
Gerontology

Contrasting theories on the causes of aging from papers delivered to the AAAS meeting in San Francisco

Is it the immune system

Many of the commonest diseases of old age—cancer, maturity-onset diabetes and chronic pulmonary disease—are associated with malfunctioning of the body's immune system. UCLA pathologist Roy L. Walford summarizes the relationship of immunity breakdown to aging.

When objects like bacteria invade the body, lymphocyte cells in the blood recognize protruding molecules as "foreign" and they release antibodies that attack the invader. Experiments with rats have shown that both the recognition and attack phases can decline with age to one fourth their vitality in youth. Simultaneously, the autoimmune response, in which the cells mistakenly attack the body itself as foreign, seems to increase.

... or endocrine changes

May nondisease changes that accompany aging seem to be controlled by alterations in the body's endocrine system. Caleb E. Finch of the University of Southern California sees the brain as the most likely center for what he calls the endocrine "pacemakers of aging." The largest biochemical change known to accompany aging is the failure of ovaries to produce the hormone estrogen after menopause. This secretion, in turn, is controlled by hormones from the brain. Researchers have found that electrical and chemical stimulation of the hypothalamus region of the brain can bring about renewed ovulation in old rats. Apparently the metabolism of nerve-transmitter chemicals called catecholamines slows down with age, Finch says.

... or changes within a cell

Despite indications that bodily deterioration with age results from specific system breakdown, Stanford microbiologist Leonard Hayflick has for 10 years been accumulating evidence that individual cells also have built-in aging mechanisms. Grown in tissue culture, human cells will undergo only about 50 divisions before dying; chicken cells survive only about half as many divisions; rat cells, even fewer. By transplanting cells from individual to individual, similar limitations were found for cells in living animals. Though a person usually dies long before the maximum number of his cell divisions has been reached, this limit may account for the cutoff point at around 90 years of age observed in all cultures.

... or a matter of genetics?

All the changes of aging might be explained if genetic "switches" could be found. One of the leading proponents of this theory is Bernard L. Strehler, a biologist at the University of Southern California.

Strehler argues that the slow accumulation of genetic damage is insufficient to cause all the observed effects of aging and that a mechanism probably exists that "switches off" certain kinds of genes during maturation. So confident is he of their existence that he predicts: "With even moderate funding this key gerontological question should yield within the next five years or less." That, in turn, might lead to "moderation, control or even reversal of man's most universal enemy, the mental and physical debilities of old age."

April 20, 1974

Geophysics

From our reporter at the annual meeting of the American Geophysical Union in Washington

The Gulf of Chaos

The complex movements of the waters of the Gulf of Mexico have long tantalized oceanographers trying to bring order out of chaos. To their likely frustration, an elaborate study of the West Florida Shelf has now provided strong evidence that chaos is the name of the game.

The western coast of Florida bears one of the broadest continental shelves in North America, the subject of a two-year investigation that has included three separate field experiments totalling 13 weeks and involving three Florida universities. The focus of the study is a 60-by-90-mile area in which researchers have made about 1,000 salinity-temperature-depth profiles and half a million current velocity and temperature correlations.

Tidal energy over the shelf turns out to be a morass of distorted, random turbulence, says Christopher N. K. Mooers of the University of Miami. The wind-driven upwelling of coastal waters is a transient thing at best, while velocity measurements show that tidal currents fluctuate by as much as six inches per second.

Even the Gulf's well established Loop Current becomes fickle where the shelf is concerned, passing sometimes over the shelf, sometimes out beyond it and sometimes right along its edge. Sometimes the current's meandering leads it to break off into strong eddies up to six miles across, which sometimes become trapped on the outer shelf.

The return of the stars

All sorts of devices have been developed to replace the stars in helping to determine locations on the surface of the earth. Now the stars are back in fashion with an instrument that literally looks at the sky and compares stellar positions with its own star map to plot surface locations to within 30 feet.

Evolved from a spacecraft star tracker, the Automated Astronomic Positioning System consists at present of a 10-by-15-inch cylindrical optical sensor, an attache-case-sized electronics package and a battery pack. Programmed in advance with a star chart from a known time and location, it is placed on the ground and looks at the stars directly overhead. It makes repeated observations, comparing them with its stored chart to establish the stars' apparent motion, and computes its own location, displaying the result directly in degrees, minutes and seconds of arc.

The AAPS developed by Joseph Carroll of Control Data Corp. for the Defense Mapping Agency, is being considered for a variety of geodetic tasks such as the measurement of ice floe movements and continental drift.

A cool blast from the past

The large ice sheets of the glacial period of about 18,000 years ago were restricted to Greenland, Antarctica, northern North America, northwestern Europe and the Taymyr Peninsula in northern Siberia, with surprisingly little ice elsewhere, says George Denton of the University of Maine. Then about 14,000 years ago, all the ice sheets outside of Antarctica began to shrink, vanishing or reaching their present size by 6,000 to 10,000 years ago. The findings arose during computations for models of ice-age atmospheres.

261