SPORTS FANS are familiar with the thrill of a come-from-behind victory in Game 7—and the agony of being on the losing end. What underlies these emotions?

Top scientists from around the country answer this question and more in Your Brain on Cubs: Inside the Heads of Players and Fans. What is it about the human brain that allows a player to hit a ball traveling at 90 miles per hour, almost before he has time to react to it? What keeps fans loyal to a losing team, year after (agonizing) year?

Other writers examine topics such as how the brain changes as a ballplayer—or anyone else—gains expertise, why left-handers are more prevalent in the Major Leagues than in the general population, and what the ethical implications are of brain-related performance enhancement.

Your Brain on Cubs centers on America’s pastime but draws in other sports as well for an intriguing examination of talent and triumph on the field and devotion in the stands.
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Jordan Grafman

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Kenneth M. Heilman

Chapter 7. It Isn’t Whether You Win or Lose, It’s Whether You Win: Agony and ecstasy in the brain
Kelli Whitlock Burton and Hillary R. Rodman

Dan Gordon, managing editor of Dana Press in Washington, D.C., edits and oversees periodicals and books for general readers about the brain. A native of Normal, Ill.—the border region between Cubs and Cardinals territory—he has been a Cubs fan since age 6. Having experienced the cycles of hope and disappointment to which all fans can relate, he realized one sunny Saturday afternoon at Wrigley Field that in the context of sports fandom, examining the brain is a natural.
In this second annual anthology, top scientists and scholars interpret the latest discoveries about the human brain and confront their implications for fields from architecture to ethics, music to health care policy. Among the provocative topics are whether free will is an illusion, the risks and rewards of new drugs based on living cells, why remembering our past is essential to envisioning the future, how brain science can inform design of better facilities for people with Alzheimer’s disease, and when using drugs to smooth the daily bumps of our emotional lives might be an ethical choice.

In his foreword, science writer Carl Zimmer says that news about the human brain tends to trigger cyclones of chatter, but we often don’t know what to make of the sheer mass of data. The provocative articles in Cerebrum, however, offer a guide to ordering one’s understanding of the brain.

“A real intellectual treat...research findings seen not just in their raw state of discovery but in the far-reaching long term implications they have for health, society, and the future of creativity and innovation.”

—Floyd E. Bloom, M.D., Former Editor of Science
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EXCERPT

Your Brain on Cubs:
Inside the Heads of Players and Fans

Dan Gordon, Editor

For the catalog description, see page 2.
To order, see page 24.

FROM CHAPTER ONE

The Depths of Loyalty:
Exploring the brain of a die-hard fan
by Jordan Grafman

Given the complex situations and thinking that Cubs fans have had to engage in, it turns out that the frontal lobes are consistently activated in almost all circumstances involving a fan thinking about the team:

• The overall hope for a World Series Champion on the North Side

Though some might point to the past century as evidence that this hope requires losing one’s mind, the hope in fact comes from a part of the brain called the prefrontal cortex. This brain region in humans is known to be important for planning, reasoning, social cognition, knowledge about the behavior of others, establishing a context, and similar
higher-level cognitive processes. The purpose of activation in this region would be to generate (obviously by analogy to other teams and situations) what the Cubs need to do to win the World Series, to retrieve knowledge about the fate of other teams that have won it, to inhibit the historical evidence related to the Cubs’ failure to go all the way, and to temper any unrealistic assumptions about winning with hopeful longer-term goals—if the past be a guide, the goals must be very, very long-term indeed.

- **The enjoyment of sitting at Wrigley Field watching the Cubs play**

  Nostalgia about the intimacy of old baseball parks, social bonding with other fans watching or listening to the game, and encoding and predicting the sequence of events occurring on the day of the game (including aspects of the action itself) also activate the prefrontal cortex. However, more posterior brain regions concerned with visual, auditory, and even tactile perception and the emotion-centered limbic system become activated when you feel the wind in your hair coming from the north and west, view the beautiful green of the vines adorning the outfield walls, inhale the smell of a ballpark hot dog, look upon the natural turf of the outfield, and sense that your behavior is mirroring that of the fans around you and even the fans on the rooftops of the apartment buildings beyond the outfield bleachers. Your auditory cortex takes delight in hearing even the off-tune singing of “Take Me Out to the Ballgame” by the guest of the Cubs during the seventh-inning stretch. Your limbic system, responsible for your emotions, is attuned to your mood as you follow the downs and ups of the Cubs’ fortunes during the game, hopefully ending with a victory. In that instance, the brain’s reward system, including the ventral brain stem
and basal ganglia, pumps dopamine into your brain with a refinement that matches the experience of seeing the froth of a congratulatory beer at a neighborhood bar after the win. (The beer’s effects in the brain involve the reward system described above, as well as the prefrontal cortex).

- **Social Bonding**
  Sitting with friends at the game, hearing or discussing the game with the fans around you, listening to it on a radio or watching it on TV allow for bonding with others. Such bonding activates the septum and the subgenual prefrontal cortex, which then releases chemicals such as oxytocin that signal the degree of pleasure of the bonding (a mother’s brain is pumping oxytocin as she bonds with her infant). For some people this bonding (such as the enjoyment of sitting in Wrigley) is powerful and brings a person back to the same situation and baseball park many times in the future, in search of a similarly pleasurable experience.

- **Who am I?**
  The prefrontal cortex is also an essential brain region for mediating our notion of self. For example, watching a baseball team play may activate memories of playing baseball in our youth. Neuroscientists have identified so-called mirror neurons in our brain that are activated whether we are playing a sport or watching others play. This mirror neuron brain system spans frontal and posterior brain regions. It helps us integrate the enjoyment of playing the game with simple knowledge of the game and memories of our playing the game in our youth. As Vittorio Gallese showed in a 2007 study, mirror neurons become activated when we watch a baseball team play.

Besides this implicit interplay between watching a sports
team play and our own memories of whom we were (and are), the love of a sports team is powerful enough for some people to influence their habits and schedules and motivate the way they form relationships with friends, relatives, spouses, and children. For the serious sports fan, this has obvious consequences: not everyone wants to devote a corner of the family room to a shrine for the team. In extraordinary circumstances, a sports team can galvanize a nation, giving the population something to identify with in a way little else could achieve.

For example, a few years ago I was in Greece, lecturing at a neuropsychology summer school. It so happened that the Greek national soccer team was competing for the European championship. Clearly an underdog, they won the championship that summer. The remarkable outpouring of happiness and emotion from the majority of Greeks, many of whom no doubt paid little attention to the team or the sport ordinarily, was particularly touching. They were Greece, Greece had won a major championship, and the celebrations lasted throughout the night. Touching though it was, thanks to my mirror neurons, watching the celebrations made the Cubs fan in me a bit wistful.

The Cubs will always remain a part of their fans’ personal identity. That occurs in a powerful symbolic way—the overwhelming majority of fans have never met a player, nor do we consider them friends. We understand that they are businessmen, that different players represent the team at different times, under different owners whose business interests trump any sense of loyalty to the city. But we ignore these counterfactuals in order to lay our symbolism on the team, dress them up with our accumulated identities, and wait for the transcendent moment they win the big one and our identities become magically transformed.
"Building for the Shattered Mind: Partnering Brain Science and Architecture"

by Kayt Sukel and Russell Epstein, Ph.D.

In *Elegy for Iris*, John Bayley’s poignant memoir chronicling life with his wife, Iris Murdoch, as she struggled with Alzheimer’s disease, the author writes, “Alzheimer’s is, in fact, like an insidious fog, barely noticeable until everything around has disappeared. After that, it is no longer possible to believe that a world outside the fog exists.”

Alzheimer’s disease, a progressive and irreversible neurodegenerative brain disorder, currently affects more than five million Americans. Because of an overwhelming loss of function, people with the disease will eventually need round-the-clock care, often provided by nursing homes or assisted-living facilities. Even the best of these facili-
ties, however, can be a tremendous adjustment for people struggling with the disease, as well as for their families.

But what if we could create assisted-living spaces for people with Alzheimer’s that could make life easier despite the “insidious fog?” What if, by bringing together knowledge of architectural design and knowledge of what goes on inside the brain of the person with Alzheimer’s, we could design buildings and interiors that will help people stay more capable over longer stretches of time, remember the outside world, and successfully interact with it?

**FROM CHAPTER SEVEN**

“Cosmetic Neurology’ and the Problem of Pain”
by Anjan Chatterjee, M.D.

Thousands of young men and women experience varying degrees of post-traumatic stress disorder following military service, and many of them fall through the cracks in our society. Few people would argue against treating such individuals, in the same way that few would argue against treating their physical ailments—even if, in practice, we fall short of treating either type of affliction.

But what about less severe traumas, or even the challenges of everyday life? Preliminary research suggests that beta-blockers may prevent post-traumatic stress symptoms when given to people who have gone to the emergency room after a car accident. In addition to dampening the emotional effects of memories after they form (retroactively), such medications could presumably be used proactively, when the memories are first encoded. If they are proven effective, and more such treatments become available soon, how widely would they be used? We could expect people to employ them for all sorts of “normal”
traumas, such as remorse over wrongdoing or breakups in relationships and the other losses and disappointments that seem integral to our existence as humans.

But what would be the long-term consequences of flattening these bumps in the road? Do we need the experience of pain to develop character? Beyond individual development, what is the role of pain in binding us communally?

FROM CHAPTER EIGHT

“When Music Stops Making Sense: Lessons from an Injured Brain”

by Petr Janata, Ph.D.

As we interact with our environment in the course of our daily lives, most of us take for granted the smoothness with which the flow of events blends together. Our brains stitch together what might otherwise seem to be a disjointed sequence of individual events into a coherent stream of information about the world around us. Language is an obvious example, of course, as letters are bound together into words, words are grouped into phrases and sentences, and sentences form paragraphs and discourse. But music, too, relies on our ability to bind together smaller elements into larger structures. Individual notes are strung together to form melodic motifs. Melodic motifs are used to shape phrases, which in turn form songs or even movements of symphonies. Notes sung simultaneously by different voices or played by different instruments are combined to create harmonies. How our brains bind together these discrete pieces of auditory information to create the experiences of hearing, remembering, or performing music is at the heart of a recent surge of neuroscience research aimed at understanding this ubiquitous human phenomenon.
Mark Hallet: We are constantly making movements. While we certainly feel we choose them freely, do we really? What would it mean if we did? The physiology of movement has been the object of intense study by scientists, and we now know the drivers of movement. These drivers include sensory input from the external world, our emotions, our biological drive for homeostasis—for balance of our physiological systems—and our past experience, including rewards and punishments that resulted from previous actions. Do these fully determine our choice or can we identify another factor, which we call free will?

The answers to these questions are easy only for the dualist, who believes in a mind separate from the brain, and who thinks that free will comes from the mind. No evidence for this position can be found, however, and therefore most scientists reject it.

Paul McHugh: Scientists rightly claim that the brain is necessary for consciousness and that manipulations of the brain affect consciousness—witness anesthesia. But correlating brain events and conscious events does not explain consciousness and certainly not the vital, first-person (that is, “my”) experience of consciousness on which choice and freedom rests.

As far as anyone can tell, mental “reasons” (and decisions from amongst them) are real aspects of nature brought into being by consciousness and, as claimed by their subjects, “free” in principle.... The answers to the philosophical question of freedom lie in the subjective realm of human life, beyond contemporary scientific capacities to explain or predict.
SeVERAL RECENT books, using anthropology, psychology, and evolution, have argued that our ethical and moral life evolved from nature. Distinguished neuroscientist, Donald Pfaff, Ph.D., takes that proposition a critical step further, right to the basics: brain signals. In this first book to describe how ethics may be a hardwired function of the human brain, Pfaff explains how specific brain circuits cause us to consider an action toward another as if it were happening to us, prompting us to treat others as we wish to be treated ourselves.

Pfaff presents a rock-solid hypothesis of why humans across time and geography have such similar notions of good and bad, right and wrong.

“Pfaff delivers a crystal-clear tour through the relevant technical intricacies of the science. The ideas that emerge are among the most important in their relevance to human affairs.”

—From the Foreword—Edward O. Wilson

“In lucid prose, an eminent neuroscientist explains how emotions guide human morality, thus breaking with centuries of emphasis on rationality.”

—Frans de Waal, author of Our Inner Ape (Riverhead, 2005)
Best of the Brain from Scientific American:
Mind, Matter, and Tomorrow’s Brain

Floyd E. Bloom, M.D., Editor

In BEST of the Brain, top neuroscientist Floyd E. Bloom has selected the most fascinating brain-related articles from Scientific American and Scientific American Mind since 1999. Bloom garnishes the impressive lineup with his own introduction.

The articles are grouped into three sections. “Mind” includes stories on consciousness and creativity, among brain researchers’ most difficult topics. “Matter” features new perspectives on our senses, psychological disorders, addiction, and more. “Tomorrow’s Brain” provides a peek into the future of brain-machine interactions and groundbreaking treatment approaches.

In the understandable, exciting language that has made Scientific American magazine popular among general readers and experts alike, Best of the Brain provides gripping stories from the frontlines of brain research.

“The past two decades have brought amazing breakthroughs in our understanding of the human brain…Best of the Brain is an irresistible guide to this new territory.”

—Oliver Sacks, M.D., author of Awakenings and The Man Who Mistook His Wife for a Hat

Floyd E. Bloom, M.D., is chairman emeritus of the Department of Neuropharmacology at the Scripps Research Institute in California, past president of the American Association for the Advancement of Science, and former editor-in-chief of Science. He is founder of Neurome, Inc., and author of 25 books.
Defining Right and Wrong in Brain Science: Essential Readings in Neuroethics

Walter Glannon, Ph.D., Editor

Defining Right and Wrong in Brain Science is an authoritative record of the emerging ideas that are defining Neuroethics. Edited by University of Calgary philosophy professor Walter Glannon, it is an essential reference for anyone who wants to understand how these issues have taken shape.

Contributors include Adina Roskies, writing on neuroethics for the new millennium, Martha J. Farah and Paul Root Wolpe on monitoring and manipulating brain function, Antonio Damasio on the neural basis of social behavior, and Alan Leshner on ethical issues in taking neuroscience research from bench to bedside.

This book will be indispensable to readers curious about how discoveries in brain science are stirring up classic — and new — questions of ethics. This new volume is the fifth in The Dana Foundation Series on Neuroethics.

"The ethical implications of neuroscience are truly novel, since the ability to intervene in the brain in many ways is a recent phenomenon."

—From the Introduction by Walter Glannon, Ph.D.

Walter Glannon, Ph.D., holds the Canada Research Chair in Biomedical Ethics and Ethical Theory at the University of Calgary in Alberta. He is the author of many professional papers as well as six books, including Bioethics and the Brain (Oxford University Press, 2006) and Biomedical Ethics (Oxford University Press, 2004).
Cerebrum 2007: Emerging Ideas in Brain Science

Foreword by Bruce S. McEwen, Ph.D.

CEREBRUM 2007 inaugurates a yearly anthology for readers who like provocative ideas that are transforming every area of our lives. It brings together more than a dozen articles and book reviews from the journal’s Web edition. Readers will be among the first to hear top experts deliver, in concise lay language, what will be tomorrow’s wisdom on topics such as the biological nature of ethical behavior, the brain basis for belief in the supernatural, the science of music, and drugs to alter traumatic memories.

“Cerebrum is excellent, exciting, and important food for the brain.”
—Kay Redfield Jamison, Ph.D., author of Exuberance: The Passion for Life

“These gracefully written essays fill the critical space between the technical reports of neuroscientists and psychologists and today’s headlines and enrich our understanding of the dramatic discoveries of the past few decades.”
—Jerome Kagan, Ph.D., author of An Argument for Mind

Bruce S. McEwen, Ph.D., is a professor and head of the Laboratory of Neuroendocrinology at The Rockefeller University, where his research focuses on the actions of stress and sex hormones on the brain and immune system. He is author of The End of Stress as We Know It (Dana Press/Joseph Henry Press, 2002) and The Hostage Brain (The Rockefeller University Press, 1994).
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