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In Search of the Secrets of Aging

National Institutes of Health

We don't know very much about the man who lived to 120 years of age, but we can assume that he escaped the diseases that kill many people in their 70s and 80s. In fact, escape from disease is the most common reason that all of us can now expect to live longer than our grandparents.

Chronic diseases and disability were once thought inseparable from old age. This view is changing rapidly as one disease after another joins the ranks of those that can be prevented or at least controlled, often through changes in lifestyle.

We now know, for example, that most people can avoid lung disease by not smoking. And heart disease and stroke rates have fallen at the same time that Americans have lowered their fat consumption, begun to exercise more, and quit smoking.

If chronic disease is not intrinsic to the aging process, as many gerontologists now believe, then what is? What are the universal or "normal" aging processes?

Many of the answers to this question are coming from the Baltimore Longitudinal Study of Aging (BLSA). In this long-term study, begun in 1958, researchers are studying the aging process in more than 1,000 people from age 20 to age 90 and beyond.

They have found that variations in human development increase as people age and that organ systems within a single individual can change at different rates. This suggests that genetic,

lifestyle, and disease processes all affect the rate of aging and that several distinct processes are involved.

More information on normal aging comes from NIA's Biomarkers of Aging project. Begun in 1987, this 10-year effort is singling out key biological signs that characterize the aging process. The project is based on the idea that biomarkers are a better measure of an organism's aging status than chronological age itself. Once the biomarkers have been identified, it will be easier to study normal aging, diseases, and anti-aging interventions.

Researchers investigating the physiology of aging have focused on two organ systems in particular that seem to serve as pacemakers of declining functions. One of these, the endocrine system, and the other is the immune system.

When Sherechiyo Izumi contracted pneumonia and died at the age of 120, it was his immune system that failed. One of the many bacteria or viruses that cause pneumonia broke through the elaborate, natural defenses that protect humans from infection. Scientists have long known that these defenses decline with age; now, some of the underlying mechanisms are coming to light.

A multiplicity of cells, substances, and organs make up the immune system. The thymus, spleen, tonsils, bone marrow, and lymphatic system, for example, produce, store, and transport a host of cells and substances -- B-lymphocytes and T-lymphocytes,

antibodies, interleukins, and interferon, to name a few.

Several are of special interest to gerontologists. These include the white blood cells or lymphocytes, which fight invading bacteria and other foreign cells.

Lymphocytes fall into two major classes: B-cells and T-cells. B-cells mature in the bone marrow, and one of their functions is to secrete antibodies in response to infectious agents or antigens. T-cells develop in the thymus, which shrinks in size as people age; they are divided into cytotoxic T-cells and helper T-cells.

Cytotoxic T-cells attack infected or damaged cells directly. Helper T-cells produce powerful chemicals, lymphokines, that mobilize other immune system substances and cells.

T-cells and their lymphokine products have intrigued gerontologists ever since it was learned that T-cells -- or more precisely the functioning population of T-cells -- declines with age. While the number of T-cells remains about same, the proportion of them that proliferate and function declines. Studies have also shown that in older people, T-cells destroyed by trauma, such as burns, take longer to renew than they do in younger people.

Most research on the aging immune system now centers on these cells. One group of T-cell products, interleukins, occurs at different levels as people age. The interleukins -- there are about a dozen identified so far -- serve as

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messengers, relaying signals that regulate the immune response. Some, like interleukin-6, rise with age, leading to speculation that they interfere in some way with the immune response. Others, like interleukin-2, which stimulates T-cell proliferation, tend to fall with age.

Gerontologists continue to study the interleukins, not only for clues to the mechanisms of aging, but also for their potential in primary care. Findings to date suggest that tests for interleukins, though not yet available, may someday help in the detection and treatment of immune problems.

Another focus of research is the interaction of hormones and the immune system. DHEA, for example, has been shown to revive immune responses in aging animals. Reducing estrogen levels depresses IL-2 levels. And two pituitary hormones, prolactin and growth hormone, may also be linked to the immune response. Pituitary tumor cells, implanted in aged rats, have induced the thymus to grow to its youthful size and increased the proportion of helper T-cells and other immune system cells.

While both the immune and the endocrine systems are undoubtedly involved in aging, researchers continue to search for the mechanisms to explain their effects. One approach to studying aging, caloric restriction, is expected to yield some clues.

In a laboratory at the University of California at Los Angeles, thousands of mice are living to the advanced ages of 30 and 40 months or more -- far beyond their normal life spans. The fundamental reasons are not yet understood. What is known is that the mice live on restricted diets. Fed 30 to 60 percent fewer calories than normal (but all the necessary nutrients), the mice survive months longer than mice on a normal feeding schedule.

The findings in this UCLA laboratory, headed by Roy Walford, are not isolated ones. In studies in other laboratories, again and again, undernutrition has increased the life spans of nearly every animal species studied -- protozoa, fruit

flies, mice, rats, and other laboratory animals.

Particularly intriguing to many gerontologists are findings that animals on restricted diets have reduced rates of disease. In one of the largest studies to date, Roderick Bronson at Tufts University found that caloric restriction not only extended life span in mice, but also prevented or slowed down development of every disease and all types of tumors. These results, described as stunning by gerontologists, have raised hope that further study of caloric restriction will help uncover the mechanisms responsible for disease in old age.

On a practical level, though, most gerontologists don't expect caloric restriction ever to become a widespread means of extending the human life span. What they hope to learn from studies of caloric restriction, once its mechanisms are understood, is how to improve health and prevent or postpone the diseases of advancing age.

Speculation about how caloric restriction works covers a broad field, reflecting the wide range of effects it has in laboratory animals. Because cutting down on calories slows metabolism, and damage. And because caloric restriction lowers body temperature slightly, cells may sustain less genetic damage and repair it more readily than at normal body temperature. In addition, scientists speculate that caloric restriction preserves the capacity of cells to proliferate, that it moderates the decline in growth hormone, and that it keeps the immune system functioning at youthful levels.

In fact its effects are so pervasive that some scientists postulate the existence of a single, master gene whose expression is influenced by caloric restriction and which in turn modifies all aging processes. Whether or not this proves correct, continued work with caloric restriction is expected to uncover much more about the mechanisms of aging.

Salads in fast-food restaurants and low-fat labels in supermarkets signal a

transformation in Americans' eating habits that is reflected in mortality rates. Deaths from heart disease have declined 45 percent in the United States since 1950, partly due to the switch to lower-fat, lower-cholesterol diets, and to other behavioral factors, like smoking cessation and exercise.

Diet and exercise, in particular, are thought to have a major impact on a constellation of changes that are common with advancing age.

These include higher levels of fats or lipids in the blood, changing levels of blood sugar and insulin, a tendency toward obesity, and increased central body fat -- that which settles around the waist and abdomen. So common are these among older people that they have been given a name -- syndrome x -- and their relationship to heart and other cardiovascular diseases is the focus of many studies.

Syndrome x may be preventable through low-fat and low-cholesterol diets, but these are not the only aspects of nutrition that may influence life expectancy. Gerontologists have been scrutinizing a wide range of nutrients with an eye toward their role in aging processes.

New territory, unexplored or only sketchily mapped, lies ahead. As gerontologists isolate and characterize more and more longevity- and aging-related genes in laboratory animals, insights into genes and gene products important in human aging will emerge.

In short, gerontologists will be charting the paths and intersections of genetic, biochemical, and physiologic aging. What they find will reveal some of the secrets of aging. It may lead to extended life spans. It will very certainly contribute to better health, less disability, and more independence in the second fifty years of life.

*Article taken from Novartis Foundation for Gerontology website: healthandage.com
NIH Publication Number 93-2756
For more information contact the National Institute on Aging at (301) 496-1752*

RECENT RESEARCH

Focus on Universal Design Designs Offer Homes for All Ages

By Vera Prosper

"Designing as much of the environment as possible to be usable as possible for as many people as possible."

Ron Mace, Center for Universal Design,
North Carolina State University

Universal Design, the concept of designing "housing for a lifetime," aims to create more functional living environments for everyone...for a lifetime. People often confuse universal design with "accessible housing," which may use wider doors to accommodate wheel chairs; ramps; and pull-down cabinets to help people with specific physical limitations to live more independently.

A universally designed home, by contrast, looks no different from conventional housing but increases its usability and safety for all family members. Universal design strives to build environments that compensate for normal life changes and the differences in size and capacity seen among individuals of all ages. The home adjusts to the user rather than forcing the residents to relocate, or to stop using parts of the home, or to have to hire help.

Examples of universal design features include:

☞ **Task lighting, which helps visually impaired people but also helps others doing homework, cooking meals, or using workshop equipment;**

☞ **Adjustable sinks and counters, which respond to the needs of taller and shorter individuals, as well as to those who need "sit-to-work" space;**

☞ **Single lever faucets, a convenience for busy homemakers—and easier for older people who have lost wrist and grasping strength;**

☞ **Non-slip floors and surfaces, which increase safety and reduce glare;**

☞ **Four- to seven-inch stair risers, which are safer for children and elders;**

☞ **Self-regulating tub and shower valves that prevent scalding; and**

☞ **Electronically controlled appliances, windows, and lights (a safety convenience for children and adults and a means to help elders with dementia)**

In addition, universally designed home includes features that allow easy, low-cost or no-cost adaptations as family circumstances change. For example, reinforcing walls during initial construction allows future installation and removal of grab bars.

The move today is clearly toward universal design because it works. The concept capitalizes on many advancements in electronic technology, building materials, architecture, lighting and energy efficiency, furniture design, and engineering. These advancements allow designers to move beyond the traditional practice of developing products and buildings for the so-called "average" person. The place when aging-related physical and mental frailties compromise their ability to live independently. For safety and extended self-management, experts recommend such features as a seat in the shower; doorway thresholds that are flush with the floor; railings that extend beyond the top and bottom stairs; staggered stove burners that automatically turn off; built-in lights in stairwells and hallways; pocket doors; and first-floor bath, bedroom, and laundry facilities.

Universal design adds flexibility, safety, and value to homes. Enabling owners to live in the present while facing the future, it shows how careful planning enhances aging in place.

Vera Prosper is a housing policy analyst for the New York State Office for the Aging, and the NISH Delegate Council member from Region III. Taken from The National Council on Aging, Inc. website: www.ncoa.org.





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CALENDAR OF CME/CEU EVENTS

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January 21, 27 & February 4, 2000

IGT - Psychology Module
 CME/CEU hours: 20 for psychologists
 Location: University of Miami School of Medicine, Sieron Building, 1425 NW Avenue, Miami, FL
 Call (305) 243-6270 to register.

February 29, 2000

Activity Based Alzheimer Care: Building a Therapeutic Program
 CME/CEU hours: 7 pending for nurses, social workers, administrators and occupational therapists
 Location: Chancellor Park, 1820 Jog Road, Boynton Beach, FL
 Call (561) 740-1180 for information.

March 9-10, 2000

Advances in Geriatrics XII: Geriatric Rehabilitation
 CME/CEU hours: 12.5 hours pending for most health care disciplines
 Location: Sheraton Ft. Lauderdale Airport Hotel, Ft. Lauderdale, FL

March 23-24, 2000

6th Annual Alzheimer's Disease Education Conference: The Prescription for Alzheimer Disease and Related Disorders
 CME/CEU hours: pending for administrators and social workers
 Location: Crown Plaza Hotel, West Palm Beach, FL

May 12, 2000

End of Life Care: Legislative Changes Affecting Healthcare Providers
 CME/CEU hours: pending for physicians, physician assistants, nurses, administrators and healthcare providers
 Location: TBA
 Call (305) 670-3077 for information.

May 19-21, 2000

IGT: Optometry Module
 CME/CEU hours: 20 pending for optometrists
 Location: Nova Southeastern University, Ft. Lauderdale, FL

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CE PROGRAM DESCRIPTION

ADVANCES IN GERIATRIC XII: Geriatric Rehabilitation - A Team Approach

Advances in Geriatrics is an annual program examining current and future trends in geriatric health care. This year's program has been designed to offer a comprehensive, multidisciplinary view of the functional aspects of older adults and geriatric rehabilitation. Classical and complementary therapies will be emphasized throughout the presentations.

The conference is divided into five sessions: BioPsychoSocial Rehabilitation, Neuro-Psych Rehabilitation, Physical Rehabilitation, & Sensory Rehabilitation. Each elective contains breakout tracks and registrants may choose presentations according to their interests. Our goal is to be able to provide information regarding rehabilitation by encompassing its spiritual, mental, physical and social aspects. Speakers from many disciplines will present on assessment, treatment, motivation, and monitoring and how these influence the sphere of geriatric

rehabilitation. The conference is punctuated with time for in-depth discussion of issues and feelings that may arise over the two day course.

CEU

This program offers up to 12.5 CME/CEUs for most health care disciplines.

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