



NEUROSCIENCE

Concentrating on Kindness

Tania Singer helped found the field of social neuroscience. Now she wants to apply what has been learned—by training the world to be more compassionate through meditation

Empathy made Antoinette Tuff a minor celebrity. On 20 August, a young man armed with an AK-47 and 500 rounds of ammunition burst into the school in Decatur, Georgia, where Tuff works as a bookkeeper. It might have ended in yet another senseless mass killing if it hadn't been for Tuff's compassionate response to the gunman, recorded in its entirety because she had dialed 911.

As the man loads his weapon, Tuff seeks a human connection with him. She talks of her own struggles, her disabled son, her divorce, her thoughts of committing suicide. Finally, she persuades him to lay down his weapon, lie down on the ground, and surrender to the police. "I love you," she says near the end of the call. "You're gonna be OK,

sweetheart." (Only after the man is arrested does she break down, crying "Woo, Jesus!")

Tuff's heroic conversation, posted on the Internet, was hailed by many commentators as evidence of the power of empathy and the value of compassion. If more people were like Tuff, there would be less violence and suffering, they say.

For neuroscientist Tania Singer, that sentiment has become an ambitious research program. Singer, a director at the Max Planck Institute for Human Cognitive and Brain Sciences in Leipzig, wants to find out if people can be trained to be more compassionate. Her program combines rigorous neuroscience with a practice some scientists dismiss as subjective and spiritual: meditation. The effort, called the ReSource Proj-

ect, involves dozens of scientists and heavy use of magnetic resonance imaging (MRI). It also includes 17 meditation teachers and 160 participants in Leipzig and Berlin who meditate at least 6 days a week for 9 months. Singer hopes to find a "signature of compassion" emerging in her subjects' brains: evidence that the instinct to be kind to others can be nurtured through meditation. Singer is candid about her ultimate goal: She wants to make the world a better place.

For Singer, two interests converge in the study, which she spent 5 years developing. She has been a pioneer in brain studies of empathy, making her "one of the most influential social neuroscientists in the world today," says Richard Davidson, a psychologist who studies emotions at the Univer-

Empress of empathy. Tania Singer has long practiced meditation herself. Now she is leading a large study to find out how meditation can mold the mind.

sity of Wisconsin, Madison. She also has a long-running interest in meditation. She tries to meditate every day, has met the Dalai Lama several times, and has been to spiritual retreats lasting months. Although compassion is the study's main focus, she also aims to discover if meditation can make people better at regulating their emotions, help them concentrate, or reduce stress.

Singer knows all of this makes some people cringe. During most of her career, she kept her interest in meditation to herself. "When I was younger, it was unthinkable for meditation research to be taken seriously," she says. "I had my life as a researcher and then I had my private life, where I could follow these interests." Even her father, Wolf Singer—a neuroscientist who until 2011 headed the Department of Neurophysiology at the Max Planck Institute for Brain Research in Frankfurt—was skeptical. "We certainly didn't practice meditation at home," Tania Singer says.

Ouch, that hurt

Empathy is the bridge that allows us to cross into the territory of someone else's feelings. It establishes a connection between two people, and it's the reason we enjoy reading novels and watching movies. But empathy has long been outside the scope of neuroscience. Scientists studied what happens in the brain when someone thinks or feels, but not how we can know and feel what someone else experiences.

But in 2004, while at University College London (UCL), Singer published a landmark paper in *Science* exploring what happens in our heads when we see a loved one suffer (20 February, p. 1157). For the study, she brought couples into her lab; the woman was lying in an MRI machine, and either she or her partner, who was sitting next to the scanner, received an electric shock to the hand.

The jolts themselves activated multiple areas involved in sensing and experiencing pain, such as the sensorimotor cortex and the insula; surprisingly, observing the partner in pain engaged some of the same brain

areas. Not the ones that tell you you're feeling a searing pain in your left hand, Singer says, but the "end note" of pain, that feeling of "ouch, that hurt." This overlap is the root of empathy, she argues.

The experiment changed how people did neuroscience, says Chris Frith, then Singer's group leader. "People hadn't thought before that you could study empathy in this very reductionist way," he says. Involving more than one person at a time in an MRI study was a daring move, Frith adds. "Tania is incredibly enthusiastic and she is prepared to deal with problems and design experiments which other people would feel are too difficult."

Other scientists are studying the importance of empathy as well. Christian Keysers, a brain researcher at the University of Groningen in the Netherlands, is approaching the topic from a different, darker angle: He is studying imprisoned psychopaths to find out what happens when the connection between people breaks down.

In a recent paper in *Brain*, Keysers reported that there was little overlap between the brain regions active when psychopaths felt pain themselves and those lighting up when they watched videos of someone else experiencing pain. But when Keysers asked

Obama has called for a more empathic society as well; as he put it in a 2011 commencement address at Xavier University, "When you choose to broaden your ambit of concern and empathize with the plight of others, whether they are close friends or distant strangers—it becomes harder not to act; harder not to help." There's a more cynical way to make that case: You help someone not because you want to reduce their pain, but your own. Feel their suffering more strongly, and you are more likely to act.

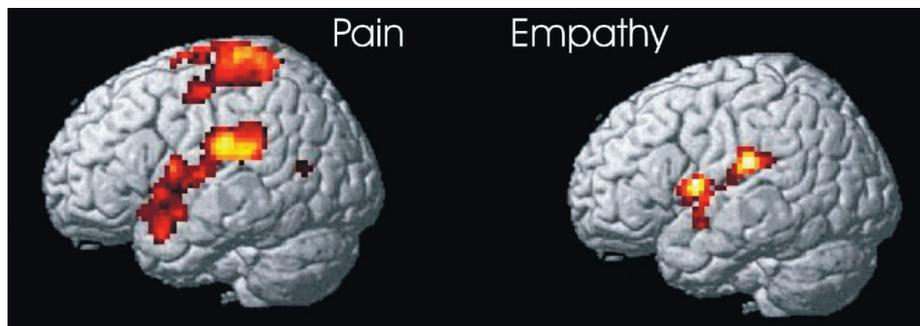
For Singer, who moved from UCL to the University of Zurich in 2006 and took her current job in 2010, the interest in empathy came naturally. She has an identical twin sister, and likes to say that she was "born as a we" and that people "constantly resonate with each other." What she is trying to train in the ReSource Project, however, is a slightly different capacity that she calls compassion. In daily life, the two words have overlapping meanings and they're often used interchangeably, but Singer suspects that they are two different phenomena associated with different brain activity patterns.

That insight came from her work with Matthieu Ricard, a French Buddhist monk who lives in Nepal and practices meditation. When Singer asked Ricard to "do his thing," focusing on compassion, in the MRI scanner, she got a surprise. The brain regions she saw light up were not the ones that she had seen time and again when subjects tuned into the suffering of another person. Instead, areas associated with romantic

love or reward, such as the nucleus accumbens and ventral striatum, were activated.

Confused, Singer asked Ricard what he had been doing. He explained that he had put himself into a state of compassion, a warm feeling of well-wishing toward the world. When Ricard went back into the scanner and concentrated on the plight of children in a Romanian orphanage he had seen in a documentary, his brain showed the typical signature of empathy. But Ricard later said that the pain quickly became unbearable. "I felt emotionally exhausted, very similar to being burned out."

Doctors and nurses have also reported being worn out by too much secondhand suf-



I feel your pain. In a 2004 paper, Singer showed that watching someone suffer activates some of the same brain areas as experiencing pain. The overlap is the root of empathy, she says.

them specifically to try to empathize with the actors in the videos, the psychopaths showed the same pattern that Singer saw in her romantic couples. "The capacity to empathize seems to be preserved in psychopaths," Keysers says. "They just don't use it automatically."

Embracing empathy

Such studies have helped to bring new attention to an age-old idea: that the world needs more love, or at least empathy. In his recent book *The Empathic Civilization*, author Jeremy Rifkin argues that humanity needs to develop a "global empathic consciousness" to avoid disaster. U.S. President Barack

fering. And empathy has other drawbacks, Harvard University psychologist Steven Pinker writes in an e-mail. Corruption, for instance, is basically a result of our natural tendency to empathize more with our friends and relatives than with strangers, and to favor them at the expense of others. “No amount of training is going to erase this difference,” Pinker writes.

Indeed, studies have shown that people are more likely to empathize with others of their own race or supporters of their favorite football team; even rats show a stronger signature of empathy toward cagemates than to other rats. The world needs justifiable policies and a robust commitment to human rights rather than more empathy, Pinker argues. “Frankly, I don’t feel empathy for every one of the two billion Indians and Chinese—who has the time or energy? But I also feel very strongly that they should not be harmed, exploited, or killed. These aren’t the same thing.”

Singer, too, acknowledges the limits of empathy. After her experience with Ricard she changed tack and concentrated on compassion, Ricard’s state of general warmth—which she also calls “empathic concern,” as opposed to “empathic distress.” “I thought we should all be more empathic and the world would be a better place,” Singer says. “But Ricard taught me that compassion is something completely different from empathy.” Now, she’s convinced it is this “caring system” that needs to be used more. The general warm feelings from compassion would not be limited to friends or relatives, and they are less stressful for caregivers than empathy.

Love generation

Numerous studies have shown that people can be “primed” to think more socially in various ways—from reading simple instructions to holding a warm cup of coffee. In one test, participants who listened to Bob Sinclar’s hit song “Love Generation” were more likely to come up with words like “help” than those who listened to Sinclar’s less uplifting song “Rock This Party.” But Singer isn’t interested in words; she wants to train people to act more socially in everyday life. And from personal experience, she believes meditation may be the way to do it.



Helping each other. Singer and economist Dennis Snower (right) received a grant to develop their ideas for a compassion-based economy.

At its most basic, the technique simply involves focusing on a feeling. In one meditation exercise in her study, participants are told to imagine a person they love and to concentrate on positive feelings toward them. “May you be happy. May you be safe and sheltered. May you be healthy. May you live with a light heart,” the teacher intones. Like bodybuilders increasing the weights they lift, meditators can intensify their compassionate feelings over time. Expert meditators can go very far, Singer says; rape victims may meditate on feeling compassion for their rapist, for instance.

“We are researching a system that ... allows us to go in peace, to trust ourselves and others more, that breeds tolerance.”

—TANIA SINGER

To measure meditation’s effects, researchers in the ReSource Project determine the level of the stress hormone cortisol in participants’ saliva, test their reaction times, have them fill out questionnaires, and shepherd them through virtual reality worlds while monitoring their heart rate. Each participant’s brain is scanned for several hours five times over the course of the study.

Participants also play computer games designed to evaluate their compassion level. In one of them, developed with Swiss economist Ernst Fehr, they have to guide a smiley along a winding path that leads to a treasure chest; they have blue or red keys to open gates

of the same color. But another smiley is also wandering the screen, on its own quest to another treasure, and players have to decide whether to open gates for it, too. In a preliminary study in 2011, Singer showed that just one day of compassion meditation made people more likely to help the other smiley, whereas 1 day of memory training did not.

Singer is also trying to better understand what goes on in the brain when it is feeling compassion. The activation patterns seen in the scanner leave open two possibilities: The feeling could be linked to the neurotransmitter dopamine and the brain’s reward circuits (which, among many other things, makes you crave chocolate) or it could be linked to what she calls the affiliation network, which is activated for example when you view a picture of your partner or your own child, and is mediated by the neurotransmitters oxytocin or opioids.

Singer admits that pinning down the neurobiology of compassion is difficult because the mental state it corresponds to remains fuzzy. A French Buddhist monk may have a very different concept of compassion than an African doctor or a British businessman, and there’s friction between the classic third-person perspective of science and subjective experiences. “But we need the first-person experience as well as the third-person science,” she says.

Wet noodle

On an evening in early September, Singer is sitting barefoot on the floor of the Berlin apartment that she rents from Danish-Icelandic artist Ólafur Eliásson, known for his mood-altering installations of water, air, and light. Beautiful globes made of wood, glass, and metal hang from the ceiling, like huge glowing molecules, as Singer talks about what compassion training, practiced on a large scale, could help achieve. At the World Economic Forum in Davos, she has spoken about “caring economics,” based on cooperation and compassion instead of just competition. A new grant from the George Soros–backed Institute for New Economic Thinking will allow her and economist Dennis Snower of the Kiel Institute for the World Economy to outline how a compassion-based economy could work.

She has also produced a free 900-page e-book, entitled *Compassion. Bridging Practice and Science*, scheduled to go online on 18 September. Based on a 2011

Berlin workshop, it covers everything from the neuroscience of compassion and empathy to specific training schedules. Bringing together texts from Singer and others, sound collages from her twin sister, and Eliasson's photos, it shows "that science and art are actually capable of producing things together," Eliasson says.

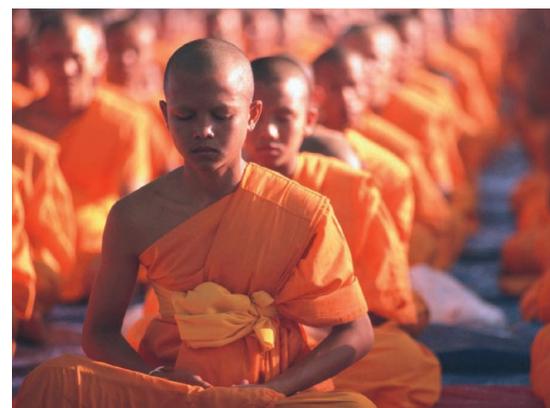
Singer hopes the book will help spread her message. People think compassion makes you vulnerable for exploitation, that it is weak, that it is a "wet noodle," she says. "In fact compassion is courageous, compassion is tough." But she's aware that many of her colleagues are skeptical of her sweeping vistas—and even more about getting there through meditation.

One problem is that historically, meditation is intertwined with religion. Scientists like Singer and Davidson take care not to include religious references in their study designs; meditation practices "offer a kind of training technology" that even strident atheists can use, Davidson says. But many meditation studies, including Davidson's,

for Complementary and Alternative Medicine sifted through more than 800 studies looking at meditation's health effects. They were not impressed. The research "does not appear to have a common theoretical perspective and is characterized by poor methodological quality," they wrote.

The most important problem has been that scientists fail to use adequate control groups. Many studies compare participants in a meditation program to people who applied for the study but did not take part. That leaves many factors unaccounted for, from being part of a group experience and having a devoted teacher to the fresh air at a retreat. In a 2012 paper, Davidson showed that many reported effects of "mindfulness" meditation disappear when the control group takes part in a similar program without the specific meditation techniques.

Singer hopes her own study design is rigorous enough to withstand criticism. During the first 3 months, both groups are trained in meditation focused on attention; then one group gets 3 months of compassion training,



Starting early. Buddhist monks are trained in meditation from a young age.

but Singer expects the first results next year.

Seasoned by skeptical responses, Singer has learned not to bring up her own meditation with fellow scientists, and she is reluctant to discuss it with *Science*. But she's encouraged that many scientists have recently become more interested. Christof Koch, chief scientific officer at the Allen Institute for Brain Sciences in Seattle, Washington, for instance, says that he used to doubt the value of studying meditation. But at a meeting between Western scientists and Buddhist monks, he was impressed by the Dalai Lama and by researchers like Singer and Davidson, "very serious basic scientists who knew their stuff." The meeting convinced him that meditation research is worthwhile, Koch says.

Singer's father, too, changed his position, after attending a 2-week meditation retreat in the Black Forest a few years ago where speaking, or even making eye contact, was forbidden. "There is no question that meditation can lead to altered states of consciousness while you are doing it," Wolf Singer says. He has become friends with Ricard, and a conversation between the two about meditation and brain sciences was just published as a book.

For Tania Singer, compassion research is a logical next step in neuroscience—but one that offers more hope for humanity than most other lines of research. "Why do other people study the amygdala and research how fear works? It's basic science," she says. "We are researching a system that is the opposite of fear, that allows us to go in peace, to trust ourselves and others more, that breeds tolerance."

—KAI KUPFERSCHMIDT



A mind for science. Postdocs prepare a Tibetan monk for an MRI study at Stanford University, where researchers are also studying compassion.

are funded by the John Templeton Foundation, a philanthropic organization that has frequently been criticized for trying to blur the boundaries between science and religion. (Davidson says that the foundation is "doing a great service" and that the money comes with no strings attached.)

Another problem is that meditation research is not known for rigor. In 2007, scientists working for the U.S. National Center

while the other focuses on "perspective-taking"—a way of viewing their own thoughts and feelings from a distance. If Singer sees differences between the groups after that, it will be due to the different meditation techniques, she says. "I've had people tell me I'm crazy to use such a conservative measurement, and that I will never find anything this way," she says. Meditation training and follow-up studies will run until 2015,