

Sudden unpredictable and catastrophic incapacity can occur at any age, but is rare in the young. Beginning at about the fifth decade there is an acceleration of the rate of occurrence, which begins to rise sharply by the 55th year, until by the 75th year it approaches the vertical.

In the young, these occurrences are due to congenital defects in some vital area, but in the older group, the catastrophe is the result of the "aging process" causing a sudden disruption of function of a vital organ. This type of episode is unpredictable for two reasons, the most frequently, because of the function of the organ is ^{apparently} perfectly normal until the instant of disruption, as determined both by the lack of subjective symptoms and by any objective method of testing so far devised. More rarely, there are subjective symptoms that are seen in their true light only in retrospect.

The process of aging is so common to all life that ~~it~~ to it is applied the term "SENESCENCE" or "NORMAL AGING." It may be defined as the gradual ~~depletion~~ ^{depletion} of the hereditary tissue reserves for factors of safety present throughout all structures of the organism. The rate of this ~~depletion~~ ^{depletion} depends on two factors - the species ~~and~~ longevity and the accidents ^{and} of living. In humans this may be interpreted as the classical three-score and ten ^{and} in the diseases and stresses and strains to which the individual is subject during his life time. More specifically, we know that there is great individual variation in longevity which has for its basis the inherited constitution of the organism. The relative importance of the life span and of the inherited constitution in the process of senescence, as opposed to environment ~~is~~ ^{is} illustrated by the fruit fly, where with the identical environment but with experimentally modified inherited constitutions the life span may vary as much as 400 percent. To be sure its a long distance from the fruit fly to man but, nevertheless, similar factors probably play a role in the phenomena

of an individual's life expectancy as shown in the relatively long-lived and relatively short-lived human families. Both ~~inheritance~~ ^{and} heredity ~~is~~ the strain and accidents of living play a role in the process of aging in man. This aging process produces changes in the physiology of the individual which, as yet, are not shown to be due to specific diseases.

1. Gradual retardation of cell division, capacity of cell growth, and tissue repair.
2. Gradual retardation of the rate of tissue oxidation (lowering of the basal metabolic rate).
3. Cellular atrophy, degeneration and fatty infiltration of all tissues.
4. Gradual decrease in the tissue elasticity and degenerative changes in the elastic connective tissues.
5. Decreased speed, strength and endurance of skeletal neuromuscular reactions.
6. Decrease in strength of skeletal muscle.
7. Progressive degeneration and atrophy of the nervous system, impaired vision, hearing, attention, memory and mental endurance. ^A These changes are not listed in the order of their importance, or of their occurrence. These processes occur at varying rates in different tissues of the same individual and the total progress of the process varies from individual to individual. As the rates of these processes vary in different organs, it accounts for the fact that an individual may have myocardial infarction due to degenerative changes in his coronary arteries, while the arteries elsewhere in his body are very little changed. It also accounts for the fact that a young, healthy, appearing man of 55 or 60, may have the inflexible mental attitude of an octogenarian.

It is the sum and total of these various processes of aging that determine an individual's physiological age, which is not necessarily parallel with his chronological age. It is of great importance to the safety of aviation to be able to detect these changes when they occur in such a way as to influence the efficiency of a pilot's function. At the present time, ^{with} the increasing mean age of the pilot population, it becomes important not only as a matter of safety, but as a matter of fairness to those individuals whose livelihood depends on their continued ability to fly. In a broad sense, it can be said that an individual's age is equivalent to the age of his arteries, because it is on the integrity of the cardiovascular system that depends practically all of our vital functions. With relatively few exceptions most of the sudden incapacities of the older age group are due to some failure or due to a failure of some part of the cardiovascular system. It is the failure of the coronary artery to carry blood that causes myocardial infarction or "heart attack". It is either the rupture or closure of an artery that ~~causes~~ causes the cerebral vascular accident "stroke." At the present time, it is impossible to forecast the occurrence of either of these catastrophes by any means which we now have.

While these catastrophic and unpredictable occurrences are the most dramatic demonstration of the aging process in man, we must be able to judge in the pilot the presence of the more subtle changes that occur with aging, and determine their effect upon his safety as a pilot. Impaired hearing is easily detected by the audiometer. Changes in visual acuity are likewise easily discovered. What are the effects of other changes that occur in the lens of the eye? With the decreasing transparency of the lens which occurs with age, the individual has difficulty in discriminating white and

green ^{light} ~~light~~. He also becomes increasingly sensitive to glare, as the hardened lens will now diffuse bright spots of light rather than transmitting them as a beam to his retina. There are subtle changes that occur within the central nervous system. Those changes affecting the cerebellum will affect his position sense so subtly that the individual may not be aware of his loss. The changes which occur within the brain proper result in the slight decrease in the I.Q., slowness in learning new tasks, particularly those that are in conflict with old habit patterns. There is a slowing of reaction time, which up to a certain age is compensated for by improved judgment which obviates the necessity for quick reactions. However, a point is reached where the reaction time is too slow to handle unexpected emergencies.

The efficiency of both the respiratory and the gastrointestinal systems remain adequate throughout life unless their function is impaired by detectable disease. This also holds true for the kidneys. The remaining system which, in fact, all others depend on, is the cardiovascular. As long as the heart and its ramifications of blood vessels remains adequate, ^{the} percentage of failure of other organs in otherwise healthy people, remains very low. It is the failure of the arterial circulation throughout the body that is responsible for the degenerative changes that occur in other parts ^{and organs} of the body. It is the inability of the medical profession to test for the adequacy of these channels of circulation that have limited ~~xx~~ them in their ability to prognosticate the catastrophes that occur in older people. However, the state of the ^{AET} heart is such now that we should expect many prognostic avenues to open within the near future.

Degenerative changes that occur within the central nervous system can be detected to a greater or less degree, ^{but} ~~with~~ acceptable tests for these impairments and their proper evaluation must be developed before they can be used to aid in the determination of an individual's physiological age, particularly as it applies to his safety in the air.