How you age

"When the age is in, the wit is out."
Shakespeare, Much Ado About Nothing

"The biologist looks at the worst aspects of aging, which tends to trouble people."
F. Marott Sinex, biochemist, Boston University School of Medicine and past president of the Gerontological Society

by Joan Arehart-Treichel

Although physical aging is one of man's most universal experiences, scientists have focused on the process only in the past decade or two. Some investigators are looking for an underlying cause for aging (SN: 11/4/72, p. 294). Others are probing various expressions of the process. What are they finding out about the aging brain, heart, senses or skin? Might any of these changes be delayed or even reversed?

Brain changes that come with age, such as loss of mental sharpness, are probably of greatest concern to most people. Scientists are beginning to note some of the ways the brain ages and that might possibly explain diminishing mental acuity although no hard and fast correlations have been made yet. A daily loss of brain cells, for example, starts in childhood. So it is not surprising that the human brain gets lighter as it gets older (it loses 150 to 200 grams between the ages of 20 and 80), and a lighter brain might not work as efficiently. There is also less space between neurons (brain cells) in older brains, which suggests that neurons might not relay brain messages as efficiently as they should. Aging neurons lose RNA (ribonucleic acid), which represents neuronal death. One might assume that loss of neurons could impair thinking. Aging neurons contain fewer mitochondria, the principal energy factories of the cell. Fewer mitochondria might possibly prevent neurons from getting all the energy they need to function properly.

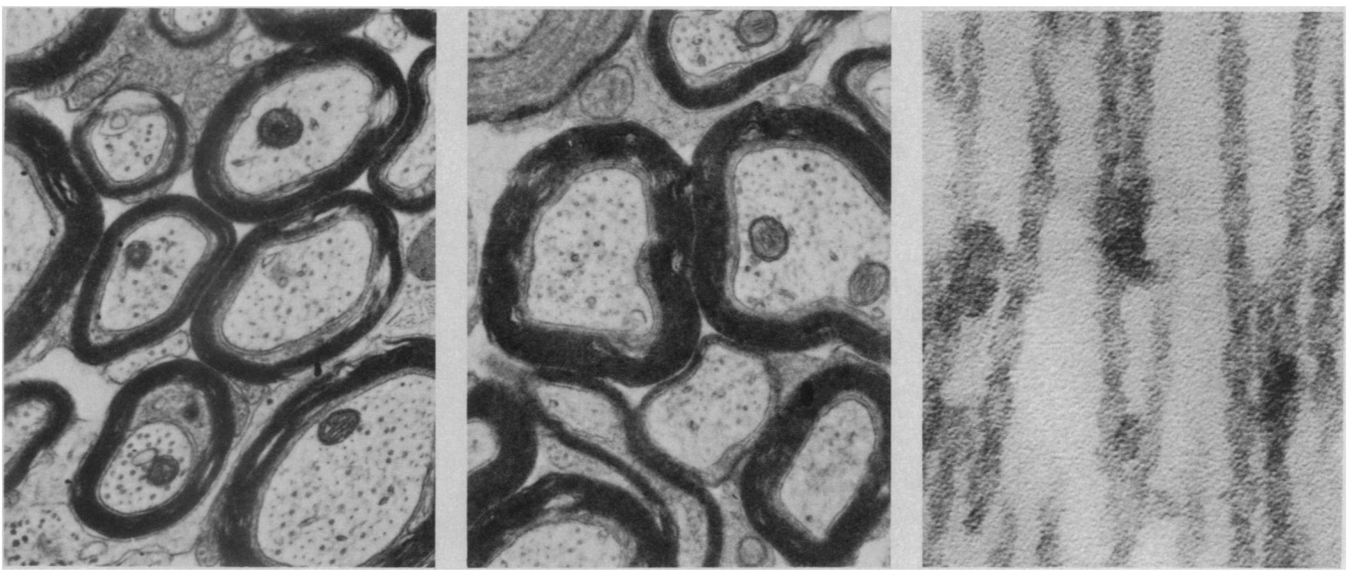
"When the age is in . . .

Although the circumferences of the axons (fibers) of nerve cells do not change with age, the myelin (fatty) sheaths around the nerve fibers thicken, Thaddeus Samorajski, a neurochemist at Case Western Reserve University, Cleveland, has found. This thickening, he believes, might account for loss of electrical conductance through nerve fibers, and hence impairment of mental activity. Some nerve chemicals, such as norepinephrine and seratonin, decrease with age. Others, such as acetylcholinesterase, do not. What such changes might mean to the thinking process is not known, because researchers still are not sure which nerve chemicals, if any, are involved in thinking.

If researchers are far from explaining biologically how the mind can become less sharp with age, they seem to be closer to pinpointing the physiological and biochemical changes that underlie senility, that is, transient memory loss, especially of recent experiences, in many elderly people. At present, neuropathologists recognize the characteristics of senility to be plaque (aggregates of altered axons and dendrites of neurons), and amyloid (a type of protein that is apparently related to immune alterations) and abnormal mitochondria and lysozymes (immunologically active enzymes) in the plaque. Actually there are a number of healthy, elderly people who have plaque, but who are not senile, so it seems to be a quantitative thing. If a person has enough plaque, he or she experiences memory loss.

Robert D. Terry and Henryk Wisniewski of the Albert Einstein College of Medicine in New York City have discovered another important hallmark of senility. It is abnormal (twisted, narrowed) microtubules. Microtubules are protein chains that are normally present in the axons, dendrites and cell bodies of nerve cells. Microtubules help maintain the structure of nerve cells. Microtubules probably also help move nutrients from the body of a neuron down its axon to where the axon synapses (connects) with the axon of another neuron. Similar to plaque, twisted, narrow microtubules are found in small numbers in healthy, elderly people, yet

. . . the wit is out."



T. Samorajski/The Journal of Gerontology Robert Terry

Nerve sheaths thicken with age: (l) 8-month rat brain; (center) 26-month rat brain; (r) senile microtubules.

in large numbers in the brains of senile people. When plaque and narrowed, twisted microtubules are present in the brain in large enough quantities, they undoubtedly upset normal neuron synapses activities. "Anything that alters synapses," Terry asserts, "is going to change memory."

Why microtubules might become twisted and narrow with age, Terry is not sure. He says that while the amino acid sequence of healthy microtubules is known, he has not yet been able to isolate any of the twisted microtubules to study their chemical composition. He speculates that a latent gene might be activated in brain cells in older age and change the structure of microtubules. It is also possible, he says, that a slow virus might introduce a new gene in brain cells. This gene might make new proteins—that is, abnormal microtubules.

Terry and Wisniewski are trying to figure out how the various markers of senility—plaque; amyloid; abnormal mitochondria, lysozymes and microtubules—might interact to cause senility. "I would not want to say," Terry stresses, "that the microtubules cause the plaque. The plaque and microtubules might be caused by the same thing."

As far as aging in other parts of the body than the brain, some of the changes are obvious. Older people, especially women, shrink in height because of a loss of collagen (fibrous protein) between the vertebrae of the spinal column. But less obvious, Isadore Rossman of Montefiore Hospital Medical Center, New York City, reports, is that such shrinkage can begin at age 20 or 30. Also obvious is the loss of fat around the legs and forearms that comes with age. Less noticeable is the loss of muscle tone, even in men who continue to lift weights into their fifties.

Although most organs of the body lose weight with age, the heart increases somewhat. Yet the heart loses resilience in other ways. It has fewer and more uneven heartbeats. There is reduced blood flow through the coronary arteries. Raymond Harris of Albany (N.Y.) Medical College reports that heart attacks among young people are often due to fat clogging the blood vessels, whereas heart attacks among older people are often due to collagen thickening the valves of the heart and to calcium lining the blood vessels.

Most people expect their vision, and possibly their hearing, to decline with age. But taste, touch and smell are reduced too. While a 70-year-old is less sensitive to the taste of foods than a 20-year-old, he or she is also three times less sensitive to pain. Mortimer Shapiro, a clinical neurologist at the Mount Sinai School of Medicine, New York City, observes that since vision provides over 50 percent of a person's sensory input, diminishing vision may explain why older people tend to retain their more youthful views of things.

"Although none of us will die of old skin," Norman Orentreich of the New York University School of Medicine avows, skin changes that come with age disturb many people. As most tissues of the body age, they are replaced by collagen. But skin, which is mostly collagen, disappears with age. "Two millimeters of skin," the New York dermatologist claims, "can tell your age within five years."

While researchers are getting a better idea of some of the changes that come with age, they are also trying to delay or reverse some of these changes. On the hypothesis that senility might be associated with lack of oxygen at the tissue or cellular level, some investigators, such as Eleanor Jacobs of the Veterans Administration Hospital in Buffalo, N.Y., have treated senile patients with hyperbaric oxygen with some success (SN: 3/18/72, p. 188). Other investigators, however, have not gotten good results. On the hypothesis that aging might be linked with too much oxygen at the tissue or cellular level, Denham Harman of the University of Nebraska School of Medicine has given antioxidants, such as vitamin E, to experimental animals. The antioxidants extended the normal life span of rodents 30 percent. Orentreich says, however, that adding a tetracycline antibiotic to the diets of rats makes them live twice their normal life span. He says "there are many things that will outdo vitamin E 20 times. . . . There is more evidence for yogurt . . . than for vitamin E." Harman defends his study results, yet admits, "We don't know whether vitamin E has a good effect or not in humans. We hope to eventually come to some concrete suggestions. We are not at that stage yet."

Orentreich says he is getting good results in reversing skin aging. By giving aging skin silicon injections or by wounding it mildly, he can get it to lay down more collagen.

Until scientists get a better idea of what biological changes come with age, they will probably not be able to offer any better preventives against aging than the following: work, exercise, rest and "drug" yourself in moderation; think young, stay involved; eat a good, well-balanced diet; stay underweight rather than overweight. In other words, because organs and tissues in a person age at different rates, it's important to take care of the total body. "And those who start with these things early generally peter out late," says psychiatrist Alvin I. Goldfarb of New York City. □