# Success Gets into Your Head—and Changes It

by Scott Berinato

Neuroscientists have long understood that the brain can rewire itself in response to experience—a phenomenon known as neuroplasticity. But until recently, they didn't know what causes gray matter to become plastic, to begin changing. Breakthrough research by a team at MIT's Picower Institute for Learning and Memory has documented one type of environmental feedback that triggers plasticity: success. Equally important and somewhat surprising: Its opposite, failure, has no impact.

Earl Miller, the lead researcher on the study (published in the journal Neuron last summer), says understanding the link to environmental feedback is crucial to improving how people teach and motivate because it's a big part of how we learn. But we absorb more from success than from failure, according to the study.

Miller's researchers gave monkeys a simple learning task: They presented one of two pictures. If it was Picture A, the monkeys were supposed to look to the left; if Picture B, to the right. When the monkeys looked in the correct direction, they were rewarded with a drop of juice. All the while the team recorded brain function.

"Neurons in the prefrontal cortex and striatum, where the brain tracks success and failure, sharpened their tuning after success," says Miller. What's more, those changes lingered for several seconds, making brain activity more efficient the next time the monkey did the task. Thereafter, each success was processed more efficiently. That is, the monkey had learned. "But after failure," Miller points out, "there was little change in brain activity." In other words, the brain didn't store any information about what went wrong and use it the next time. The monkey just tried, tried again.

Miller says this means that on a neurological level, success is actually a lot more informative than failure. If you get a reward, the brain remembers what it did right. But with failure (unless there is a clear negative consequence, like the shock a child feels when she sticks something in an electrical outlet), the brain isn't sure what to store, so it doesn't change at all.

Does this research confirm the management tenet of focusing on your—and your team's—strengths and successes? Miller cautions against making too tidy a connection between his findings and an environment like the workplace, but he offers this suggestion: "Maybe the lesson is to know that the brain will learn from success, and you don't need to dwell on that. You need to pay more attention to failures and challenge why you fail."

Expect more breakthroughs from Miller's lab that pertain to management. Understanding the complex brain functions used in business requires the ability to record activity in several regions of the brain simultaneously, and his team is being credited with pushing the technology further than any other research group. Miller has collected data from three regions of the brain at the same time with as many as 50 electrodes.

That number will increase. As neurologists use more and more electrodes to

record brain activity, they will gain much greater insight into functions such as decision making and attention. In a report in The Scientist last fall (in which Miller had the "Hot Paper" of the month, meaning it was cited 50 to 100 times more than the average research paper), a fellow brain researcher called his aggressive use of multiple electrodes "the tool of the future."