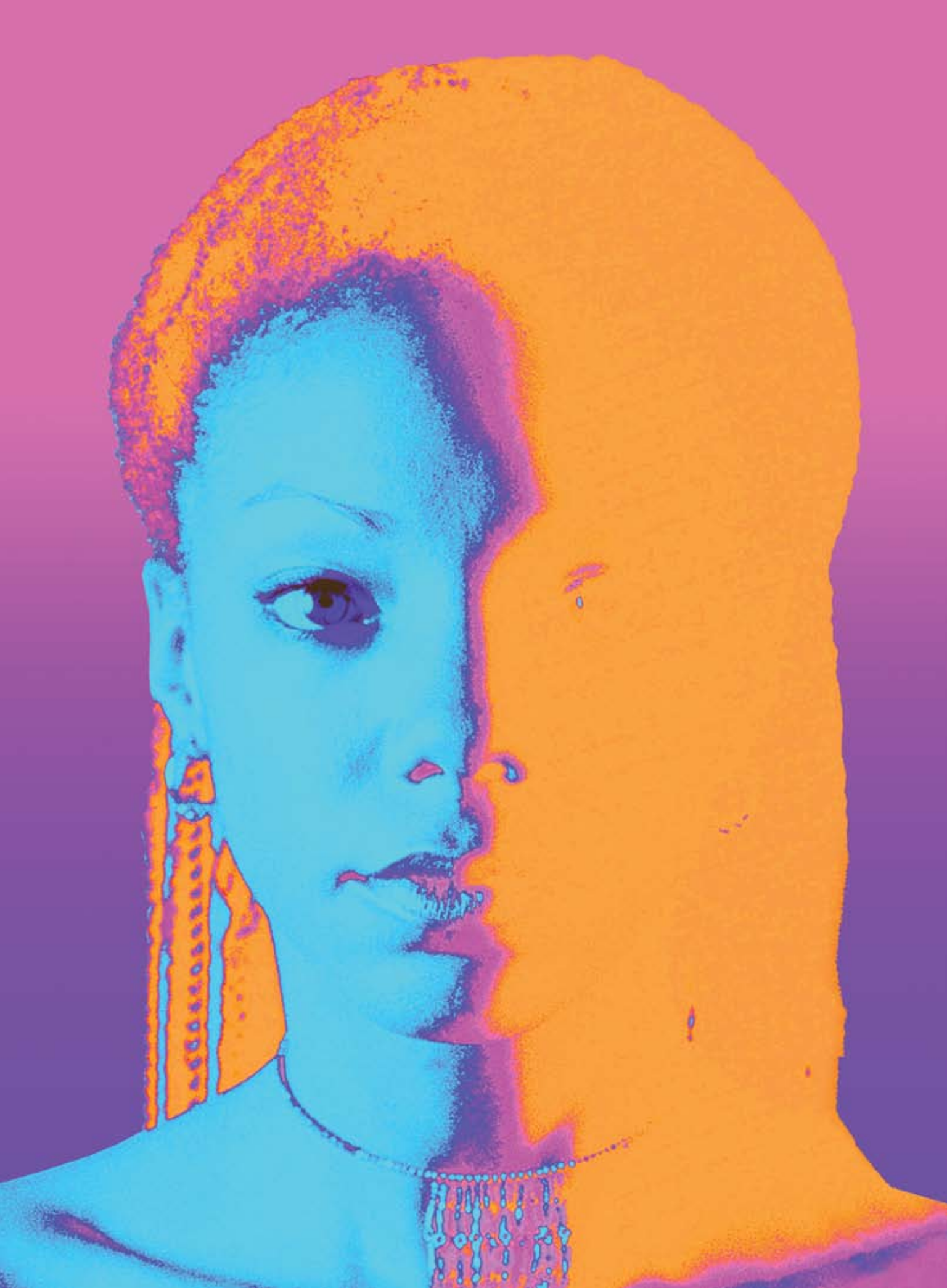

The **Brain** at Work

Science is shedding light on why people behave the way they do and how to better manage them.

By Adrienne Fox

Recall the many times you have been jazzed up after hearing a motivational speaker. You vow to return home and put those dynamic insights into practice immediately. But somewhere between the presentation and the next day's business, that resolution disappears more quickly than doughnuts at a Monday morning meeting.

Don't despair: It's not you; it's your brain. And you will find solace in learning that there are scientific explanations for why you didn't act on the speaker's advice, as well as for many other perplexing human behaviors.

Why do people only retain a fraction of what they learn? Why do they get a boost of energy when their bosses meaningfully praise their work? Why do they tire when focusing on one activity?

Once mere speculators about the hows and whys of human response, cognitive scientists are discovering what happens in the brain to cause such reactions. And as neuroscientists continue to study why humans do the things they do, human resource professionals can turn that knowledge to practical use in the workplace.

The joining of psychology (the study of the human mind and behavior) and neuroscience (physiological study of the brain) sheds light on the brain's role in human nature and behavior. Researchers in this field now map what happens in the brain during learning, engagement, motivation and social interaction.

Thanks to technologies such as magnetic resonance imaging (MRI) and positron emission tomography as well as wave analysis, scientists study neural connections as they happen in the living brain. This research

helps scientists understand the ways humans think, feel, act and perceive.

While many discoveries confirm HR professionals' hunches about workplace behavior, scientists' research still can help make the arguments for changing the way organizations perform. "I don't want to say [the discoveries are] common sense because if they were, we would never have a toxic workplace," says Ellen Weber, Ph.D., director of the MITA International Brain Based Center in Pittsford, N.Y. "By knowing the neuroscience and helping your employees understand it, you can prevent your workplace from turning toxic or help it get back on track."

Old Dog, New Tricks

One of the most exciting discoveries is the brain's enormous plasticity—the ability to change and learn. Scientists once believed that the brain was "hard-wired" early in life. They now know that the brain of a 71-year-old is the same as the brain of a 17-year-old in its ability to make new connections. Unfortunately, most people stop learning meaningful new concepts around age 30, and the brain's ability to learn begins to shrink.

Just as it is with teaching an old dog, getting the brain to learn new tricks requires effort. To make learning stick, the brain must move information from "working memory" to the basal ganglia at the base of the brain. That requires heavy lifting: Working memory is energy-intensive; your brain literally tires out after learning.

Research shows that making just one decision reduces the glucose—blood sugar—available for the next decision, says David Rock, founder and chief executive officer of Results Coaching Systems in New York. This explains why people revert to habits ingrained in their basal ganglia—the part of the brain that stores routine activity.

Working memory stores information temporarily; its capacity is small. As you integrate knowledge throughout the day—from the mundane to the complex—important information you learned earlier gets replaced and lost forever. That is, unless you move that knowledge into the basal ganglia.

How do you get it there? Use it or lose it. Researchers add a step to that mantra: sleep.

Neuroscience confirms the suspicion that "the brain shuts off after a certain amount of time, and there is a limit to how much information can be digested," says Rock, founder of the NeuroLeadership Institute. "If you are really paying attention to learning something new, the time limit is 20 minutes before the brain says, 'enough.' "

During breaks in learning, "we need to sleep and then integrate and hard-wire the brain, and then come back and learn more," he says. That maximizes the way the brain works. Neuroscientists call this "memory consolidation."

Rock suggests that trainers break learning into bite-size nuggets. If you break eight hours of training "into one-hour sessions over a few weeks, you could increase the learning by a dramatic factor—according to neuroscience," says Rock.

While that may make training more expensive in the short term, HR can explore repackaging training with technology, in smaller groups and with internal coaching. The long-term return on investment may be greater if employees more reliably move new concepts into their long-term memories.

Go to Bed, Sleepy Head

Neuroscientists have been mystified by the brain's need for sleep. Why do humans need to spend one-third of their days sleeping?

Sleep occurs in cycles of about 90 minutes with the deepest and most important phase—rapid eye movement (REM)—coming nearly 60 minutes into the cycle. If you wake up in your REM cycle as the brain rewires, it will feel like a Mack truck hit you.

"Without REM sleep, we lose what we learned the day preceding sleep," says Pierce Howard, Ph.D., director of research at the Center for Applied Cognitive Studies in Charlotte, N.C. Citing Cornell University psychology professor James Maas, he explains that sleep "transports memories in the form of neural patterns to the hippocampus area of the brain and resupplies the system with neurotransmitters used up during the previous day."

People can maximize their brains' ability to retain learning with the right kind and amount of sleep. Trainers can emphasize the need for employees to get a good night's sleep after sessions. "If you have learned a lot of information and sleep on it, you can wake up with better insights into what you have just learned," says Ed Boyden, Ph.D., assistant professor in the MIT Department of Biological Engineering and The MIT Media Lab, where he leads the Neuroengineering and Neuromedia Group in Cambridge, Mass.

Howard suggests getting a "natural" night's sleep using no alarm clock to ensure REM sleep after you have spent effort learning something new.

Weber emphasizes acting on information before going to sleep by reviewing or

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For more information about the implications of neuroscientific discoveries on management of people, see the online version of this article at www.shrm.org/hrmagazine for links to:

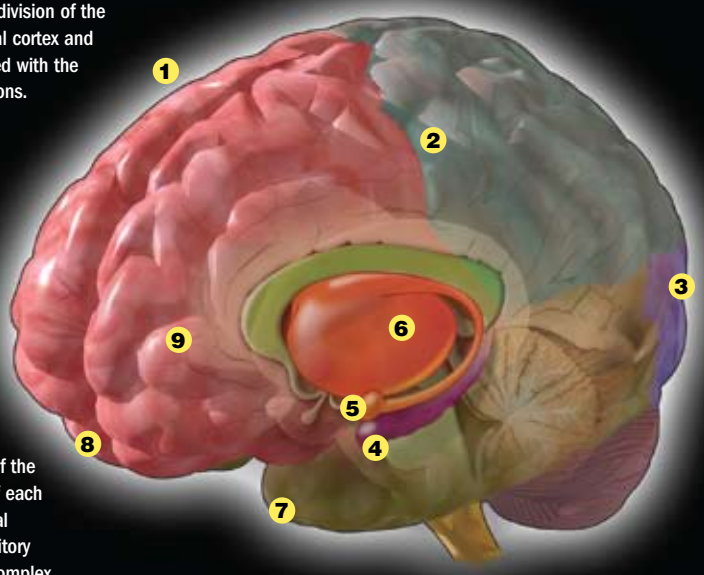
- **A glossary of neuroscience terms.**
- **An online sidebar on how HR can assess traits in workers.**
- **An article on smoothing change management.**
- **Web sites of Ed Boyden, the Center for Applied Cognitive Studies, the MIT Neuroengineering and Neuromedia Group, the NeuroLeadership Institute, and the Society for Neuroscience.**

1 Cerebral hemispheres: The left hemisphere is specialized for speech, writing, language and calculation; the right hemisphere is specialized for spatial abilities, face recognition in vision, and some aspects of music perception and production.

2 Cerebral cortex: The outermost layer of the cerebral hemispheres responsible for all forms of conscious experience, including perception, emotion, thought and planning.

Parietal lobe: One of four subdivisions of the cerebral cortex. It plays a role in sensory processes, attention and language.

9 Forebrain: The largest division of the brain includes the cerebral cortex and basal ganglia. It is credited with the highest intellectual functions.



3 Occipital lobe: Controls vision and color recognition.

8 Frontal lobe: One of the four divisions—others include parietal, temporal and occipital—of each hemisphere of the cerebral cortex. It has a role in controlling movement and associating the functions of other cortical areas.

4 Hippocampus: This seahorse-shaped structure functions in learning, memory and emotion. It acts like a sorting machine–collecting and sending information to other parts of the brain. The hippocampus houses immediate or "working memory," an extremely short-lived phase of memory. When learning new concepts, the information goes to the hippocampus first until it gets lost or moved into long-term memory in the basal ganglia.

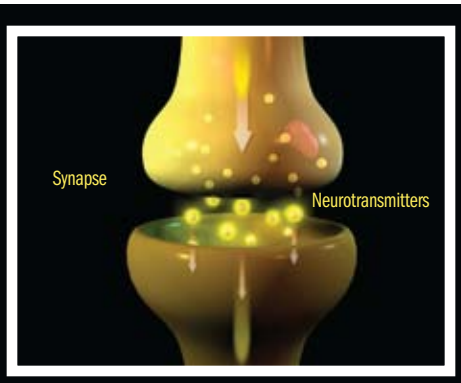
7 Temporal lobe: One of the four major subdivisions of each hemisphere of the cerebral cortex. It functions in auditory perception, speech and complex visual perceptions.

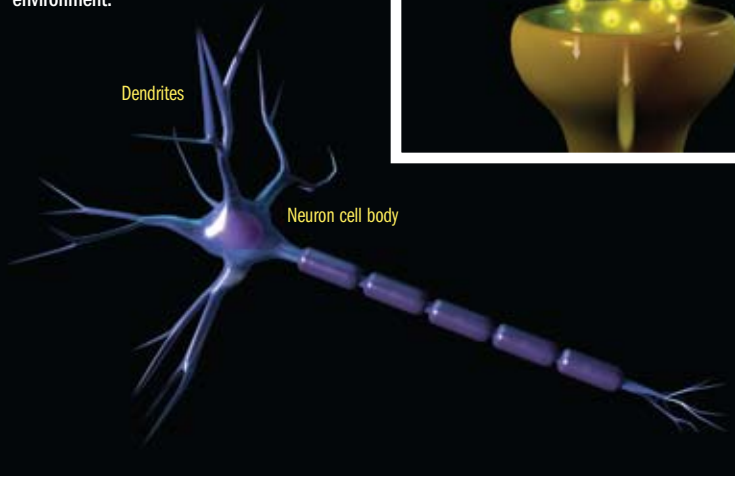
5 Amygdala: A structure in the forebrain. Sustained levels of high amygdala arousal can cause a person to think unclearly.

6 Basal ganglia: Clusters of neurons located deep in the brain that play an important role in movement. With effort, information comes from the hippocampus and other areas of the brain into long-term memory in this area. Long-term memory constitutes the final phase of memory when information storage may last from hours to a lifetime. Neuroscientists use the term "memory consolidation" to refer to the physical and psychological changes as the brain organizes and restructures information to make it permanent.

Neuron: Nerve cell. Functioning unit of the nervous system that receives, integrates and transmits information. Information moves from the dendrite to soma to axon to terminal buttons to synapse. A **synapse,** a gap between two neurons, functions as the site of information transfer from one neuron to another. A **neurotransmitter** is a chemical released by neurons at a synapse for the purpose of relaying information via receptors. **Endorphins** are neurotransmitters produced in the brain that generate cellular and behavioral effects like those of morphine. Endorphins are released in response to neurotransmitters and bind to neuron receptors. **Serotonin** is a neurotransmitter believed to play roles including temperature regulation, sensory perception and the onset of sleep. Low serotonin levels have been linked to depression. Praise can help release serotonin in the brain.

Dendrite: A tree-like extension of the neuron cell body. Along with the cell body, it receives information from other neurons. The dendrite branching is changeable and can grow when the brain is exposed to a learning environment.





ILLUSTRATIONS BY MATT ZANG

Source: Society for Neuroscience.

speaking to someone about the information. "Make a small plan for the next day, or talk to or teach someone else about it. Then sleep on it," says Weber, who helps companies use neuroscience to create what she calls "brain-based" businesses.

To help with learning retention, HR professionals can provide assignments to participants to be completed on the training day.

Your Brain Needs Others

Weber's recommendation to talk with someone about what you just learned derives from something that neuroscientists are learning more about—the brain as a social animal that needs interaction with others.

Rock cites one study showing that social pain—being rejected or berated—lights up the same regions of the brain as physical pain. As far as brains are concerned, social pain proves just as harmful as physical pain.

Furthermore, research shows that the brain finds fairness intrinsically important. In MRIs, scientists find that when people judge a scenario to be fair, reward centers of the brain light up just as when they see a loved one or taste good food.

On the flip side, "unfair situations generate significant amygdala arousals, the brain's fear circuitry," and light up a region of the brain activated when we experience disgust, Rock says. One study found that fairness was more important to the brain than money.

In the workplace, HR professionals can instill fairness and thereby create rewards for people that make them feel positive. "This explains the improved retention and performance of companies with healthy cultures," says Rock.

Social fairness and respect also help employees learn. "If a manager shows interest in employees, supports them and praises them genuinely, he 'squirts' a chemical called serotonin into their brains," says Weber. Serotonin opens employees' minds to ideas, and creates desires to get to know managers better and to support whatever the managers need done.

However, Weber continues, "If you diminish me, you 'squirt' cortisol into my brain that shuts it down and closes it off to new ideas and my willingness to help you."

Stress on the Brain

Howard says stress can occur when behaving in an unnatural manner or going against the grain of your brain's natural abilities (see "The Brain's Limitations," below). Prolonged stress produces sustained high levels of cortisol. As a result, Howard explains, the hippocampus—where memory is stored—shrinks, reducing the production of neurons and affecting memory, mood and other mental functions.

The Brain's Limitations

Despite the popularity of management books on motivating employees, David Rock, founder and chief executive officer of Results Coaching Systems, argues that workplace behavior is not motivated the way many think.

The crux of organizational transformation traditionally has been that if you apply incentives, people will change their behavior. The carrot and stick may work in the short term, Rock says, but it doesn't change behavior over the long term. Rewards and punishment won't change a person's intrinsic behavior—the way the brain is wired.

In addition, many performance management strategies involve one-way feedback methods. But simply telling someone, even in a constructive, positive way, that she is not meeting sales goals will not help her meet goals. People need to be involved in the decision-making and solution to get a release of adrenaline.

Scientists are investigating the brain's limitations based on genetics. "Behavior is inherited," says Pierce Howard, Ph.D., director of research at the Center for Applied Cognitive Studies and author of *The Owner's Manual of the Brain* (Bard Press, 2006). "We have been operating since World War II on the assumption that anyone can do anything, [that if] you give me a capable student and the right situation, I can teach him to do anything. That may be true, but there are certain traits and abilities that will make the learning better supported, depending on the individual."

For example, Howard says, "I can train someone to be an excellent proofreader, but he may not have an inherent ability to proofread as a day-to-day work responsibility. That does not mean he can't be a good proofreader; it means his natural tendency does not support it. And if he does it for a significant part of his work life, it will become a demotivator."

Instead of training people against their inherent abilities, Howard recommends placing them in positions that capitalize on abilities or providing other support to overcome deficiencies. "If someone scores low on strategic thinking, it would be a waste of money to train that person on strategic thinking," he explains. Instead, "bring in other people who are good at strategic thinking and delegate the task."

–Adrienne Fox

In short, stress on the brain can cause you to think unclearly. "There is an inverse relationship between the arousal of the amygdala—the part of the brain that stores emotional memories—and the ability to think clearly," says Rock. "A little arousal caused by an impending deadline will help you focus. But ongoing and high arousal will cause the brain to shut down. That switching point is different for everyone. Some people thrive in high-arousal situations, and some people can't bear any amount."

Unfortunately for those who don't thrive on stress, workplace anxiety is high. Leaders should look at stress the way neuroscientists do, says Weber, noting that participants in some workplace cultures brag about being stressed and busy all the time. "Did you know that stress shrinks the brain mass and knocks off at least 10 years of your life and lowers your [immunity]?" she warns.

To offset stress, Howard recommends getting 10 minutes of vigorous exercise to get oxygen to the brain—the neuroscientific basis for "blowing off steam." This strategy also helps prepare for stressful situations. "To be calm, opt for an aerobic activity," he says. To be aggressive, "choose a competitive sport in which you are likely to win."

You need to work to get your body's intake of oxygen to the brain. Sitting still all day deprives the mind and body of oxygen, explains Weber.

Some HR professionals promote stress-reducing activities in the workplace by sponsoring yoga classes or fitness centers. Now, they can cite neuroscience to back up these decisions.

Tell the Brain What To Expect

Another area of cognitive research with workplace implications reveals the physical impact that expectation has on the brain. "Expectations can determine whether we see or don't see information," says Rock. One study found that a mere warning that a stimulus would hurt less reduced patients' rating of the pain as much as a dose of morphine.

How does this play out in the workplace? Rock explains that when people have expectations that are met, they get a nice level of dopamine in the brain, a chemical critical to the ability to think clearly. When people are not expecting positive outcomes and get them, they get even higher levels.

When people expect a positive outcome and get the opposite, they receive lower levels of dopamine. If people expect a negative event and the expectation is met, dopamine levels also drop. "To think, solve problems and make decisions requires using the prefrontal cortex, and this requires the right levels of dopamine and other neurotransmitters," says Rock.

Arousing fear circuits overloads the prefrontal cortex and reduces functioning and decision-making. Uncertainty, for example, creates that stimulus. The brain likes to be able to predict moment to moment and long term. "Even the mildest uncertainty, like not knowing what a word is on a page, gets your attention and increases adrenaline and arousal in the amygdala," notes Rock.

Large amounts of uncertainty significantly increase adrenaline levels. People undergoing constant fear—during layoffs, for instance—can decrease their capacities to make decisions. "The uncertainty itself—not the fact that the person may be laid off—generates the shifting neurotransmitter levels that inhibit the thinking," Rock explains.

As an HR professional, you can minimize uncertainty. "If layoffs are coming and you say to a team, 'We don't know when we will have information,' you will drive people crazy," says Rock. "However, if you say, 'We don't have information on the layoffs, but we will in four weeks,' logically, you haven't said who will be laid off, but you have given the brain a higher amount of certainty."

In addition, employees need to have some ownership in changes to better accept them. Neuroscientists have found that the brain doesn't build connections when told what to do. It only changes patterns by being involved in the process. HR managers involved in change initiatives know this intuitively. Now, neuroscience illustrates why.

Rock explains that people experience adrenaline-like bursts of insight if they go through the process of making connections themselves. ❯

Lessons from Neuroscience

Discoveries about brain functioning have practical implications for employers, social scientists, teachers and others, experts say. Among them:

- People need sufficient sleep to integrate learning into long-term memory.
- Because the brain "shuts off" after a period of time, learning should be broken down into bite-size nuggets.
- Social pain—being rejected or berated—affects the brain the same as physical pain.
- Social fairness and respect give the brain a chemical boost. Unfairness and disrespect do the opposite.
- Stress can cause people to think unclearly.
- Uncertainty arouses fear circuits and can decrease ability to make decisions.
- Employees need some ownership over situations to better accept changes. Even a little choice helps.
- Engaging people in more active learning techniques improves retention.
- Employees' ability to think clearly can be hindered when employers fail to meet expectations or create uncertainty in the workplace.

Focus, Focus

You may have heard psychologists say that if you give negative things attention, negativity in your life grows.

Turns out, that concept wasn't psychobabble but based on sound neuroscience. "Cognitive scientists now know that the brain changes as a function of where an individual puts his or her attention," according to David Rock, founder and chief executive officer of Results Coaching Systems.

Ellen Weber, Ph.D., director of the MITA International Brain Based Center, illustrates how this plays out in the workplace: "Every time I vent, I've grown new brain cells for that purpose, and over time I get better at it."

MRI evidence of this shows up in the brains of people who possess a specialty and work on that specialty every day. For example, the areas in the brain that control the fingers, tongue and lips are larger in flute players. An accountant who works with numbers every day will have a larger representation of the area of the brain that controls math ability.

Each day a person surfs the Internet, he wires his brain for more of the same the next day, says Weber. This can be true for positive or negative behaviors. For instance, she explains, "If I were to look at pornography every day, I would rewire my brain to need more of it. But you can focus your attention on positive behavior and grow those connections as well. That's powerful for the workplace. The basal ganglia can be wired for toxic behavior or positive behavior."

"Because of brain-imaging technologies, we know that we use only 3 percent to 5 percent of our brains," Weber says. "If you send me to your staff meeting and sit me there and talk to me, I use 3 percent of my brain, and that is the reason I hate being there and why I'm disengaged."

However, "If you stir up my environment meaningfully so that I can teach the person next to me something that I [just learned], I will use 90 percent of my brain," suggests Weber.

The Brain, a Control Freak

To get even more engagement, ask employees to come up with strategies at the meeting and engage them in discussion. "Behind the scenes, the brain is rewiring its dendrite connectors—how the brain receives messages—for things other than whatever you're discussing," says Weber (see "Focus, Focus," above). So, not only do you get more brain power during the meeting, you're rewiring brains to make better insights later.

What's more, you reboot meeting participants' dendrites—those neurons receiving information—if you give a task in the opposite direction of the problem.

For example, Weber worked with one HR professional struggling with poor morale caused by grousing and helplessness about problems her employees encountered daily. Tired of listening to her employees vent, she told them, "No longer will I listen to a problem unless you submit at least a portion of the solution."

Weber explains what happened next in neuroscientific terms: "The next day, the basal ganglia were at work continuing to vent about the problems with no solution." One employee went to the HR professional's office. He didn't have a solution, so she sent him away.

"About three days later, workers realized she was serious. So, a different person went into her office with a solution to the problem. The HR professional agreed to and supported the solution put forward with slight revisions to keep it under budget."

That simple change transformed the employees' dynamics—and their brains—by turning control over to them. "The conversation in the basal ganglia went from problem-focused to solution-focused," says Weber. "When people in that department went to sleep at night, they rewired their brains for the new behaviors."

Change management initiatives, according to neuroscientists, will be more successful when ownership is transferred to those who need to buy into the change—employees. Neuroscientists call this "self-directed neuroplasticity," creating more connectivity in the brain.

On the Horizon

Discoveries based in neuroscience about human behavior come out every week, and include breakthroughs with real impact on workplace management.

For example, researchers want to understand "why mindfulness has dramatic impact on health and performance," says Rock. "Mindfulness is the ability to observe your brain functioning. What is self-awareness? Why is self-awareness so important? Why is it so important to know why it is you do the things you do? Every training program says you need more self-awareness. Why? Neuroscience is studying this. If we know why, you can focus on it more."

Other research explores "reappraisal," the ability to look at a situation and change your interpretation of it, according to Rock. For instance, you see your boss stomping down the hall and instead of concluding quickly that you're about to get fired, you reappraise the situation for what it is—your boss having a bad day.

Reappraisal changes your brain's interpretation of the event, dampens the amygdala response and changes the actions you take, Rock says.

Such cognitive insights may change the way people work in the future. "We are getting closer to understanding exactly why it is that a meeting has gone wrong or how to run the best possible brainstorming session or how to give feedback," says Rock. "We are getting closer to these answers by understanding the underlying physiology."

Adrienne Fox, a freelance writer in Alexandria, Va., is a contributing editor and former managing editor of *HR Magazine*.