation. Moreover, he banished melancholy, hatred and other passions of the soul. In his work regimen he was inspired by Galen's temperate life. The latter guarded against excessive eating and drinking and was not sick

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more than one day at a time. Cornaro was badly bruised at the age of seventy years by a run-away accident, but he recovered without drugs, bleeding, etc., which he attributed to his temperate life. At this time the doctors said he could not live more than three days and his recovery they considered miraculous. At seventy-eight he was prevailed upon by his friends to eat more. At the end of ten days he began to feel ill effects including disorders of both mind and body. Returning to the old diet he recovered. Cornaro maintains that every man should be his own physician, for no man can be a perfect physician to another. The only difficulty in following a temperate life is making a beginning. Cornaro refers to Plato, Cicero, Isocrates and others who, like himself, followed the temperate life. He asserts that what may agree with others may not agree with him. He accordingly cautions against quantity in general, making quality a more individual matter, in speaking of food. Cornaro, through his discourses gives several interesting apostrophes to the temperate life. He discusses the advantages of old age at length. As for himself he is able to mount his horse at eighty-three unassisted; ascending a stair, even a hill, with ease and agility. He is cheerful, happy, contented, etc., is fond of conversing with the honorable men of his circle. He reads, writes and enjoys his beautiful home; spends time at his country place, several times a year, taking keen delight in the hills. He does some hunting, that best suited to his age. He also puts in some pleasant days at his villa on the plains and takes fine satisfaction as he looks back upon the work of reclaiming a certain marshy tract now so beautiful. He travels and enjoys his friends. At eighty-three, too, he finished a comedy which he thinks is unusual, for the old ordinarily turn to tragedy. He takes great pride in his posterity. He says,

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"I am given the additional comfort of a species of immortality in the succession of my descendents" (p. 71).

He takes profound delight in his eleven grandchildren, with whom he often sings and believes his voice is even better than ever before. His senses, too, are acute and he enjoys eating more than when he was intemperate. His strong religious belief leads him to believe that he cannot fall sick. This the writer believes a significant factor in Cornaro's remarkable preservation.

In his second discourse (written at eighty-six years) Cornaro has further reduced the quantity of his food and expects to continue to do so, for the power of digestion lowers with old age. He laments that the talented do not live long because of intemperance. Because his stomach cannot stand much food at a time, the old like children, must eat many times a day.

In the third discourse (written at ninety-one years) Cornaro is strong in his belief that men may possess an earthly paradise after eighty years of age. He lauds his powers of mind and body until one feels he must be overstating the case.

Cornaro's faculties, he affirms in the fourth discourse (written at ninety-five years) are in as perfect condition as ever. He is happy, sleeps well, his mind being more than ever clear and keen; judgment sound, with voice strong, which enables him to sing aloud his prayers, once said in a low and hushed tone. He does not fear death, having lived long and well.

To the writer the tone of the fourth discourse especially may indicate that Cornaro's faith in sobriety may be as large a factor in his health and optimism as his diet.

Joseph Addison () has stressed the regimen of Cornaro in the Spectator of October 13, 1711. He emphasized temperance and exercises and refers to the Venetian centenarian as a most remarkable instance of temperance toward the procuring of long life.

Sir Francis Bacon (), moreover, was impressed with the experience of Cornaro as one finds in his History of Life and Death. Among other things he says,

"diet, well ordered, bears the greatest part in the prolongation of life" (p. 129).

Sir William Temple (1628-1699) () in his Health and Long Life, probably influenced by Cornaro to a considerable extent, maintains that mind and body must both be kept in health. As common factors in length of life he indicates temperance, open air, easy labor, little care, simplicity of diet and abundance of water. To him temperance is the first virtue. He accepts Socrates saying that it is pleasant to grow old with good health and a good friend. He even believes

"one comfort of age may be, that whereas younger men are usually in pain when they are not in pleasure, old men find a sort of pleasure whenever they are out of pain" (p. 154).

W. Spooner Smith () made a trip around the world at the remarkable age of eighty-eight as a party of one. He tells the story of his experience in his Travel Notes of an Octogenarian. He was truly made over. Eyes were opened, and the real joy of living came to him for the first time. The notes are printed to serve as an inspiration to the old. To the writer this is a striking instance of what change of scene can do for one. The book is unusual.

As a representative case of heredity and hygiene working together towards longevity, Dr. G. M. Humphry () in 1886 reported a study of Miss Joanna Hastings who died at the age of one hundred four. She came of a typical long-lived family of strong constitution with bodily organs strong and well balanced. Her appetite was good and her digestion extraordinary. She was a small eater, took little alcohol and little meat. Her bowels

were regular, her frame spare but robust and energetic. She was benevolent, of happy disposition, of good ability. Her health was remarkably good. All her life she took a fair amount of outdoor exercise. She suffered no illness till near the close of life. At an advanced age she showed a remarkable power of recovering from severe attacks, such as bronchitis, pneumonia and the like.

Captain Goddard E. D. Diamond, born at Plymouth, Massachusetts in 1796, at the age of one hundred ten years has completed several editions of his small volume upon "The Secret of a Much Longer Life and More Pleasure in Living It." The evidence for the age of Captain Diamond seems acceptable. He has never married and has lived a simple, temperate life, making use of much pure olive oil both externally and internally. He thinks that many of the ills that the flesh is heir to are due to wrong diet and over-eating. He is especially abstemious of flesh food, as are many who have attained advanced years. He came to his program of life through a threatened early senescence, which caused him to resort to olive oil, which worked wonders for him. He describes his methods of application, involving, briefly, for external use, rubbing the skin with a course towel until it glows, applying and rubbing in the oil with the hand.

Probably the most truly remarkable recent case of profound rejuvenescence is that of Sanford Bennett (). At fifty he was an old man physically--from an over-strenuous business career; at seventy-two he is almost young again. When fifty he was "wrinkled, partially bald, cheeks sunken, face drawn and haggard, muscles atrophied, and thirty years of chronic dyspepsia finally resulted in catarrh of the stomach, with acid rheumatism periodically adding its agonies" (p. 18). Bennett comes of a short-lived family, whose history is known for two hundred years; but his desire

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Probably the most truly remarkable recent case of profound rejuvenescence is that of Sanford Bennett (). At fifty he was physically an old man — from an over-strenuous business career. He was then "wrinkled, partially bald, cheeks sunken, face drawn and haggard, muscles atrophied, and thirty years of chronic dyspepsia finally resulted in catarrh of the stomach, with acid rheumatism periodically adding its agonies" (p. 18). Bennett comes of a short lived family, whose history is known for two hundred years, but his desire to live impelled him to struggle back to health without guides, although Carnaro shows part of the way clearly. He gave up drugs, resorting to "Nature's principal methods of inducing health — sunlight pure air, pure water, nourishing food, cleanliness and exercise." Thus he came to greater youth at three score and ten than he had at thirty-five. Clinical examination at seventy-two showed no senile changes except a very slight degree of arterio-sclerosis. This clinical report (1912) gives further:

"The face is remarkably smooth and free from wrinkles. The sagging of the cheeks, chin and throat, evident 17 years ago, are no longer present. He has the appearance of an unusually well preserved man of middle age, and his movements evidence an elastic body. The entire muscular structure is remarkably well developed. He has a normal digestion. No attention seems to be paid to any particular system of diet, and I regret to say that he pays little regard to my advice not to smoke or overeat." (p. 46).

Bennett emphasizes the importance of digestion for which good teeth, well cared for, and effective chewing are essential. He advocates deep breathing and exercise for all organs of the body. He quotes Lorand who finds the source of gray hairs ⁱⁿ and the lack of thyroid function. By massaging his thyroid gland, Bennett produced a darkening of his already gray hair in patches. When the massaging stopped the gray hairs returned to him. Upon resuming the massage of the gland his hair again grew darker. Imperfect elimination

resulting in arterio sclerosis and adipose tissue means age and is overcome by exercise, nature's method. All muscles must be exercised. Glands fail in functional power and conduce to old age. This must be corrected by muscular exercise, also. Bennett has developed an elaborate set of exercises, which are done in a horizontal position. He stresses healthful mental exercise, too, and recommends joining a congenial church, club or other social group. One of his key words is optimism. He recommends sunlight, fresh air, moderation in eating and drinking, but he himself eats everything, having a child's appetite. He advocates a fasting cure for a cold. To this end, go to bed, drink much water and eat nothing till better. He believes in fasting for appendicitis and other ills as well. Of ^{the} all books Bennett has read upon old age deferred, he has found a minimum of attention paid to exercise which for himself has been the way to youth.

takes of both men and women, and tend to produce serious distress. Curative measures are to be found in fresh air, taking care so as not to over-exercise; golfing and fishing are good; change of scene in easy travel, including sea voyages; a less stimulating diet, natural waters of the tonic kind, the chalybeate, adapted to different temperaments, for this improves the dyspeptic, making for a better state of brain and mind. Stimulants must not be taken and diet reduced in amount, for waning vital forces require less; especially must the flesh diet be reduced. Fruit, vegetables, cereals fish are typical diet during the climacterium.

At the climacterium certain hereditary diseases are apt to show themselves, for the natural defences are lowered. Attention to general health is important.

(3) At the Climacterium.— This stress period, for some in particular, must be wisely safeguarded. A few precautionary measures follow, chiefly from Clouston ()—cf. also Church () and Mendel (): During the climacterium the individual cannot safely practice intense energizing, ceaseless thinking, overdoing all kinds of work and enjoyment. The output must be lowered to the capacity of the machine. Collapse is due to heredity, to over-stress or both, for at this time the weak points of the individual's make-up tend to come out. For this period rest, change of scene, a long easy voyage, a let-up in business, etc., change of diet, are among the numerous recommendations. At this time diet must be changed in both kind and amount, for metabolism is lessened.

Overwork and worry, idleness and aimlessness, love of over-eating and drinking and too little exercise are characteristic mistakes of both men and women, and tend to produce serious distress. Curative measures are to be found in fresh air, taking care so as not to over-exercise; golfing and fishing are good; change of scene in easy travel, including sea voyages; a less stimulating diet; natural waters of the tonic kind, the chalybeate, adapted to different temperaments, for this improves the dyspeptic, making for a better state of brain and mind. Stimulants must not be taken and diet reduced in amount, for waning vital forces require less; especially must the flesh diet be reduced. Fruit, vegetables, cereals fish are typical diet during the climacterium.

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(4) The Body.— Many consider diet the first consideration of hygiene. Of the numerous experiments upon animals to determine the relation between diet and longevity, activity, well-being, etc., only one can be given.

In a careful study of the effect of a strictly vegetarian diet, on the spontaneous activity of growth and longevity of the albino rat, Slonaker^() found that the carefully measured spontaneous activity of the rats fed on a general diet was when compared with the activity of the vegetarian rats as 7.5:1 for the life cycle. He found, too, that the females exceed in activity. The omnivorous female surpassed in activity the vegetable fed female as 11:1. The former travelled over 5,000 miles during her life. Furthermore, the average longevity of the omnivorous rats totaled 1,020 days, while the average life span of the vegetarian amounted to 555 days. The control rats without so much activity lived longer.

It is to be especially noted that Slonaker's investigation covered the life span of the rats. The negative results of many dietary experiments are doubtless due to the too short duration of the feeding and tests. While it is impossible to generalize from experimentation upon lower animals and say what man shall eat, this experimentation does show unmistakably the importance of diet. In all dietetics for the aged two features stand out boldly, first, reduction of the quantity of food taken in general, and, second, reduction of meat consumption.

Keith, () apparently inspired by Cornaro, pleads for the temperate life. He advocates a light diet, holding that the sick are often cured by the starving method, the taking of about three glasses of milk and plenty of water daily. In many cases he prescribes the rejection of food for a period of days, followed by

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the use of soup or oatmeal gruel. Abstemiousness seems to be his passion. He has used little food for half a century himself. Simple diet, he holds makes for morals even. Early in his profession he derived extraordinary success from the prescription of his so-called starving cure, and reports many cases in which it succeeds after all other efforts of cure have failed.

Among the extremely senescent a fatal tendency to overeating sometimes develops, as reported by Thompson ():

"In my personal observation among the very aged, overeating and consequent overtaxing of the intestine is a very common error. I know a gentleman who shortly after celebrating his centennial died of overindulgence in lobster salad, and I saw a woman of 96 years who died of intestinal obstruction as a result of long-continued overeating, from which her family were unable to restrain her. In her seventh decade she was a moderate eater, but with advancing years her appetite grew and amounted to bulimia" (p. 277).

Dr. Kellogg, of Battle Creek, in a letter to the writer

says, regarding hygiene:

"Since I was fourteen years of age, I have ^{been} earnestly seeking to find the biologic way of life and to follow it. In diet, my study of the subject has led me to the conclusion that being a primate, man should follow the dietetic principles of other primates, that is, that he should exclude meats except in cases of emergency, that he should live out of doors as much as possible and should sleep in the fresh air. I have become satisfied in recent years that frequent movement of the bowels is a matter of very great importance in relation to the postponement of senility. The bowels should move at least three times a day or after each meal."

One cannot refrain from remarking that three actions of the bowels daily may be advantageous to Dr. Kellogg, but not to others. This is too frequent for those with a diathesis towards dysentery.

For the whole... is wholesome in itself. says Thompson.

Thompson (), who through long experience has worked out important considerations regarding diet in relation to age and activity is justly opposed to faddism. He thinks all kinds of food are good, depending upon the age and constitution of the individual. Hearty, active persons may eat more than required and not feel its inconvenience, for elimination is more powerful. Thompson believes that more than one half of the chronic complaints which embitter middle and later life, among the middle and upper classes, are due to avoidable errors in diet. As age advances, or rather as activity diminishes, the amount of nutriment must be diminished or the individual will suffer- obesity, gout, rheumatism, etc. will set in to shorten and make life less painless, though the converse is the popular view. Rich food and cordials are for young life, if for any. Anxious wives too often overfeed their husbands, whose appetites and needs are declining. Artificial teeth may lead man to eat too much, especially flesh food. Toothless old age is able to eat sufficiently of the right kinds of food--cereals, soft foods, fish, eggs, etc.

Thompson gives this picture of a normal senescent: "The typical man of eighty or ninety years, still retaining a respectable amount of energy of body and mind, is lean and spare, and lives on slender rations" (p. 53). Increased weight in old age from fat and not from muscles is a handicap. Not one fat man in fifty lives to good old age. Some reserve stored away is of course necessary for prolonged exertion, or starvation, as in fever, etc. Just what and how much to eat depends upon the individual, his habits, needs and the like, but brain workers require a light diet and out-of-door exercise. Vegetables, fruits, cereals, fish are

for warm weather. No food is wholesome in itself. Says Thompson, "That food only is wholesome which is so to the individual; and no food can be wholesome to any given number of individuals" (p. 79).

The first part of Thompson's book was written in 1886; the second part, in 1901. In the latter he advises more strongly than ever simplicity in diet. With advancing age and reduction of activity of mind and body, not more than two or three kinds of different food should be eaten at any one meal. This does not require, however, that the same kind of food should be eaten every day. The stomach may digest easily materials injurious to the constitution. Thompson stresses again the necessity of avoiding obesity in advancing years. Its prevention is insured largely by reducing the use of fatty foods,-

"fat of meat, bacon, ham, etc., by renouncing all pastry which contains that element largely; also cream, and much milk, as well as all starchy matter, which abounds in the potato and other farinaceous products of the vegetable kingdom; and especially in those combinations so popular and so universally met with at the family table, as rice, sago, tapioca, and corn flour puddings, made with milk and eggs, of which the yolks contain much fat, the whole being sweetened with sugar- a combination of 'carbo-hydrats of the most fattening kind"(p. 91).

The above is good for active life, but if corpulence appears in old age, these foods must be tabooed. No drink should be taken at meals, and little soon afterwards, for drink at meals makes against mastication which is so important. Four meals daily in advanced life are preferable to three. There should be no eating of any kind between meals.

Thompson prescribes daily physical exercise in the form of walking, in all weather. He also stresses mental work, giving, withal, a carefully wrought out dietary, time for meals, etc., etc. One notices at several points his indebtedness to Carnaro.

Based upon a study of 32,430 cases of alcoholism, Owen () concludes,

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"That total abstinence and habitual temperance augment considerably the chance of a death from old age or natural decay, without special pathological lesion" (p. 1317).

When this investigation was carried through the factors involved in alcoholism were considered less complex than they are now found to be and it would be unwise to attach too great importance to it; for the tendencies towards alcoholism might also be tendencies, in themselves, making for short life, etc., thus accentuating unobservably the reputed alcoholic effects.

The role of milk in health has come up for new discussion since Metchnikoff proposed the bacillus Bulgaricus, - the most active of the bacilli in scouring milk, - as the most effective agent for reducing the bacterial flora of the large intestine which produce auto-intoxication, bring disease, and shorten life, according to the Metchnikoffian school. Metchnikoff disclaims proposing butter-milk to extend the human space. It is scientifically soured milk, which insures the presence of viable bacilli Bulgarice or the bacilli in tablet or liquid form, that his followers advocate. In consequence, there are now (March 24, 1915, according to the Ferment Company, N. Y.) in the United States alone, after eight years, thirty-three competing companies, offering for sale Metchnikoffian products. One of these alone, (the Ferment Company) is recognized by Metchnikoff. This Company maintains that the products of its competitors are inferior, that many products do not contain the bacillus Bulgaricus at all, that they are contaminated or that a large per-centage of the bacilli are not living, but dead. About fifty percent. of the Lactobacilline Products (of the Ferment Co., N. Y.) are sold on physician's perscriptions, and the sale is increasing. These Products are taken to free the large intestine of of micro-organic toxins, the agents of auto-intoxication, which is

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held to be responsible for numerous distresses, as arterio-sclerosis, Bright's disease, etc. Other ailments arising from intestinal putrefaction, including old age itself, are indigestion, flatulency, gastritis, chronic fatigue, etc., etc., but these cannot be discussed here. It is needful only to speak of the scientifically soured milk as a food for elderly persons having faulty digestion or poor appetites. To prepare this food milk ferment or tablets are introduced into milk to effect the souring under controlled conditions for the production of the maximum quantity of Bacilli Bulgarici. This diet is highly recommended by many and promises to be extensively used for others than the elderly.

Douglass () finds soured milk has been much esteemed in the dietary of various countries from ancient times, as Egypt, Arabia, Turkey, the Balkan states and others. He notes the different forms (a half dozen or more) of soured milk used, and discusses them at length. He, furthermore, gives full details for souring milk in the home and has much to say about its value. The future for scientifically soured milk seems pretty well assured; it has already passed from faddism to utility.

Sajous () finds adrenal degeneration with advancing age. We need their functions, but it is dangerous to stimulate them especially since there is likely to be arterial scelerosis. Therefore it is expedient to use the active principle of the adrenals, thus compensating for their deficient work. Brown-Sequard rejuvenated himself by means of the injection of testicular juice. This gave excellent results without impairing the adrenals, but we now can use a later and better method. Milk contains the adrenal principle. In fact, all animal tissues owe their activity to its presence.

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"In milk, buttermilk especially (since it is almost pure plasma), we have a ready and inexpensive means to compensate for deficient adrenal activity. If debility and other signs of hypoadrenia prevail, I advocate the daily addition to the plain, though varied diet to which elderly people should restrict themselves of the expressed juice (uncooked) of one pound of fresh beef daily taken in soup, if distasteful otherwise, and salted to taste. This is a powerful agent for good which is well borne by the stomach, and which more than compensates for the weakened adrenals, since it rapidly restores strength and vigor-provided, of course, harmful influences in other directions are avoided, and a hygienic mode of life, with reasonable out-of-door exercise, prevails" (Vol 1, p.97).

Bishop () believes that nine cases of heart disease and arterio-sclerosis out of every ten are due to disturbances of the chemistry of the body. This can be prevented by the regulation of this chemistry, particularly that pertaining to the intestine and liver through diet, rest, exercise, simple remedies and the limitation of nervous strain. The latter is a most important condition. The presence of the trouble is to be detected by the examination of the urine, for it is too late to help the heart when the trouble makes its appearance there. Cardiovascular disease past middle life is the result of chronic amino-acid poisoning by acids to which the tissues of the individual are sensitive. Intestinal putrefaction plays an important role here, but this, notwithstanding, is a new over-worked consideration. The damage is done by foods to which the patient is idiosyncratic. The results are gradual, the amino-acids are derived from the breaking down in the intestinal tract of nitrogenous food-from eggs, fish, meat, and soups. One food does not effect all persons alike; for example, almost fatal heart disease may result from eating fish. The signs of amino-acid toxicardia are disturbances of heart action- in the rapidity or premature contraction, sense of oppression, pain over the heart, shortness of breath upon exertion, and poor circulation. This poison may likewise attack the nerves, causing neuresthenia and recurrent head-

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ache. A combination of headache and palpitation are common. From the study of many thousands of cases, Bishop has carefully worked out the order of the development of the symptoms. It can only be said here, however, that in the early stages of the affection there are no symptoms, and for this reason the onset of the trouble must be detected by an examination of the urine for indican or the derivatives of katol or phenol, one or all of the putrefaction group. If the trouble continues, albuminuria develops and a few hyaline casts appear. Last of all the blood vessels are affected, not so much directly as indirectly through the kidneys which are damaged and unable to do their work except with additional blood pressure. At first we have hypertrophy of the blood-vessels, followed by the deposit of fibrous tissue. Before structural changes have taken place in the kidneys enough to increase the blood pressure, these patients have low blood pressure on account of the disturbance of the tone of the heart muscle and the elements muscular of the blood vessels.

The prevention of arterio sclerosis (Bishop) comes through the reduction of the protein diet so common in our varied dietary. If this is not done the individual lays himself open to the attacks of the many kinds of amino-acids, any one of which may be the one to work him harm. Reducing the protein one-half is always safer on the theory of chance; doing with a single protein is almost certain to insure escape from harm. Dietetic management then is fundamental. The chemistry of the body can, however, be upset by nervous strain, anxiety and distress. Further the abuse of drugs, especially saline laxatives and mineral waters or accidental food poison, a severe attack of malaria, dysentery or infectious fevers, as well as a lack of rest and exercise, can upset the chemistry of the body. When

suspicious of beginning trouble, begin a course of treatment with castor oil, and a temporary diet from which eggs, meat, fish and soups are excluded, cheese being allowed to supply nitrogen in the safest form. When the danger is past, proteins should be added one at a time, say meat once a day and later eggs and fish, but proteins must be kept down. Supposedly healthy persons should have an occasional chemical examination to detect and correct conditions that would lead to heart disease. It must be remembered that idiosyncrasy to certain poisons varies much with individuals.

Like Bishop, Cornwall() gives valuable hints for the dietetic treatment of cardiovascular troubles. He prescribes avoidance of food which contains nitrogenous extractives or putrid bodies; these produce putrefactive poisons in the intestines. Accordingly, food from the animal kingdom, except milk, and ripe legumes, must be eaten sparingly, if at all. This will take work off of the liver. Furthermore, avoid alcohol, as it produces toxins, forego large meals, especially at night, and food and drink near bedtime. Fight indigestion. If the patient is too fat, the fuel ration should be cut down. In a great majority of cases allow meat, fish or poultry from one to four times a week. Protein should be derived chiefly from milk (one quart contains nearly as much protein as one-half pound of beef) and cereal food. Milk can be taken soured by lactic acid bacilli, taken in cereal gruels, or diluted with ^{al}kaline waters, both still or carbonated; or it may be taken in plain water. Cereals including bread, with butter added, can well be eaten ~~as~~ to supply fat. Moist cooked cereals must never be served with canesugar to patients with cardiovascular disease. Seven ounces of cereal cooked-a large saucerful- contains more protein than a lamb chop and possesses twice the fuel value; or two ounces of bread, without

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butter, yields more protein than one ounce of sirloin steak and possesses fuel value more than twice as great. All green vegetables which are easily digested are good. Green fruits, too, that do not contain too much sugar and are digestible, are recommended. Potatoes and carrots are ordinarily allowable. Butter and olive-oil are digestible and agreeable fats. A small amount of bacon is ordinarily useful, occasionally, for variety. Soups made with milk and green vegetables are fine. Cheese, especially cream cheese, can be allowed in many cases, and is a valuable source of non-putrefiable protein. Cane sugar should largely or entirely be excluded, the sweets being derived from honey, and milk sugar, though the latter does not have a very sweet taste. More than three meals daily, if small ones are sometimes good. Diet is the essential part of the treatment, and in early stages no other treatment may be called for. Too much cannot be said in favor of prophylactic treatment. Many persons have insufficient cardiovascular equipment and liver. It is necessary to get at the family history of apoplexy, Bright's disease, obesity or chronic rheumatism, and to use non-putrefactive diet, as preventative, in such cases.

Lorand () stresses the importance of the ductless glands in determining the length of life, giving first place in importance to the thyroid gland. He holds that the qualities of these glands are inherited and insists upon the right hygiene in maintaining their health. He points out that eunuchs early grow senescent as do those suffering from diseases of the sex glands, especially women. He finds,

"symptoms of old age, in quite early years, in persons whose ductless glands (the thyroid, ovaries, testicles, liver, kidney, pancreas, adrenals, pituitary body) are degenerated by disease; nervous affections; alterations of the mind; grief, sorrow, etc.; chronic infections; numerous pregnancies, etc.; or by faulty hygiene; excesses in food, alcohol, sexual

pleasures, etc."(p. 64).

He goes so far as to hold that immunity against infectious diseases depends upon the proper function of the ductless glands. Persons inheriting a degenerate thyroid are short lived and poorly developed both mentally and physically.

"Thus there can be no doubt that persons with healthy ductless glands, especially the thyroid and testicles or ovaries, will live long provided, of course, no other vital organ be irreparably diseased!" (p. 65).

Lorand makes arterio-sclerosis a resultant of defective function of the ductless glands, rejecting Metchnikoff's denial of this.

Lorand maintains that contagious disease weakens the glands. Coffee and tea are injurious to them, to children especially, as is alcohol. For mental ends children should be early influenced by music, literature, painting and religion. Too, instruction in sex hygiene should be given before puberty. Marriage is important for regularity of habits and of mental and sex hygiene. The bearing of numerous children or the nursing of the child too long is productive of a weakening of the glands. Of first importance at the climacteric are patience, care, philosophy and religion. Lorand recommends the taking of throid, ovarian and testicular tablets, in addition to daily ^{action of the bowels and bath, the eating of little meat, thorough} mastication, consumption of much milk, vegetables, eggs and fruit, but not the eating of vegetables alone. He taboos coffee and tea in quantities; prescribes a regimen for sleep, early to bed and early to rise.

Degeneration of the kidney, according to Lorand, leads to auto-intoxication. To prevent this more work should be thrown upon the skin, which can be done through a daily bath with soap, air baths once or twice daily, ten minutes at a time or longer, by the wearing of loose-fitting underwear and porous clothing. In the air

"The rational hygiene of the thyroid gland consists in the avoidance of all agents that may prove harmful to the gland, the most important of which are infectious diseases; frequent pregnancies; sexual excesses; intoxication by food, stimulants or drugs; and emotions, such as grief, sorrow, etc." (p. 145).

If this regimen has not been lived up to, thyroid tablets are recommended, just as they should be taken after infectious disease, pregnancy, especially if the milk is scanty, etc.

Lorand prescribes a hygiene for the liver also, consisting in a healthy alimentary tract, vegetable-fruit diet, healthy pancreas, baths, avoidance of stimulants, etc.

Lorand makes arterior-sclerosis rest upon hyper-activity of the adrenals causing a rise in blood pressure and upon a degeneration of the thyroid gland, which normally antagonizes the effect of the hypertrophy of adrenals by lowering the blood pressure.

Degeneration of the kidney, according to Lorand, leads to auto-intoxication. To prevent this more work should be thrown upon the skin, which can be done through a daily bath with soap, air baths once or twice daily, ten minutes at a time or longer, by the wearing of loose-fitting underwear and porous clothing. In the air

To sleep in a very dark and very quiet room, and with a window open; and not to sleep less than six to six and one-half hours, more than seven and one-half, and for women eight and one-half hours.

To have one complete day's rest in each week without even reading or writing.

To avoid mental emotions and also worries about things that have happened and cannot be altered, as well as about things that may happen. Never to say unpleasant things and to avoid discussing to such, if possible.

bath one should rub with a towel and take breathing exercise to prevent contraction of a cold.

Lorand's precepts to add to longevity are:

"1. To be as much as possible in the open air, and especially in the sunshine; and to take plenty of exercise, taking special care to breathe deeply and regularly.

"2. To live on a diet consisting a meat once a day, eggs, cereals, green vegetables, fruit and raw milk of healthy cows (as much as the stomach will permit) and to masticate properly.

"3. To take a bath daily; and in addition, once a week or once every two weeks, to take a sweat bath (if the heart can stand it).

"4. To have a daily action of the bowels; and in addition to take a purgative once a week if there is any tendency to constipation.

"5. To wear very porous underwear, preferably cotton; porous clothing, loose collars, light hat (if any) and low shoes.

"6. To go to bed early and rise early.

"7. To sleep in a very dark and very quiet room, and with a window open; and not to sleep less than six to six and one-half hours, more than seven and one-half, and for women eight and one-half hours.

"8. To have one complete day's rest in each week without even reading or writing.

"9. To avoid mental emotions and also worries about things that have happened and cannot be altered, as well as about things that may happen. Never to say unpleasant things and to avoid listening to such, if possible.

"10. To get married, and if a widow or widower, to marry

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again; and to avoid sexual activity beyond the physiological limit, as also to avoid total suppression of the functions of these organs.

"11. To be moderate in the use of alcohol and tobacco; and also in the use of coffee and tea.

"12. To avoid places that are over-heated, especially by steam, and badly ventilated. To replace or reinforce the functions of the organs which may have become changed by age or diseased, by means of extracts from the corresponding organs of healthy animals; but only to do this under the strict supervision of medical men who are thoroughly familiar with the functions of the ductless glands" (p. 457-58).

While a number of Lorand's conclusions may yet be hypothetical merely, there is running through them a measure of common sense altogether worthy of consideration.

A careful student of his subject for fifty years, Weber(), distinguished in the English medical profession, gives (1903), at the age of eighty, his findings upon means towards longevity. His family has a record of short life, but by care has lived on, and according to Who's Who (1915), he is still living. As seen elsewhere (Chapter 2) Weber finds individual differences in long-lived families, but all are endowed with good heart and blood-vessels, from which an efficient respiration and vaso-motor equipment cannot be separated. Weakness of the vaso-motor system seems correlated with a tendency to early death in certain families. We should study the causes of death in short-lived families. As far as we now know, such causes may be warded off in part by exercise, walking and breathing, by moderation in food, alcohol, etc. He says:

"Death from old age is caused by a kind of atrophy of of the tissues and organs connected with changes in the blood vessels and the atrophy of the haematogenic glands..... We must counteract the tendency to senile atrophy by supplying the tissues and organs with healthy blood; and to do so we must endeavor to produce a healthy state of the blood and to maintain the blood vessels and lymphatics in a sound and vigorous condition. Life, we may say, depends to a great extent on the state of the organs of circulation" (pp.1445-1446).

Muscular or neural activity means more blood and that means a greater chance of feeding the tissues. Mosso showed that in thinking more blood is present in the brain. From studies, Sir George Oliver concludes "that exercise (whether respiratory or solely muscular or combined) stimulates the fluid exchange between the blood and tissue spaces" (p.1446).

Walking to Weber is the most natural exercise. Atrophy is one of the first manifestations of senility, one of the main causes of the loss of weight in old people. Walking postpones this phase of senility; indeed, it is not only splendid for the muscles, but for all the organs of the body. If health is fairly good, walking should be done in all weather. Moltke, the great general, said ^{in his ninetieth year, that} he maintained his health and activity: "By great moderation in all things; by regular outdoor exercise in all weather, good and bad; never a whole day at home" (p. 1446).

"It is of great use for those who are still in fair vigor, ^{Says Weber,} to take regularly once a week, a day of more prolonged exercise up to four and six hours; and those who live in town ought to spend this day of extra exercise in the country, if possible, on account of the purer air and the change of scene" (p. 1446).

The value of walking is greater, if during it only a small quantity of food and liquid be taken, as a sandwich, apple or orange. This facilitates elimination, makes the tissues hungry, through the elimination of water chiefly. ^{though it costs several pounds} Different from the young, if the aged leave off walking for some time, it is hard to begin again. Consequently, walking must be kept up regularly. In this respect

of weight

it is better to follow Luther who said, "Rast ich so rost ich."
 In addition to the daily and weekly tramping, once or twice a year there should be a walking or climbing trip of three or four weeks or longer in the mountains. The organs must not be diseased, if this kind of a tramp is to be taken. Dr. Weber reports decided benefit from these long walks.

For the improvement of the heart's nutrition and action, deep inspirations should be taken. This is the chief value of prolonged climbing. In this connection one should work out a system of respiratory exercises. Weber insists that on one system of respiratory exercises is best for all individuals. He takes such exercises once or twice daily from three to five minutes, up to from ten to fifteen minutes. This is especially recommended for literary and professional people. It is, however, not recommended for delicate persons.

Dr. Weber recommends riding and other kinds of sports, also. He makes attention to food and the digestive system almost as important as similar attention to the circulatory system. It is impossible to lay down any strict rule for all. To this, however, there is one exception. Great moderation in the amount of food, especially the most nourishing articles, as flesh food and pulses, - this is cardinal.

"Few people know how little food is required to maintain health, especially in advanced age. Amongst the results arrived at by the Collective Investigation Committee of the British Medical Association we find that only few (five per cent.) of the persons above eighty years had been large eaters of animal food, and that the majority had eaten only little meat, and this is the result of my own experience"(p.1448).

Dr. Weber subscribes to the ^{advice} given by Sir Henry Thompson (), Dr. George Keith () and others concerning simple diet for the aged. He praises the simple dietary of the renowned Cornaro and

says,

"Most people live longer and enjoy better health with only little meat and flesh food and a large quantity of vegetables to which milk and its derivatives may be added" (p. 1448).

Especially in advanced age should gouty persons eat meat sparingly.

Dr. Weber quotes Sir George Cheyne as follows,

"The aged should... lessen the quantity and lower the quality of their food gradually as they grow older, even before a manifest decay of appetite forces them to it" (p. 1448).

Similarly he quotes Sir Henry Thompson,

"Less nutriment must be taken in proportion as age advances, or rather, as activity diminishes, or the individual will suffer" (p. 1448).

The aged should not be alarmed by loss of weight. Indeed, an increase of weight after seventy or seventy-five years of age is not usually good. Corpora secca durant is a true saying of antiquity.

In old age there is a special need of thorough mastication. The bolting of food is positively harmful.

Dr. Weber disagrees with those who hold that wine is the milk of old age. He follows Owen who found that among 4,284 persons the length of life was greatest among the total abstainers.

According to Dr. Weber whether tea, coffee and cocoa are productive of good or ill results seems to depend upon the state of the digestion and the general constitution of the individual. Tobacco and snuff are discouraged in large quantities. Their harmful results seem to depend upon individual differences. Constipation must be avoided. Action of the bowels seems to need to be more frequent with some than with others. Predigested food is not recommended.

Brown bread is important for bulk. Fruit, especially fresh fruit, well masticated is productive of salutary results.

Mental work is strongly encouraged by Dr. Weber. It is dangerous to retire too early from active life, as from business, the army or the navy. One should pursue such hobbies as chess and cards

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assiduously. Friends and families of the aged ought to play with with them. Active mental work means more nutrition through increased circulation in the brain. Cheerfulness is strongly recommended. Passion must be restrained. Dissatisfaction with one's self from a selfish life spells a miserable old age. A cultivated will is a powerful factor in health and happiness. Mental work with relaxation keeps one young. As examples of this Weber points to these who work on into old age. Among painters Titian and Sidney Cooper; brain workers Sophocles, who is said to have written tragedies at ninety and more; Plato, Galen, Cato, Cicero, Michael Angelo, Wesley, Samuel Rogers, Chevreul, Sir Henry Holland, William I of Germany, von Moltka, von Ranke, Mumsey, Gladstone and many others.

The amount of sleep varies with the individual. Many over sleep yet there are numerous individual differences. Important functions of the skin grow defective in old age. It becomes drier, in part perhaps by the diminution of some of the capillaries. There should be bathing to keep the skin more active. A warm bath followed by a cold sluice is recommended. But here again individual differences make it impossible to prescribe one form of bath for all.

Dr. Weber prescribes massage for eyes, ears, nose, thyroid, scalp, etc. The kind of clothing, the house, and climate are other important factors. Dr. Weber recommends a change in the latter for six to eight weeks yearly.

His conclusions are:

- "Moderation in eating, drinking and physical indulgence.
- "Pure air out of the house and within.
- "Keeping the organs of the body as far as possible in good working order.

"Regular exercise everyday in all weather; supplemented in many cases by breathing movements, and by walking and climbing tours.

"Going to bed early and rising early, and restricting the hours of sleep to six or seven hours.

"Daily baths or ablutions according to individual conditions, cold or warm, warm followed by cold.

"Regular work and mental occupation.

"Cultivation of placidity, cheerfulness and hopefulness of mind.

"Employment of the great power of mind and controlling passion and nervous fear.

"Strengthening the will and carrying out whatever is useful and in checking the craving for stimulants, anodynes, and other injurious agencies"(pp. 1450-51).

Forel () makes work essential to the well being of old age. To rest is to no longer exist. This, however, may be possible to those who have spent their whole lives in pleasureseeking.

"If anyone wants to be as happy in old age as possible, he must first of all never betray his optimism; second, never brood over the past and dead; third, work away till the last breath to keep as much of his cerebral elasticity as possible" (p.325).

Forel finds the aged with a pessimistic selfish discontent usually resting upon inactivity. There are bad peculiarities not inherited, of quarrelsome, tyrannical old age, of those who demand everything and do nothing. These result from brain changes and to a selfish stunting of the spirit and to a lack of an ideal end of life. Such individuals use their remaining powers in burdening and tormenting, instead of working usefully. When the brain is sound, thinking and working bring happiness. Consistent muscular activity as far as it is possible is also recommended for the aged.

Taylor () maintains that the elasticity of the bodily tissues depends for its maintainance upon well-balanced and perfected activities. Of this he writes:

"If the activities have been habitually of an objectional sort, monotonous in character as from labor limited in scope or from choice, or inadequate in variety and character, the tissues acquire stiffness sooner than they should"(p.402).

These changes, too, will occur earlier and more conspicuously if the individual has not acquired full, symmetrical development of the muscles. Hence if this be true, one may conclude, that full-rounded muscular development before the close of the plastic teen age has another argument in preparation for a normal, useful and happy senescence.

In the hygiene of senescence, as mentioned to the writer, Dr. Burnham ranks diet of first, and right periods of work and rest of second importance. Old people tire quickly and recover slowly; therefore, in old age new habits of work, recreation and rest must be developed. Old people, like old horses, can be frisky for a little while, but should not be for long. This is a lesson hard to learn, quite the same as that of reduction in diet as years creep on. Learning, furthermore, is not synonymous with giving up meaning only the making of new adjustments for more salutary ends. This classical instance of over-exertion, from Humphrey, (), is in point. Dr. Willis, the attendant upon King George III at the age of ninety, after a walk of four miles to see a friend, sat down in his chair and went to sleep or was thought to be asleep, but he did not wake again (p. 927). There are many similar cases.

The failure of the senses compels retirement of the self inward, developing the autocentric point of view; thus hygiene, in consequence, is of prime moment. Eye and ear especially should be

entrusted to expert medical care, for even at best little often
 can be done to stay the closing of these important soul-gates.
 For those becoming blind, particularly if yet vigorous of mind
 and body, Javal's () book on this subject cannot be too strongly
 recommended. It is replete with suggestions for happy usefulness
 from an eminent French physician who lost his sight in the midst
 of a busy professional career.

the Northwest, spoke five times in one
 day, following Carrie Nation and Billy Sunday, speaking in a men's
 meeting (Y. M. C. A.) in the afternoon, Woman's Club in the evening
 and later attended a men's reception and banquet. To him varied
 experiences break up the deadening round of life that makes for
 listlessness and for the auto-centric.

Cleaves () believes something can be done to make old age
 happy and even useful; that best hygienic rules are occupation
 suitable to the period-freedom from exciting and harassing work;
 a well cultivated knowledge of what and when to give up things
 that occasion stress. Honor, respect, good friends, or a friend are
 important. Cleaves is right in his famous dictum, "For what is more
 satisfying than old age surrounded by the studious attention of
 youth." The typical environment of old age is a quiet home, some
 daughters, grandchildren, though one need not live in the same home
 with them, but they should be frequently accessible. Seeing young
 people, trying to sympathize with them, and even at times following
 in the wild way some youthful pursuit or game, - these are salutary.
 Selfish isolation. To be jealous of the young alienates them. It
 is through them that the wisdom of the aged ought to be conserved
 to all needs. Gentle exercise, fresh air, not too much exposure to
 light, well cooked, not stimulative, easily digested

(4). The Mind.- One prescription for the postponement of old age, given by a distinguished American of advanced years, is to get out and meet all kinds of people, to be in many different places in a short time. He goes in hot and cold weather; addresses all kinds of audiences, and is variously entertained. Once not long ago he was snowbound in the Northwest, spoke five times in one day, following Carrie Nation and Billy Sunday, speaking in a men's meeting (Y. M. C. A.) in the afternoon, Woman's Club in the evening and later attended a men's reception and banquet. To him varied experiences break up the deadening round of life that makes for fixedness and for the auto-centric.

Clouston () believes something can be done to make old age happy and even useful; that best hygienic rules are occupation suitable to the period-freedom from exciting and harassing work; hobbies well cultivated-knowledge of what and when to give up things that occasion stress. Honor, respect, good friends, or a friend are important. Cicero is right in his famous dictum, "For what is more gratifying than old age surrounded by the studious attention of youth." The typical environment of old age is a quiet home, sons, daughters, grandchildren, though one need not live in the same home with them, but they should be frequently accessible. Seeing young people, trying to sympathize with them, and even at times following in some mild way some youthful pursuit or game,-these are salutary. Loneliness is to be warded off by all means. It makes for a moody, selfish isolation. To be jealous of the young alienates them. It is through them that the wisdom of the aged ought to be conserved by all means. Gentle exercise, fresh air, not too much exposure to cold, light diet, well cooked, not stimulative, easily digested-

this will do much for the mind. Much milk, little flesh, ordinarily a very small quantity of alcohol in any form, are facts not to be overlooked. Wintering in the south may prolong life. Generally the less physic taken the better. While good for all, the simple life is especially recommended for the aged.

Much is said now-a-days about marriage for sex hygiene. It would seem that marriage is also of senile importance for mental hygiene. It makes something to life for. In fact, there is evidence that the aged, when the days of rumination come, reflect most persistently upon the days of early married life when the will to live was strong and the capacity to enjoy life keen. It may be that marriage, like a task for Emerson, is a life preserver. The writer has observed several senescents without family ties and for them rapid decline set in when the wife or the last child died, for, as they said, there was nothing to live for any longer, even the old friends had largely passed away.

The prophylactic against worry in old age (Saleeby, ; Chapter 14) is established right practises and interests in early life, but in case such are not performed the last resort is to discover man's strongest points and make a final effort to develop some lively interests here. Spencer's development for complete living will ^{so} equip the mind that in old age something will always be left to arouse interest to the very last. Vegetative ease in old age will no longer work for the race that does not take vegetative ease through life. The most beautiful attribute of old age is a sympathetic interest in youth. Mental riches for old age in many hobbies, interests and occupations are a veritable life saver. Passing through life living solely for sport or business is dangerous. Happiness in old age cannot be purchases in wealth. It is often

found in cultivating nature and an interest in the rural. The picture of the one-talent-cultivated man in old age is pathetic. The health declines, gout sets in, he becomes stout, scant of breath, with sleep impaired. Then everything loses its flavor. Having long starved his palate for poetry, high thinking, flowers and music, life becomes miserable, food insipid. High living is no substitute for high thinking. There are no condiments which act as a substitute for the power to enjoy children. The old confined with others of their age hasten each other on a downward course. The fit companion for old age is youth. There is truth in the old notion that the company of a young girl is the best means for the rejuvenation of an old man. Perhaps old age never was so much abandoned to its own devices as now. Herbert Spencer thought morals needed more correction in an increased care of the aged by the young as a part compensation of their up-bringing than anywhere else.

Since there is, as previously indicated, such a marked re-individualisation in old age, a return to the selfishness and restrictive point of view of the first childhood in so many cases, this offers a new argument for increased social education. Americans may be said to be notoriously individualistic upon growing old. With the set of habits and crystallization of point of view, it is all the more difficult to make social adjustments which are desirable. This is the time when it is important to be able to return to the social habits once established, either in earlier or in middle life. This makes for a broader outlook, for greater adjustment to the naturally narrow conditions of life, and for a marked increase in both the efficiency and happiness of the individual. The advocates of social education and broad cultural interests should look to senescence for a further vindication of much of their propaganda.

Because, then, the aged drop back so uniformly into the point of view, habits, and in part the recreations of early life, it may be strongly recommended that children learn various forms of sport, numerous games, and as many ways of doing and bringing things to pass as possible. This may serve as a bank account in old age that can be drawn upon and utilized for happiness. The same can be said in the cultivation of a fine taste for literature and study in general. Many aged individuals pass much time and find great satisfaction in living in the illustrious achievements of history and the pleasing characters of fiction. This makes for health and contentment. It tends to make the individual heterocentric as does love. It is well known that in case hobbies are postponed for cultivation till middle life or old age, they are seldome taken up. It is to be recommended that young people have every opportunity to cultivate and ride hard numerous hobbies in play, books, and nature. It was true for Emerson that, "A walk in the woods is one of the secrets of delaying old age"; but to whomsoever the woods is a closed book, these are idle words. It must be reiterated that much of the capacity to enjoy needs early to be acquired and education fails, if it does not realize in many individuals this ideal.

As one reads biography he is impressed with the distinct importance of work for the mind, to insure a useful, contented old age; and the boon companion of work is optimism. The books and magazines teem with such notions. Some ascribe their health to their illusions, refusing to disbelieve in men. Many or all have cultivated emotional control through a long life. Amelia E. Barr at eighty-three stresses the vivifying power of love; it is a poor mail that does not bring her one or more messages of love. There is general agreement that old age is not such a bugaboo after all.

These are notes sounded in a number of letters I have received. One concluded, "The philosophy of it all is to accept old age gracefully, rejoice in it as we do in the rising sun and enjoy it as we do the days when we are 'knee deep in June'". Another individual a lecturer of national repute, at seventy-four, writes that he is about to start upon a trip to the Pacific Coast states from the East, during which he is under contract to lecture twelve weeks, seven times a week for Chautauquas. This gentleman can walk as fast as in middle life and nearly as far and not tire. He talks as fast and does as much work as twenty-five years ago. The only thing he can think of which has stayed old age is constant activity of mind and body and a cheerful disposition. He writes:

"I try not to worry. Though forty years on the platform I never once reproved any one in an audience, I never once complained about my room or fare in a hotel to a manager, though I have made a few comments later to friends. I never had a law suit, I do not cherish a feeling of dislike. In my humble way I have tried to do good and I believe every kind word and deed helps to drive away the approach of old age."

Another powerful weapon against decadence is maintaining the continuity of life unbroken, continually re-editing experience, for it is the best thing we have, says President Hall. Goethe considered himself greater than other men, because he was ever going back and working over and re-evaluating the data of life, as expressed in Wilhelm Meister, etc. Americans are too much inclined to break the life continuity by moving from place to place and not retracing the path of years. Localities change less than people. Revisiting the former brings to the fore memories numerous, which could possibly never be otherwise aroused; and they are a great panacea for old age. They give rebirth, bring back the warmth and point of view of childhood and youth. Diaries carefully kept and glanced over now and then might do much the same in preserving

the life span unbroken. One individual reports she grew young in reading over the sermons she heard her father preach when a child and which for years lay forgotten in a garret. They proved her life line. She glowed again with childish emotions and reveled in the fancies, dreams and aspirations of her girlhood, as she read on and on, in exhalted erethism. The foregoing but suggest how far we are from utilizing to the full the possible means of tying closely together all the years of life into an unbroken thread of ~~enjoyous~~, fruitful youth.

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