

ON THE METHODOLOGY OF STUDYING AGING IN HUMANS

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1. Introduction

Methods for studying the aging of human beings cover a wide span of scientific endeavor. The literature in the field is large and research is expanding rapidly. Some indication of the scope of research activity on aging is obtained from the following listing of topics found in the 15-page table of contents of Nathan Shock's bibliography of gerontology [39].

(A) Biology of aging (1) cellular biology and physiology, (2) climate and geography, (3) exercise, (4) longevity (comparative physiology, diet, drugs, heredity, marriage, mortality rates, national groups, occupation, sex), (5) metabolism, (6) mortality rates, (7) nutrition, (8) parental age, (9) physiological age, (10) rejuvenation,

(B) Organ systems,

(C) Geriatrics,

(D) Psychological processes,

(E) Social and economic aspects.

Out of this maze of information and theory a number of lines of thought have been gathered in this paper to focus attention on some biostatistical phases of the enigma of aging. That this is a subject which is eminently biostatistical is obvious from its nature. Observation and experimentation are carried out all the way from the most basic cellular level up through drosophila, flatworms, rotifers, rats, horses, elephants and man. As one proceeds up the developmental ladder experimentation is replaced by observation and direct knowledge is replaced by indirect inference. At the human level our real understanding of aging is indeed poor, depending as it must on the evidence of vital statistics and hampered by the time required to follow groups of subjects through an appreciable part of their lifetime. A difficulty, not reserved for the problem of aging but particularly nasty in this case, is the lack of specifiability of conditions under which observations are made. Statistically speaking, nature is rather poor at the design of experiments, especially when it comes to untangling the effects on human mortality of environment and heredity, of endogenous and exogenous factors, and of exposure and susceptibility.