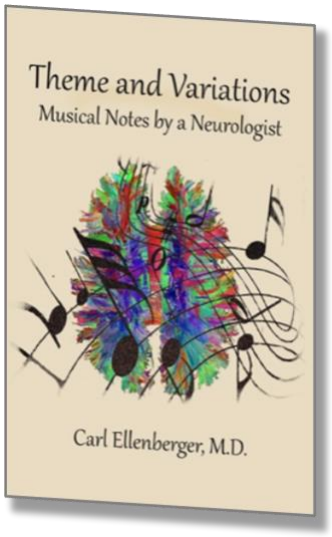

At bookstores

The Power of (Neuro)Music

Early in my career, I came upon *On Matters of Doubt* by Dr. Lewis Thomas, the penultimate chapter in his book, *Late Night Thoughts on Listening to Mahler's Ninth Symphony*. That book title was the name of the last essay which, like Mahler's Ninth, was a cry of despair near the end of a life. Thomas' despair was for the world he was about to leave, but there was at least one consolation in his life.

If you are looking about for really profound mysteries, essential aspects of our existence for which neither the sciences nor the humanities can provide any sort of explanation, I suggest you start with music. The professional musicologists. . . haven't a ghost of an idea about what music is, or how the human mind makes music on its own, before it is written down and played. Nobody can explain it. It is a mystery, and thank goodness for that.

I read Thomas' medical and literary essays during my formative years as a physician, often learning more about what we didn't know than what we did. Thomas' despair might be even greater now, though, I hope, not because we have begun to solve his mystery.

Daniel Levitin, a musician and psychologist, published *This is Your Brain on Music* in 2005, giving voice and credibility to an embryonic field of inquiry called "neuromusic." Levitin helped to catalyze this multidisciplinary effort that uses new methods like imaging to find answers to musical "matters of doubt." My

own life suggests that one of Levitin's observations is indeed true:

Fourteen is a sort of magic age for the development of musical tastes. You're in the ninth grade, confronting the tyrannies of sex and adulthood, struggling to figure out what kind of adult you'd like to be, and you turn to the cultural products most important in your day as sources of cool—the capital of young life. Musical tastes become a badge of identity . . . .

Studying patients afflicted by diverse disorders affecting musical perception and performance, neurologist Oliver Sacks laid groundwork for solving the mystery in *Musicophilia* in 2007. He *listened* exquisitely – to people as he did to music – and wrote fluently, the way he probably played a Beethoven sonata. An Admirer wrote:

Both his science and his life were undergirded by a profound reverence for music–music seemed to be this intellectual giant's greatest form of spirituality. He knew that the life of the mind and the life of the body were one, and understood that music married the two–an understanding he carried in his synapses and his sinews.

The search for answers continues. One effort is *Sound Health*, a partnership between the Kennedy Center and National Institutes of Health and the National Endowment for the Arts. Indeed, answers are what we need. Too often, claims prevail, such as broad generalizations and assertions recently in the Wall Street Journal, like "music enhances the brain's ability to facilitate healing," or ". . . has huge diagnostic and healing properties." A music program at Walter Reed National Military Medical Center recalls ancient asylums in Bagdad:

In addition to baths, drugs, [and] kind and benevolent treatment given to the mentally ill, music therapy and occupational therapy were also employed . . . Special choirs and live music bands were brought daily to entertain the patients by providing singing and musical performances.

Amid the claims, neuromusic research is accelerating in several disciplines, including Psychology and Neurology. The results begin to suggest that science may eventually support the timeless phrase, "The Power of Music." Using music as input, we can illustrate, study, and better understand important concepts of brain function, such as learning and memory, neuroplasticity,

connectivity, neural durability, and creativity. Our new understanding can guide us in using music more intelligently in education and therapy.

Take the concept of a *critical period*, a finite epoch during the early years of brain development when neuroplasticity for the acquisition of any particular ability is greatest. A classic example of a critical period is the time before six years of age when it still is possible to restore useful vision in an amblyopic ("lazy") eye by patching the normally-sighted eye. After that age, only partial improvement can ever be achieved. A similar period is critical for the acquisition of the skills to play music, including the musical memory required for naming notes from any source called "absolute pitch" (AP, or "perfect pitch"). The period for acquiring AP ends midway through the first decade. The strength of elusive qualities, like "musicality" and "musicianship," seems to parallel a spectrum of musical memory: absolute pitch at the high end and "amusia" (inability to distinguish one pitch from another), at the low end. It is far easier for humans to rise on the spectrum during the first two decades of life. Almost all species below *homo sapiens* in the evolutionary scale fall at the lowest end, probably because they lack the neocortex that has evolved in *homo sapiens*. With or without AP, aspiring artists must start practicing as early as possible in their first decade of life to be able to reach full professional competency before that critical period ends around the age of twenty. No matter how much late-starters practice as adults, their ability, in most cases, will remain at an amateur level.

Anatomic correlations with these concepts show that music practice during the critical periods can actually build brain capacity by enlarging the cerebellum, corpus callosum and other major white-matter tracts, density of neurons in gray matter, and the abundance and complexity of connectivity. Reduced connectivity, innate or from neglect, may underlie congenital amusia and developmental dyslexia, and their recently discovered comorbidity.

Music practice is one of the first learning experiences that children can have; they learn that they can learn. Playing music with others not only improves the ability to collaborate and listen but also the eventual ability to distinguish (disambiguate) speech from background. And, as does multilingualism, music as a second language increases *cognitive reserve* that may delay the onset of dementia. Learning to entrain musical rhythms can facilitate movement of Parkinson patients. Adding song to language can aid the communication of demented patients and help stroke patients to transfer language function to intact regions of the brain. Fluency in musical performance can transfer to speech and *vice versa*.

Normal neuroplasticity underlies the acquisition of most, if not all knowledge and skills, including musical skills. It also accounts for much of the therapeutic potential of music. But neuroplasticity can turn dysfunctional during the repetitive practice of complex tasks in 1-2% of classical musicians. Formerly called, "overuse syndrome" or mistakenly diagnosed as tendonitis, "task-related dystonia" manifests in a broad range of symptoms, increasing under the pressure of competition. Studying dystonia in musicians can lead to better management of the condition and understanding of the process of neuroplasticity.

Long before I heard the word, "burnout," music had inoculated me against that new professional plague, as I progressed through a musical education before and then in parallel to medical education. That path led to occasional guilt from neglecting one in favor of the other, and to humiliation in performance when music was the neglected of the two. Indeed, errors in musical performance are obvious instantly, those in medical practice may never be revealed. I learned to listen, to my patients as well as to the great music made by humans in my lifetime and written in centuries past. —
Carl Ellenberger

Theme and Variations: Musical Notes by a Neurologist, 2018, Promusica Press; see carlellenberger.com