

# SOLUTIONS MANUAL



## ADULT DEVELOPMENT AND AGING

First Canadian Edition



John C.  
CAVANAUGH  
Fredda  
BLANCHARD-FIELDS  
Joan E.  
NORRIS



# SOLUTIONS MANUAL



## ADULT DEVELOPMENT AND AGING

First Canadian Edition



John C.  
CAVANAUGH  
Fredda  
BLANCHARD-FIELDS  
Joan E.  
NORRIS



## CHAPTER 2: PHYSICAL CHANGES

### Chapter Outline

The chapter describes the major physical changes that occur during adulthood. Many of these changes begin in your 20s and continue into late adulthood. Some of these changes are normative age-related changes while others are nonnormative. A major point of this chapter is that physical health is not just a matter of biological influences. To truly understand health and aging, consideration of the other developmental forces (psychological, sociocultural, and life-cycle) and their interaction with biological forces is necessary.

#### 1) WHY DO WE AGE? BIOLOGICAL THEORIES OF AGING

- a) **Rate-of-Living Theories:** assume that people are born with a limited amount of energy to be expended in a lifetime
  - i) **Metabolic rates:** slower metabolic rates in animals is correlated with longer life spans
  - ii) **Caloric intake:** decreased caloric intake is associated with lower risk of premature death, slower normative age-related changes, and longer life spans
  - iii) **Adaptation to stress:** the body's ability to deal with stress decreases with age
- b) **Cellular Theories:** point to causes of aging at the cellular level
  - i) **Hayflick limit:** suggests that there might be limits on how often cells divide before dying
    - (1) **Teleomeres:** the tips of chromosomes become shorter with each replication and eventually become unable to replicate
    - (2) **Cross-linking:** results from proteins interacting and randomly producing molecules that make the body more stiff
    - (3) **Free-radicals:** highly reactive chemicals produced randomly during normal cellular metabolism resulting in cellular damage
- c) **Programmed Cell Death Theories**
  - i) The innate ability of cells to self-destruct, and the ability of dying cells to trigger processes in other cells, is thought to be due to a genetic program that is triggered by physiological processes
- d) **Implications of the Developmental Forces**
  - i) Biological theories provide ways to describe biological forces
  - ii) We cannot truly understand health and aging without considering the other developmental forces (psychological, sociocultural, and life-cycle)

#### 2) APPEARANCE AND MOBILITY

- a) **Changes in Skin, Hair, and Voice**
  - i) **Changes in the Skin**
    - (1) **Wrinkles:** are the result of a complex, four step process
      - (a) First, the outer layer of skin becomes thinner and more fragile
      - (b) Second, collagen fibers lose their flexibility, making the skin less able to regain its shape after being stretched or pinched
      - (c) Third, elastin fibers lose their ability to keep the skin stretched out
      - (d) Fourth, the underlying layer of fat which makes the skin look smooth diminishes
    - (2) How quickly your face ages is largely under your control

- ii) **Changes in the Hair:**
    - (1) **Thinning and greying hair:** results from the cessation of pigmentation
    - (2) **Hair loss:** caused by the destruction of the germ centers that produce hair follicles
  - iii) **Changes in the Voice:** older adults voices tend to be thinner and weaker
  - b) **Changes in Body Build**
    - i) Decreases in height result from the compression of the spine, changes in the discs between vertebrae, and changes in the spine
    - ii) Weight gain is an additional change in body build in midlife (between 20s and mid-50s) followed by weight loss in late life
  - c) **Changes in Mobility**
    - i) **Muscles:** amount of muscle decreases with age, but strength and endurance only change slightly
    - ii) **Bones:** Loss of some bone mass is normative and begins in the late 30s, with an acceleration in the 50s
      - (1) Women lose bone mass twice as fast as men, and this puts them at an increased risk for osteoporosis
        - (a) **Osteoporosis:** a bone degeneration disease in which bones become brittle and honeycombed
    - iii) **Joints:** beginning in the 20s, cartilage in joints shows signs of deterioration which leads to aching joints
      - (1) **Osteoarthritis:** results from degeneration of cartilage
        - (a) It is marked by the gradual onset and progression of pain with only minor signs of inflammation
        - (b) This is a wear-and-tear disease
      - (2) **Rheumatoid arthritis:** a more destructive disease of the joints
        - (a) It affects different joints and includes aching along with swollen joints
  - d) **Psychological Implications**
    - i) Many appearance changes cause women and men to use aids to compensate for changes
    - ii) Mobility changes make people feel as if they are not able to adapt and function in the environment
    - iii) These changes may cause older adults to withdraw from society and activities which would keep them healthier (e.g., exercise)
- 3) **SENSORY SYSTEMS**
- a) **Vision**
    - i) **Structural Changes in the Eye**
      - (1) There is a decrease in the amount of light that passes through the eye, so increased illumination is often required
      - (2) With increasing age, the ability to adjust to changes in illumination takes longer and leads to slower light and dark adaptation
      - (3) The lens of the eye becomes more yellow with age causing poorer color discrimination in the green-blue-violet spectrum
      - (4) **Presbyopia:** because of stiffening, the lens has a harder time adjusting and focusing, making it difficult to see nearby objects
      - (5) Disease can cause abnormal structural changes in the eye
        - (a) **Cataracts:** opaque spots on the lens that limit the amount of light transmitted

- (b) **Glaucoma:** is the build up of pressure on the eye due to fluid not draining correctly and can lead to vision loss
- ii) **Retinal Changes**
  - (1) The retina lines the inner two thirds of the eye with specialized receptor cells known as rods and cones
  - (2) The most densely packed area of rods and cones in the retina are at the focal point region known as the macula
    - (i) With increasing age, the likelihood of macular degeneration increases and results in the inability to see details
  - (3) Diabetic retinopathy is a by-product of diabetes, which can lead to blindness
    - (a) This involves fluid retention in the macula, detachment of the retina, hemorrhage, and aneurysms
  - (4) As a result, there is a decrease in acuity, or the ability to see detail and discriminate different visual patterns
- iii) **Psychological Effects of Visual Changes**
  - (1) The psychological effects can be seen in many areas most young people take for granted such as reading, watching television, and driving a car
    - (a) These changes may cause older adults to withdraw from society and activities which they previously enjoyed
- b) **Hearing**
  - i) Hearing loss is one of the most well-known normative changes with age
  - ii) **Presbycusis:** reduced ability to hear high-pitched tones
    - (1) Results from four types of changes in the inner ear
      - (a) Sensory changes due to atrophy and degeneration of receptor cells
      - (b) Neural changes due to loss of neurons in the auditory pathways in the brain
      - (c) Metabolic changes due to diminished supply of nutrient to the receptor area
      - (d) Mechanical changes due to atrophy and stiffening of the vibrating structure in the receptor area
- c) **Somesthesia and Balance**
  - i) **Somesthesia:** systems that convey information about touch, pressure, temperature, pain, movement, and body position
    - (1) With age it takes more pressure to feel touch on smooth, nonhairy skin such as the fingertips
    - (2) Older adults report having more trouble regulating body temperature to comfortable levels, however research is inconsistent on the cause of this
    - (3) Some degree of age-related change in pain sensitivity has been identified, with older adults reporting more, but research is inconclusive about the causes
    - (4) Kinesthesia, or your sense of body position, involves sensory feedback from passive and active movements
      - (a) Differences have been found for passive movements, or those initiated by something or someone else, but not for active or voluntary movements
  - ii) **Balance**
    - (1) The vestibular system is responsible for maintaining our balance and initiating movements
    - (2) Dizziness and vertigo are common in older adults and increase with age
      - (a) Dizziness is the feeling of being unsteady, floating, and lightheaded

- (b) Vertigo is the feeling that one or one's surroundings are spinning
- (3) Because of these changes, falls become more likely and life-threatening with increasing age
  - (a) One way to improve balance is through Tai Chi training, which increases body position awareness (see "How Do We Know?")

d) **Taste and Smell**

i) **Taste**

- (1) The ability to taste declines gradually and varies greatly taste to taste and from individual to individual

ii) **Smell**

- (1) The ability to detect odors begins to decline after the age 60 in most people, but there are wide variations
  - (a) Interestingly, there are abnormal changes in Alzheimer's patients' smell ability
- (2) The psychological impact of changes in taste and smell are easy to see
  - (a) With reduced pleasure in eating due to these changes, diets suffer
  - (b) Also, decreases in the ability to smell can lead to dangerous situations

4) **VITAL FUNCTIONS**

a) **Cardiovascular System**

- i) As part of aging, some fat accumulates in and around the heart as well as the stiffening of the heart muscle
  - (1) As a result, the amount of blood pumped declines from 5 liters per a minute at 20 years of age to 3.5 liters at 70 years of age
  - (2) The stiffening of arterial walls is caused by calcification of the arterial walls and less elastic fibers
  - (3) By the age of 65 most adults experience a 60 to 70% decline in aerobic capacity

ii) **Cardiovascular Disease**

- (1) 80% of Canadians have at least one risk factor for cardiovascular disease.
- (2) Deaths from cardiovascular disease have been declining, especially among men.
- (3) **Types of cardiovascular disease**
  - (a) **Congestive heart failure:** occurs when the ability of the heart to contract severely declines along with cardiac output
  - (b) **Angina pectoris:** chest pain that occurs when the supply of oxygen to the heart becomes insufficient
  - (c) **Myocardial infarctions:** heart attacks occur when blood supply to the heart is severely reduced or cut off
  - (d) **Atherosclerosis:** age-related disease caused by the buildup of fat deposits on and the calcification of arterial walls
  - (e) **Cerebrovascular accident (CVA):** strokes result when blood flow to a portion of the brain is completely cut off
    - (i) CVAs are the fourth leading cause of death in Canada, especially among older women.
    - (ii) **Tissue plasminogen activator (TPA):** treatment for CVAs which dissolves blood clots, the cause of 80% of CVAs
  - (f) **Hypertension:** results when blood pressure increases to severe levels

- (i) Defined as 140 mm Hg or greater systolic (heart rate during contraction phase) pressure or 90 mm Hg or greater diastolic (heart rate during relaxation phase) pressure
  - 1. Normal blood pressure is 120/80 mm Hg
- (ii) Older adults with hypertension have three times the risk of dying from cardiovascular disease, and it impairs cognitive abilities
- (g) **Hypotension**: low blood pressure with symptoms such as dizziness and lightheadedness

## b) **Respiratory System**

- i) With increasing age
  - (1) The rib cage and air passageways become stiffer and make it harder to breathe
  - (2) The appearance of the lungs changes from pink to gray due to breathing carbon particles from air pollution
  - (3) There are decreases in the maximum amount of air we can breathe into the lungs occur, which begins in the 20s and by age 85 has decreased 40%
  - (4) There is a lowered ability to exchange oxygen and carbon dioxide results, which from the destruction of membranes of the air sacs in the lungs
- ii) **Respiratory Diseases**
  - (1) **Chronic obstructive pulmonary disease (COPD)**: a family of diseases which includes chronic bronchitis and emphysema
    - (a) **Emphysema**: most serious type of COPD which results from the destruction of membranes around the air sacs in the lungs
      - (i) Most cases result from smoking (82%)
    - (b) Chronic bronchitis is more prevalent in people over the age of 45, especially those exposed to high levels of dust and pollution

## 2) **THE REPRODUCTIVE SYSTEM**

### a) **Female reproductive system**

- i) **Climacteric**: the transition from being able to have children to being unable to bear children
  - (1) **Perimenopause**: time of transition that usually begins in the 40s, as menstrual cycles become irregular, and is complete by the mid 50s
    - (a) This is accompanied by the end of menstruation, a reduction in estrogen and progesterone, changes in reproductive organs, and changes in sexual functioning
  - (2) **Menopause**: refers to the point at which ovaries stop releasing eggs
  - (3) A variety of physical and psychological symptoms may occur during perimenopause and menopause
    - (a) These most frequently include hot flashes, night sweats, headaches, and mood changes
    - (b) There are ethnic and cultural differences in number and type of reported symptoms
  - (4) Hormone replacement therapy has resulted in much contradictory data (see “Current Controversies”)
- ii) Physiological changes in women’s sexual performance include increased possibility of painful intercourse due to
  - (a) Smaller and thinner vaginal walls

- (b) Smaller vagina
- (c) Reduced and delayed vaginal lubrication

**b) Male Reproductive System**

- i) With increasing age
  - (1) Men show a gradual decline in testosterone levels beginning the mid 20s
  - (2) Sperm production declines gradually with age for men
    - (a) However even at the age of 80 men are still half as fertile as they were at 25
  - (3) The prostate gland enlarges, becomes stiffer, and may interfere with urination
    - (a) Annual screenings are important for men over 50 years of age
- ii) Physiological changes in men's sexual performance include
  - (1) longer time and the need of more stimulation to achieve an erection and orgasm
  - (2) a failure to achieve an orgasm
  - (3) a much longer resolution time
  - (4) the loss of erection during intercourse

**c) Psychological Implications**

- i) The social constraints placed on older adults reduce the opportunity to engage in these relationships

**3) THE NERVOUS SYSTEM**

**a) Central Nervous System**

- i) **Neurons:** individual brain cells (Figure 2-6 provides a good schematic of a neuron)
  - (1) **Dendrites:** where neurons receive chemical information from other neurons
  - (2) **Cell body:** where the signal is brought in and converted into an electrochemical signal
  - (3) **Axon:** the tail of the neuron where the now electrochemical signal is sent
  - (4) **Terminal branches:** where the signal converted back into a chemical message to be transmitted to other neurons
  - (5) **Neurotransmitter:** chemicals that carry the information signal to the next neuron
  - (6) **Synapse:** occurs when the chemicals are sent out into the gap between neurons to be picked up by a neighboring neuron's dendrites
  - (7) We are born with about 1 trillion neurons; all the neurons we will ever have

**ii) Structural Changes in Neurons**

- (1) **Neurofibrillary tangles:** occurs when fibers in the axon become twisted to form spiral filaments
  - (a) Although there are losses there are also gains in dendrites
  - (b) **Plasticity:** capability of the brain to adapt and change its functional and structural organization
- (2) **Neuritic plaques:** occurs when dying neurons collect around a core of protein
- (3) The above changes are normal, but in high numbers are associated with Alzheimer's disease

**iii) Changes in Communication between Neurons**

- (1) **Dopamine:** controls motor movement, levels decrease with age
  - (a) **Parkinson's disease:** characterized by tremors of the hands, arms, and legs due to extreme declines in dopamine
  - (b) Treatments include L-dopa, which can be converted to dopamine, and COMT which block the breakdown of L-dopa before reaching the brain
  - (c) Surgical treatments are available and embryonic stem cells hold promise



- (2) **Acetylcholine:** declines are linked with memory problems in old age
  - (a) Research has speculated that abnormally low levels of acetylcholine are related to Alzheimer's disease and Huntington's disease
- iv) **Studying Brain-Behavior Relations: Imaging Techniques**
  - (1) Three types of brain imaging techniques are frequently used (see Table 2.2 for complete descriptions):
    - (a) **Computed tomography (CT)**
    - (b) **Magnetic resonance imaging (MRI)**
    - (c) **Positron emission tomography (PET)**
- b) **Autonomic Nervous System**
  - i) **Regulating Body Temperature**
    - (1) Older adults
      - (a) Have a decreased ability to tell that their core body temperature is low resulting in them being less able to tell that they are cold
      - (b) Have a vasoconstrictor response, the ability to raise one's core body temperature, when the body's peripheral temperature drops
      - (c) Do not sweat as much and are less likely to drink water to cool themselves
    - (2) All of this puts older adults at increased risk for hypothermia (body temperature below 95 degrees) and hyperthermia (body temperature above 98.6 degrees)
  - ii) **Sleep and Aging**
    - (1) Older adults
      - (a) Take longer to fall asleep
      - (b) Are awake more at night
      - (c) Are more easily awakened
      - (d) Experience major shifts in their circadian rhythms
        - (i) There is a move from a two-phase rhythm (awake during the day and asleep during the night) to a multiphase rhythm (daytime napping and shorter sleep cycles at night)
    - (2) Other major causes of sleep disturbances include
      - (a) Sleep apnea
      - (b) Leg jerks
      - (c) Heartburn
      - (d) Frequent need to urinate
      - (e) Poor physical health
      - (f) Depression
- c) **Psychological Implications**
  - i) Fear revolves around potential dementia or the loss of memory, emotional response, and bodily functions (described in detail in Chapter 4)
    - (1) This is further perpetuated by the use of the term senile which no longer has any medical or psychological meaning

#### 4) PUTTING IT ALL TOGETHER

### Going Beyond the Book and Lecture Suggestions

1. Focus on the most visible signs of aging. This is a section that will easily generate student interest. Combine the physiology (e.g., how wrinkles form) with the psychosocial factors of personal and societal reactions. Bring in lifestyle factors (e.g., sun bathing, working out) as well.
2. Lecturing on each sensory system and how it changes is monotonous for students because the text covers this section clearly and concisely. Instead of lecturing on this topic, have the students conduct a sensory simulation (see “Suggested Activities and Assignments” for details) and use their experiences to illustrate some of these changes.
3. Osteoporosis is something that students are interested in, and they are bombarded with advertisements for related products. Describe the risk factors, how to prevent it, and how to minimize the effects of osteoporosis.
4. Death rates from cardiovascular disease have been dropping since the early 1980s. Target the reasons for this decline in lecture (e.g., diet and exercise). This is also a good place to discuss gender differences in cardiovascular disease.
5. An opportunity for social consciousness raising exists when discussing respiratory changes. Bring in statistics about local air quality and discuss the consequences in view of the text.
6. If the students in the course are primarily from health-related majors, or have a strong interest in physiology, you could emphasize additional body and organ systems. Some that could be covered are the endocrine system, the gastrointestinal system, and the immune system (as a preview for Chapter 3).
7. Expand upon the text discussion of menopause by discussing topics such as the psychological consequences of being in menopause.
8. Hormone replacement therapy has been the focus of much research and debate. Describe the different options as well as the risks and benefits of each.
9. Students definitely do not want to think about sexuality in older adults. Present statistics demonstrating that many older adults do engage in sexual activity and the reasons why some do not engage in sexual activity. Discuss why older adults do not have sex and the possible solutions.
10. Students are generally interested in brain imaging. If possible, bring in examples of CT, MRI, and PET scans. The Whole Brain Atlas is a very good site that contains this type of information ([www.med.harvard.edu/AANLIB/home.html](http://www.med.harvard.edu/AANLIB/home.html)).

### Discussion Questions

1. What is the difference between normal and abnormal aging?
2. Given your newly acquired knowledge of physical development and aging, how have your perceptions of “you as an older adult” changed?
3. How can we change society's attitude toward looking old? What evidence can you find from popular cosmetics products and health aids to support the notion that people are concerned about looking old?
4. How might our knowledge of sensory changes in the elderly allow us to build more effective housing, communication, and transportation devices for this population?
5. Why is menopause given so much negative attention by the media? How might this attention alter the way women experience the menopause?

### Suggested Activities and Assignments

1. Students can examine first hand normal and pathological neurological aging by using the World Wide Web. Some sites that provide descriptions and graphics of abnormal neurological changes include Alzheimer's Society of Canada (<http://www.alzheimer.ca/english/index.php>) site. Have students simulate sensory loss. Although this isn't what it would really be like, it gives them an idea of the changes and the degree they impair daily functioning. The Secure Project: Older Adult Sensitivity Program (<http://www.leememorial.org/shareclub/secure.asp>) is an excellent tool for this. With this program students simulate visual changes (including, yellowing of the lens, macular degeneration, and presbyopia), hearing changes, and mobility changes (in particular arthritis) while completing everyday tasks (such as reading the newspaper, selecting medications, threading a needle, listening to a conversation, etc.). Helpful tips and suggestions are also given.
2. Given what you now know about normative changes in appearance, what would you say about the stereotypes of aging you identified in the Discovering Development exercise you did in Chapter 1?
3. Investigate the cross-cultural incidence rates of osteoporosis. How do these compare with Canada? Why?
4. Have students visit arthritis sites on the web to gather additional information about both rheumatoid and osteoarthritis. Students should also look at sites that provide arthritis "cures." A very good site that students can begin with is the Canadian Arthritis Society (<http://www.arthritis.ca/custom%20home/default.asp?s=1>). Here they can find the latest information about the disease, diagnosis, and treatment.
5. Cardiovascular disease is the major killer in industrial nations. Examine the risk factors for these diseases and design an intervention program to minimize risks.
6. Investigate the cross-cultural incidence rates of cardiovascular disease. How do these compare with Canada? Why?
7. Have students design a brief environmental intervention to prevent respiratory diseases?
8. As a prelude to later chapters and to make changes at the cellular level more concrete, interview middle-aged and older adults to see if they notice changes in their memory. Have the adults describe the psychological consequences of noticing that their memory is not as good as it used to be.
9. This chapter points out many physical changes encountered by older adults. Think about some of the products that you use in everyday life. Are these designed for younger adults or older adults? What modifications could you make to this product to be more appropriate for older adults?

### Suggested Websites

Canadian Heart and Stroke Foundation. This site contains a vast amount of information on cardiovascular disease, including risk assessments. Also available at this site are diet recommendations and prevention ideas.

The federal government's "Seniors On-Line" site (<http://seniors.gc.ca/home.jsp?lang=en>) provides information on a variety of aspects of aging. Among this information are brochures and reports that may be helpful in conveying information to students.

The Canadian Arthritis Society (<http://www.arthritis.ca>) provides the most up-to-date information on arthritis. You can use this site to supplement information in the textbook. There is information on the causes and effects of arthritis through out the life span.

### **Additional Suggested Readings (Available Through InfoTrac)**

Have your students read the following articles, and use the questions listed for each article either to stimulate in-class discussion or on an exam.

Dorval, M., Vallée, M., Plante, M., Chiquette, J., Gaudet, M., & Simard, J. (2007). Effect of the Women's Health Initiative study publication on hormone replacement therapy use among women who have undergone BRCA1/2 testing. *Cancer epidemiology, biomarkers & prevention : a publication of the American Association for Cancer Research*, 16, 157-60.

Since the July 2002 release of findings from the Women's Health Initiative (WHI) study, women have worried more about the effect of hormone replacement therapy (HRT) on the development of breast cancer and heart disease. Consequently, the use of HRT has decreased substantially in the general population. This Canadian study was designed to compare HRT use before and after the release of these findings among women who had a genetic mutation which put them at risk for breast cancer.

- What is the relationship between HRT and serious medical conditions?
- The age of the participants in the Women's Health Initiative study was significantly older than most women who take HRT. How might studying varying-aged women impact the results?
- Women who were not carriers of the genetic mutation also reduced their use of HRT. Why do you think this was?

Cain, V. S., Johannes, C. B., Avis, N. E., Mohr, B, Shocken, M., Skurnick, J., & Ory, M. (2003). Sexual functioning and practices in a multi-ethnic study of midlife women: Baseline results from SWAN. *The Journal of Sex Research*, 40, 266–276. A109907232

This study examined the sexual practices and function of middle-aged women. Importantly women of different ethnicities and in different menopausal stages were investigated. This article can also be used to illustrate research design topics discussed in Chapter 1.

- Discuss the importance of inclusion of women from a variety of ethnic backgrounds.
- Discuss the reasons for and not for engaging in sex outlined in this study of middle-aged women.
- Is menopausal status related to sexual functioning?
- How do the findings of this study differ from your own beliefs about sex in middle-adulthood? Do these results vary by ethnic group membership?
- From a research design perspective, what are the strengths and limitations of this study?

Gallagher, B. (2003). Tai Chi Chuan and Qigong: Physical and mental practice for functional mobility. *Topics in Geriatric Rehabilitation*, 19, 172. A107490137

This article can be used to stimulate discussion regarding changes in physical health of elderly adults and the role of Tai Chi of improving mobility.

- Describe the psychological consequences of mobility losses and frailty outlined in the article.
- Describe the findings that show Tai Chi's ability to reduce falls in the elderly.
- How does Tai Chi impact health in other areas beyond balance and strength?
- Create a brochure to advertise the benefits of Tai Chi based on the research discussed in this article. What would you include and why?

Pierce, J. D., Cackler, A. B., & Arnett, M. G. (2004). Why should you care about free radicals? *RN*, 67, 38–42. A112862262

This article, written to inform healthcare professionals, discusses the impact and the effects of free radicals on the aging process. This article also includes a quiz at the end that can be used to check comprehension.

- What are free radicals and how do they form?
- What diseases have free radicals been linked to?
- Discuss situations that can increase the negative impact of free radicals.
- How do antioxidants work to reduce free radical damage?
- What are some common antioxidants?