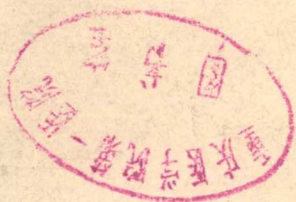


NUTRITION FOR THE ELDERLY

Anthony A. Albanese, Ph.D.

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Preface

The present volume constitutes an effort by the author and his associates to review the available literature and studies during the past 30 years on the effects of the aging process on the nutritional needs of the elderly and their relationship to the maintenance of normal health. The most important concept that can be derived from existing data is that while the same nutrients are essential for all individuals, changes accompanying the aging process call for variations in the amounts required by the elderly. Thus, providing adequate nutrition for this group must take into account the physiological, mental, social, physical and economic changes associated with aging. Generally speaking the elderly person requires fewer calories than the younger adult because of decreased basal metabolic rate and physical activity. However, this is not necessarily true for the other nutrients. The elderly may need fewer, the same, or greater amounts of individual nutrients depending on circumstances involving the factors mentioned above.

Despite the many advances in methodology there is still no consensus as to when senescent changes in animals and man are initiated. Whether they start during fetal life, at birth, at maturity when somatic growth largely ceases, or at some later time remains a matter of opinion rather than fact. Some would regard age associated alterations in physiologic functions as normal for the age of the individual. Others would interpret these changes as evidence of progressive degeneration—where the diagnostic devices at our command fail to demonstrate the presence of clinically identifiable disease. The need to resolve this dichotomy is essential to the application of dietary modalities for the maintenance of optimal nutrition or for minimizing ontoward effects of episodes of ill health.

The recent establishment of the National Institute of Aging and the infusion of federal funds for research gives hope for the early clarification and prevention of the problems of malnutrition prevailing in many of the 24 million citizens of 64 + years of the U.S. — our fastest growing minority.

The author wishes to acknowledge with deep gratitude the invaluable assistance of Louise Orto, Dorothy Zavatarro, Evelyn Wein and Lynne Carroll in our research program and the many details incident to preparation of this volume. Last, but not least, many thanks are due the Production Staff of the Publisher for their unstinting cooperation.

Anthony A. Albanese, Ph.D.
White Plains, New York
September 1980

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The Aged in Society

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INTRODUCTION

Year after year the number of Americans over 65 increases as a percentage of the total population. And, just as the elderly populace increases so does the average age of the individuals of this group. A variety of unique situations confront the elderly and those concerned with maintaining proper health and nutritional status in the aged. The nutritional and health status of the elderly is greatly influenced by physical, physiological, and social factors. Loneliness and depression resulting from separation from family or death will frequently reduce the desire of the elderly to care about their nutritional needs and eventually lead to anorexia and associated clinical problems. Physical problems, such as reduced activity, dentition complication, arthritis, and reduced vision, smell, and taste can all work against the maintenance of proper dietary and nutritional needs. The increased incidence of disease and ill health in the elderly often reduces efficiency of digestion, absorption, and metabolism, thereby impairing full utilization of available nutrients.

The United States is not alone in searching for more effective ways to serve its aged. In 1972, the World Health Organization pointed out that the increased proportion of the aged in the populations of the developed countries would "weaken seriously the capacity of populations to look after old people in the traditional ways and make the development of new methods of care necessary." Demographic pressures have only intensified since then. Some 23 million people in the United States (almost 11% of the population) are age 65 and over; by 2030, according to the U.S. Bureau of Census, the elderly population may be almost 55 million, or 14–22% of the population, depending on future fertility levels (Fig. 1:1). Furthermore, the expectations of persons now approaching old age are different from those of the present elderly; the future elderly will be generally better educated, more affluent, and more accustomed to regarding social services and support as rights [1].

Nursing-home care has become an important component of overall health costs, reaching \$7.7 billion in 1975 for nursing-home care for the elderly. Relying upon both general revenues and trust funds paid in by the working population, including

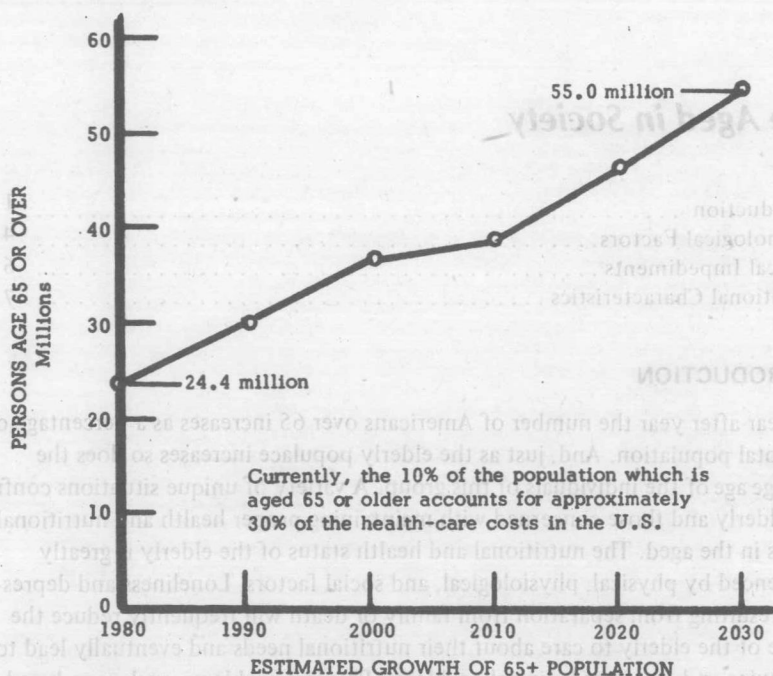


Fig. 1:1. Estimated growth of 65+ population.

current retirees, governments at all levels now pay \$20 billion annually for personal health care of the elderly. These costs confirm the increasing need to develop a firm and clear understanding of the interrelationships of the biochemical, nutritional, physical, and mental health problems of the aged. Such investigations can be expected to establish preventative or improved therapeutic modalities which would reduce disease incidence and medical costs.

Although it is accepted that several ailments may occur in one person simultaneously, the interaction of these ailments is not always taken fully into account in diagnosis and treatment of the elderly. Metabolic malfunctions, congestive heart failure, thyroid or vitamin deficiencies, drug toxicities, liver and kidney failures — any of these can cause a second illness, organic brain syndrome, which is treatable if the original cause is recognized. Diabetes mellitus, alcoholism, and some malignancies may singly or in combination cause a dormant infection to flare up; because of reduced immunological protection with age, this can result in tuberculosis in an elderly patient. The tendency — indeed, often the need — to treat multiple disorders with multiple drugs, commonly results in overdosages and toxicities — an added spur to research on the multiple nature of geriatric disease.

An intriguing characteristic of the diseases of the elderly is that their expression often results from the interplay of biological changes of aging and disease processes. Understanding these interplays should enable us to improve medical care for the aged; further, by examining the way changes are expressed in illness, we may gain insights into the changes themselves.

The interaction of aging and disease is evident in various groups of diseases. There are diseases whose incidence with age has shifted to include more of the elderly; for example, rheumatoid arthritis, whose severity, in its rapidity of onset and its effects on joints, may depend on normal physiological changes that occur with age in bone mass and connective tissue. Some diseases are almost unique to the aged. An example is accidental hypothermia: a growing inability, with age, to cope with cold temperatures; coupled with other factors, it can cause a person to become so insensitive to drastic falls in temperature that he may freeze. Finally, some diseases take a different form in old age. Among these are tuberculosis, diabetes mellitus, infective or bacterial endocarditis (inflammation of heart membrane and connective tissues), and thyrotoxicosis (a disease of the thyroid gland).

The physician who is unaware of the effects of altered physiology on symptoms can be deceived. Changes in renal clearances — the removal by the kidney of substances from the blood, including sugar — can result in little or no sugar in the urine of the elderly diabetic; therefore, his condition may be misdiagnosed. A test for one variant of tuberculosis may be negative in the elderly. The sensitivity to pain is often markedly different in the elderly — hence the painless coronary thrombosis, the silent intestinal obstruction, or the lack of localized pain in acute appendicitis.

The symptoms and courses of such illnesses in the elderly are often described as unconventional and atypical. But what is unconventional is that symptoms differ from those in the young. Research is needed to link the bodily changes of aging with the expression of illness not because aging is the cause of these illnesses (there is no evidence of that) but because it determines their nature.

A remarkable advance in biomedical research on aging has been the measurement of the physiological and structural changes that occur with age. Although most of these changes have been measured only in men, and none of them occurs in any sort of lockstep fashion, varying by individuals and by the particular changes measured, some general trends of aging do emerge. Muscles lose some of their elasticity. The senses blur, with consequent changes in sensitivity to light, noise, odor, and pain. Blood pressure rises and glucose tolerance declines. Body composition redistributes, with the proportion of protein going down and that of fat going up. Electrical patterns in the brain change, the dominant electroencephalographic rhythms slowing with age. Possibly because of the loss of nerve cells, the elderly are often less sensitive to thirst; they may become dehydrated, then confused and constipated — simply because they lack thirst cues and are therefore not drinking enough liquids.

PSYCHOLOGICAL FACTORS

The preceding examples illustrate that some of the physical problems confronting geriatrics are great indeed, but they represent only part of the total picture. Psychological conditions also contribute to the nutritional problems associated with aging. Conditions such as anorexia and emotional depression can sometimes result in an inadequate intake of food. Personal taste preferences might also affect food intake in the elderly, many of whom have developed strong likes and dislikes. For this reason, in caring for the aged it is important to avoid abrupt dietary changes lest emotional problems occur. Dietary changes should be gradual and tailored to the individual insofar as possible.

These psychological situations are perhaps even more difficult to deal with than physical problems and they may promote some nutritional deficiencies associated with anxiety, apathetic behavior, and other mental problems. Some 15% of the elderly in the United States — about 3 million — have mental disorders; 5% have severe disorders. Mental illnesses of the aged are either functional, organic, or a combination of both. Most of the functional disorders are curable, and some 15% of the organic disorders respond to treatment.

The aging brain seems more vulnerable to anoxia (lack of oxygen), low blood pressure, and low blood sugar. These vulnerabilities are still poorly understood and consequently their role in mood changes and mental illness is not always apparent to the individual's family and friends, and sometimes not even to his physician. We also know that many organic brain syndromes are due to some specific malfunction: congestive heart failure, liver or kidney failures or thyroid or vitamin deficiencies — e.g., thiamin, B₁₂, niacin, plus tryptophan deficiency. What are the actual relationships between organic brain syndromes and the physical impairments?

It is generally conceded that anxiety, especially in the elderly, is a complex phenomenon with three distinct aspects: the psychological, the behavioral, and physiological. Multiple frames of reference create other problems for the determination of the causes and management of anxiety among the elderly. Not only is there uncertainty as to how physiological measures relate to the psychological parameters but also as to how these indices of anxiety relate to behavioral characteristics. The complexities and interactions of the multiple mechanisms which produce anxiety have been assembled schematically in Figure 1:2 by Blumenthal [2]. Whatever their exact relationship, there is some intimate connection between physiological and/or nutritional concomitants of anxiety and the emotion of anxiety which occur more frequently in the elderly. In attempts to mollify the psychological effects some individuals indulge in excesses of food and/or alcoholic beverage. The frequency of these "self-selected" therapeutic measures are reflected statistically in the increased incidence of obesity and alcoholism with aging. Others respond to anxiety symptoms by reduced food intake (to a point of inanition), loss of weight, and/or reduced physical activity

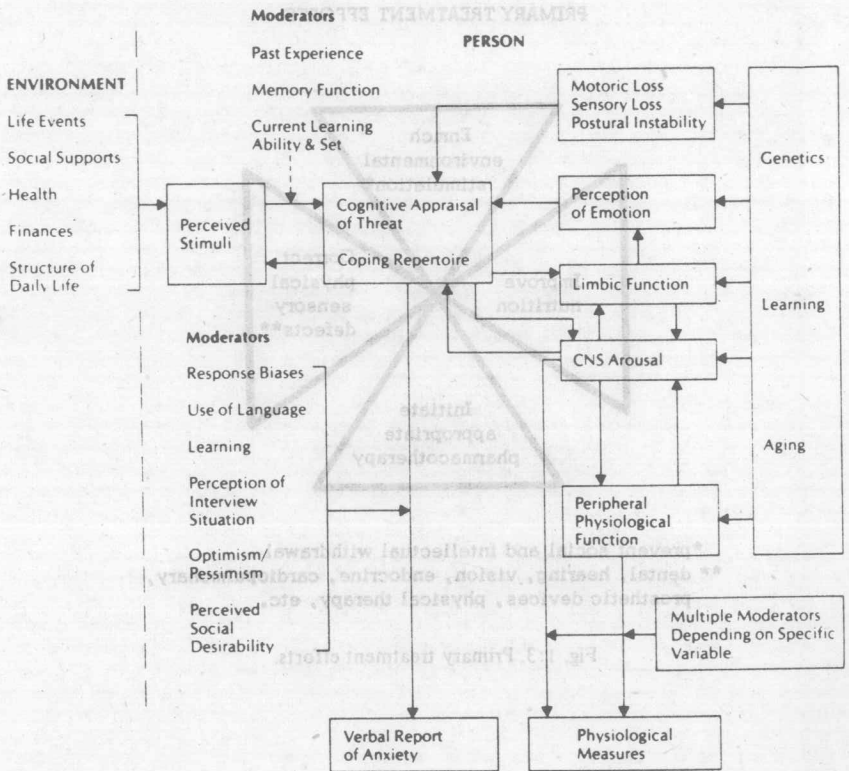
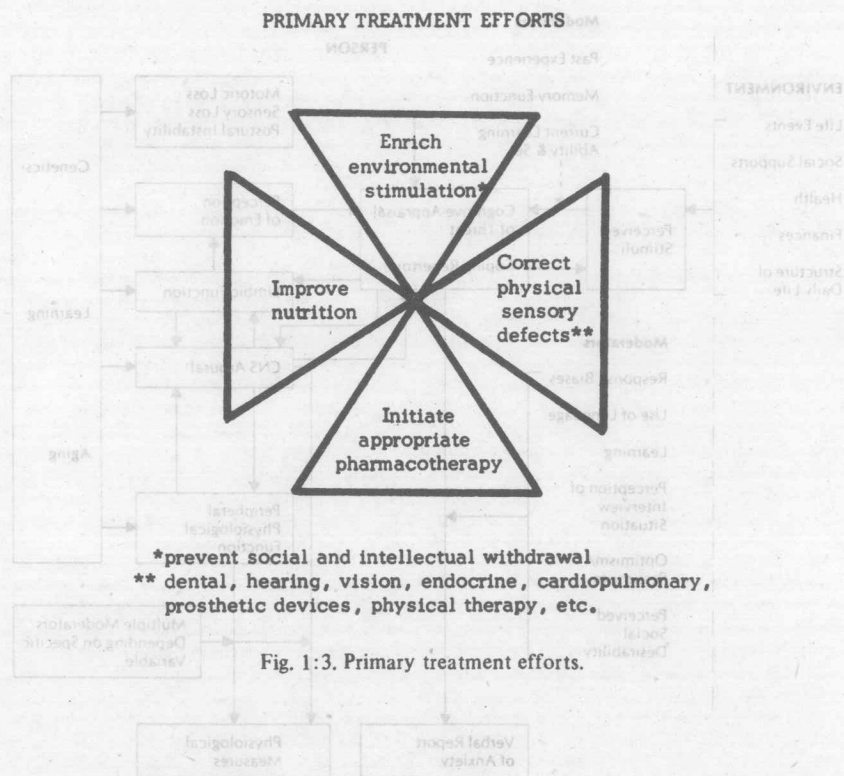


Fig. 1:2. Model of mechanisms of anxiety.

(with its untoward effects on nutrient utilization). Still others respond by abstaining from foods which provide nutrients – vitamins or minerals – essential to the maintenance of good health. Refusal to eat is an extreme manifestation of some anxiety symptoms.

A survey of publications on diagnosis and treatment of anxiety in the aged reveals intensive and extensive research efforts in the development of drugs to reduce or minimize the psychological symptoms of anxiety. The available products are evaluated for the most part in terms of effects on symptoms with a minimum, if any, reference to 1) nutritional parameters or status, or 2) application of nutritional modalities now known to have mood beneficial properties. These considerations indicate that treatment of mental impairment in the elderly should include not only pharmacologic treatment but also the other three tools shown in Figure 1:3.



CLINICAL IMPEDIMENTS

There are a number of clinical conditions which affect the nutritional status of the elderly. These conditions can either be a part of the natural aging process or may be induced by a lifelong habit. For example, a history of heavy smoking can impair taste and smell and therefore represents habit-induced damage to these senses. On the other hand, excretion problems in the elderly are often associated with the general aging process and are manifested in two extremes — constipation and fecal incontinence.

Constipation is one of the most common and most difficult problems to manage in the aged and can result from improper dietary habits, inadequate physical activity or, emotional stress, or it may also be drug-related. Proper levels of bulk, water, and sufficient exercise can help prevent constipation, and the problems associated with fecal incontinence can be minimized by directing the patient to consume a low residue diet.

Another common characteristic of the aged — poor dentition — may result either from natural loss of teeth due to aging or be habit-induced owing to generally poor dental hygiene. Some 50% of the populace over 65 years of age have lost

all their teeth and only 75% of this group have satisfactory dentures. It can thus be assumed that a significant portion of elderly persons find chewing difficult or even impossible, causing them to turn to soft processed food which may have nutrients reduced or removed through refinement. Or, the elderly may consume more "empty calorie" (high carbohydrate, low protein) foods such as gelatin, snack foods, candy, soft pastries, and other confectionaries. One alternative available to the elderly person with dental problems is to consume more liquids with high nutrient content [3].

Smell, taste, and dentition influence the elderly person's ability and desire to consume a proper diet. In addition, physical weaknesses such as arthritis, bursitis, and other maladies which impair joint mobility may make the simple mechanical process of eating most painful and difficult. Extreme cases of these types of physical limitations and other conditions such as oral surgery, inability to chew and swallow, paralysis, anorexia, and depression may warrant utilization of tube feeding in order to supply proper nutritional levels.

The nutritional status of the elderly is also influenced by a number of chronic diseases such as diabetes, atherosclerosis, and other vascular diseases. There is varying opinion on whether osteoporosis, an abnormally high degree of bone porosity, is a disease in itself or a natural consequence of aging. Whatever the case, osteoporosis can be brought on by altered calcium, phosphorus, and magnesium metabolism induced by a number of conditions, one of which is insufficient dietary supply of these minerals.

These chronic diseases not only are significant problems in themselves but they further compound the situation by introducing additional stress to the aged person's system — stress which may impair the ability to properly utilize ingested nutrients.

NUTRITIONAL CHARACTERISTICS

Numerous experiments in animals and studies of humans have demonstrated that caloric intake and nutritional balance do play a role in health maintenance and longevity [4]. The danger of obesity cannot be denied, but it does appear to be of greater danger to the elderly man than to the elderly women.

In recent years there has been a recurrence of reports of groups of people that include a significant number of centenarians. One group lives in Vilcabamba, a small village in Ecuador. Two others are in widely separated regions of Asia: the Hunzukuts of the Karakorum Range in Kashmir and the Abkhazians of the Republic of Georgia, USSR. All live in relatively isolated mountain regions. The cultures are primarily agrarian, physical activity is high, family ties are close, and wine and tobacco are used without negative effects. Longevity is attributed to genetic factors, diet, and work patterns. These reports indicate that these unusually old persons do adhere to certain nutritional patterns. They

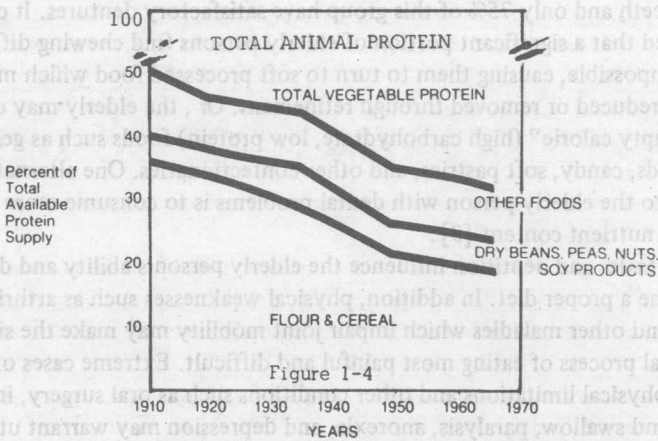


Figure 1-4

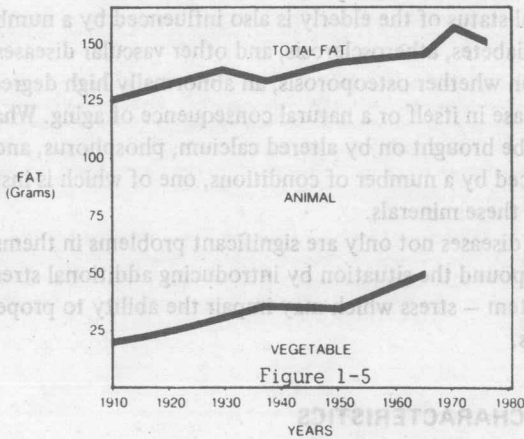


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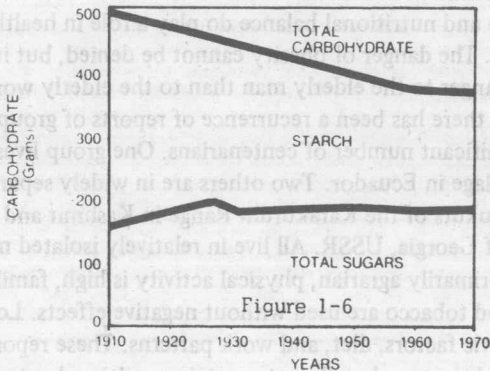


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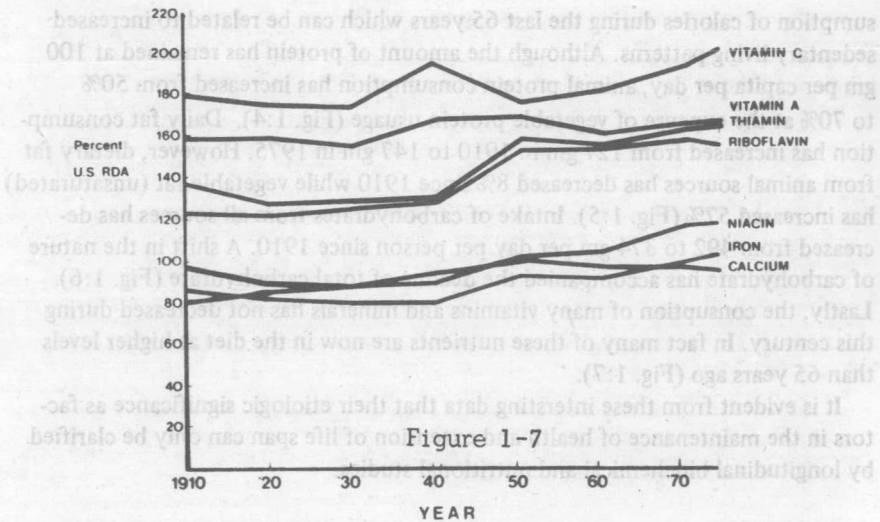


Fig. 1:4-1:7. Changes in U.S. food consumption 1910-1970.

believe that overeating and being overweight are dangerous and that continuing physical activities is vital to life. Their diet is characterized by relatively little meat — eaten perhaps once or twice a week. Fish is avoided and there is preference for chicken, beef, young goat, and in the winter, pork. A cornmeal mush takes the place of bread. Goat cheese is eaten daily, and about two glasses of buttermilk are consumed each day. Their diet includes fresh fruits, especially grapes, fresh vegetables, including green onions, tomatoes, cucumbers, cabbage, baby lima beans, and large quantities of garlic. Few Abkhazians smoke. They drink neither coffee nor tea, but almost everyone drinks a large glass of dark wine. It is of interest to note that in many societies garlic is looked upon as a very healthful food that adds to longevity. However, one should be aware that the distinguished Russian scientist Medvedev does not accept the reliability of the advanced years claimed by the elderly Abkhazians of the Caucasus.

Actual statistics reveal that average life expectancy in the United States has increased from 45 years in 1900 to 75 in 1980. The increase of 30 years life expectancy within 80 years is dramatic and the causes are many, some assessable, others imponderable. The effects of medical advances, improvements in socioeconomic circumstances, and changes in life style can be readily assessed — the impact of nutritional components are not clear. Recently, Celender and co-workers [5] have reported a comprehensive study of food consumption patterns over the last 65 years which should be considered as a possible factor in life extension in the past 80 years. They found a 5% decrease in per capita con-

sumption of calories during the last 65 years which can be related to increased sedentary living patterns. Although the amount of protein has remained at 100 gm per capita per day, animal protein consumption has increased from 50% to 70% at the expense of vegetable protein usage (Fig. 1:4). Daily fat consumption has increased from 127 gm in 1910 to 147 gm in 1975. However, dietary fat from animal sources has decreased 8% since 1910 while vegetable fat (unsaturated) has increased 57% (Fig. 1:5). Intake of carbohydrates from all sources has decreased from 492 to 374 gm per day per person since 1910. A shift in the nature of carbohydrate has accompanied the decline of total carbohydrate (Fig. 1:6). Lastly, the consumption of many vitamins and minerals has not decreased during this century. In fact many of these nutrients are now in the diet at higher levels than 65 years ago (Fig. 1:7).

It is evident from these interesting data that their etiologic significance as factors in the maintenance of health and extension of life span can only be clarified by longitudinal biochemical and nutritional studies.

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INTRODUCTION

Until recently, aging has been regarded as an inevitable process of gradual decline in vital capacities, to ultimate death, about which nothing can be done. In recent years, however, ever-increasing knowledge in biology, biochemistry, and physiology give promise that some of the untoward changes are not inevitable. Indeed, it is now felt that as we learn more about the effects of age and the mechanisms behind the events, much could be done to minimize disabilities of older people and perhaps increase the life span with good health.

Cross-sectional analyses show that some physiological functions remain quite stable over the entire life-span. For example, fasting blood glucose levels do not change clinically, significant with age. Similarly, other blood constituents measured under basal or resting conditions, such as blood volume, pH, red cell content, and osmotic pressure, are rather constant. From these results, it may be inferred that, under resting conditions, the essential characteristics of the internal environment necessary for cell life are maintained.

Some physiological characteristics show a gradual decrement with age. Marked individual differences in the effects of age are notable. Thus, some 90-year old subjects may have renal blood flow as high as that of average subjects 20 years

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their juniors. This variation between individuals occurs in most of the physiological measurements made by Shock and shows clearly that aging proceeds at different rates in different individuals [1].

Similar measurements for a wide spectrum of physiological tests have been made. Some of the results are summarized in Figure 2:1. In this representation average values for 30-year olds have been taken as 100%, and values for increasing age categories are shown as a percentage of this value. It is obvious that age does not affect all organ systems in exactly the same fashion. For example, basal metabolic rate expressed in terms of surface area falls about 20% over the age span of 30 to 90 years. In contrast, renal blood flow and maximum breathing capacity fall about 50% over the same age span. There is, of course, no assurance that these decrements are linear, as shown, but because of the individual variation in cross-sectional data, linear regressions represent our best approximation. There is no assurance that individuals will follow the same age curve as those based on averages. An understanding of the prevalence of persistent variables lies in the recognition of the concept of biochemical individuality which underlies all life processes which result from genetic, anatomical, enzymatic and hormonal differences [2].

LOSS OF CELLS AND FUNCTIONS

One factor contributing to the loss of reserve capacities with advancing age is the gradual loss of functioning cells from many organs and tissues of the body. Although certain types of cells, such as skin, hair, lining of the gastrointestinal tract, and even liver cells, retain their capacity to divide and reproduce themselves in the adult, other cells, such as muscle and nerve, lose this capacity. In a number of instances, it is possible to correlate physiological findings with anatomical and histologic evidence of cellular loss. Physiological tests show that the decrement in a number of discrete renal functions, such as glomerular filtration rate, renal blood flow, maximum capacity to excrete paraaminohippuric acid (PAH), maximum ability to reabsorb glucose, all fell at approximately the same rate, namely 0.6% per year. These observations lead to the inference that at least a part of the decrement in renal function can be ascribed to the loss of functioning nephrons as units. Histologic examinations carried out on rats show that the number of nephrons in the kidney diminishes with age after attainment of maturity.

Other physiological evidence for the presumption that cell loss is an important factor in aging stems from studies on the reduction in basal oxygen consumption with increasing age. Since the water content of cells remains remarkably stable over the entire life-span, an estimate of the total body water, or better, intracellular water, offers a useful index of functioning cell mass. Dilution techniques, whereby a substance which will distribute itself equally within the total water