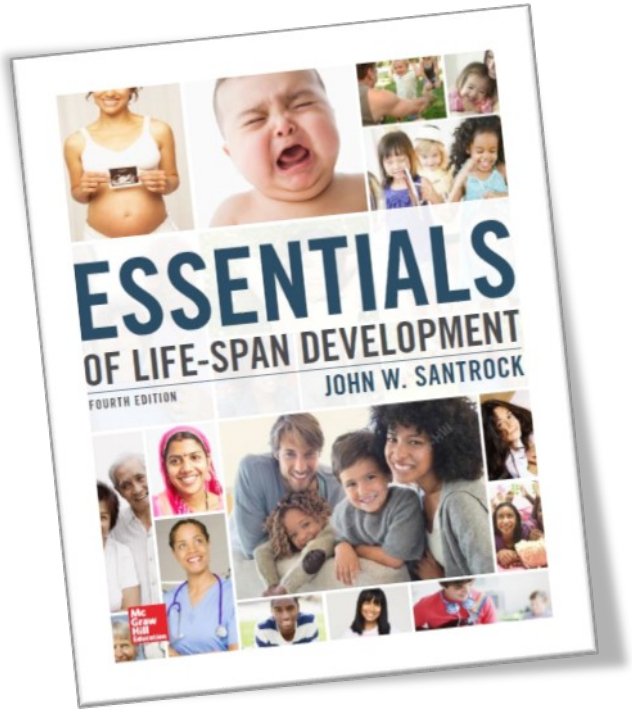


ESSENTIALS OF LIFE-SPAN DEVELOPMENT

4e

JOHN W. SANTROCK

PHYSICAL AND COGNITIVE DEVELOPMENT IN LATE ADULTHOOD

15

CHAPTER OUTLINE

- Longevity, biological aging, and physical development
- Health
- Cognitive functioning
- Work and retirement
- Mental health

LONGEVITY, BIOLOGICAL AGING, AND PHYSICAL DEVELOPMENT

- **Life span**: Maximum number of years an individual can live
  - Between 120–125 years
- **Life expectancy**: Number of years that the average person born in a particular year will probably live
  - Average in the U.S. = 78.7 years
- Differences in life expectancy across countries due to factors such as health conditions and medical care

LONGEVITY, BIOLOGICAL AGING, AND PHYSICAL DEVELOPMENT

- In 2011, the overall life expectancy for women was 81.1 years, and for men, it was 76.3 years
- Beginning in mid-30s, women start to outnumber men because of:
  - Social factors, such as health attitudes, habits, lifestyles, occupation
  - Biological factors – females outlive males in virtually all species

LONGEVITY, BIOLOGICAL AGING, AND PHYSICAL DEVELOPMENT

- Centenarians – living beyond 100 years
  - Despite physical limitations, most centenarians have low rate of age-associated diseases, good mental health
  - *Supercentenarians* – ages 110-119
- *Compression of morbidity* – staving off of high-mortality chronic diseases until much later ages
- Longevity genes and ability to cope with stress among factors associated with living beyond 100
  - Low rates of obesity, smoking, and only a small percentage had significant changes in thinking skills

LONGEVITY, BIOLOGICAL AGING, AND PHYSICAL DEVELOPMENT

- Biological theories of aging
  - **Evolutionary theory**: Natural selection has not eliminated many harmful conditions and nonadaptive characteristics in older adults
  - **Cellular clock theory**: Cells can divide a maximum of about 75 to 80 times
    - Age makes cells less capable of dividing
    - *Telomeres* – DNA sequences that cap chromosomes become shorter, drastically reduced after about 70-80 replications
      - Healthy centenarians have longer telomeres

LONGEVITY, BIOLOGICAL AGING, AND PHYSICAL DEVELOPMENT

- **Free-Radical Theory –** Aging occurs because normal cell metabolism produces unstable oxygen molecules (*free radicals*)
  - Free radicals damage DNA and other cellular structures – leads to disorders such as cancer and arthritis
- Related theory emphasizes decay of *mitochondria* due to oxidative damage and loss of critical micronutrients supplied by the cell
  - Leads to range of disorders, including cancer, arthritis, Alzheimer disease

LONGEVITY, BIOLOGICAL AGING, AND PHYSICAL DEVELOPMENT

- **Hormonal stress theory** – Aging of the body's hormonal system lowers resistance to stress and increases likelihood of disease
  - With age, hormones stimulated by stress remain at elevated levels for longer periods of time
  - Increases risk to disease – cardiovascular disease, cancer, diabetes, and hypertensions
  - Focus on stress-buffering strategies to attenuate negative effects of stress on the aging process
- Variation of hormonal stress theory focuses on immune system decline with age

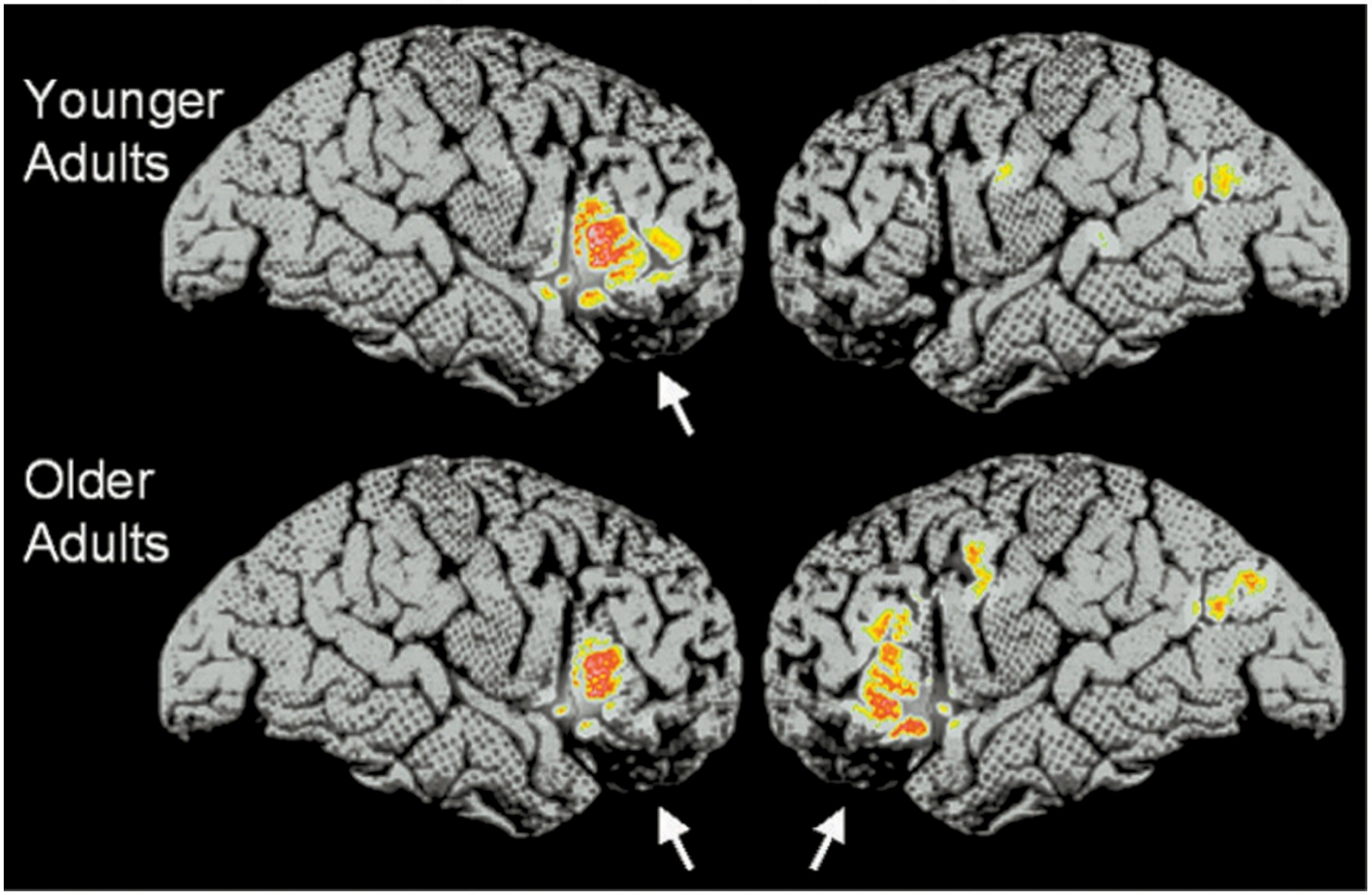
LONGEVITY, BIOLOGICAL AGING, AND PHYSICAL DEVELOPMENT

- Brain loses 5-10% of its weight between 20-90 years old
- Brain volume decreases due to:
  - Shrinkage of neurons
  - Lower numbers of synapses
  - Reduced length of axon
- Slowing of function in the brain and spinal cord begins in middle adulthood, accelerates in late adulthood
- Decline in neurotransmitter production
- Changes in myelination and neural networks

LONGEVITY, BIOLOGICAL AGING, AND PHYSICAL DEVELOPMENT

- *Neurogenesis*, generation of new neurons, can occur in human adults
  - May play role in neurogenerative diseses, such as Alzheimer disease, Parkinsons disease, and Huntington disease
- Dendritic growth may possibly occur in older adults
- Decrease in lateralization in aging adults
  - May play compensatory role to improve cognitive functioning

FIGURE 15.2 - DECREASE IN BRAIN LATERALIZATION IN OLDER ADULTS



Courtesy of Dr. Roberto Cabeza.

LONGEVITY, BIOLOGICAL AGING, AND PHYSICAL DEVELOPMENT

- The Nun Study
  - Ongoing investigation of aging in 678 nuns
  - Nuns lead intellectually challenging lives, may contribute to their quality of life and longevity
  - Participate in annual assessments of cognitive and physical functioning and agree to donate brains for research upon death
  - Examination of nuns' brains lead neuroscientists to believe in brain's remarkable capacity to change and grow, even in old age

LONGEVITY, BIOLOGICAL AGING, AND PHYSICAL DEVELOPMENT

- Physical appearance and movement
  - Most noticeable changes - Wrinkles and age spots
  - Shorter with aging due to bone loss in vertebrae
  - Weight drops after age 60
    - Muscle loss gives body a sagging appearance
  - Older adults move more slowly
  - Exercise and appropriate weight lifting help to reduce muscle mass decrease and improve body's appearance

LONGEVITY, BIOLOGICAL AGING, AND PHYSICAL DEVELOPMENT

- Vision
  - Vision declines becomes more pronounced in late adulthood:
    - Light-dark adaptation
    - Glare tolerance
    - Visual field diminishes
    - Events in peripheral vision may not be detected
    - Depth perception declines

LONGEVITY, BIOLOGICAL AGING, AND PHYSICAL DEVELOPMENT

- Diseases that impair vision of older adults:
  - **Cataracts -** Thickening of the lens of the eye
    - Vision becomes cloudy, opaque, and distorted
  - **Glaucoma** – Optic nerve damage due to pressure buildup of fluid in the eye
    - If left untreated, can destroy vision
  - **Macular degeneration -** Deterioration of the macula of the retina
    - Produces relatively normal peripheral vision, but inability to see center of visual field

FIGURE 15.3 - MACULAR DEGENERATION

© Cordelia Molloy/Science Source.

LONGEVITY, BIOLOGICAL AGING, AND PHYSICAL DEVELOPMENT

- Hearing
  - Differing degrees of decline in hearing - 63% of adults aged 70 or older had hearing loss
  - Hearing loss associated with reduced cognitive functioning
- Smell and taste
  - Most older adults lose some of their sense of smell or taste, or both, beginning around age 60
- Touch and pain
  - Decline in touch sensitivity - not problematic for most
  - Estimated 60-75% of older adults report at least some persistent pain
  - Older adults are less sensitive to pain, but may be less pain tolerant

LONGEVITY, BIOLOGICAL AGING, AND PHYSICAL DEVELOPMENT

- Circulatory system and lungs
  - Cardiovascular disorders increase in late adulthood
    - Resistant hypertension – cannot be controlled by at least 4 antihypertensive agents – is a growing concern in U.S.
  - Lung capacity drops 40% between the ages of 20 and 80, even without disease
    - Can be improved with diaphragm-strengthening exercises

LONGEVITY, BIOLOGICAL AGING, AND PHYSICAL DEVELOPMENT

- Sleep
  - Approximately 50% of older adults complain of difficulty sleeping
  - Sleep time and sleep efficiency declines in older adults
  - Poor sleep is a risk factor for falls, obesity, lower cognitive functioning, and earlier death
  - Many sleep problems are related to health problems

LONGEVITY, BIOLOGICAL AGING, AND PHYSICAL DEVELOPMENT

- Sexuality
  - Can be lifelong in the absence of disease or beliefs that older people should be asexual
  - Aging induces changes in sexual performance, more so in males than females
    - Orgasm becomes less frequent in males with age, more direct stimulation needed to produce an erection
  - Many are sexually active as long as they are healthy

HEALTH

- As we age, the probability of having some disease or illness also increases
  - Chronic diseases become more common in late adulthood
    - Arthritis is the most common followed by hypertension
- Causes of death in older adults
  - Nearly 60% of 65–74-year-olds die of cancer or cardiovascular disease
  - Cancer as leading cause of death in this age group
  - Cardiovascular disease is leading cause of death for adults aged 75-84 and 85+

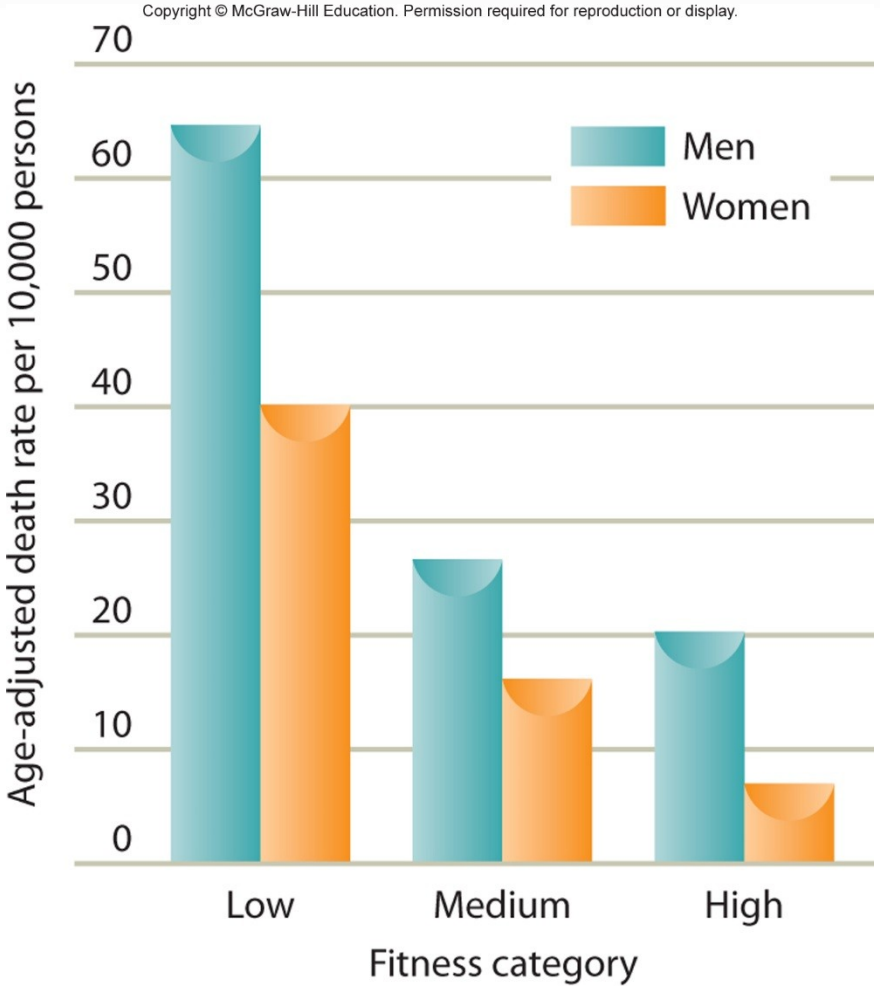
HEALTH

- **Arthritis**
  - Inflammation of the joints accompanied by pain, stiffness, and movement problems
- **Osteoporosis**
  - Extensive loss of bone tissue
- Accidents are the 6th leading cause of death among older adults
  - Falls as leading causes of injury deaths for adults 65 and older

HEALTH

- Exercise
  - Low cardiorespiratory fitness is a significant predictor of all-cause mortality
  - Strength training is recommended in addition to aerobic activity and stretching
    - Current recommendations include:
      - 2 hours and 30 minutes of moderate-intensity aerobic activity per week
      - Muscle strengthening activities 2 or more days per week
  - Exercise has positive effect on older adults' cognition
  - Linked with increased longevity

FIGURE 15.4 - PHYSICAL FITNESS AND MORTALITY



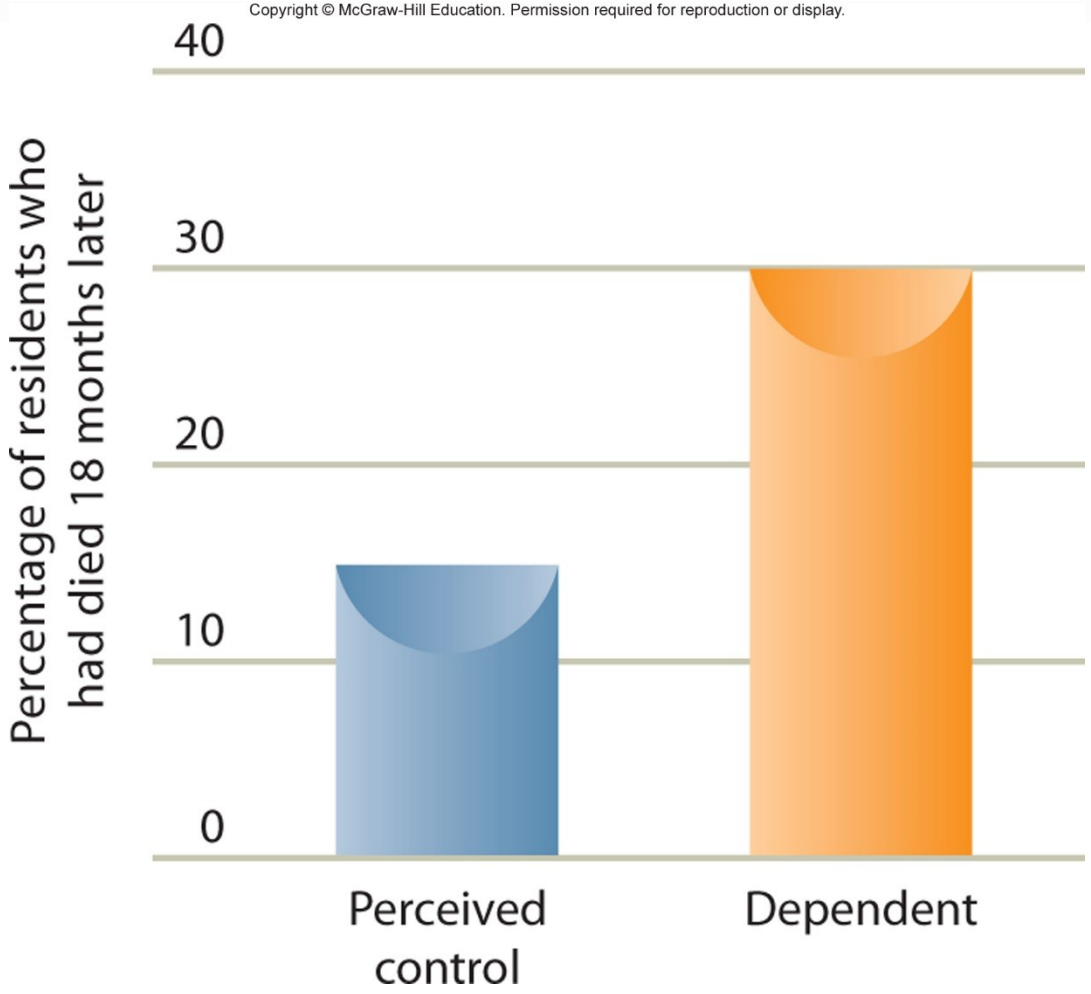
HEALTH

- Nutrition and Weight
  - Calorie restriction increases animals' life span, benefits unclear in lengthening human life span
  - Typircal calorie restriction levels about 30% decrease:
    - About 1120 calories per day for the average woman
    - About 1540 calories per day for the average male

HEALTH

- About 3% of adults 65 or older in U.S. live in a nursing home at some point in their lives
  - With age, likelihood of living in a nursing home or extended care facility increases
- Quality of nursing homes and other extended-care facilities for older adults varies enormously
  - Home health care, elder care centers, and preventive medicine clinics as alternatives
  - Feelings of control and self-determination linked to health and survival in nursing homes

FIGURE 15.5 - PERCEIVED CONTROL AND MORTALITY



COGNITIVE FUNCTIONING

- Attention
  - *Selective attention* – focusing on a specific aspect of experience while ignoring others that are irrelevant
    - Generally decreases in older adults
  - *Sustained attention* – ability to focus attention on a selected stimulus for a prolonged period of time
    - Older adults perform as well as middle-aged and younger adults

COGNITIVE FUNCTIONING

- Memory
  - **Explicit memory** – memory of facts and experiences that individuals consciously know and can state
  - **Implicit memory** – memory without conscious recollection
  - Implicit memory is less likely to be adversely affected by aging than explicit memory

COGNITIVE FUNCTIONING

- Episodic and semantic memory are forms of explicit memory
  - **Episodic memory** – Retention of information about the where and when of life's happenings
    - Younger adults have better episodic memory than older adults
  - **Semantic memory** - Person's knowledge about the world
    - Older adults often take longer to retrieve semantic information, but can ultimately retrieve it
    - Ability to retrieve very specific information, such as names, usually declines in older adults
  - Episodic memory declines more than semantic memory

COGNITIVE FUNCTIONING

- Declines in *working memory* - memory as a place for mental work - during late adulthood
- Perceptual speed – amount of time it takes to perform simple perceptual-motor tasks – shows considerable decline in late adulthood
  - Strong link between perceptual speed and working memory

COGNITIVE FUNCTIONING

- Executive functioning
  - Involves managing one's thoughts to engage in goal-directed behavior and self control:
    - General aspects of executive functioning decline in late adulthood
    - Considerable variability in executive functioning among older adults

COGNITIVE FUNCTIONING

- **Wisdom**: Expert knowledge about the practical aspects of life that permits excellent judgment about important matters
  - High levels of wisdom are rare
  - Factors other than age are critical for wisdom to develop to a high level
  - Personality-related factors are better predictors of wisdom than cognitive factors

COGNITIVE FUNCTIONING

- Education, work, and health are important influences on cognitive functioning of older adults
  - Important factors in cohort effects that need to be taken into account in studying older adults
- Successive generations of Americans in 20th century:
  - Were better educated
  - Had work experiences that included stronger emphasis on cognitively-oriented labor
  - Have been healthier in late adulthood
    - Better treatments for a variety of illnesses

COGNITIVE FUNCTIONING

- Use it or lose it
  - Certain mental activities can benefit the maintenance of cognitive skills
    - Reading books, doing crossword puzzles, going to lectures and concerts
  - Research suggests that mental exercise may reduce cognitive decline
- Training cognitive skills
  - Improves the cognitive skills of many older adults
  - Some loss in plasticity in late adulthood, especially in the oldest-old
  - Cognitive vitality of older adults can be improved through cognitive and physical fitness training

COGNITIVE FUNCTIONING

- Cognitive neuroscience and aging
  - *Cognitive neuroscience* - Discipline that studies links between the brain and cognitive functioning
  - Relies on brain imaging techniques, such as fMRI, PET, and DTI (diffusion tensor imaging) to reveal brain areas activated when individuals engage in certain cognitive activities
  - Changes in the brain can influence cognitive functioning, and changes in cognitive functioning can influence the brain

WORK AND RETIREMENT

- Work
  - After 1995, adults aged 65+ engaging in full-time work rose substantially
    - Also increases in part-time work after retirement
    - Reflected in nation's economy, may not have adequate money reserves to fund retirement
  - Increasing number of middle-aged and older adults are embarking on 2nd or 3rd careers
    - Opportunities for productive activity, social interaction, and positive identity
  - Older workers have lower rates of absenteeism, fewer accidents, and higher job satisfaction than their younger counterparts
    - Older adults who continue to work have better physical profiles than those who retire

WORK AND RETIREMENT

- Retirement in the U.S.
  - When people reach their 60s, the life path they follow is less clear
    - Some individuals don't retire, continuing in their career jobs
    - Some retire from their career work and then take up a new and different job
    - Some retire from career jobs but do volunteer work
    - Some retire from a post-retirement job and go on to yet another job
    - Some move in and out of the workforce, so they never really have a "career" job from which they retire
    - Some individuals who are in poor health move to a disability status and eventually into retirement
    - Some who are laid off define it as "retirement"

WORK AND RETIREMENT

- Older adults who adjust best to retirement are:
  - Are healthy
  - Have adequate income
  - Are active
  - Are educated
  - Have an extended social network including both friends and family
  - Usually were satisfied with their lives before they retired

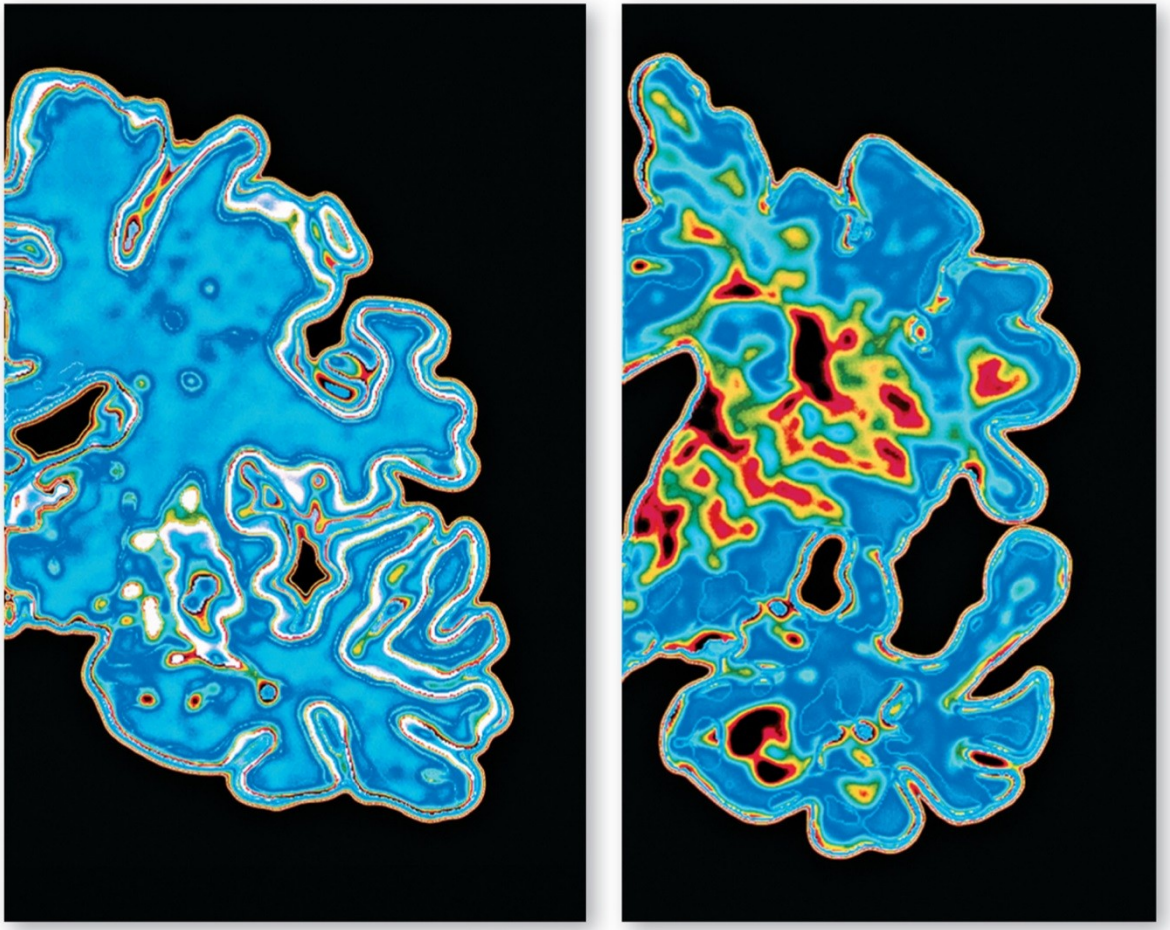
MENTAL HEALTH

- Psychological disorders among older adults are point of concern
  - Older adults do not have a higher incidence of psychological disorders than younger adults
- **Dementia –** Global term for neurological disorders in which primary symptoms involve deterioration of mental functioning
  - Often lose the ability to care for themselves and may become unable to recognize familiar people or surroundings
  - 23% of women and 17% of men 85 years or older are at risk for developing dementia

MENTAL HEALTH

- **Alzheimer Disease –** Progressive, irreversible brain disorder characterized by deterioration of memory, reasoning, language, and eventually, physical functioning
  - Estimated 5.4 million adults in the U.S have Alzheimer disease
  - Women are more likely to develop Alzheimer disease because of longer life expectancy
  - Involves a deficiency in the brain messenger chemical *acetylcholine*
  - Formation of *amyloid plaques* (dense deposits of protein that accumulate in blood vessels) and *neurofibrillary tangles* (twisted fibers that build up in neurons)

FIGURE 15.8 - TWO BRAINS: NORMAL AGING AND ALZHEIMER DISEASE



© Alfred Pasieka/Science Source.

MENTAL HEALTH

- *Mild Cognitive Impairment (MCI)*
  - Represents a transitional state between the cognitive changes of normal aging and very early disease
  - fMRI shows smaller brain regions involved in memory for individuals with MCI

MENTAL HEALTH

- Drug treatment of Alzheimer disease
  - Cholinerase inhibitors and other drugs slow the downward progression of the disease
- Caring for individuals with Alzheimer disease
  - Support is often emotionally and physically draining for the family
  - Respite care services

MENTAL HEALTH

- **Parkinson disease**
  - Chronic, progressive disease characterized by muscle tremors, slowing of movement, and facial paralysis
  - Triggered by the degeneration of dopamine-producing neurons in the brain
  - Several treatments are available – drug treatments and deep brain stimulation (DBS)
    - Difficult to determine correct dosage, loses efficacy over time
    - DBS involves implantation of electrodes within brain
    - Stem cell transplantation and gene therapy are being explored as treatment options