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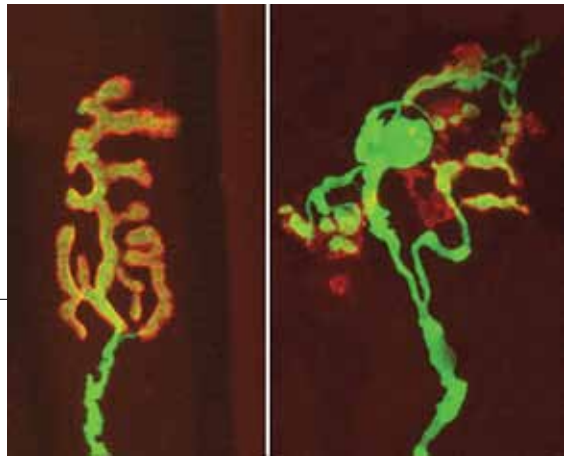
THE PSYCHE ON AUTOMATIC

Amy Cuddy on snap judgments, stereotypes, and the postures of power



VALDEZ, TAPIA, KANG, ET AL.

Exercise and caloric restriction both mitigate the degradation of synapses that occurs with age. In the healthy synapse at left, the receiving end, or muscle receptor (red), and the transmitting end (yellow), attached to a nerve, overlay each other perfectly. With age, the synapse literally falls apart, as shown at right.

wasting that accompanies old age."

Key to the experiment was a technique developed by Sanes and Lichtman that allows individual synapses to be tagged with a fluorescent protein. (The researchers studied neuromuscular junctions in skeletal muscle, rather than synapses in the brain, because the former are large enough to be seen using a light microscope.) The technique allows investigators to surgically open, and capture an image of, a single tiny synapse, and then find the same synapse later, during a second surgical procedure to observe and document the effects of different protocols.

Sanes and Lichtman found that reducing caloric intake in mice by 40 percent for 24 months protected both muscle fiber and motor neurons (which diminish in number with age), as well as synapses. Their exercise experiment gave the lab mice, which typically live two to three years, an exercise wheel at 22 months of age ("Unlike humans, mice actually run voluntarily," notes Sanes). Just one month later, they observed in the synapses that they had surveyed earlier "a partial reversal of structural alterations that had already occurred."

Because the exercise and caloric-restriction experiments were of different duration, Sanes and Lichtman will now reverse the conditions, testing lifelong exercise against short-term caloric reduction. Meanwhile, one of their postdoctoral fellows is conducting similar experiments, this time using synapses in the brain. "The research gives us a hint," says Sanes, "that the way these extremely powerful lifestyle factors act is by attenuating or reversing the decline in our synapses."

—JONATHAN SHAW

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TEACHER DIVIDENDS

Kindergarten Matters

Attending a quality kindergarten that provides experienced teachers and small classes yields measurable benefits, such as higher salaries in adulthood. That finding, in a study led by professor of economics Raj Chetty, has caused a stir by demonstrating that even the earliest school experiences can affect students' subsequent quality of life, exerting more influence than researchers previously thought.

Chetty and his colleagues, including Harvard Kennedy School associate professor of public policy John Friedman, examined data from Project STAR, a study of nearly 12,000 Tennessee kindergartners conducted in the mid 1980s. The children were randomly assigned to their teachers and to classes that were small (about 15 students) or large (around 24 students) and subsequently tracked (see "The Case for Smaller Classes," May-June 1999, page 34).

Previous analyses of Project STAR showed that children in small classes, and those with the best teachers, scored higher on standardized tests in the primary grades. But by the time those students reached junior high, the advantage vanished, a phenomenon known as "fade out." "By the time they're in seventh or eighth grade, the kids in a better kindergarten class are not doing any better on tests than the kids in not-so-good classes," Chetty says. Conventional wisdom held that the boost from a good kindergarten ebbed with time. "What's really surprising about our study," Chetty says, "is that [the advantage] comes back in adulthood."

When he and his colleagues looked at what the students—now in their early thirties—recently earned, they found that those who had the best kindergarten teachers make more money. "We estimate that if you

ERIK ISAKSON/GETTY IMAGES

Raj Chetty

Portrait by Jim Harrison

move from an average teacher to an excellent teacher, each student gains an average of $1,000 per year in earnings," Chetty says. "If you add that up over a student's working life, and adjust for inflation and interest rates, you get a total lifetime gain of around $16,000 per child." In a classroom with an average of 20 students, then, an excellent teacher means a total gain in earnings of $320,000 for the entire class. And students from small classes experienced other important advantages: they were more likely to attend college, to own a home, and to save for retirement.

What characteristics separated the best teachers from the worst? Chetty says researchers know little about the teachers except that the standouts tended to have worked in schools longer than the least effective teachers.

And how do excellent teachers create these long-term advantages? Chetty suspects the answer lies in so-called "non-cognitive measures." When the STAR students reached the eighth grade, their teachers evaluated them on attributes such as manners, the ability to focus, and self-discipline. Students who had the best kindergarten teachers excelled at these measures, even in eighth grade. "This is a little speculative, but I think it's consistent with the evidence: A good kindergarten teacher raises your kindergarten test scores by teaching you skills like how to be a disciplined student," Chetty says. "Those skills don't necessarily show up in later academic tests, but they end up having a big pay-off in the long run."

Visit harvardmag.com/extras for Chetty's working paper and graphs of his findings.

Chetty and his colleagues are working to publish their results, which have not yet been peer-reviewed. When they first presented the findings last July, at a meeting of the National Bureau of Economic Research, wide publicity followed, including comments from bloggers who doubted the researchers could distinguish the influence of kindergarten from such factors as parental education or income. Chetty responds that their findings are particularly meaningful because the students were literally assigned to their classrooms by coin toss. "There was no way for the richer parents or the more informed parents or the more motivated parents to put their kids in better classes," he says. Randomization ensured that the composition of classes was comparable, so "any differences across the classes can be attributed to the classes themselves, rather than to potential things like parental background."

He also disagrees with those who say a gain of $1,000 a year is too small to matter, pointing out that these students earned an average of $16,000 a year at age 27, so $1,000 represents a significant 6 percent raise. Chetty adds that the new study merely highlights the benefits of a single year. It's likely, he says, that each subsequent year with an excellent educator would yield additional pay increases: "The point is that over the years, that adds up to quite a bit of money."

~ ERIN O'DONNELL

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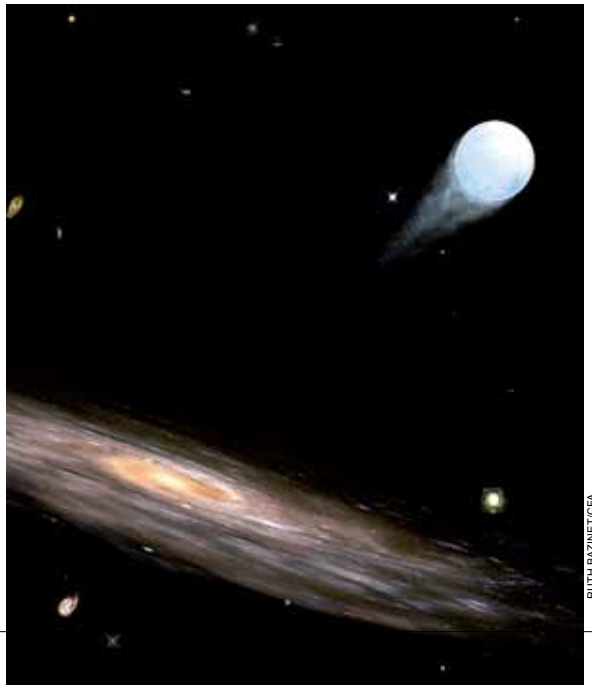
MAPPING MATTER

Hypervelocity Stars

The center of the Milky Way galaxy is a crowded, busy neighborhood: clusters upon clusters of pulsating young stars, giant clouds of gas, dying stars exploding, and, in the middle of it all, a massive black hole. So powerful is the gravitational pull of the black hole that stars in closest orbit have been measured circling it at 26.8 million miles per hour—far faster than the sun, which pokes around the galaxy at a mere 500,000 miles per hour.

According to Warren Brown, an astronomer at the Harvard-Smithsonian Center for Astrophysics, this black hole has an effect that extends beyond its close neighbors. In rare cases, certain star clusters have come too close to the black hole and been slung free on a trajectory that sends one of the stars hurtling out of the galaxy—leaving in its wake clues about both the history and the structure of the universe.



RUTH BAZINET/CFA

Brown discovered the first of these "hypervelocity" stars in 2005 by sheer serendipity. After finishing his Ph.D. in astronomy at Harvard in 2002, he set out to study the movement of older blue stars on the fringes of the Milky Way. (Their increased end-of-life luminosity and puffed size makes them stand out more clearly.) In the midst of his surveys, he discovered a much younger blue star inexplicably speeding toward the edge of the galaxy—on an escape trajectory—at 1.6 million miles per hour. "It was an outlier," says Brown. "It was so fast that you couldn't explain it with normal mechanisms."

He theorized that the star, to generate so much speed, must initially have been part of a trio: a close pair of stars and a third that orbited the two. "We think this third, outer, star was sort of trapped into an orbit around the black hole because it was farther out," says Brown. As the third star was pulled off, the remaining pair gained gravitational energy from the black hole and were propelled away at an accelerated speed, eventually merging into one.

His most recent paper