

A Musician Who Performs With a Scalpel

A Musician Who Performs With a Scalpel

For Claudius Conrad, a 30-year-old surgeon who has played the piano seriously since he was 5, music and medicine are entwined — from the academic realm down to the level of the fine-fingered dexterity required at the piano bench and the operating table.

“If I don’t play for a couple of days,” said Dr. Conrad, a third-year surgical resident at Harvard Medical School who also holds doctorates in stem cell biology and music philosophy, “I cannot feel things as well in surgery. My hands are not as tender with the tissue. They are not as sensitive to the feedback that the tissue gives you.”

Like many surgeons, Dr. Conrad says he works better when he listens to music. And he cites studies, including some of his own, showing that music is helpful to patients as well — bringing relaxation and reducing blood pressure, heart rate, stress hormones, pain and the need for pain medication.

But to the extent that music heals, how does it heal? The physiological pathways responsible have remained obscure, and the search for an underlying mechanism has moved slowly.

Now Dr. Conrad is trying to change that. He recently published a provocative paper suggesting that music may exert healing and sedative effects partly through a paradoxical stimulation of a growth hormone generally associated with stress rather than healing.

This jump in growth hormone, said Dr. John Morley, an endocrinologist at St. Louis University Medical Center who was not involved with the study, “is not what you’d expect, and it’s not precisely clear what it means.”

But he said it raised “some wonderful new possibilities about the physiology of healing,” and added: “And of course it has a nice sort of metaphorical ring. We used to talk about the neuroendocrine system being a sort of neuronal orchestra conductor directing the immune

system. Here we have music stimulating this conductor to get the healing process started.”

Born in Munich, Dr. Conrad took up the piano when he was 5 and trained in elite music schools in Munich, Augsburg and Salzburg, Austria. After high school he served his obligatory military service as a sniper in the German Army’s mountain corps, where his commander found every opportunity to fly him out of the Alps for some piano time.

After his service he decided to pursue medicine while continuing to study music. He earned a bachelor’s degree at the University of Munich and then, more or less simultaneously, two doctorates and a medical degree.

Dr. Conrad’s music dissertation examined why and how Mozart’s music seemed to ease the pain of intensive-care patients. He concentrated not on physiological mechanisms but on mechanisms within Mozart’s music.

“It is still a controversial idea,” he said recently, “whether Mozart has more of this sort of effect than other composers. But as a musician I wanted to look at how it might.”

Dr. Conrad noted that Mozart used distinctive phrases that are fairly short, often only four or even two measures long, and then repeated these phrases to build larger sections. Yet he changed these figures often in ways the listener may not notice — a change in left-hand arpeggios or chord structures, for instance, that slips by unremarked while the ear attends the right hand’s melody, which itself may be slightly embellished.

These intricate variations are absorbed as part of a melodic accessibility so well organized that even a sonata for two pianos never feels crowded in the ear, even when it grows dense on the page. The melody lulls and delights while the underlying complexity stimulates.

But even if this explains the music’s power to stimulate and relax, “an obvious question that comes up,” Dr. Conrad said, “is why Mozart would write music that is so soothing.”

Mozart's letters and biographies, Dr. Conrad said, portray a man almost constantly sick, constantly fending off one infection or ailment after another.

"Whether he did it intentionally or not," Dr. Conrad said, "I think he composed music the way he did partly because it made him feel better."

Recently, Dr. Conrad has focused on specific mechanisms that may help explain music's effects on the body.

In a paper published last December in the journal *Critical Care Medicine*, he and colleagues revealed an unexpected element in distressed patients' physiological response to music: a jump in pituitary growth hormone, which is known to be crucial in healing. "It's a sort of quickening," he said, "that produces a calming effect." *Accelerando* produces *tranquillo*.

The study itself was fairly simple. The researchers fitted 10 postsurgical intensive-care patients with headphones, and in the hour just after the patients' sedation was lifted, 5 were treated to gentle Mozart piano music while 5 heard nothing.

The patients listening to music showed several responses that Dr. Conrad expected, based on other studies: reduced blood pressure and heart rate, less need for pain medication and a 20 percent drop in two important stress hormones, epinephrine and interleukin-6, or IL-6. Amid these expected responses was the study's new finding: a 50 percent jump in pituitary growth hormone.

No one conducting these studies had yet measured growth hormone, whose work includes driving growth, responding to threats to the immune system and promoting healing. Dr. Conrad included it because research over the last five years has shown that growth hormone generally rises with stress and falls with relaxation.

"This means you would expect G.H., like epinephrine and IL-6, to go down in this case," Dr. Morley, of St. Louis University, said of growth hormone. "Yet here it goes up."

He added, "The question is whether the jump in growth hormone actually drives the sedative effect or is part of something else going on."

Dr. Conrad argues that the growth hormone does have a sedative effect. In his paper he cites a 2005 study showing that growth hormone releasing factor, a chemical messenger that essentially calls growth hormone to duty, reduced activity of interleukin-6. This suggests, he said, that growth hormone itself may reduce the interleukin-6 and epinephrine levels that produce inflammation that in turn causes pain and raises blood pressure and the heart rate.

This explanation gets a mixed reception among stress researchers. "The two dynamics aren't necessarily the same," said Dr. Keith W. Kelley, an endocrinologist at the University of Illinois at Urbana-Champaign and an expert on inflammatory responses. "I personally don't buy the particular cellular mechanism he's proposing."

Yet Dr. Kelley and other stress-response experts, including Dr. Morley and Dr. Bruce S. McEwen of Rockefeller University in New York, say Dr. Conrad's study clearly suggests that a rise in growth hormone may somehow dampen inflammation and stress responses.

"This is a really intriguing possibility that bears a closer look," Dr. McEwen said.

For Dr. Conrad, the finding offers a sort of scientifico-musical elegance: Here, it seems, may be a hormonal parallel to music's power to simultaneously rouse and soothe.

He hopes to expand his study of music's effects on growth hormone in intensive-care patients. He is also planning roughly similar studies of how music affects a surgeon's performance. That line of study goes way back — at least to 1914, when The Journal of the American Medical Association published "The Phonograph in the Operating Room," by E. Kane.

More recent studies have shown that surgeons perform math calculations faster and more accurately when they listen to music they like. Dr. Conrad hopes to find neurophysiological dynamics related to this performance

enhancer.

In short, he will continue to carry his study of music into the operating room — along with his music itself.

“When I was a resident, you just picked a radio station,” said Dr. Randall Gaz, an attending surgeon at Massachusetts General Hospital who is one of Dr. Conrad’s teachers in the operating room, and an amateur pianist, oboist and church organist as well.

“This new wave of surgeons bring their iPods,” he continued. “They bring whole mixes. It’s like they have the whole thing choreographed.”

When Dr. Conrad operates, he brings an iPod stocked not just with Mozart, Liszt and Scarlatti but also with gigabytes of European techno-rap bands his colleagues have never heard of (and cannot understand), including Klee, M.C. Solaar and Armin van Buuren.

Asked if he could actually work with that kind of music, he replied, slightly sheepishly: “Well, that’s not the music you want when you’re in the middle of a delicate procedure. But once you’re through that part and you’re closing up” — he shrugged — “it’s a good time to liven things up.”

Occasionally, his operating room colleagues do give him grief. Then, he said with a grin, “I remind them that there is only one person in the room with a doctorate in music philosophy, so if you don’t like the music, the expertise is on my side.”