CHAPTER 8

Music and Well-being

LEARNING OUTCOMES

By the end of this chapter you should be able to:

1. Describe the training required to become a music therapist, and the factors that therapists consider when deciding upon passive and active forms of therapy.
2. List ten reasons music is an effective tool for promoting health and well-being.
3. Outline the benefits of music for health and well-being among typical and atypical infants and children.
4. Provide an account of the benefits of music for pain management.
5. Appraise evidence that music is an effective therapy for impairments following stroke or neurodegenerative disease, and describe two potential mechanisms that may underlie the benefits of music-based interventions.
6. Critically evaluate research on the effects of listening to violent music on aggressive thoughts and behaviors among teenagers and young adults.

Music as Therapy

Throughout history and in all known human cultures, music has been used to promote health and well-being (Gouk, 2000; Horden, 2001). In the Peruvian highland tropical forest, shamans known as *vegetalistas* use chanting as a primary tool through which healing takes place. In Ghana, West Africa, drumming accompanies the traditional healing ceremonies of the Ashanti people. Egyptian frescoes from the fourth millennium B.C. depict the use of music in therapeutic contexts. In the first millennium B.C. the Greek god Apollo was portrayed as a patron of both music and medicine. Ancient Greek "physicians" such as Xenocrates and Sarpander used harp music and rhythm to control seizures and heal illnesses. Music continued to be used for health and well-being in the Middle Ages, and the practice goes on today in cultures all around the world. In the late 20th century, with the rapid growth of psychology, scientists began to question the validity of using music for health and well-being. Why should an aesthetic form of entertainment such as music have health benefits?

Although music therapy became established in the United States as a health profession with the establishment of the National Association for Music Therapy in 1950, it was a speculative field supported primarily by anecdotal evidence and a handful of studies that were often poorly designed. Over the past several decades, however, an important body of evidence has gradually accumulated and suggests that the benefits of music for health and well-being are quite real, extending well beyond the benefits of mere leisure and recreation (MacDonald, Kreutz, & Mitchell, 2012a; Rickard & McFerran, 2012).

When music is used for therapeutic purposes by health professionals who do not have specific qualifications as a music therapist, the practice is often called music medicine. Although various forms of music medicine are used in hospitals and other health settings around the world, music therapy is a more specific set of practices requiring intensive training in professional programs that tend to be accredited by a national health association. The first undergraduate degree in music therapy was launched at the University of Michigan in 1944, and there are now master's and doctoral programs. Typically,

The Australian Music Therapy Association reported that "Playing the didgeridoo is good medicine" (March 2012). An innovative program at an Australian Primary School set out to show that playing the didgeridoo and singing can help asthmatic children. With research showing that one in four indigenous children have asthma, compared with about one in ten in the wider community, the Australian federal government provided $160,000 to fund a music therapy program for Aboriginal students. Some 20 students with asthma took part in the study and received weekly didgeridoo or singing lessons.

a music therapy degree requires the ability to play a range of musical instruments, improvisation skills, and counseling and health care skills.

The approach adopted in music therapy varies from one practitioner to the next, and there are many documented techniques. Not surprisingly, effective therapeutic techniques depend crucially on the nature of the problem, whether neurological (stroke, Parkinson's disease), psychiatric (depression, schizophrenia), developmental (premature birth, autism, learning disability), or coping with catastrophic or challenging life circumstances (posttraumatic stress disorder, palliative care, oncology). One important distinction is between receptive (or passive) and creative (or active) techniques of administering music therapy.

Receptive music therapy, in which the patient listens to recorded or live music in order to achieve a desired outcome such as reduced anxiety, is most appropriate in circumstances where active music participation is not possible or desirable, as in palliative care. In the *Bonny Method of Guided Imagery and Music* (developed by Helen Lindquist Bonny), music listening is used to evoke a "dynamic unfolding of inner experiences" in the form of therapist-assisted mental imagery (Trondalen & Bonde, 2012, p. 44). This imagery, in turn, is used as a basis for therapeutic discussions and allows clients to confront and embrace their experiences and feelings.

Active music therapy involves creative participation in music making by patients, whether individually or in groups. Singing is often used because it can help patients with articulation and breath control, improve the oxygen saturation rate, and stimulate language and other regions of the brain. Playing instruments, in turn, can improve fine and gross motor control, facilitate cooperation and attention, and enhance joint mobility, range of motion, rhythm, balance, strength, and self-esteem. In the Nordoff-Robbins approach, called *Creative Music Therapy*, clients and therapists engage in a nonthreatening creative process of musical improvisation. Depending on their music background, clients may be given instruments that are easy to make a sound with, such as cymbals or drums; more experienced clients may be given keyboards or wind instruments and be invited to improvise. As with receptive music therapy, the music experiences that arise during the therapeutic process can be used as a springboard for discussions, but many benefits arise spontaneously from engaging in an enjoyable activity that stimulates reward centers in the brain, promotes cooperation and a sense of accomplishment, and engages a range of cognitive-motor functions (Leins, Spintge, & Thaut, 2010; Thaut, 2005, 2008; Thaut & Abiru, 2010).

One challenge in conducting research on music and health is the lack of a consistent definition of the term *health*. It is tempting to conceive of health as the absence of physical disease, but one quickly realizes that such a definition is problematic, especially when many diseases go undiagnosed or are psychological in nature. According to the World Health Organization, *health* is defined as a "state of complete physical, mental, and social wellbeing and not merely the absence of disease or infirmity" (www.who.int/about/definition/en/print.html). This definition implies that health is not merely a state

of wellness but includes a positive state of mind referred to as well-being. Music has a special capacity to influence well-being, and the influence is usually positive. As we will discuss later, however, the benefits of music depend on the nature of the music experience. Exposure to violent and antisocial messages contained in music, for example, can have negative social and cognitive consequences on children and adolescents.

The effects of music on health can be analyzed on several levels, from cognitive functions to emotional experiences, to relationships among individuals, to social and cultural practices. Music can even alter brain functions because neural circuitry is highly adaptable to changes in the environment, a characteristic known as *plasticity*. Plasticity can account for changes that are observed in the brain following music training, or the effects of music therapy for patients with degenerative diseases such as dementia. Some changes to the brain resulting from music exposure are transient, but extensive engagement with music may lead to long-lasting changes.

Why Music Matters

The profession of music therapy blossomed in the late 20th century, and a range of therapists, health practitioners, and caretakers now use music in clinical settings such as hospitals, mental health and rehabilitation facilities, mental health clinics, drug and alcohol programs, nursing homes, correctional facilities, halfway houses, and schools. Are the benefits genuine? Why should music bring any benefits to health and well-being? Ten overlapping properties of music may help to explain why music can have beneficial effects on well-being, and why it remains a powerful tool for the therapeutic process (cf. MacDonald, Kreutz, & Mitchell, 2012b, pp. 4–6).

First, music is *ubiquitous*. Not only are musical activities found in every known culture; within industrialized cultures people have convenient and inexpensive access to a range of music-related media. The extensive musical choices that are available mean listeners can be highly selective about what they listen to. We can customize our musical experiences in ways that optimally manage our state of mind, calming or energizing us so as to enhance our sense of well-being.

Photo courtesy of Rainbows Hospice for Children and Young People

Where Do Music Therapists Work?

- Hospitals
- Mental health and rehabilitation facilities
- Outpatient clinics and daycare treatment centers
- Community mental health clinics
- Drug and alcohol programs
- Nursing homes
- Correctional facilities
- Halfway houses
- Schools

Second, music is highly *emotional*. It has a number of acoustic qualities that seem to interact with our emotional systems, such as the flow of fulfillments and violations to our expectations, the speed with which events unfold, the uses of harmony and dissonance, associations that music may have with our personal history, and a predictable cycle of strong and weak beats that allow us to synchronize our movements in time with the music. When people engage in musical activities together, their emotional states tend to become more homogeneous, which may decrease the potential for conflict.

Third, music is *engaging*. Playing music involves numerous mental and physical processes, and neural activation can be seen throughout the brain. In other words, music casts a wide net, increasing the chances that its positive uses will lead to benefits for health and well-being.

Fourth, music is *distracting* and can draw our minds away from negative experiences such as pain and discomfort. Playing it requires

concentration, and listening to it is highly rewarding, so our attention is naturally drawn to it. For people who are unwell, music can provide a welcome diversion and a haven.

Fifth, music is often *physical*. When we play, we execute a sequence of complex movements that are carefully timed and continue until the end of the performance, requiring prolonged physical movements and sustained attention. The physical exercise involved in playing music, on its own, can have health benefits. When music is played with others, participants must also coordinate their movements with those of other group members. Moving in a coordinated way requires concentration, but it is also pleasurable and seems to strengthen social attachments among group members (Overy & Molnar-Szakacs, 2009; Wiltermuth & Heath, 2009). A group session of music therapy often leaves participants feeling exhilarated, exhausted, and friendly toward one another.

Sixth, music is *ambiguous*. This property is significant because it means we can interpret musical experiences creatively and hence optimally benefit our sense of well-being. For some individuals, a piece of music might evoke episodic memories, such as their home country and the friends they have known; for others, the same piece of music might encourage a creative process of imagery that allows them to compartmentalize their disease and distinguish it from the many positive aspects of their lives.

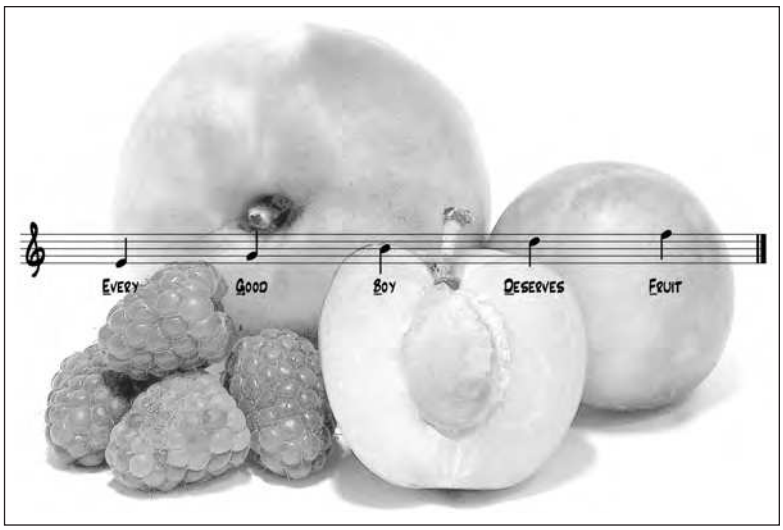
Seventh, music is *social*. It can be experienced in isolation, but it is often experienced in social situations, whether at parties, ceremonies, or in formal concert settings. Music is rarely directed toward one individual but can reach out to multiple listeners at the same time, connecting those individuals in a shared aesthetic experience. Social connection is a basic human need, whereas social isolation is a risk factor for morbidity and mortality (Cacioppo & Hawkley, 2003). By encouraging connectedness, music can help people fulfill a human need for contact, promoting emotional health and avoiding the health risks associated with social isolation (Koelsch, 2012; Koelsch & Stegemann, 2012).

Eighth, music is *communicative*, even though it often has an ambiguous meaning. Emotions are strongly associated with music, and people who have difficulty expressing their feelings in words sometimes feel more comfortable expressing these emotions through music. Active music therapy, in particular, can be used to improve skills of nonverbal communication.

Ninth, music is *manipulative*. Background music in malls and stores can affect the amount of time we spend shopping, how much we spend, and our consumer choices (Hallam, 2012; Milliman, 1986). It can also affect the quality and speed of our driving behavior (Brodsky, 2002; North & Hargreaves, 1999). These observable effects of music on behavior illustrate the enormous power of music to affect our actions.

Finally, music is *personal*. Few other activities are connected so strongly to our sense of self. For teenagers, musical tastes help to define their identity, connecting them with some social groups while differentiating them from others (such as their parents and siblings). Because music is so personal, the messages contained in music can be highly persuasive, influencing clothing preferences, reading and health choices, and friendships (Zillman & Gan, 1997).

Although no one attribute is unique to music, its power and flexibility as a source of well-being lies in having all 10 of these attributes. Like a Swiss army knife, the multifaceted nature of music means it can be used in many ways. From a scientific



By taking the first letter of each topic (Ubiquitous, Emotional, Engaging, Distracting, Physical, Ambiguous, Social, Communicative, Manipulative, and Personal), we derive the sequence UEEDPASCMP. We can rearrange these letters to produce a more memorable acronym, such as "MAPPED CUES," and the acronym can then serve as a mnemonic for the complete set of words. A mnemonic is a strategy or cue that helps people remember something. Melodies can also constitute a mnemonic for accompanying lyrics. For example, the "ABC" song is a musical mnemonic through which children learn the alphabet.

perspective, it has been difficult to pinpoint specific sources of well-being because effects are overlapping and entangled; hence they cannot easily be evaluated separately in a controlled study. Most data on music and well-being are qualitative and anecdotal. As the following sections make clear, however, carefully designed studies are beginning to emerge, allowing a number of important conclusions to be drawn.

Infants and Children

From within the womb, prenatal infants can perceive and respond to music. Of course, hearing in utero is very different from hearing outside of the womb. The amniotic fluid and the uterine wall have the effect of muffling and distorting sounds in the environment, but when the mother is speaking the prenatal infant perceives some of this sound through bone conduction. Are there reasons to believe that such intimate sounds, even if distorted and muffled, have any benefits for the well-being of the infant?

To answer this question, it is worth considering what the infant can actually hear. Responses can be elicited to auditory stimulation as early as 19 weeks of gestation, and consistent fetal responses to auditory stimulation are observed at 28 weeks. Interestingly, measurements taken from within the womb suggest that the fundamental frequency of the human voice (between 125 and 250 hertz) is attenuated by only 20 dB. As such, prenatal infants with functional auditory systems can perceive speech sounds quite clearly. Because the mother's voice is also amplified by bone conduction, it is only attenuated by about 8 dB relative to measurements taken outside of the womb. In fact, the mother's voice is arguably the primary auditory experience for prenatal infants, and probably assists in refining auditory development.

What are the effects of such prenatal auditory stimulation? Newborn infants at two to four days old display preferences for sounds to which they were exposed while in the womb: to music, their mother's voice, and the native language of people around them. Remarkably, they even prefer stories that were read to them in utero which, obviously, they cannot understand but somehow recognize as familiar. Once out of the womb, infants can recognize the voices of

their parents and siblings; can differentiate among sad, happy, and soothing sounds; and are familiar with the overall soundscape of their environment. This familiarity for voices, music, and other sounds in their environments is extremely valuable. It facilitates learning and reduces the stress that a newborn infant might experience in first encountering the novelty of life outside the womb, an experience William James famously described as "one great blooming, buzzing confusion" (1890, p. 462). Without such prior exposure, an infant might experience sensory overload, leading to stress and difficulty in sleeping in the presence of noise. A newborn requires up to 17 hours of sleep every day as part of healthy development (So, Adamson, & Horne, 2007), and reduced stress is likely to facilitate these long periods of needed rest.

During childbirth itself, slow and gentle music is often used to help the mother relax by encouraging deep abdominal breathing, thus reducing the stress associated with labor, and helping to promote an easier delivery. If the infant is born prematurely, music can also have significant benefits, whether administered by trained music therapists or by nurses with no formal training in music therapy. In comparison with infants not furnished with background music, premature infants who are given background music exhibit a higher level of food intake and ultimately remain in hospital for a shorter period (Cassidy & Standley, 1995; Hallam, 2012). Background music also helps to increase the amount of "quiet sleep states" among infants and reduces the extent of crying. Not surprisingly, such effects also help caregivers to feel less anxious (Lai et al., 2006).

Lullabies such as "Hush Little Baby" have been observed throughout the world and seem to have a natural capacity to soothe or energize infants. They also nurture bonds between caregivers and infants. Music can also be used as therapy for infants in intensive care. Infants who lack stimulation tend to create their own stimulation through physical movement. However, for neonates this behavior carries the effect of expending valuable energy, placing a medically fragile infant at risk. Music stimulation can be used as a low-risk source of stimulation that encourages immature neurological systems in premature infants to develop rapidly (Standley, 2003).

Across the first three years of postnatal development, an infant's brain will triple in size. Incredibly, the density of synapses is then the highest it will ever be. Connections between brain cells are continuously

being stimulated in response to experience, a process called *experience-dependent synaptogenesis*. The process of forming new connections reflects the flexible or plastic nature of the brain. The brain of an infant has a heightened capacity to change in response to stimulation (high plasticity). Brain plasticity is exceptionally high in the first several years of life and then gradually starts to decline. Thus, exposure to music can powerfully shape the infant brain. Infants and parents naturally engage in such musical activities as singing lullabies, clapping together, and playing background music during sleep time. These simple bonding activities literally change the brain such that the infant is "tuned" to music and its association with parental affiliation. Many of the benefits of this early music exposure are emotional. For children with emotional and behavioral problems, relaxing and quiet background music can have a calming effect; reduce blood pressure, pulse rate, and temperature; and increase the ability to concentrate (Hallam & Price, 1998).

Does music benefit infants and young children more than it benefits adults? Researchers do not yet know, but it seems likely. It is generally accepted that there are "critical periods" in development within which certain skills or abilities must be attained. For example, if an infant experiences no visual input before the age of about three years old, then neurons that are specialized for vision may die. Similar critical or "sensitive" periods have been proposed for skills associated with language and music, but no one has considered whether there are sensitive periods within which music can maximally have an impact on emotional well-being.

Autistic Spectrum Disorder

Music therapy has also been used to treat individuals with autistic spectrum disorder (ASD). This refers to a range or "spectrum" of disorders of brain development affecting at least one in 100 children, and more common in boys than girls. It can sometimes be diagnosed in childhood as young as age three, although symptoms are not always detectable at that early developmental stage. ASD is characterized by difficulties in verbal communication and social interaction, along with repetitive behaviors. According to the U.S. Centers for Disease Control and Prevention, the prevalence of ASD appears to be

increasing. In the United States, it rose 78% between 2002 and 2012. The reasons are unknown but can be partly explained by a global increase in awareness on the part of parents, teachers, and doctors, as well as improvement in diagnostic tools.

Anecdotal evidence suggests that music therapy can be used in this population to support and improve communication (Wigram & Elefant, 2008; Wigram & Gold, 2012) and to encourage play (Kern & Aldridge, 2006). Research by Pamela Heaton and her colleagues has shown that, contrary to popular belief, children with ASD can perceive and interpret emotions at typical levels, even if their social and interpersonal behavior seems to imply otherwise (Heaton et al., 1999). It may appear that autistic children are insensitive to emotional cues, but their problems might actually be more related to a difficulty expressing what they know and feel. By helping children express their thoughts and feelings—each in their own way—a sensitive music therapist can gain access to the emotional world of children with ASD.

Adam Ockelford (2008) describes his experiences teaching piano to Derek, a blind five-year-old boy with ASD:

> I started to imitate what he was doing . . . enabling us to have a genuine musical 'conversation'. . . . With no words to get in the way, a whole world of sophisticated social intercourse was now opened up to him. . . . he now came to realize that he could communicate *through* music. . . . for Derek, music came to function as a proxy language. (p. 106)

For Derek, communicating in language was virtually impossible, and his restricted capacity for communication was leading to isolation and jeopardizing his well-being. Remarkably, however, with Adam's help Derek started to communicate through his piano improvisations, eventually allowing him to develop both socially and emotionally. His newly discovered communication skills also gave him a sense of control over his environment. On the basis of this experience, Ockelford (2012) developed a range of strategies to help other children with ASD communicate through musical improvisation.

Why should music have such powerful effects on communication? One reason is that it has a special capacity to engage parts of the brain that relate to social thinking. Steinbeis and Koelsch (2008) found that music listening engages a network of brain structures associated

What is Theory of Mind? Premack and Woodruff (1978) coined the term (ToM) to refer to the ability to attribute mental states to oneself and others as a way of understanding the behavior of others in everyday life. The attribution of mental states is called a "theory" because we cannot directly observe mental states such as beliefs, desires, intentions, and knowledge, and yet we use our understanding of these states to predict the behavior of others.

Photo by Zak Moore-Boyle and Nina McIlwain

with "mental state attribution" or "theory of mind." When we listen to music, we automatically seem to try to understand the intentions of the musicians who produced the music, devising a kind of "theory" about what was going on in their minds when they created it. By engaging in mental state attribution during musical activities, children with ASD can gradually hone their ability to recognize the inner states of other people, giving them a core skill for successful social interaction.

Music can also improve social skills in typically developing children. Greitemeyer (2009, 2011) reported that exposure to prosocial music decreased aggressive thoughts and feelings in university students and promoted empathy toward others. Music can also help children and youth to affirm their personality and social identity, and it can teach them about relationships. As children develop a sense of identity, their musical tastes are often used to differentiate their sensibilities from those around them, such as their parents and other sources of authority. Because of their enormous celebrity status, popular musicians are powerful role models. When a song containing positive or prosocial messages is sung by a teen idol, it has enormous potential to influence and benefit children.

Music and Pain

One of the most common therapeutic uses of music is pain management. Because pain is a fundamental biological response to any form of injury, there are innumerable contexts in which it can affect us. It is the primary reason for most healthcare consultations, and chronic pain affects roughly 20% of all adults (Breivik, Collett, Ventafridda, Cohen, & Gallacher, 2006; Gureje, Von Korff, Simon, & Gater, 1998). Pain was once thought to be primarily a physical reaction, but psychological research on pain in the 1960s demonstrated that cognitive and emotional factors can moderate the degree of pain experienced (Melzack & Wall, 1965). More recent research suggests that listening to music, especially preferred music, can increase tolerance to pain (Mitchell & MacDonald, 2012). In one study, participants were instructed to immerse their hands in very cold water, which induced *cold pressor* pain. One group of participants sat alone in silence, a second group sat in silence with the experimenter present, a third group listened to nonpreferred music, and a fourth group listened to preferred music. Ratings of pain intensity did not differ between groups, but pain tolerance—the amount of time they were able to keep their hands in the near-freezing water—was greater for the group that listened to preferred music than for any other group (Hekmat & Hertel, 1993).

It seems that preferred music is effective for pain management, but the effects reported might underestimate the true effect of music, because all of it was supplied by the experimenters. That is, the so-called preferred music was only preferred relative to the other choices available and was not the participants' own favorite music. To address this problem, Mitchell and MacDonald (2006) asked a group of participants to bring their own choice of music to the lab. Using the same cold-water procedure, the researchers compared pain tolerance and perceived intensity under three conditions of auditory exposure: preferred music, white noise, and relaxing music chosen by the experimenters. Again, only the preferred music influenced pain management: Participants tolerated the pain for longer, and they also reported feeling more in control when they listened to the self-selected music than when they listened to white noise or relaxation music. For female participants, listening to preferred music also led to a reduction in the perceived intensity of the pain.

Anxiety and Depression

One of the most common uses of music is for relaxation. Parents sing to their infants to calm them, and people under stress often listen to music as a way of keeping their anxiety under control. Research has confirmed that relaxing music can reduce subjective feelings of anxiety (e.g., Knight & Rickard, 2001; Rickard, 2004), and a few investigators have reported a corresponding reduction in the stress hormone cortisol, or a reduced increase in cortisol in response to stress (Nilsson, 2009a, 2009b; Nilsson, Unosson, & Rawal, 2005; Nakayama, Kikuta, & Takeda, 2009). Interestingly, however, other researchers have failed to observe effects of music on cortisol even when participants report feeling less anxious. Such findings suggest that cortisol does not always predict or determine subjective feelings of anxiety.

Various types of music experience can elevate mood. Among people who have not been diagnosed with depression, music can alleviate negative mood states whether the music is experienced during physiotherapy (Le Roux, Bouic, & Bester, 2007), receptive music therapy (McKinney, Tims, Kumar, & Kumar, 1997), active music therapy (Nakayama et al., 2009), or while listening for pleasure (Hirokawa & Ohira, 2003). Using music to treat clinical depression is another matter. To date, there is little evidence that music is an effective treatment for clinical depression (Maratos, Gold, Wang, & Crawford, 2008; Koelsch & Stegemann, 2012), although it may help to ease the anxiety experienced by depressed individuals.

Impairment Following Stroke

Music engages a wide range of brain regions involved in emotion, cognition, and motor functions. Given such sweeping effects, some researchers have wondered whether musical activities might have rehabilitative benefits for people with neural damage. In one study, a team of investigators from Finland recruited 60 patients who had suffered a stroke in the left or right hemisphere middle cerebral artery (Särkämö et al., 2008). Patients were randomly assigned to one of three groups: a music listening group, an audio-book listening group,

or a control group (no additional treatment). All groups received standard stroke rehabilitation, but for two months the patients in the music and audio-book groups listened every day to music they chose for themselves (e.g., pop, classical, jazz, or folk) or to audio books, while the control group received no listening material. It is well known that quite dramatic changes can take place in the brain during the first weeks and months of recovery from stroke, especially in response to environmental stimulation. For this reason, the researchers commenced treatment as soon as possible in the acute poststroke stage.

Stroke patients who listened to music daily showed greater recovery in verbal memory and in focused attention when tested after three months, compared with stroke patients who listened to audio books or did not listen to anything. More specifically, three months after the stroke, verbal memory had improved by 60% in the music listeners, whereas it improved by less than 30% for patients in the other two groups. Similarly, focused attention improved by about 17% in music listeners, but there was no significant improvement seen in audio-book listeners and nonlisteners. Interestingly, music listening gave rise to only selected benefits. The researchers evaluated a range of cognitive skills, and music listening did not lead to enhanced recovery for several other functions, such as working memory, executive function, and visual-spatial cognition.

Nonetheless, the results suggest that music can accelerate the recovery of certain cognitive functions following stroke. The researchers speculated there might be three neural mechanisms by which music can facilitate recovery from stroke:

1. Enhanced arousal (alertness), attention and mood, mediated by the *dopaminergic mesocorticolimbic* system, a part of the nervous system that is associated with pleasure, reward, arousal, and memory
2. Direct stimulation to the damaged areas of the brain, which may promote accelerated recovery
3. Stimulation of general mechanisms associated with brain plasticity

It should be emphasized, however, that most of the music the patients in the music group listened to contained lyrics. Therefore, it is not entirely clear whether the musical component alone was

responsible for the improvements, the lyrics were responsible, or the benefits depended on the combination of music and lyrics. Regardless, an important implication of this research is that, during the initial weeks and months after stroke, patients should probably spend as much time as possible actively seeking stimulation such as music listening. Unfortunately, most stroke patients spend about three-quarters of their time in nontherapeutic activities, often inactive and without any interaction, thereby missing an ideal opportunity to initiate recovery.

The capacity of the damaged brain to change and recover in response to intense musical stimulation is a prime example of plasticity. This is a general term referring to changes in the brain in response to experience, but it occurs on multiple levels of analysis (Altenmüller & Schlaug, 2012). Changes in the efficiency and size of synapses can occur within a matter of minutes, or less, in response to sensory input. Hours of sensory stimulation can lead to the growth of new synapses and dendrites. Several weeks of sensory experience can lead to a general increase in gray and white matter density. Long-term training can lead to the development of blood vessels and other support structures, which may increase the size of brain regions associated with music. Finally, long-term training can affect the size of the corpus callosum, the nerve fibers that connect the two hemispheres. Any or all such changes to the brain may be implicated in recovery from stroke.

Melodic Intonation Therapy

In some cases, a stroke can leave patients with so much damage to their left hemisphere that they are unable to speak, a condition known as nonfluent aphasia. Nonfluent aphasia usually arises when the stroke leads to significant brain damage in Broca's area in the left frontal lobe. Patients with nonfluent aphasia often have fairly good speech comprehension, but they have great difficulty speaking with any fluency. Stroke can also lead to a condition known as fluent aphasia, whereby speech comprehension is impaired. Up to 50% of acute stroke patients will have some form of aphasia initially, and about 12% of survivors will have significant speech (production or perception) impairments when tested six months after stroke.

Starting in the 1960s, several researchers became intrigued by a long-standing observation: People with nonfluent aphasia can often sing words they cannot produce in speech (Gerstman, 1964; Geschwind, 1971; Keith & Aronson, 1975). This research eventually led to a singing-based treatment called Melodic Intonation Therapy (MIT), developed by Albert, Sparks, and Helm (1973). MIT involves asking patients to sing short sequences of words set to a simple melody, while simultaneously tapping with their left hand in time with the sung syllables. The melody is designed to follow the natural intonation that would be used if those words were spoken. For example, the phrase "good morning" might involve a simple three-note melody with the middle pitch a minor third (three semitones) higher than the first and last pitches. Phrases selected for training may get progressively longer as the treatment progresses. The tapping is thought to serve as a catalyst for fluency, and it may even be central to the effectiveness of MIT (Stahl et al., 2011). With intensive treatment that often lasts many weeks, patients eventually move from singing to speaking.

The effectiveness of MIT is still in question, but benefits have been reported for the Boston Diagnostic Aphasia Examination (BDAE; Goodglass & Kaplan, 1983) following MIT treatment (Bonakdarpour, Eftekharzadeh, & Ashayeri, 2000; Sparks, Helm, & Albert, 1974) and for measures of articulation and phrase production (Wilson, Parsons, & Reutens, 2006). Some researchers believe MIT works because singing engages the undamaged right hemisphere, essentially recruiting it to assume responsibility for a task that is normally handled by the (damaged) left hemisphere (Schlaug, Marchina, & Norton, 2008). The left-hand tapping, in turn, is thought to help trigger or facilitate vocalization by engaging a sensorimotor network that controls both hand and articulatory movements (Meister, Buelte, Staedtgen, Boroojerdi, & Sparing, 2009).

In one study, Schlaug et al. (2008) compared the effects of MIT with a speech repetition therapy. The investigators found that, after 40 daily sessions, the benefits of MIT for speech fluency were significantly greater than those following mere speech repetition. MIT also led to increased activation in a right-hemisphere network involving premotor, inferior frontal, and temporal lobes. The authors suggested that MIT eventually leads to neural reorganization within a right-hemisphere vocal-motor network, and such changes in the brain may account for the improvements in speech fluency.

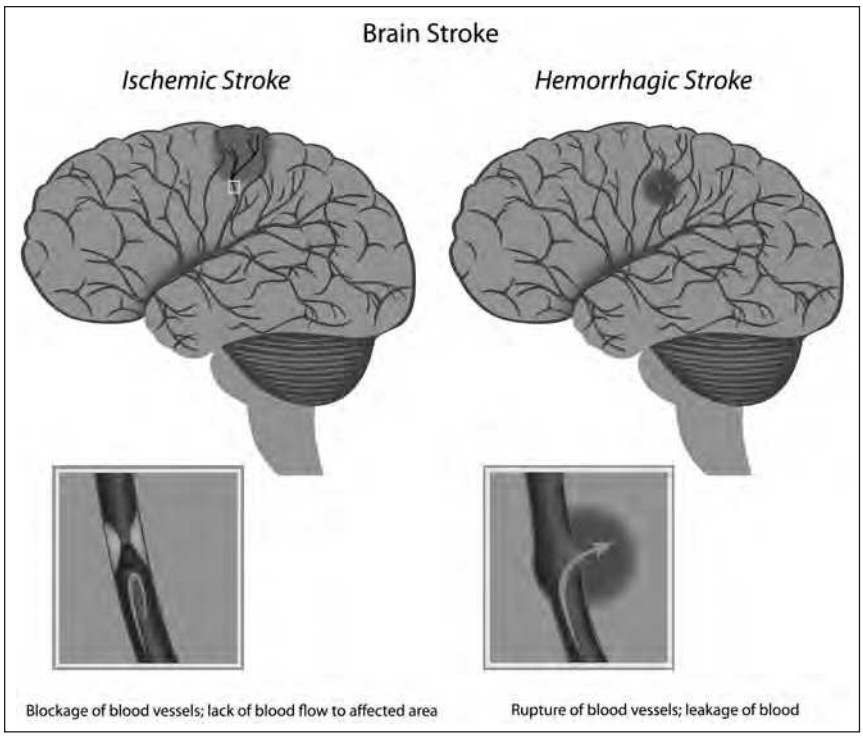
Diseases of the Elderly

The remarkable advances in medicine over the past century, along with greater awareness of healthy lifestyle choices, have led to a global increase in longevity. In the next 25 to 30 years, the number of people older than 65 will double, reaching approximately 1.4 billion by 2040, or about 14% of all people on the planet. With this rapidly expanding population of older people, there is an urgent need to confront diseases of the elderly. Two such diseases, dementia and Parkinson's, respond to certain types of treatment but are usually chronic and ultimately incurable. There are also no reliable strategies to prevent them. Musical engagement, however, can sometimes have striking effects among individuals with these conditions, bringing back vivid memories, stimulating movement, lifting spirits, and reducing agitation and anxiety.

Dementia

Dementia is not a particular disease; it describes a range of symptoms associated with cognitive decline. A diagnosis is usually given when cognitive decline starts to interfere with an individual's capacity to engage in everyday activities. The most common form of dementia is Alzheimer's disease, a neurodegenerative disease that accounts for more than 60% of all cases. Stroke, which can occasionally lead to vascular dementia, is the second most common cause. Certain types of dementia, such as those caused by thyroid problems and vitamin deficiencies, are reversible.

Music has been used extensively in the management of dementia, but it is challenging to evaluate the efficacy of this treatment scientifically. First, people with dementia are highly diverse, and everyone responds differently to music. Second, relatively few studies have employed rigorous research methods, such as random assignment of patients to experimental and control conditions. In one meta-analysis, Koger, Chapin, and Brotons (1999) considered the effects of music therapy on measures of well-being such as agitation, disruptive vocalization, wandering, cooperativeness, social participation, sleeping, memory, emotional status, and global cognition.



What does it feel like to have a stroke? Jill Bolte Taylor was given a research opportunity that few brain scientists would desire: She had a massive stroke and observed her own experiences as her brain functions—movement, speech, self-awareness—shut down one by one. On December 10, 1996, a blood vessel burst in Jill's left hemisphere. Following the hemorrhage her brain quickly deteriorated over the next four hours to the point where she could no longer walk, talk, read, write, or recall any of her life. There was physical pain at the back of her eye, comparable to the feeling of "brain freeze" after drinking a slushy. She also experienced visual distortions of her body and a distortion of body size. She felt an enlarged body sense and seemed to lose the ability to define the boundaries of her body. She also believed that the normal "brain chatter" associated with left hemisphere function was missing. Jill explained it this way: Unlike the right hemisphere, the left hemisphere processes information linearly and methodically. It organizes experiences in terms of past and future, and it continuously categorizes, organizes, and thinks in language. After seven years of recovery, Jill now believes this style of processing gives rise to an ongoing "brain chatter" that is so constant we are aware of it only if it stops. The stroke affected the left hemisphere and stopped this normal left-hemisphere chatter, giving rise to an eerie silence in her mind. At the same time, she experienced a profound sense of oneness and warmth with the world, a feeling she believes is associated with right-hemisphere thinking. Although she was unable to read or speak on the telephone, all of the stressors related to the external world disappeared and she felt lighter. She went into a coma in the ambulance but recovered several hours later following an operation to remove a huge blood clot in her left hemisphere that was pushing against the language areas of the brain. It took her eight years to recover, but she believes the experience has given her insight into the human condition.

Studies included a variety of approaches including both receptive and creative forms of music therapy, and most of the studies showed modest or strong support for the efficacy of music therapy. In many cases, however, it was difficult to distinguish between the effects of music and the benefits of interacting with the therapist. The studies also did not allow the researchers to conclude that one form of therapy was any better than another: whether receptive or creative therapy, and whether music in receptive therapy was live or recorded.

In a more recent and rigorously designed study, Gerdner (2009) compared the effects of individualized music and classical relaxation music on agitation behaviors in people with Alzheimer's disease. Before commencing the treatment, the researcher recorded patterns of agitated behavior for each individual on a daily basis; the intervention was to play music to each participant starting 30 minutes prior to the time of day that was associated with the patient's maximal agitation. Starting from the time of the intervention, observations were recorded over the next 60 minutes. The intervention was administered twice a week for six weeks. This phase of the research was then followed by a "wash out" period, and then the interventions were swapped between the two groups: Those participants who had received individualized music were administered classical relaxation music, and vice versa, for the next six weeks. This design feature allowed the researchers to compare the effects of the two types of music treatment within the same individuals (within-subject design), increasing the power of the research. Individualized music significantly reduced the frequency of agitated behaviors, and it was significantly more effective as an intervention than the use of classical relaxation music.

One promising avenue is the use of music to stimulate memory processes in individuals with dementia (Cuddy & Duffin, 2005). Music can evoke a range of emotions and memories, and such evocations remain evident in people with dementia who otherwise have severely impaired cognitive function. One reason music-associated memories are often preserved in people with dementia is that music affects so many neural areas and pathways throughout the whole brain and so many of its effects survive neuropathology. One study, for example, showed that people with dementia can accurately judge the emotional content of music in spite of global deficits in cognitive function (Gagnon, Peretz, & Fulop, 2009).

Parkinson's Disease

Parkinson's disease occurs in about one in 200 people over the age of 60 and is the second most common neurodegenerative disorder after Alzheimer's disease (Barber, 2012; Chen, 2010). The condition arises from degeneration of the *substantia nigra*, which supplies the neurotransmitter dopamine to the basal ganglia. An imbalance of neurotransmitters appears to impair the function of the basal ganglia. Symptoms include tremors, poorly timed movements including those involved in walking, impaired speech, and reduced facial expressions. Among the most visible impairments associated with Parkinson's disease are motor problems. In early stages, they are fairly mild, but they often get progressively worse.

In his remarkable book *Awakenings*, Oliver Sacks (1973/1990) described a group of patients who fell victim to the *encephalitis lethargica* epidemic that swept throughout the world between 1915 and 1926. The epidemic ultimately disrupted individuals' dopamine system and, for some, led to a set of symptoms similar to late-stage Parkinson's disease, a condition known as Parkinsonism. They were rendered catatonic and, tragically, remained virtually unable to move for decades. Transfixed and trapped in their bodies, no amount of effort could set them free from their prison of immobility. Incredibly, however, music was sometimes capable of releasing them. People who were normally unable to take a single step would unexpectedly dance in the presence of music; those who were previously mute would sometimes sing out. The effects of music were striking and unanticipated for these patients.

Not surprisingly, rhythm is the most crucial dimension for initiating movement in people with Parkinsonism (Thaut, 2008). All skilled motor activities depend on timing; without any timing skills people would be unable to execute movements appropriately. Individuals with Parkinsonism have damage to the parts of the brain that are responsible for generating timed sequences, including the motor sequences producing normal movements such as those involved in walking, talking, and daily actions like picking up a set of car keys.

Timing is also central to music. Musical rhythm, by initiating a sequence of audible events, allows patients to time their movements

Rhythmic auditory stimulation (RAS) is a technique of using musical rhythm to improve mobility. Rhythm can have a powerful effect on movement because the auditory system has rich connections to motor systems in the brain. These connections help explain why music often makes us want to dance, and why it feels so natural to tap along with music. Clinical studies by Michael Thaut and others suggest that RAS is an effective treatment for movement disorders associated with conditions such as stroke, Parkinson's disease, and traumatic brain injury.

without having to produce their own internally generated sequence plan. It is difficult for people with PD to time their movements; they often move too quickly or slowly. Playing music at a desired tempo allows patients to time their movements at this desired rate, a phenomenon known as *rhythmic entrainment*.

These dramatic effects seem to occur automatically, and a trained music therapist is not needed in order to elicit benefits to mobility in response to music. In fact, all that is required is some form of rhythmic stimulation. In the 1990s, Michael Thaut and his colleagues began studying the effects of *rhythmic auditory stimulation* (RAS) as a rehabilitation technique for motor therapy (Thaut & Abiru, 2010). They eventually developed standard protocols for RAS for training gait, which are part of a practice known as *neurologic music therapy* (NMT).

Their studies would often begin by asking patients to walk at a comfortable speed. RAS would then be applied at a tempo matched to this walking pace, along with RAS that was 10% faster. In comparison to no RAS, walking with the faster RAS led to significant improvements in average gain velocity, cadence, and stride length. With prolonged RAS treatment, improvements can even be maintained after the treatment ceases. McIntosh, Rice, Hurt, and Thaut (1998) reported that, after three weeks of home-based RAS training, improvements in gait were maintained for up to three to four weeks, after which decreases in gait performance began to reemerge. Presumably, movement benefits would be better maintained with regular treatment. In other words, the benefits to motor function appear to depend on ongoing treatment.

Are such benefits of music restricted to whole-body movements such as walking, or does music stimulation also influence specific movements, such as reaching for objects? Sacrey, Clark, and Whishaw (2009) examined the effects of listening to preferred music on skilled reaching. Control and Parkinsonism groups were given a skilled reaching task that was performed with and without preferred music. Unfortunately, preferred musical pieces did not lessen limb and hand movement impairments, but patients at advanced stages of the disease were found to have enhanced visual engagement with the target object when they were listening to preferred music.

Such mixed results are typical in the literature. On the basis of a review of research on music and the elderly, Barber (2012) concluded that the evidence is equivocal regarding the potential for music to change symptoms of neurodegenerative disease in the elderly. Most of the evidence is anecdotal, and many of the controlled studies have yielded inconclusive results. It is not even clear whether the benefits that have been observed are sustainable. One of the greatest challenges of this area is that neurodegenerative diseases can give rise to a range of cognitive-motor problems; the symptoms of dementia and Parkinsonism are highly variable. Such variability is one of the main reasons for music holding such promise as a therapeutic device. Just as neurodegenerative diseases are wide-ranging in their consequences for health and well-being, music can impart numerous neurological, physical, motivational, and emotional benefits.

If familiar and calming music has a positive effect on our sense of well-being, music that conflicts with our preferences and expectations can sometimes lead to negative emotions. Igor Stravinsky's ballet and orchestral work *The Rite of Spring* premiered in 1913, set to choreography by the legendary Russian-born dancer Vaslav Nijinsky. The music involves pounding rhythms that drive the action relentlessly forward. One commentator likened the sound to the "rhythm of engines" that "grinds and shrieks like laboring metal" (Rosenfeld, 1920), while the opera composer Giacomo Puccini evidently called the ballet score the work of a madman (Adami, 1974). In the 1913 premier, the unconventional music and choreography shocked many people in the audience. Those with an open mind embraced the daring innovation; others were horrified and began to boo. Ultimately scuffles broke out among audience members and escalated to the point where, according to some accounts, a near riot ensued. Throughout the chaos, the dancers and musicians continued their courageous performance.

Ballet Company: La Luna Dance Center. Photographer: Andrea Balducci.

Negative Effects of Music on Well-being

If music can have benefits for health and well-being, does it sometimes have negative effects? Many children and teenagers, for example, enjoy music that is edgy, countercultural, and even violent. Although it is difficult to characterize and judge the value of any one musical style, some music undoubtedly has a violent quality, and the messages conveyed are often antisocial. Does long-term exposure to violent and antisocial themes in music influence the minds of children and teenagers?

Before addressing this question, we need to consider the extent to which children and teenagers are actually exposed to music, how much music means to them, and the plasticity of the developing brain. In most cultures, music listening is virtually ubiquitous by the time children are in primary school. According to one large-scale U.S. study conducted by Rideout and colleagues (Rideout, Foehr, & Roberts, 2010), youths between the ages of eight and 18 listen to music an average of two hours and 31 minutes every day. Females spend more time than males listening, and the amount of listening increases steadily with age. By age 15–18, U.S. teenagers are listening to an average of three hours and 21 minutes every day. Because this high level of exposure occurs at developmental stages associated with heightened neuroplasticity, it seems almost inescapable that children and adolescents must be influenced by these experiences. But how?

Over the past three decades, there has been growing attention to the possible negative consequences of music (Warburton & Braunstein, 2012). This research suggests that children who regularly listen to violent and antisocial music, compared to those who do not, are more likely to exhibit antisocial and aggressive behaviors, engage in substance use and premature sexual behaviors, hold misogynistic attitudes, and contemplate self-harm and suicide. Such associations are perhaps not too surprising. Consider the misogynistic and antisocial themes in the hugely popular music by the rap artist Eminem. The song "Kill You" from *The Marshall Mathers LP,* which sold in excess of 19 million copies worldwide, contains such lyrics as:

> Slut' you think I won't choke no whore
> Til the vocal cords don't work in her throat no more. . .
> "Oh, now he's raping his own mother, abusing a whore. . .
> Blood, guts, guns, cuts, knives, lives, wives, nuns, sluts

One must always consider the full context in any set of lyrics: Eminem is widely believed to be a thoughtful musician. Nonetheless, one has to wonder whether it is healthy for impressionable adolescents to be persistently exposed to lyrics in which women are referred to in abusive terms.

As another example, the remarkably popular death-metal band Cannibal Corpse is known for horrific lyrics that focus on death,

Adolf Hitler observed that, "by the clever and continuous use of propaganda, a people can even be made to mistake heaven for hell, and vice versa" (Bach, 2008, p. 83). It is no surprise, then, that he appointed a skillful filmmaker to influence public opinion on a massive scale. In her 1935 film *Triumph of the Will*, Leni Riefenstahl used music strategically to glorify Hitler as the Fuhrer. The film portrays Hitler as triumphant and all-powerful. For example, Riefenstahl used musical rhythms to match the action of a seemingly endless procession of rows of black-uniformed SS officers. The film celebrated Hitler's presence with religious fervor. Filled with seductive images and spellbinding music, it glorified him as the German messiah. Considered one of the most manipulative films ever made, public exhibition of it is now forbidden in Germany.

Photo courtesy of the U.S. National Archives and Records Administration

suicide, murder, and rape. Their songs, including "Hammer Smashed Face," "Meat Hook Sodomy," "Dismembered and Molested," and "Hacksaw Decapitation," offer a taste of some of the violent themes in their albums, which are given equally violent titles such as *Torture* and *Necropedophile*.

Taken at face value, the level of violence celebrated in this music is alarming, but it is crucial to examine the nature of the research that has been conducted before leaping to any sweeping conclusions about its aftermath. Most studies on the negative effects of violent and antisocial music—although by no means all—are correlational. For example, Martin, Clarke, and Pearce (1993) found that suicidal ideation and acts of self-harm were significantly correlated with a preference for rock and heavy metal. Similarly, Stack, Gundlach, and Reeves (1994) found a correlation between suicide rates and

Sound Example 8.1

American metal band Cannibal Corpse combines aggressive sounds with excessively violent and sexually explicit lyrics. However, not all death metal bands communicate such violent themes in their lyrics. As an example, the melodic death metal band *Dark Tranquility from Gothenburg* can be heard in Sound Example 8.1 on the *Music, Thought, and Feeling* online playlist on www.oup.com/us/thompson.

subscriptions to heavy metal magazines. The authors surmised that music with suicidal themes may nurture suicidal tendencies that are already present in members of the heavy metal subculture.

How seriously should we take such evidence? A correlation indicates that two measures of interest, such as engaging in self-harm and a preference for heavy metal, tend to vary in the same (or opposite) way. It should first be noted that the reported correlations tend to be relatively small, in the order of 0.23 on average (Allen et al., 2007). A correlation of 0.23 means that only about 5% of the variation in negative behaviors can be predicted by exposure to music, whereas 95% remains unaccounted for and must be explained by other factors, such as a predisposition for violence. More importantly, the correlations do not prove conclusively that music caused the negative behaviors. A correlation might arise, for example, if adolescents who already hold aggressive and suicidal thoughts tend to gravitate to this type of music. Perhaps violent music merely furnishes these adolescents with a benign outlet or catharsis for their anger, affirming their feelings and reassuring them they are not alone. In other words, we cannot infer from correlational evidence that exposure to violent music actually *causes* negative behaviors. For example, the Beatles inspired the murders perpetrated by Charles Manson's "Family," but clearly Manson was already delusional. The Beatles can hardly be blamed for his gruesome actions.

These caveats aside, evidence reported over the past 20 years strongly suggests there are indeed some negative consequences of exposure to violent and antisocial music. In addition to the many correlational studies that imply (without proving) such effects, there are now numerous experimental studies that allow causal inferences to be made (as reviewed in Warburton & Braunstein, 2012, Chapter 4). These studies demonstrate that listening to violent music can actually *cause* negative thoughts and attitudes. In one study, 194 participants heard music with or without violent lyrics (Brummert-Lennings & Warburton, 2011). The music selections included "Let the Bodies Hit the Floor," by Drowning Pool (2001), "Fight Music," by D-12 (2001), and "You Can't Bring Me Down," by Suicidal Tendencies (1990). "Let the Bodies Hit the Floor" is a violent heavy metal song; "Fight Music" is a rap song about murder, fights, and rape; and "You Can't Bring Me Down" is an edgy rock song set in a prison.

Immediately after exposure to the songs, the participants were asked to allocate hot chili sauce to another (unmet) participant. They were also told that this participant would be required to eat the entire allocation of hot chili sauce, and that the person intensely disliked spicy or hot foods. Aggressiveness was measured by the amount of hot sauce the participant allocated. Those exposed to the violent lyrics allocated significantly greater amounts of hot chili sauce than controls, demonstrating that exposure to the violent lyrics caused aggressiveness in the participants.

In an extension of this study, Warburton and colleagues (Warburton, Mohi, & Brummert-Lennings, 2012) showed that, aside from the effects of violent lyrics, music that sounded violent also caused listeners to allocate more hot chili sauce. The same music was performed with different instruments and uses of expression in order to create a violent-sounding version (heavy/death metal) and an easy-listening version. Apparently, mere exposure to violent-sounding music can lead to an elevation of aggressiveness. These and other experimental and correlational findings reviewed by Warburton and Braunstein (2012) suggest that music can indeed have a negative effect on well-being.

Such effects are likely to have consequences for healthy social interactions and overall well-being. Whether they can account for physical acts of violence or suicide has not been conclusively demonstrated. It seems doubtful that exposure to violent music can cause an emotionally stable and nonviolent individual to run out and commit a violent or suicidal act. However, it is possible that exposure to violent music can sometimes encourage or trigger such antisocial acts among people who are already contemplating them.

In spite of such isolated instances of negative effects, most musical activities bestow decidedly positive and healthy benefits. Aside from the concrete therapeutic benefits described here, musicians and artists are increasingly involved in promoting music in various healthcare and community settings to enhance an overall sense of community well-being—a trend referred to simply as *community music*. The goal of community music is to promote music making among groups of individuals who are experiencing challenges in health and well-being, such as those with dementia, homeless individuals, and people with a physical disability (Ansdell & DeNora, 2012; Davidson & Emberly, 2012; Murry & Lamont, 2012). Such community benefits

are not restricted to those who are unwell. Music in all its forms of engagement can contribute to the formation and maintenance of a personal and cultural identify, emotional bonds, enhanced coordination, improved collaboration, and an enduring sense of well-being.

Additional Readings

MacDonald, R., Kreutz, G., & Mitchell, L. (2012a). *Music, health and wellbeing*. Oxford: Oxford University Press.

Rickard, N. S., & McFerran, K. (2012). Lifelong engagement with music: Benefits for mental health and wellbeing. New York: Nova Science.