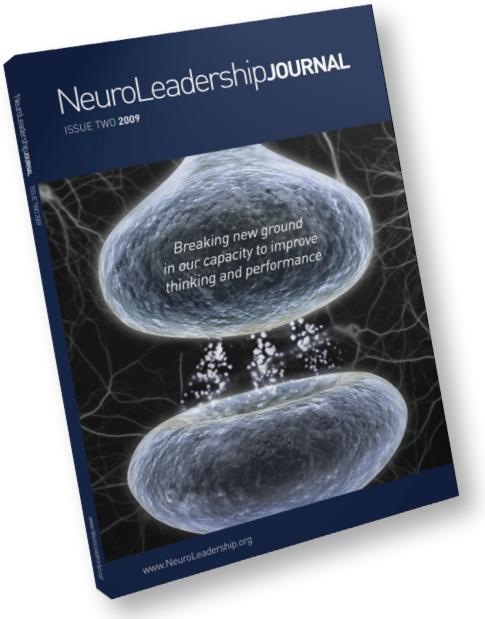
NeuroLeadership in 2009

Dr. Al H. Ringleb and David Rock



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On the basis of virtually every objective measure, the applications of neuroscience to leadership: NeuroLeadership, a word first coined by one of the authors, David Rock, in 2006, are growing in recognition and acceptance. It has now been more than two decades since the first fMRI paper was published. In 1992, only four such papers were published; in 2007, there were eight published per day (Editorial, 2009). Based on our observations and discussions with leading neuroscientists and leadership scholars, there is every reason to believe those numbers will continue to increase, with advances in technologies providing us with more and more detailed information about the brain. A simple search of research databases reveals that the number of articles in virtually every media discussing neuroscience and its applications relevant to the effective practice of management and leadership are increasing rapidly. According to searching on amazon.com, in 2009, there were 230 books written on the brain; for 2010, there are more than 200 slated to be published in the first half of the year alone.

The purpose of this article is to look back over 2009 and discuss some of the more interesting articles and books on NeuroLeadership. Perhaps as little as five years ago, that task could easily have been performed in an afternoon. Again, speaking to the growing importance of this field of research, this has become a far more daunting undertaking. In getting some assistance, we called upon the research community to assist us, and we were pleased to get responses from several scientists, including Prof. Robert Coghill, Prof. Yiyuan Tang, Prof. Mark Beeman, and Prof. Matthew Lieberman.

In reviewing the available research, and guided by suggestions from the scientists, we decided to categorize the research based on the four domains we set out in the first **NeuroLeadership JOURNAL** which established the field (Ringleb and Rock, 2008): decision making and problem solving; emotional regulation; collaborating with others; and facilitating change. In selecting research articles and books for inclusion, we were led by the following criteria: relevance to the field of NeuroLeadership; likelihood of significantly expanding or creating research linkages between neuroscience and leadership/management; impact on current thinking as driven by social science research; and, perhaps most important, the interests of the practitioners in this growing field.

Decision making and problem solving

A cursory review of the traditional leadership literature on decision making and problem solving reveals that the majority focuses on how an individual makes decisions. Much of the more recent work has involved the affirmation or extension of this traditional body of work through the application of insights about the functioning of the brain drawn from neuroscience research. Although a number of authors allude to the importance of open group discussion for the purpose of overcoming shortcomings in individual decision making, neuroscience has only just begun to look at the neural basis for decision making in social or group settings.

A study with implications for decision making in group settings looked at Oxford rowers and showed that in training together members of the team were able to tolerate far more pain than when they trained on their own

(Cohen *et.al*, 2009). A number of prior studies had shown that physical exercise stimulates the release of endorphins, creating a mild sense of euphoria. Using pain tolerance (a conventional non-invasive assay for endorphin release), the Cohen study showed that group training heightened the endorphin surge compared with a similar training regime carried out alone. The authors speculate that this heightened effect from synchronized activity may explain the sense of euphoria experienced during other social or group activities that involve social bonding (such as laughter, music-making, dancing, or working together to solve a problem or make a difficult decision).

...innovation and creativity are important leadership and management thinking processes.

A study focused on individuals, but with potentially interesting applications to group settings, is the work on the brain's 'braking system' presented in this Journal by Prof. Matthew Lieberman. Prof. Lieberman looked at a study undertaken by Prof. Michael Mischel, often referred to as the 'Marshmallow Study' (Mischel and Ebbeson, 1970). Mischel's study involved four-year-olds who were presented with a marshmallow and then told if they could resist eating it for fifteen minutes they would earn a second marshmallow. The Mischel's study took on new significance when those same children were studied years later, the resisters were more successful on the basis of virtually every objective measure (including job and family satisfaction, income, education success, even SAT scores) while those unable to resist were found to be more troubled, stubborn and indecisive, mistrustful, and less self-confident. Prof. Lieberman asserts that those children who were able to resist eating the marshmallow did so by putting the marshmallow 'into a frame,' thereby removing or controlling their emotional desire to eat it. Interestingly, studies expanding upon the Mischel study have not found a relationship between the ability to resist and IQ, but have instead found a relationship with decision making competency. It is interesting to speculate as to the role neuroscience may play in both the development of, say, a 'Rationality Quotient' or 'RQ' assessment instrument (to assist in defining an individual's 'Rational Intelligence') and then in the development of how such an instrument might be used in the selection of managers or leaders.

As evidenced by the volume of research spent in defining them, innovation and creativity are important leadership and management thinking processes. Using standard psychology assessments as a measure of creativity, Profs. William Maddux and Adam Galinsky found that the experience of living in a foreign country substantially fosters creativity (Maddux and Galinsky, 2009). The study showed that subjects who had either lived abroad or who had spent an extended period abroad were able to solve structured problems at a significantly higher rate than those who had not. Their study becomes particularly interesting when combined with the work of Profs. Jia, Hirt and Karpen, who showed that it is possible to induce a similar state of distance of 'psychological distance,' simply by changing the way we think about a particular problem. The authors hypothesized that this distance could be achieved by attempting to take another person's perspective or by thinking of the problem as being unreal or unlikely. The authors showed that by increasing psychological distance to make the issue seem further away can actually lead to an increase in creativity (Jia, Hirt and Karpen, 2009). The combination of the two studies leads to speculation, and thereby motivates corresponding research inquiries, about how to go about stimulating a creative work environment.

'Clearing your mind' is an often suggested approach to avoid making 'foolish' decisions. It is the expectation that clearing your mind will reduce the likely recent information or experience (even if irrelevant) and may bias your thinking. In a study published in the *Proceedings of the National Academy of Sciences*, Profs. Ophir, Nass, and Wagner surveyed more than 250 students to determine the affect of their multitasking lifestyle on performance (Ophir, Nass and Wagner, 2009). Then, taking the students who multitasked the least and the most, they asked each student to take a series of computer-based tests, completed while focusing only on the task at hand. In each of the tasks, students who spent less time multitasking; reading e-mail, surfing the net, talking on the phone, and watching television, performed best. The tests were intended to reveal ability to ignore irrelevant information, organize information into working memory, and show how quickly an individual is able to switch from doing one thing to another. Given the brain's neuroplasticity, will additional research on the neural basis of this finding show that we are beginning to pick up new skills as a consequence of our multitasking environment? Will it suggest more efficient ways to develop such skills? One author has gone so far to suggest that it may even imply some interesting contradictions: 'mindful web-surfing or mindful Twittering' (Anderson, 2009).

It is now generally accepted practice in both the managerial practice of coaching and in coaching in general to use the power of questioning to motivate insight. Profs. Subramaniam, Kounios, Parrish, and Jung-Beeman assessed several mood

and personality variables in 79 participants before they attempted to solve problems (Subramaniam *et.al*, 2009). They found that participants who were higher in positive mood solved more problems, specifically more with insight, compared to those participants who were found to be lower in positive mood. Similarly, Profs. Schmitz, De Rosa, and Anderson found that when an individual is in a positive mood their visual cortex takes in more information, while being in negative moods result in tunnel vision (Schmitz, De Rosa and Anderson, 2009). These studies combine in remarkable ways with Prof. Lieberman's *brain's braking system* inquiry and the Ophir, Nass, and Wagner study by suggesting that positive mood enhances insight by modulating attention and cognitive control mechanisms (through the anterior cingulate cortex -ACC).

In considering books relevant to the decision making and problem solving domain, Jonah Lehrer's *How We Decide* provides the reader with a good understanding of the neuroscience of decision making and problem solving (Lehrer, 2009). It provides a deep bibliography on which to build a foundation for additional research within this domain. The insightful reader will see particularly interesting neuroscience connections after reading Lehrer's discussion of Damasio's work on decision making and emotion (Bechara *et.al*, 2000; Damasio, 2004) and then Prof. Lieberman's article in this Journal on the *brain's braking system*.

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Emotional regulation

Leadership researchers and psychologists have both come to explicitly recognize the importance of emotion and emotional stability in effective leadership. The research indicates there is reason to believe that emotion, more than intellectual ability, drives a leader's thinking in decision making and in interpersonal relationships (Goleman, 1995; Goleman, 2006). An effective leader has the ability to perceive, identify, understand, and successfully manage their emotions and the emotions of others. In this sense, they harness and direct the power of emotion to build trust and improve follower satisfaction, morale, and motivation, and thus to enhance overall organizational effectiveness.

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Ferreting out and understanding the neural basis for these emotions provides us with insights into how we can better develop leaders. A study conducted by Profs. Halberstadt, Winkielman, Niedenthal, and Dalle published in *Psychological Science* considered how the way we initially think about the emotions of others then biases our subsequent perceptions of their facial expressions (Halberstadt *et.al*, 2009). The study's twenty-seven participants were shown photographs of several faces computer-morphed to express ambiguous emotion and instructed to label each face as being either angry or happy. Participants then watched movies of each face as it slowly changed expression from angry to happy and then were asked to identify the photograph of the face as it appeared in the initial viewing. Not only did participants' initial interpretations bias their memories, but faces they had initially interpreted as being angry were remembered as expressing more anger and faces interpreted as being happy were remembered as expressing more happiness. Further, via electromyography (EMG), the researchers discovered that participants imitated the emotion with their own faces when viewing the initial ambiguous faces again. This imitation was significant in that as a largely automatic response, it reflects how the ambiguous face is actually being perceived. Given that some participants saw the same ambiguous face as being angry while others saw it as being happy, participants were literally seeing differing expressions. The study illustrates the extent to which neuroscience is taking leadership from the physical to the mental world. Leaders clearly need to be sensitive to the fact that what they say may not necessarily be what followers are hearing. That is, 'seeing is believing'

works well in the physical world but the practical truth is that 'believing is seeing' may be closer to the reality of the mental world in which managers/leaders actually reside.

In the workplace, 'engagement' refers to the degree of positive emotion a person attaches to the organization, their job, and their colleagues. When a person is engaged, they are attracted to, inspired by, committed to, and even fascinated by their work or their input to the work relationship. As we saw previously in the study by Profs. Schmitz, De Rosa, and Anderson, when an individual is in a positive mood, their visual cortex takes in more information, while negative moods result in a far narrower focus (Schmitz, De Rosa and Anderson, 2009). Herein, Rock and Tang in their article *The Neuroscience of Engagement* explore this line of thinking and its implications with the intent to encourage additional NeuroLeadership research.

Mindfulness is increasingly being viewed as a key ingredient not only in providing leaders with greater personal control over negative emotionality and stress (thereby enhancing well-being), but also as a necessary state from which to approach personal intentional change and then sustain the resulting changes (Tang *et.al*, 2007). In a 'before and after' study of 70 physicians, researchers Krasner, Epstein, Beckman, Suchman, Chapman, Mooney, and Quill sought to determine whether an intensive educational program (involving mindfulness meditation, communication, and self-awareness exercises) was associated with improvement in primary care physicians' well-being, psychological distress, burnout, and capacity for relating to patients. The year-long study looked at a variety of measures for mindfulness, burnout, empathy, personality and mood, all measured at baseline and then again at two, twelve, and fifteen months, with the statistical analysis showing that participation in the program resulted in sustained improvements in well-being and attitudes associated with patient-centered care (Krasner *et.al*, 2009). The Siegel and Pearce-McCall article herein, *Mindsight at Work: An Interpersonal Neurobiology Lens on Leadership*, significantly extends this line of thinking and its applications to leadership. Prof. Siegel's current book, The *Mindful Brain: Reflection and Attunement in the Cultivation of Well-Being,* and his forthcoming book, *Mindsight: The New Science of Personal Transformation* (Siegel, 2010), provide considerable additional detail and research support on this important NeuroLeadership subject.

Collaborating with others

In looking to significant additions to leadership research on collaborating with others, the driving force of NeuroLeadership research is the principle the brain is 'deeply social' (Lieberman, 2007). David Rock's SCARF model, set out in last year's Journal, lent considerable definition to the relationship between social neuroscience and leadership (Rock, 2008). Rock has further refined his thinking and broadened SCARF's applications, particularly as it relates to creating more productive work environments, in *strategy+business magazine* (Rock, 2009).

For leadership theorists and practitioners, the SCARF model provides considerable insight into our experiences and observations. Importantly, neuroscience research is beginning to provide empirical evidence on the neural basis for more and more of the emotions elicited by those experiences. For example, Prof. Takahashi and his team of researchers conducted two fMRI studies to elucidate the neurocognitive mechanisms of envy and schadenfreude, the latter defined as delight in another's misfortune (Takahashi *et.al*, 2009). The studies showed that if, in a social comparison, an individual assesses themselves as being superior to another, reading about the other person's accomplishments evoked envy and inflicted social pain activating the individual's threat circuitry (in the ACC). In the second study, they found that individuals who experienced envy also experienced schadenfreude; in fact, they had significantly greater brain activation associated with schadenfreude than those individuals who did not experience envy. Reading about the envied person's misfortunes activated the individual's reward circuitry (in the dorsal ACC). As Profs. Lieberman and Eisenberger showed us in last year's Journal, our emotional responses to these psychological events rely on much of the same neural circuitry that underlies the simplest physical pains and pleasures (Lieberman and Eisenberger, 2008).

Within the SCARF model, certainty in the work environment is defined by the leader's ability to provide clarity in job expectations, to explicate role responsibilities, and to communicate a clear vision. Followers want to understand their leader's vision and goals, with success in the organization determined, to a great extent, by how clearly the leader communicates them. In a study published in the journal *Neuron*, Profs. Bromberg-Martin and Hikosaka looked into the neural basis for why advance information about rewards to be received in the future is preferred to being left in suspense. Working with Rhesus monkeys, the study focused on a form of cognitive reward involving anticipation of a substantial future gain. Recording the activity of dopamine reward neurons in the monkeys' midbrain while they performed a simple decision task, the study found that the neurons which signaled the monkeys' expectation of rewards also signaled the expectation of advanced information; the dopamine neurons treated information about future rewards as if it was a reward itself. As a way of conveying future rewards to NeuroLeadership scholars, Profs. Berkman and Lieberman lay out a neuroscience and social psychology research plan in this area in their article *The Neuroscience of Goal Pursuit: Bridging the Gaps between Theory and Data* (Berkman and Lieberman, 2009).

A particularly interesting book relevant to this domain is Dr. De Waal's *The Age of Empathy*. In his book, de Wall

provides considerable evidence, including his own research, that we are wired to respond to others' moods. As he asserts, and neuroscience research supports, 'Bonding... is what makes us happiest.' The article herein by Profs. Iacoboni and McHaney, *Applying Empathy and Mirror Neuron Concepts to NeuroLeadership*, lays the foundation for what will certainly be a considerable body of neuroscience research. For example, studies in this area have established that we respond more readily to those with whom we feel a bond or connection. Taking into account neuroscience's growing understanding of mirror neurons, language, and the neural basis for empathy, NeuroLeadership research on the neuroscience of storytelling is a subject for additional NeuroLeadership research inquiry.

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Facilitating change

Whether from a management, leadership, or personal perspective, much of leadership research on change has focused on investigating the psychological nature of behavior. An understanding of follower behavior was thought to provide leaders with the ability to appropriately motivate people in the interest of organizational change and performance. Concerns about how motivation occurs generated considerable research on the process of motivation, emphasizing expectations, feedback, fairness, goal-setting, and performance appraisal in explaining the various approaches used by leaders in bringing about behavioral change. In providing guidance to organizations in overcoming follower resistance to change, leadership and management theorists touted the importance of such tools and techniques as coaching, mentoring, and training programs. Neuroscience's understanding of the brain's approach-avoidance response (its fundamental organizing principle to minimize danger and maximize reward (Gordon, 2000)), social pain, neuroplasticity, attention, and mindfulness has, in several cases, shown us that traditional approaches to motivation are not only ineffective, but can actually produce the opposite result (Jacobs, 2009).

Of considerable interest to coaches and leadership development is the neuroscience notion of neuroplasticity. While neuroscience has completely expunged the idea that after a certain level of development the brain is no longer capable of change, considerable research is still being done on how quickly the brain changes and the extent to which those changes are sustainable. In their study published in the *Journal of Neuroscience*, Profs. Dilks, Baker, Liu, and Kanwisher show that the brain can adapt to changing demands and conditions in visual deprivation much faster than what had been previously expected (Dilks *et.al*, 2009). While similar studies have been done on the somatosensory system (Ramachandran, 1992), relatively little work had been done on the perceptual consequences of deprivation in the visual system and no work investing the time course of any such consequences, the latter part of the study being the most interesting with regard to neuroplasticity. Based on the reactions of 48 individuals aged 19 to 50 years, the study found that neurons reacted to visual deprivation (each participants' left eye was patched) in a matter of seconds. The research team left us with a very important question for future research: 'Are these phenomena related to, or entirely distinct from, the neural mechanisms underlying developmental plasticity?'

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Returning once again to the notion of engagement in the workplace, and the Rock and Tang article *The Neuroscience of Engagement* herein, in moving organizations toward an engaged workforce, most leaders soon learn through trial and error that 'carrots and sticks' (and behavioral psychology) work poorly. With regard to the SCARF model, a growing body of research now shows that every action a leader takes and every decision a leader makes either supports or undermines the perceived levels of status, certainty, autonomy, relatedness, and fairness among followers. The process of moving toward an engaged workforce starts by reducing the threats inherent in both the organization and its leaders' behavior. Because the threat response is so strong, immediate, and difficult to ignore, organizational and leadership behavioral threats often overwhelm reward. In a study published in *Science*, Profs. Rand, Dreber, Ellingsen,

Fudenberg, and Nowak offer empirical evidence that rewards (robustly) built compliance and cooperation. The study involved 192 participants involved in a public goods game and contradicts previous research which had stated that pure punishment is the only effective mechanism for promoting public cooperation.

The process of moving toward an engaged workforce starts by reducing the threats...

In a study with interesting implications for both the neural basis of engagement and social pain, Profs. Zhou, Vohs, and Baumeister showed that money has considerable psychological power, enough to alter reactions to social exclusion and even physical pain (Zhou *et.al*, 2009). That is, money could be a possible substitute for social acceptance by enabling even rejected or unpopular persons to get what they need from the social system. Building on past research showing that a social relationship can make things hurt less (Eisenberger *et.al*, 2003), participants were asked to put their fingers in bowls of water heated to 122°F and rate how uncomfortable it felt. Participants who earlier had been counting money reported that the water did not feel as uncomfortable as it did for another group of participants who had counted slips of paper.

In a study with implications for the change domain as it relates to learning and memory, Profs. Histed, Pasupathy, and Miller used monkeys to investigate the neural basis of learning from our mistakes. They demonstrated that if a behavior is successful, cells in the prefrontal cortex and basal ganglia (specifically the caudate nucleus which is correlated with behavioral adjustment) become more finely tuned to what is being learned. In the event the trial behavior was a failure, they found little or no change in the brain as well as no improvement in behavior. After a correct response, the electrical impulses coming from neurons in each of these brain areas were stronger and clearly conveyed more information. These impulses lasted for several seconds, until the next trial; from four to six seconds spanning the entire timeframe between trials; with the neural activity following the correct answer and reward assisting the monkeys in doing better on subsequent trials. On the basis of the observed neural activity, the research team concluded that it may explain why we seem to learn more from our successes than our failures. This study, when taken together with both mindfulness and a recent study by Profs. Yeshurun, Lapid, Dudai, and Sobel showing that the first smell we associate with an object is given privileged status in the brain (Yeshurun *et.al*, 2009) will create enthusiasm for research to better understand how outcome-related brain activity develops during learning.

AHR: The year 2009 saw the publication of a very important book on the brain that provides the reader with depth of coverage in all four domains and an extensive bibliography to support further research. David Rock's book, *Your Brain at Work* (Rock, 2009), is based not only on detailed personal inquiry into the important functions of the brain but also on extensive interviews with many of the neuroscientists driving today's leading edge research. I can personally attest to the long hours that have gone into writing this book, and recommend it to all of my students as being a gateway to the bountiful insights that neuroscience is just beginning to provide on the brain's role in effective management and leadership. I wholeheartedly agree with Prof. Warren Bennis' assessment: 'This is the best, most helpful, and brainiest book I have read on how the brain effects how, why, and what we do.'

Conclusion

Neuroscience research is clearly expanding rapidly with the growth in brain imaging technology. As research in neuroscience expands, the linkages with leadership and leadership development are providing fertile grounds for the development of better and better tools and techniques that allow us to increase the managerial and leadership productivity and effectiveness. It is important that we begin to both identify these linkages and provide input to neuroscientists as to the kind of research that would be most beneficial to leaders and leadership development. The neuroscience of feedback, conflict management, storytelling, and issue resolution are examples of the broad-based research articles that are likely to have the greatest impact on driving more and more specific research in those areas. As quoted in our last introductory article, and in the words of Prof. Matthew Lieberman: 'It may be time for leadership theorists to take a neuroscientist to lunch.'

References

Anderson, S. (2009). *In defense of distraction.* New York.

Bechara, A., Damasio, H., & Damasio, A. (2000). Emotion, decision making, and the orbitofrontal cortex. *Cerebral Cortex, 10*(3), 295-307.

Berkman, E., & Lieberman, M. D. (2009). The neuroscience of goal pursuit: Bridging gaps between theory and data. In G. Moskowitz & H. Grant (Eds.) *The Psychology of Goals*. New York, NY: Guilford Press, pp. 98-126.

Cohen, E. E. A., Ejsmond-Frey, R., Knight, N., Dunbar, R. I. M. (2009). Rowers' high: Behavioural synchrony is correlated with elevated pain thresholds. *Biology Letters,* doi: 10.1098/rsbl.2009.0670.

Damasio, A. (2004). Decartes' error: *Emotion, reason, and the human brain.* New York: Grosset/Putman.

Davis J. M., & Davidson, R. J. (2007). Mental training affects distribution of limited brain resources, *PLoS Biol., 5*(6), 138.

Dilks, D. D., Baker, C. I., Liu, Y., & Kanwisher, N. (2009). Referred visual sensations: Rapid perceptual elongation after visual cortical deprivation. *The Journal of Neuroscience, 29*(28), 8960-8964.

Editorial (2009). Connecting the dots. *Nature Neuroscience, 12*(2), 99.

Eisenberger, N. I., Lieberman, M. D., & Williams, K. D. (2003). Does rejection hurt? An fMRI study of social exclusion. *Science, 302,* 29-292.

Goleman, D. (1995). *Emotional intelligence: Why it can matter more than IQ.* New York: Bantam Books.

Goleman, D. (2006). *Social intelligence.* New York: Bantam Books.

Gordon, E. (2000). *Integrative Neuroscience: Bringing together biological, psychological and clinical models of the human brain.* Singapore: Harwood Academic Publishers.

Halberstadt, J., Winkielman, P., Niedenthal, P. M., & Dalle, N. (2009). Emotional conception: How embodied emotion concepts guide perception and facial action. *Psychological Science, 20*(10), 1254 – 1261.

Jacobs, C. (2009). *Management rewired: Why feedback doesn't work and other surprising lessons from the latest brain science.* New York: Portfolio Hardcover.

Jia, L., Hirt, E. R., & Karpen, S. C. (2009). Lessons from a faraway land: The effect of spatial distance on creative cognition. *Journal of Experimental Social Psychology, 45*(5), 1127-1131.

Krasner, M. S., Epstein, R. M., Beckman, H., Suchman, A. L., Chapman, B., Mooney, C. J., & Quill, T. E. (2009). Association of an educational program in mindful communication with burnout, empathy, and attitudes among primary care physicians. *Journal of the American Medical Association, 302*(12), 1284-1293.

Lehrer, J. (2009). *How we decide.* New York; Houghton Mifflin Co.

Lieberman, M. D. (2007). Social cognitive neuroscience: A review of core processes. *Annual Review of Psychology, 58,* 259–289.

Lieberman, M. D. & Eisenberger, N. I. (2008). The pains and pleasures of social life: A social cognitive neuroscience approach. *NeuroLeadership Journal, 1,* 38-43.

Maddux, W. W. & Galinsky, A. D (2009). Cultural borders and mental barriers: The relationship between living abroad and creativity. *Journal of Personality and Social Psychology, 96*(5), 1047-1061.

Mischel, W., & Ebbeson, E. B. (1970). Attention in delay of gratification. *Journal of Personality and Social Psychology, 16,* 329-337.

Ophir, E., Nass, C., & Wagner, A. D. (2009). Cognitive control in media multitaskers. *Proceedings of the National Academy of Sciences, 106*(37), 15583-15587.

Ramachandran, V. S. (1992). Filling in the blind spot. Nature, 356, 115.

Ringleb, A. H., & Rock, D. (2008). The emerging field of NeuroLeadership. *NeuroLeadership Journal, 1,* 3-19.

Rock, D. (2008). SCARF: A brain-based model for collaborating with and influencing others. *NeuroLeadership Journal, 1,* 78-87.

Rock, D. (2009). Managing with the brain in mind. *strategy+business magazine, 56,* 58-67.

Rock, D. (2009). *Your Brain at Work: Strategies for overcoming distraction, regaining focus, and working smarter all day long.* New York: HarperCollins

Schmitz, T. W, De Rosa, E., & Anderson, A. K. (2009). Opposing influences of affective state valence on visual cortical encoding. *The Journal of Neuroscience, 29*(22), 7199-7207.

Siegel, D. (2007). *Mindful brain: Reflection and attunement in the cultivation of well-being.* New York: W. W. Norton & Company.

Siegel, D. (2010). *Mindsight: The new science of personal transformation.* New York: Bantom.

Subramaniam, K., Kounios, J., Parrish, T. B., & Jung-Beeman, M. (2009) A brain mechanism for facilitation of insight by positive affect. *Journal of Cognitive Neuroscience, 21*(3), 415-432.

Takahashi, H., Kato, M., Matsuura, M., Mobbs, D., Suhara, T., & Okubo, Y. (2009). When your gain is my pain and your pain is my gain: Neural correlates of envy and schadenfreude. *Science, 323*(5916), 937-939.

Tang, Y., Ma, Y., Wang, J., Fan, Y., Feng, S., Lu, Q., Yu, Q., Sui, D., Rothbart, M. K., Fan, M., & Posner, M. I. (2007). Short-term meditation training improves attention and self-regulation. *Proceedings of the National Academy of Sciences, 104*(43), 17152-17156.

Yeshurun, Y., Lapid, H., Dudai, Y., & Sobel N. (2009). The privileged brain representation of first olfactory associations. *Current Biology, 19*(21), 1869-1874.

Zhou, X., Vohs, K. D., Baumeister, R. F. (2009). The symbolic power of money: Reminders of money alters social distress and physical pain. *Psychological Science, 20*(6), 700-706.