chapter 1

Introduction

Where this icon appears, visit http://go.jblearning.com/ManascoCWS to view the corresponding video.

Neurogenic Communication Disorders

A neurogenic communication disorder is a problem with communication that arises as a result of damage to the brain or other part of the nervous system. Neurogenic communication disorders discussed in this text include the aphasias, the dysarthrias, apraxia of speech, right hemisphere disorders, dementia, as well as the myriad of deficits that can accompany these disorders and negatively affect communication in disease and trauma.

Neurogenic communication disorder A disorder of communication arising from damage to the nervous system.

The Treatment Environment

Speech-language pathologists see and treat the disorders, diseases, and deficits discussed in this book in a variety of settings. Some of these settings are as follows:

Skilled nursing facility. Also known as nursing homes or long-term care facilities, skilled nursing facilities offer 24-hour care for their residents.

Acute care facility. Acute care is the usually short but intensive medical care provided for severe injury or illness. The acute care facility (hospital) often has centers with professional teams that specialize in specific dangerous and severe health scenarios, such as the intensive care unit (ICU), cardiac care unit (CCU), and neonatal intensive care unit (NICU).

Rehabilitation facility. Patients well enough not to require intensive acute medical attention can go to a rehabilitation facility, which provides hospital-level care for the medically stable individual while focusing on providing services such as speech-language therapy, physical therapy, and occupational therapy.

Outpatient rehabilitation facility. When a patient is well enough to return home from the primary rehabilitation facility he or she might still need a great deal of therapy services. These services are often available on an outpatient basis, meaning

that the individual lives at home but returns to the rehabilitation center to take part in therapy sessions.

- *Home health care.* Often once a person leaves inpatient or outpatient rehabilitation, or when the individual's insurance does not pay for those services, the person can receive speech therapy at home.
- *Hospice care.* Hospice care is palliative care meant to manage a person's symptoms and keep the person as comfortable as possible when restoration of health is not possible. The role of the speech-language pathologist in hospice care involves ensuring that the hospice patient has a functional method of communication and swallows as safely as possible.
- *Children's hospital.* Although most of the deficits discussed in this book concern adults, many can occur, sometimes very often (such as traumatic brain injury), in the pediatric population.
- *Schools.* Children who do experience neurogenic communication disorders may never leave school and, if they do so, usually return to school to receive ongoing treatment for speech, language, and cognitive disorders from a speech-language pathologist.

Although these settings are major arenas in which speech-language pathologists treat neurogenic communication disorders, note that many other treatment settings combine characteristics of the settings mentioned. For example, neurogenic communication disorders might be treated in a long-term acute care floor in a hospital. Whereas long-term care facilities serve patients who are medically stable, the more fragile patient might require extended care in an acute facility. See the video *Rasmussen's Encephalitis, Seizures, and Hemispherectomy* for a patient description of moving through various types of facilities in recovery from brain surgery

Speech-language pathologists usually see the disorders, diseases, and communication disorders discussed in this book in clinical settings such as medical facilities, not in schools. As a result, I often hear this question from students, "If I plan on working in schools and never working with adults, why do I need to know all this about stroke, disease, and the brain?" I am always pleased to hear this question because it gives me an opportunity to present a cautionary tale, of which there are many (see the following Author's Note).

Author's Note

Horses and Zebras

In the medical culture it is popular to say, "When you hear hoof beats, think horses, not zebras." The meaning of this charming maxim is that the most obvious diagnosis and simplest explanation for a set of symptoms are probably correct. Simply put, the horses are those patients whose symptoms are the result of the most obvious and likely diagnosis, whereas the zebras are those patients whose symptoms are the result of an unlikely and generally unexpected diagnosis.

Hence, if you are a speech-language pathologist working in the schools and a child walks into your office with a speech or language impairment, the odds are that the child is a horse and the problem is a basic developmental articulation or language disorder. Similarly, if you are a pediatrician and a child walks into your office with a low red blood cell count, it is more likely that the child is experiencing a normal variation resulting from a recent cold than it is that the child is a zebra and is one of three diagnosed cases on the continent of an extremely rare blood disorder known cryptically as Diamond Blackfan anemia—yes, this happened to my child. However, shortly after I learned the horses and zebras maxim in graduate school my father presented me with another, which goes: *It does not matter how rare if it is in your chair.*

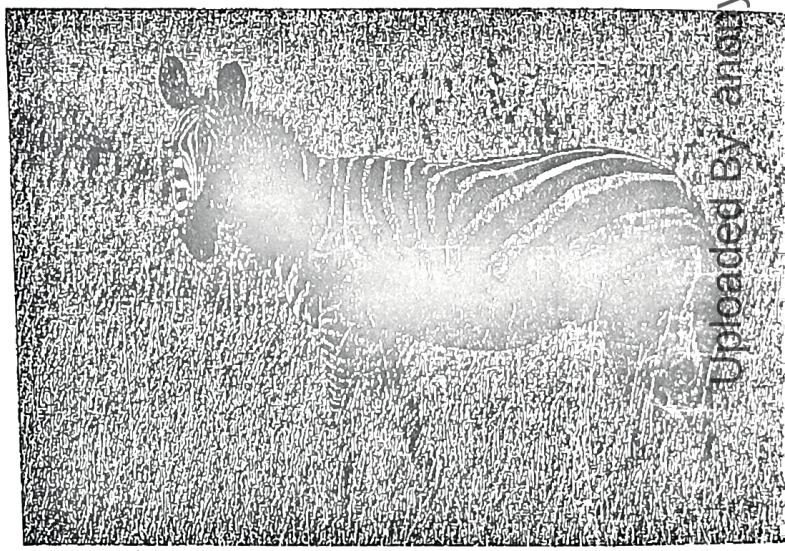

Figure 1-1
Source: © Jitendra Kumar Singh/ShutterStock, Inc.

This presents an opposite caveat from the first and emphasizes this important idea: You must be able to recognize and treat those problems in your field that are very out of the ordinary or even extraordinary.

If you work in the schools, it is true that you might not employ the brain-based knowledge you learned in college every day, but at some point a zebra will walk into your office—and probably many will come to you over the course of your career. To treat them appropriately you must have the correct knowledge.

A few years ago, a student of mine in her second year of graduate school approached me with this tale: A middle-school-aged girl had been referred to the clinic because she had been in therapy for articulation problems all her life and the problems had not improved. After a few sessions with her, my student noticed some subtle differences in the gait and muscle tone of her young client. When the student looked in this girl's mouth she was surprised to see the uvula resting on the back of the tongue, which is highly abnormal. Following her clinical judgment, the student approached her supervisor and they the young girl to a neurologist for an eval turns out that just before this girl was born bleed in her brain stem that lead to a mild c cid cerebral palsy, which was the underlyin affecting her speech. In short, this girl was the schools, a string of speech-language p had seen this girl over her entire life and ha recognize that she was not presenting wit articulation disorder. If they had, her prob speech as a result of her low muscle tone been more appropriately addressed.

As it was, this young girl wasted 10 year therapy with speech-language pathologist targeting a nonexistent articulation disord seen similar circumstances with other dise multiple sclerosis and Tourette syndrome ognized or being misdiagnosed in the scho In short, you have to be able to recogn both your horses and your zebras, no ma ting you decide to practice in.

Cognition, Language, and Speech

Before going further, it is necessary to draw some lines in the sand. To understand the information in this book, the reader must know exactly what is meant by *cognition*, *language*, and *speech*.

Cognition

Cognition is the ability to think. Hallowell and Chapey (2008) define cognition as the ability to acquire and process knowledge about the world. The term *cognition* means slightly different things in different disciplines, but, in most settings, cognition means the ability to process thought. In the field of speech-language pathology, the specific cognitive abilities that are recognized as important to processing thought and supporting communication include arousal, attention, working memory, short-term memory, long-term memory, orientation, problem solving, inferencing, and executive function. Understanding cognition is important in speech-language pathology because many cognitive processes underlie and support appropriate and effective communication. A lack of appropriate cognitive abilities undermines the ability to communicate effectively. For instance, if a patient cannot remember what the speech-language pathologist just said, the individual will be unable to respond appropriately and communication will be impaired. Hence, the speech-language pathologist must be able to identify and treat deficits in cognition that contribute to disordered communication.

Cognition The ability to acquire and process knowledge about the world.

Arousal The level of wakefulness and the ability to respond to stimuli.

Orienting The ability to direct attention toward a stimulus.

Attention The ability to hold focus on a stimulus when aroused enough to know that the stimulus is there and using orienting skills to direct attention to the stimulus.

The following types of cognition are referred to repeatedly throughout this text:

1. Arousal. The level of wakefulness and the ability to respond to stimuli.
2. Orienting. The ability to direct attention toward a stimulus.
3. Attention. In the most fundamental sense, attention is an individual's ability to hold focus on a stimulus once a person is aroused enough to know that it is there and can orient to direct his or her attention to the stimulus. However, the speech-language pathologist must be sensitive to different kinds of attention. These are presented in the following list in the hierarchical order in which speech-language pathologists usually treat them:
   - Vigilance. The ability to stay alert to the occurrence of a possible stimulus.
   - Sustained attention. The ability to hold attention on a single stimulus.
   - Selective attention. The ability to hold attention on a stimulus while ignoring the presence of competing stimuli.
   - Alternating attention. The ability to move or alternate one's attention back and forth from one stimulus to another.
   - Divided attention. The ability to attend to one stimulus while simultaneously attending to another stimulus; also known as multitasking.

Vigilance The ability to stay alert to the occurrence of a possible stimulus.

Sustained attention The ability to hold attention on a single stimulus.

Selective attention The ability to hold attention on a stimulus while ignoring the presence of competing stimuli.

Alternating attention The ability to move or alternate attention back and forth from one stimulus to another.

Divided attention The ability to attend to one stimulus while simultaneously attending to another stimulus. Also known as multitasking.

- Working memory. The ability to hold a finite amount of information for immediate processing and manipulating, which is lost within a few seconds if not somehow reinforced (Parente & Herrman, 2003). In a model put forth by Baddeley (1986), working memory can be subdivided into the phonological loop responsible for retention and processing of speech and language (Martin, 1987) and the visuospatial sketchpad that is responsible for retaining visual information for active processing. In Baddeley's (1986) model, a higher-level component of working memory, the central executive, regulates the operations of the phonological loop and visuospatial sketchpad subsystems.
- Short-term memory. There is no set and agreed upon division between short-term memory and long-term memory. Some individuals use the term *short-term memory* to refer to the ability to store information in one's memory for a period of only a few seconds or minutes (this definition of short-term memory encompasses the preceding idea of working memory) (Kempler, 2005). Others prefer to define short-term memory as the ability to store information in one's memory over hours or days. Despite the disagreement over length of time and the confusion it has created, it is clinically useful to distinguish between the memory range of a few seconds (working memory), the memory range of a few hours, and the memory range of months and years. In this book, the term *short-term memory* is used to indicate the retention of information for longer than 30 seconds up to a few hours.
- Long-term memory. The ability to retain information successfully over months or years.

Working memory The ability to hold a finite amount of information in the mind for immediate processing and manipulating.

Short-term memory The retention of information for longer than 30 seconds to a few hours.

Long-term memory The ability to retain information successfully for months or years.

- Procedural memory. The memory of sequences of actions used to complete tasks (i.e., procedures); for instance, the memory of how to brush teeth. Brushing teeth requires a series of steps that must be undertaken in the correct order for successful accomplishment of the task. However, most people brush their teeth in a completely automated and overlearned fashion. Much of procedural memory is overlearned and deployed in an entirely automatic fashion.
- Declarative memory. The ability to remember facts.
  - Episodic memory. Burda (2011) defines episodic memory as the recall of specific, recently experienced events (or episodes), such as a vacation.
  - Orientation. Orientation is usually judged by person, place, and time. In other words, this is an individuals' ability to know who they are, where they are, and when they are.
- Problem solving. The ability to find an appropriate solution to a problem. Luria (1966) describes problem solving as the ability to pick a strategy to solve a problem, apply the strategy, and evaluate the results.
- Inferencing. Given details, the ability to make a leap in judgment to a correct interpretation of the overall meaning of the details.

Procedural memory Memory of sequences of individual actions used to achieve larger objectives.

Declarative memory The ability to remember facts.

Episodic memory The recall of specific, recently experienced events or episodes.

Orientation The ability of individuals to know who they are, where they are, and when they are.

Problem solving The ability to find an appropriate solution to a problem.

Inferencing The ability to take previous knowledge and experience and apply it to the interpretation of the present situation. The ability to make a leap in judgment to a correct interpretation of the overall meaning.

Executive functions. These are high-level cognitive systems that employ and manage other lower-level cognitive functions. Executive functions are housed within the prefrontal areas of the frontal lobes. Executive functions use cognitive functions such as attention, memory, planning, problem solving, initiating, and organizational behaviors to meet high-level goals. Brookshire (2007) states that executive functioning includes the ability to initiate purposeful behavior, the ability to plan a sequence of actions to achieve a goal, the ability to maintain behaviors meant to accomplish goals; and the ability to monitor a situation and modify behavior accordingly.

Language

Once thoughts have been formulated using cognition, if communication is desired, the brain must find the appropriate symbols that will communicate these thoughts to another person. The symbols used by people to communicate meaning are known as language. Language is commonly defined as a set of symbols used to communicate meaning. These symbols are most often words that are visual, as in written language; verbal, as in spoken language; or the manual signs used in signed languages. The process of symbol selection for most individuals happens automatically and below the level of awareness. For most people, the brain automatically assigns language to express meaning and automatically assigns meaning to language received.

Executive functions High-level cognitive abilities used to employ other lower-level cognitive functions appropriately to meet high-level goals.

Language A set of symbols used to communicate meaning.

Speech The sounds made with the vocal and articulatory structures of the body to produce verbal language.

The ability to use language to communicate is divided into receptive and expressive language abilities. Expressive language is the words people assign to ideas to express the meaning of thoughts to other people. Expressive language is usually verbal or written. Conversely, receptive language is the ability to understand language. More specifically, receptive language skills are most commonly thought of as the ability to understand spoken and written language.

Speech

Speech, is simply the sounds made by the vocal and articulatory structures of the body to create verbal language. However, all sounds made by the vocal apparatus do not necessarily constitute language, just as all marks on a page do not constitute written language. Sounds can be produced nonsensically or in a way that does not communicate any meaning at all. Simply put, language is the words used to communicate and speech is the sounds made to produce those words verbally.

Interactions

It is important to keep in mind that speech is merely the verbal production of language. Deficits in language do not necessarily imply deficits in speech production. Conversely, a deficit in speech production does not imply deficits in the ability to formulate language. An individual unable to use his mouth for speech but with intact expressive language abilities might still be able to produce written or sign language to communicate.

Furthermore, a deficit in language abilities does not imply deficits in cognition. Although deficits in language and cognition often co-occur, an individual might have grossly intact cognition but devastated language abilities. This person can think clearly but cannot put those thoughts into words for communication. Conversely, an individual might display devastatingly impaired cognition and have intact language. This person can produce only disordered thoughts, but every disordered thought might be perfectly expressed and articulated because of intact speech and language abilities.

Changes in Speech, Language, and Cognition with Healthy Aging

Finally, consider the degree of changes to speech, language, and cognition that occur, not as a result of pathology, but as a result of normal aging. This section provides a short review of changes in speech, language, and cognition that occur with age. It is important for the student first to learn the nature of normal changes that can occur so that he or she can correctly recognize any abnormal, pathological changes. Many changes that occur for the worse in normal aging are still within the realm of *normal*. A sharp line should be drawn between the subtle and normal *decline* in abilities (often notable only in carefully controlled laboratory situations) and the immediately noticeable and incapacitating *deficits* in abilities discussed throughout the remainder of this book.

Changes in Speech with Healthy Aging

Significant physiologic changes occur in the body with age. However, in healthy aging adults these changes do not have a large negative impact on speech and voice production, which remain intact overall in most aging adults (Burda, 2011).

Changes in Cognition with Healthy Aging

Orientation

Orientation remains intact during normal aging. It is abnormal if an older adult does not know where she is, who she is, or what time of day it is.

Attention

Normally aging adults do not show changes in sustained attention (Berardi, Parasuraman, & Haxby, 2001). However, on selective attention tasks older adults perform more slowly than younger persons (Plude & Doussard-Roosevelt, 1989), indicating a greater susceptibility to distraction. Whereas divided attention skills remain normal for basic tasks, they can be compromised on higher-level or complex tasks in older adults (Simpson, Kellas, & Perraro, 1999).

Memory

Long-term memory remains intact during normal aging. Healthy aging individuals do not forget deep-seated memories such as where they grew up or their first car. Procedural memory also shows no decline in normally aging adults, who never forget everyday procedures such as how to brush their teeth, drive their car, or wash the dishes. However, healthy aging adults can show decline in short-term memory and episodic memory (Ericsson & Kintsch, 1995; Naveh-Benjamin, Hussain, Guez, & Bar-On, 2003). This is often illustrated by older adults (or their family members) commenting on their ability to remember events from their childhood consistently but having great difficulty remembering recent events. Declarative memory and working memory also show a decline with normal aging (Craik, 2000).

Executive Functions

Older adults tend to perform more poorly on tests of executive function than do younger adults, but their use of executive function in their daily lives remains functional (Burda, 2011).

Changes in Language with Healthy Aging

As individuals age, they might experience slight delays in their processing of verbal language (Federmeier & Kutas, 2005). However, the ability to process verbal language in daily life remains functional. Also, reading might slow (Connelly, Hasher, & Zacks, 1991), but comprehension remains intact.

Evidence-based practice: The notion that therapy and evaluation procedures must be determined to be effective based on clinical opinion and/or valid and reliable research.

The most notable change in language abilities with age is a decline in word finding ability (Au et al., 1995). This most often manifests as greater difficulty with confrontational naming. Specifically, older adults often will state that they have more difficulty remembering the names of new acquaintances than they did when they were younger.

Evidence-Based Practice

Over the past decade, the field of speech-language pathology has been moving toward standard implementation of evidence-based practice. Evidence-based practice is the idea that therapy and evaluation techniques must be deemed effective based on clinical opinion and/or valid and reliable research. The American Speech-Language-Hearing Association (ASHA) defines evidence-based practice as the integration of "clinical expertise and expert opinion" with "scientific evidence" to provide "high-quality services" to individuals seen in therapy (American Speech-Language-Hearing Association, 2012). In other words, speech-language pathologists need to have some legitimate basis for employing the therapies used to treat individuals with speech, language, and cognitive disorders. Speech-language pathologists who do not use methods supported by evidence run the risk of not servicing their patients appropriately and damaging their professional reputations and the reputation of the profession.

The need for evidence-based practice might seem obvious, but speech-language pathology is a relatively new field of study and is very much a hybrid of many different disciplines such as education, psychology, neurology, and counseling. As such, there is no great store of past research in the field of speech-language pathology. In many cases, researchers are still struggling to understand the very nature of certain disorders, much less having built up a repository of supportive research on how to treat these disorders effectively. However, over the last 20 years researchers have made strides to build support for certain therapies.

Nevertheless, a lack of evidence-based practice or even a perceived lack can seriously affect speech-language pathologists and the populations that rely on them for rehabilitation. A powerful and recent example of this is the refusal of the U.S. Department of Defense to pay for rehabilitative cognitive therapy for soldiers returning from battle with traumatic brain injuries (the signature injury of modern U.S. warfare). These soldiers are now returning home in huge numbers after multiple deployments to the wars in Iraq and Afghanistan. To avoid paying for therapy for the cognitive deficits following these traumatic brain injuries, in 2010 the Department of Defense cited a lack of appropriate scientific evidence that cognitive therapies help individuals with brain injuries recover (Miller & Zwerdling, 2010). As a result, many U.S. soldiers and veterans still cannot get the appropriate speech-language pathology services they need to maximize their recovery after being wounded in battle.

The need for speech-language pathologists to use evidence-based practice in their clinical decision making is paramount. Therapists must constantly explore expert opinion as well as keep up with recent and valid research on the efficacy of therapy methods to ensure that they administer the highest level of care to their patients.

مراجعة

Main Points

- A neurogenic communication disorder is a problem with communication that arises as a result of damage to the brain or other part of the nervous system.
- Neurogenic communication disorders include the aphasias, the dysarthrias, apraxia of speech, as well as the myriad of communication problems that may arise following deficits associated with right hemisphere disorders, traumatic brain injury, and dementia.
- Speech-language pathologists treat the communicative difficulties that result from neurogenic communication disorders in a variety of settings.
- Treatment settings include skilled nursing facilities, acute care facilities, rehabilitation facilities, outpatient rehabilitation facilities, home health care, hospice care, children's hospitals, and schools.
- The aspects of neurogenic communication disorders that speech-language pathologists target in therapy include speech, language, and cognition, and the subcategories of each.
- Cognition is the ability to think, acquire, and process knowledge about the world. This is important because many cognitive processes underlie and support effective communication.
- Cognitive abilities important to the processing of thought and support of communication include arousal, attention (which includes vigilance, sustained attention, selective attention, alternating attention, and divided attention), working memory, short-term memory, long-term memory (which includes procedural memory and declarative memory), orientation, problem solving, inferencing, and executive functions.
- Language is an agreed upon set of symbols used to communicate meaning. If communication is desired, the brain must find the appropriate symbols to be produced to communicate thoughts to others.
- Language abilities are generally divided into expressive language and receptive language abilities.
- Speech is the sounds made by the vocal and articulatory structures of the body to produce verbal language. The sounds produced are used as vehicles for language to express thoughts to others.
- Deficits in speech, language, or cognition can occur separately or can co-occur, though a deficit in one area does not imply deficits in all other areas: A person can have a deficit in speech, though not in language and vice versa. However, deficits in both language and cognition do often occur. Different deficits can interact with one another and change the overall presentation of deficits in patients.
- There are degrees of change to speech, language, and cognition that occur not as a result of pathology, but as a result of normal aging. It is important to understand the nature of normal changes so that abnormal, pathological changes can then be recognized.
- Changes in healthy aging generally do not negatively affect a person's daily life. If daily life is disrupted, an abnormal change not associated with aging should be suspected.
- Healthy aging can result in varying levels of slight decline in cognition such as in selective attention, divided attention for complex tasks, short-term memory, episodic memory, declarative memory, and working memory. However, healthy older adults retain orientation, long-term memory, divided attention for basic tasks, procedural memory, and executive functions.
- Healthy aging can result in varying levels of slight decline in language abilities such as verbal language processing, reading, and word finding;

however, healthy older adults retain functional verbal processing and comprehension.

- Generally, subtle changes in speech ability and voice production do occur with normal aging, but not enough to negatively affect daily life or warrant therapy.
- Evidence-based practice is the integration of research evidence with clinical expertise and expert opinion to provide effective and high-quality services.
- Speech-language pathologists must keep their knowledge base up to date with the latest research on evidence supporting therapy methods.

Review Questions

1. What is a neurogenic communication disorder?
2. What are some examples of neurogenic communication disorders?
3. What are some settings in which a speech-language pathologist provides therapy for neurogenic communication disorders?
4. Why is it important to know and understand neurogenic communication disorders even if you never plan on working in a clinical setting?
5. Compare and contrast speech, language, and cognition.
6. What are some subcategories of cognition?
7. How might communication be compromised if a person's cognition is not intact?
8. What is a general definition of attention?
9. List and describe the individual levels of attention.
10. Compare and contrast working memory and short-term memory.
11. What are the two gross divisions of language?
12. Do deficits in one aspect of speech, language, or cognition constitute a deficit in another area of speech, language, or cognition? Why or why not?
13. What are three areas of cognition that can decline in healthy aging?
14. What are three areas of cognition that are retained in healthy aging?
15. What are three areas of language that can decline in healthy aging?
16. What are three areas of language that are retained in healthy aging?
17. Why is it important to know changes in speech, language, and cognition that are brought about by healthy aging?
18. Why is evidenced-based practice important?
19. How might speech-language pathologists know that the therapy techniques they use are evidence based?
20. What rationale did the U.S. Department of Defense present in 2010 for denying cognitive rehabilitation services for veterans and soldiers returning from wars in Iraq and Afghanistan?

References

1. American Speech-Language-Hearing Association. (2012). Introduction to evidence-based practice. Retrieved from http://www.asha.org/Members/ebp/intro/
2. Au, R., Joung, P., Nicholas, M., Obler, L., Kass, R., & Albert, M. (1995). Naming ability across the adult life span. *Aging and Cognition, 2*, 302–311.

3. Baddeley, A. (1986). *Working memory*. Oxford, England: Oxford University Press.
4. Berardi, A., Parasuraman, R., & Haxby, J. (2001). Overall vigilance and sustained attention decrements in healthy aging. *Experimental Aging Research, 27*, 19–39.
5. Brookshire, R. (2007). *Introduction to neurogenic communication disorders* (7th ed.). St. Louis, MO: Mosby-Elsevier.
6. Burda, A. (2011). *Communication and swallowing changes in healthy aging adults*. Burlington, MA: Jones & Bartlett Learning.
7. Connelly, L., Hasher, L., & Zacks, R. (1991). Age and reading: The impact of distraction. *Psychology and Aging, 6*, 533–541.
8. Craik, F. (2000). Age-related changes in human memory. In D. Park & N. Schwarz (Eds.), *Cognitive aging: A primer* (pp. 75–92). Philadelphia, PA: Psychology Press.
9. Ericsson, K., & Kintsch, W. (1995). Long term working memory. *Psychological Review, 201*, 211–245.
10. Federmeier, K., & Kutas, M. (2005). Aging in context: Age-related changes in context use during language comprehension. *Psychophysiology, 44*, 491–505.
11. Hallowell, B., Chapey, R. (2001). Introduction to language intervention strategies in adult aphasia. In R. Chapey (Ed.), *Language intervention strategies in aphasia and related neurogenic communication disorders* (4th ed.). (pp. 341–382). New York, NY: Lippincott Williams & Wilkins.
12. Kempler, D. (2005). *Neurocognitive disorders in aging*. London, England: Sage.
13. Luria, A. (1966). *Higher cortical functions in man*. New York, NY: Basic Books.
14. Martin, R. (1987). Articulatory and phonological deficits in short-term memory and their relation to syntactic processing. *Brain and Language, 32*(1), 159–192.
15. Miller, C., & Zwerdling, D. (2010 December 20). Pentagon plan won't cover brain-damage therapy. *National Public Radio*.
16. Naveh-Benjamin, M., Hussain, Z., Guez, J., & Bar-On, M. (2003). Adult age differences in episodic memory: Further support for an associative-deficit hypothesis. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 29*, 826–837.
17. Parente, R., & Herrman, D. (2003). *Retraining cognition: Techniques and applications* (3rd ed.). Austin, TX: Pro-Ed.
18. Plude, D. J., & Doussard-Roosevelt, J. A. (1989). Aging, selective attention, and feature integration. *Psychology and Aging, 4*, 98–105.
19. Simpson, G., Kellas, G., & Ferraro, F. (1999). Age and the allocation of attention across the time course of word recognition. *Journal of General Psychology, 126*, 119–136.

zygomatic
vated, and
which are
- The gloss
sensory-m
informatio
tongue an
for swallo
- The vagus
nerve tha
soft palat
informati

Revie

1. Describe
system,
function
2. What thr
3. What ar
cortex c
4. What is
and wha
5. Which f
bral hem
sural fib
hemisph
6. List five
7. List two
8. Name th
and des
areas o
to occu
9. Which
and ten
to infer
lobes?
10. List thr
tify the