AMERICAN MUSEUM OF NATURAL HISTORY

BRAIN

The Inside Story

PLAY COMPUTER BRAIN GAMES

DOZENS OF EXCITING INTERACTIVES

WALK THROUGH A GIANT NEURAL NETWORK

NOVEMBER 20, 2010 - AUGUST 14, 2011

Press Kit

Brain: The Inside Story

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November 2010

BRAIN: THE INSIDE STORY
ON VIEW AT THE AMERICAN MUSEUM OF NATURAL HISTORY
FROM NOVEMBER 20, 2010 THROUGH AUGUST 14, 2011

INTERACTIVE EXHIBITS SHOWCASE LATEST RESEARCH ABOUT THE HUMAN BRAIN

EXHIBITION BEGINS INTERNATIONAL TOUR IN NOVEMBER 2011

The human brain—the result of millions of years of evolutionary history—uses molecular, chemical, and electrical signals to interpret information, weigh decisions, and learn at every stage of life. Drawing on 21st-century research and technology, ***Brain: The Inside Story*** offers visitors a new perspective and keen insight into their own brains through imaginative art, vivid brain-scan imaging, and dynamic interactive exhibits for all ages. The exhibition, which is on view at the American Museum of Natural History from Saturday, November 20, until August 14, 2011, brings visitors up to date on the latest in neuroscience, highlighting the brain's surprising ability to rewire itself in response to experience, disability, or trauma, and showcases new technologies that researchers use to study the brain and treat conditions such as Alzheimer's and Parkinson's.

"The human brain is the most complex and fascinating biological structure known, and we are delighted to explore its many facets in ***Brain: The Inside Story***," says Ellen V. Futter, President of the American Museum of Natural History. "This exhibition illustrates how our remarkable brains work and what makes them so special, while featuring what is currently one of the hottest and most promising fields in science today—neuroscience. Visitors will not only learn what's in store for our brains in the 21st century, but will come away with an enriched perspective on the extraordinary brain, the vehicle for all of the things that makes us human."

"***Brain: The Inside Story*** combines Museum research focus on evolutionary history and the diversity of life with the recent explosion in technology that is giving scientists a deeper understanding of brain chemistry and function," says Michael Novacek, Senior Vice President and Provost for Science at the Museum. "For instance, we illustrate how some of the basic components of the human brain, such as the limbic system that allows communication and social behavior, are also found in other mammals."

Brain: The Inside Story begins as visitors walk past a 3-pound preserved brain—a modest, small white mass—then step into the exhibition through an exhilarating "tunnel" of firing neurons, an installation created for this exhibition by the Spanish artist Daniel Canogar, who used lines of light projected onto hanging recycled wires to represent the brain's connectivity and to highlight its electrical impulses.

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After immersing visitors in the electric firings of the human brain, the exhibition unfolds with engaging illustrations, vivid brain scan images, and brain-teaser games and interactive exhibits that will entertain and enlighten visitors of all ages. A stunning array of visuals brings the brain's myriad functions into view: a dramatic **6-foot-tall homunculus**, a human figure with abnormal proportion that highlight how much of the brain is devoted to the sense of touch in different parts of the body; a **multimedia video piece** with a clear resin brain that lights-up the functional areas used by a student dancer as visitors view a video that follows her while she auditions for Julliard; an engaging **neuron gesture table** that shows how brain cells connect and communicate with each other; a glowing 8-foot-tall **model of the subcortical brain** (the region that includes evolutionarily "older" parts like the brain stem and cerebellum) that, by connections to exhibits, illustrates how the brain processes language, memory, and decision-making; and a **deep-brain stimulation implant**, the first of its kind on display in a museum. The exhibition also features a "**brain lounge**" where visitors can watch scans of the brain of a New York Knicks shooting guard as he reacts to the whoosh of the net and the roar of the crowd and see how the brains of musicians light up to classical and rock music.

"I see this exhibition as a coming-out party for the 21st-century brain," says lead exhibition curator Rob DeSalle, a curator in the Museum's Division of Invertebrate Zoology who conducts research at the Sackler Institute for Comparative Genomics. "I think visitors will be fascinated with the complexity of their brains. Brains change with every bit of information that is taken in, and the stimulating information and stunning exhibitry of this exhibition will engage the brains of every visitor."

Brain: The Inside Story utilizes two creative and innovative ways to present scientific information: artistic interpretations and interactive exhibits. In addition to the Canogar installation, the work of visual artist **Devorah Sperber** plays with visitors' senses and memory by turning spools of thread into a work of art. The exhibition also features a second installation by Canogar that illustrates the rapid development of the human brain *in utero*. Finally, the Museum's exhibition team has developed a wide range of exciting games, videos, and interactive educational exhibits to enhance and deepen visitors' understanding of the brain and its functions. In addition to the neuron gesture table and the brain lounge, highlights include a build-a-brain puzzle and brain-exercising games. *(For more information, see the accompanying press releases on Science and Art, and on Technology).*

Exhibition Sections

Brain: The Inside Story is divided into the following **seven sections**:

- **Introduction.** After encountering a preserved human brain—small and static—visitors walk through an installation by Daniel Canogar that simulates the energetic activity of firing neurons through an ingenious use of light that moves along hanging wires at great speed. The art piece— 1,500 pounds of wire suspended from a frame along a 35-foot walkway—was created from recycled materials that Canogar and assistants collected from dumpsters in New Jersey and Connecticut.

- **Introductory Theater**. To learn some basics about the brain and how it functions, visitors follow a Julliard dance student during an audition. A video projection shows how her activities simultaneously correlate with activity in her brain through the illumination of a large **three-dimensional brain model** in the theater.
- **Your Sensing Brain**. As you read this press release, your eyes are sending information to your visual cortex to help you recognize the letters and make sense of what you see. Our senses help us process the outside world, with specific areas of the brain devoted to hearing, smelling, tasting, seeing, and touching. In this section of the exhibition, these areas will be showcased through a series of interactive experiences. An **installation by artist Devorah Sperber** forces the visitor to visually interpret pieces of a visual puzzle—color, angles, figures—to create the image of a familiar painting, and a **waterfall illusion** juxtaposes an image of a waterfall with sound that may or may not correspond**.** Other highlights include a 6-foot-tall **homunculus** with enlarged hands and facial features, representing the brain's management of the sense of touch; **Kiki and Booba**, shapes that, in a famous experiment, have been identified as either Kiki or Booba by up to 98 percent of people across different languages and cultures; and an interactive **neuron gesture table** that lets visitors use their hands to understand how neurons communicate with each other.
- **Your Emotional Brain**. This section explores how emotions are processed in the brain. The **emotion projection** links fMRIs (functional magnetic resonance imaging) of brains processing specific feelings—fear, rage, disgust, joy, sadness, and surprise—to how people typically see or read these emotions on the faces of others. Because many physical manifestations of human emotions are rooted in the experiences and behaviors of our early ancestors, this section also examines the evolution of the human brain. A series of animal models, as well as **a build-a-brain interactive exhibit**, illustrate the evolving brain by comparing human brain parts to those found in lizards (for example, the brain stem, which controls breathing and instinctive behavior), in mammals (the limbic system, which allows mammals to form more complex behavior and social relations), and in primates (the large prefrontal cortex, which assists in planning and decision-making). Using an **interactive kiosk,** visitors can explore how neurotransmitters relay messages between neurons in a classic cookie-jar conundrum (the dilemma of wanting something you know you should not have). Finally, this section presents beautiful **model neurons** in oxblood resin, with computer-controlled lighting that simulates the exchange of neurotransmitter messages.
- **Your Thinking Brain**. This section asks visitors to think about thinking, as intelligence is portrayed in all of its complexity as a sum of different types of intelligence, including spatial, general, mathematical, and emotional. Visitors walk into a "brain" by entering a room lined with illuminated fabric that represents the folding of the cortex (the outer layers of the brain), which allows people to think, plan, and imagine. At the center of the room glows the rounded sculpture of the **subcortical brain**: 35 times larger than in life, made of opaque resin, and connected to other exhibits in the room to highlight the connective brain wiring between the inner and outer regions of the brain, enabling functions such as language, memory (short-term, procedural, long-term, and emotional), and decision making.

- Although people are wired to learn language—a function that relies on several sections of the brain—our ability to learn new languages diminishes as we grow older. The **language acquisition interactive** demonstrates that the ability to accurately pronounce particular sounds is more difficult if brain connections are not made early in life.
- Interactive exhibits linked to memory include **chunking numbers**, a game that demonstrates how grouping helps people remember long sequences; **star tracing**, a task that shows how practice makes the difficult task of tracing a shape in a mirror easier; and **London taxi,** an illustration that demonstrates how long-term memory can actually grow the human hippocampus, where spatial information is stored. This section also delves into the variation in and reliability of people's memory and into the importance of sleep in transferring short-term memories to long-term storage.
- The executive, reasoning part of the brain is highlighted by two games: a **color concentration task,** which illustrates how the brain decides what information is relevant; and a **stacking game**, which requires strategy to stack blocks in as few steps as possible.

- **Your Changing Brain.** This part of the exhibition examines the brain's development over a lifetime and its amazing ability to rewire itself. To evoke the dramatic rate of neuron development in a human fetus—in the first five months, neurons form at an average pace of half a million a minute—Canogar created a second artistic installation, the **neuron development sculpture:** a funnel-shaped mass of fine copper and silver filaments. But brain development does not end at birth; the brain continues to mature, making new connections and pruning unused ones throughout life. The brain's plasticity sometimes allows it to co-opt new areas if needed: the blind, for example, use their visual cortex to read Braille, and a **touchable Braille interactive** allows visitors to try using their sense of touch to read. An aging brain can be destroyed by diseases such as Alzheimer's, as seen in a **preserved, damaged brain**. But activity over time can help maintain sharpness, and **three brain games** developed by neuroscientists show visitors how to boost their gray matter.
- **Your 21st-Century Brain.** What we think of as futuristic is already here: electrodes are implanted into brains to help control epileptic seizures; direct electrical stimulations treat patients with Parkinson's disease or depression; implants let deaf people hear and blind people see; and brain-computer interfaces are being developed to help paralyzed people control computerized devices and possibly even move again. Some of this research is highlighted in a **New Therapies video** that follows cutting-edge neuroscience research at the State University of New York in Albany on the use of neural implants for paralyzed individuals. This new treatment may benefit millions but also raises ethical questions about enhancing or improving healthy brains. Finally, visitors can relax on biomorphic benches in the immersive **Brain Lounge** to experience the exhibition's stunning finale: floating projections of fMRIs that tell the story of four people: a translator from the United Nations who seamlessly moves from Arabic to English; a classical musician playing hauntingly

beautiful tones; a rock star playing a set; and a basketball player reacting to action on and off the court during a game. As visitors watch the fMRIs, they glimpse how their own brains might work in similar situations.

Exhibition Organization

The exhibition is curated by Rob DeSalle, curator in the Division of Invertebrate Zoology who carries out research at the Museum's Sackler Institute for Comparative Genomics. Several consultants assisted with ***Brain: The Inside Story***: Maggie Zellner, a research associate at The Rockefeller University, and Joy Hirsch, director of the Program for Imaging and Cognitive Sciences (PICS) at Columbia University. The exhibition is designed and produced by the American Museum of Natural History's award-winning Exhibition Department under the direction of David Harvey, senior vice president for Exhibition.

Exhibition Sponsorship

Brain: The Inside Story is organized by the American Museum of Natural History, New York (amnh.org), in collaboration with Codice.Idee per la Cultura, Torino, Italy, in association with Comune di Milano—Assessorato Cultura, Italy (where the exhibition will be on display from March 2, 2013, to August 18, 2013); the Guangdong Science Center, Guangzhou, China (November 19, 2011, to April 30, 2012); and Parque de las Ciencias, Granada, Spain (July 14, 2012, to January 6, 2013).

Generous support for ***Brain: The Inside Story*** has been provided by the Eileen P. Bernard Exhibition Fund, Virginia Hearst Randt and Dana Randt, and Mary and David Solomon. Additional support for the ***Brain: The Inside Story*** and its related educational programming has been provided by Roche.

Special Programming

A series of lectures for adults and educational programming for children are being offered in conjunction with ***Brain: The Inside Story*** and include *BRAINfest* (January 15, 2011), *This is Your Brain on Ping Pong* (January 19, 2011), *Under the Sea, Inside the Mind: Brain Research and Ocean Life* (March 6, 2011), and more. Two Global Weekends programs celebrate the creative mind: *Living in America: Brain and the Tibetan Creative Mind* (January 25–January 30, 2011), and African-American Heritage: Saluting Our Elders (February 19, 2011). *For more information, please see the accompanying release on Public Programs.*

The Brain Shop

Accompanying the exhibition is a special gift shop on the third floor that offers visitors a wide array of items and gifts inspired by the brain. Visitors to **The Brain Shop** will find unique toys, entertaining DVDs, challenging brain games, and engaging books including two children's books co-authored by Rob DeSalle, curator of ***Brain: The Inside Story***: *Your 21st Century Brain* and *Brain: A 21st Century Look at a 400-million-year-old Organ.* (*For more information on retail items, please see the accompanying release on* ***The Brain Shop***.)

***Brain: The Inside Story* on the Museum Website**

Visitors can learn about ***Brain: The Inside Story*** by visiting the "On Exhibit" section of the Museum's website, amnh.org, for Behind-the-scenes video, information, and more. Visitors can also purchase tickets to the exhibition at amnh.org.

American Museum of Natural History (amnh.org)

The American Museum of Natural History is one of the world's preeminent scientific, educational, and cultural institutions. Since its founding in 1869, the Museum has advanced its global mission to explore and interpret human cultures and the natural world through a wide-reaching program of scientific research, education, and exhibitions. The Museum accomplishes this ambitious goal through its extensive facilities and resources. The institution houses 46 permanent exhibition halls, state-of-the-art research laboratories, one of the largest natural history libraries in the Western Hemisphere, and a permanent collection of more than 32 million specimens and cultural artifacts. The spectacular **Frederick Phineas and Sandra Priest Rose Center for Earth and Space**, which opened in February 2000, features the rebuilt Hayden Planetarium and striking exhibits about the nature of the universe and our planet. With a scientific staff of more than 200, the Museum supports research divisions in anthropology, paleontology, invertebrate and vertebrate zoology, and the physical sciences. With the launch of the **Richard Gilder Graduate School** at the Museum in 2006, the American Museum of Natural History became the first American museum with the authority to grant the Ph.D. degree. The Museum this year welcomed approximately 5 million on-site visitors from around the world and has produced exhibitions and Space Shows that can currently be seen in venues on five continents, reaching an audience of millions more. In addition, the Museum's website, amnh.org, extends its collections, exhibitions, and educational programs to millions beyond the Museum's walls.

Collaborators

Codice, Idee per la cultura, Torino, Italia

Codice. Idee per la cultura is a private company based in Turin that was established in 2002 to promote a new form for the dissemination of knowledge, with a particular attention towards scientific and technological knowledge. Codice has created a planning process that takes into consideration the necessary elements for a successful cultural product—planning the content, territorial marketing, benchmarking with the international realities relevant for the project's objectives, communication strategy, and identification of potential financial partners.

Since its founding, Codice has managed many successful events such as the *Genoa Science Festival*, the *Festival of Sciences* in Rome, *Siena Biotech*, and others. The production of scientific exhibitions is the main focus of Codice's activity, with more than 24 exhibitions in seven years (*Mirrors*, *Four Elements*, *Life*, *Earthsong*).

Codice collaborated with the Palazzo delle Esposizioni di Roma, Comune di Milano and Regione Puglia in presenting the American Museum of Natural History ***Darwin*** exhibition in Italy between February 2009 and March 2010, marking the first major traveling exhibition dedicated to the famous English scientist that has gone on exhibit throughout Italy (Rome, Milan, Bari), with more than 210,000 visitors.

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Codice is already a collaborator of the American Museum of Natural History for the ***Traveling Silk Road*** exhibition that will be hosted at Palazzo delle Esposizioni di Roma during fall 2012.

Vittorio Bo is the founder and CEO of Codice (www.codicecultura.it).

Comune di Milano, Department of Culture, Italy

The primary mission of the Cultural Department of the City of Milan, Italy, is the increase and diffusion of knowledge. Their offices manage the city's museums and cultural institutions: the conservation of and addition to collections; the cataloguing of artistic, scientific, and historical heritage; the development of services for visitors; and the promotion of Cultural Institutes through exhibitions, conferences, research, and teaching. The Department of Culture in Milan also carries out international events with the participation of personalities from the art, scientific and entertainment fields, produces specialized publications, and supports organizations that carry out activities in the cultural field—often bringing together scientific and humanistic knowledge. It is affiliated with 21 theaters in addition to the Piccolo Teatro and the Teatro degli Arcimboldi.

The cities of Milan and New York were born as financial clusters, manufacturing cities, and trade centers. But this would not have been possible if either city lacked a "culture of doing" that unites our stories with a specific strategic mission: to broaden and to deepen the scope of human knowledge. By participating in ***Brain: The Inside Story***, the Department of Culture intends to reaffirm the importance of offering to the public events of international importance, also taking into consideration Expo 2015, with the intention of creating a collaboration on all sides in terms of production, use, and training of cultural science.

Guangdong Science Center, Guangzhou, China

As a large science education base developed by Guangdong Provincial Committee of the CPC and the People's Government of Guangdong Province, Guangdong Science Center (GDSC) is currently both the largest popular science education base in Asia and a comprehensive platform for exhibition, popularization, trading, and academic exchanges of scientific achievements and technological products. The hope is that GDSC will be an exhibition window and exchange platform of international standards for modern scientific and technological achievements.

GDSC covers a land area of 450,000 square meters with a gross floor area of 137,500 square meters. With its unique overall building form and magnificent posture, GDSC boasts a representative green building in China and a landmark of Guangzhou.

Since its opening in September 2008, GDSC has received more than three million visitors. There are nine permanent exhibition zones, four science theaters, and several temporary exhibition zones and open labs. The exhibits organically integrate science, knowledge, and fun to enable the visitor to learn through hands-on participation. The outdoor science exploration park comprises an artificial lake of 80,000 square meters, 60 classical scientific exhibits, and over 2,000 species of special plants in Lingnan Region.

As the largest science education base of Asia, GDSC has attracted interest from people and organizations in various circles at home and abroad. The Asia Pacific Network of Science and Technology Centres 2011 Conference will also be hosted by GDSC.

Parque de las Ciencias, Granada, Spain

Parque de las Ciencias is the Interactive Science Museum of Andalusia, in the south of Spain. The museum is well situated in the center of Granada, the town of the Alhambra and Federico García Lorca. Parque de las Ciencias, under the motto *A new kind of Museum*, was founded in 1995 and occupies 70,000 square meters. The museum holds permanent and temporary exhibitions, a planetarium, educational facilities, a cultural gallery that includes an auditorium for 500 people, three movie theatres, a restaurant, and a bookshop.

Parque de las Ciencias counts amongst its council members the University of Granada and the Spanish National Research Council (CSIC), the largest public institution dedicated to research in Spanish. The museum also houses "Windows to Science" and "Live Science," which—through crystal bounded spaces—provides visitors with an insight into science as it is really done in labs.

With over 600,000 visitors a year, it is also an open-air museum (more than 20,000 square meters of its whole area are open air and green spaces, including a butterfly house) where visitors can learn and feel the science and technology.

The Museum is a Consortium formed by the Regional, Provincial and Local government, the University of Granada, and CSIC as well as Caja Granada and Caja Rural, two financial institutions.

At the American Museum of Natural History

The Museum offers a broad array of programs for adults, children, families, students, educators, and scientists. These range from special exhibitions to symposia, lecture series, workshops, and film festivals. Highlights include the Hayden Planetarium Space Show ***Journey to the Stars***, narrated by Whoopi Goldberg; ***Race to the End of the Earth*** (May 29, 2010–January 2, 2011), which recounts one of the most stirring tales of Antarctic exploration: the contest to be the first to reach the South Pole in 1911-1912; ***The Butterfly Conservatory: Tropical Butterflies Alive in Winter*** (October 16, 2010–May 30, 2011), an annual attraction that transforms the iciest day into summer with up to 500 fluttering, iridescent butterflies; ***Highway of An Empire: The Great Inca Road*** (October 17, 2009–September 2011), an exhibition of more than 35 striking photographs featuring roads and trails built by the Inca six centuries ago; ***On Feathered Wings*** (June 21, 2008–May 1, 2011), an exhibition of more than 30 striking photographs featuring dramatic images of birds in flight; ***Vital Variety: A Visual Celebration of Invertebrate Biodiversity*** (ongoing), an exhibition of 23 large-format color photographs highlighting the immense diversity of invertebrates; **Space Show Double Feature** (Friday and Saturday evenings in the Hayden Planetarium), back-to-back screenings of the Museum's first two Space Shows: *Passport to the Universe* (narrated by Tom Hanks), which launches visitors on a thrilling trip through space and time, and *The Search for Life: Are We Alone?* (narrated by Harrison Ford), which explores a question that has always captivated the imagination: does life exist beyond Earth?;

and **One Step Beyond**, the popular monthly party series where guests can dance in the Museum's Cullman Hall of the Universe to sets by the biggest names in techno, electronica, hip-hop, and indie rock.

Hours
The Museum is open daily, 10 am–5:45 pm
The Museum is closed Thanksgiving and Christmas.

Space Show Hours
Journey to the Stars is shown every half hour Monday–Friday, 10:30 am–4:30 pm (first show on Wednesday begins at 11 am), and Saturday and Sunday, 10:30 am–5 pm.

Admission
Suggested general admission, which supports the Museum's scientific and educational endeavors and includes 46 Museum halls and the Rose Center for Earth and Space, is $16 (adults) suggested, $12 (students/seniors) suggested, $9 (children) suggested. All prices are subject to change.

The Museum offers discounted combination ticket prices that include suggested general admission plus special exhibitions, IMAX films, and Space Shows. All prices are subject to change.
- Museum plus special exhibition, IMAX film, or Space Show: $24 (adults), $18 (students/seniors), $14 (children)
- Museum Supersaver (includes all special exhibitions, IMAX film, and Space Show): $32 (adults), $24.50 (students/seniors), $20 (children)

Visitors who wish to pay less than the suggested Museum admission and also purchase a ticket to attend a special exhibition, IMAX film, or Space Show may do so only on-site at the Museum. To the amount they wish to pay for general admission, they should add $20 (adults), $16.50 (students/seniors), or $11 (children) for a Space Show, special exhibition, or IMAX film.

Public Information
For additional information, the public may call 212-769-5100 or visit the Museum's website at amnh.org.

Now you can prepare for your Museum visit by downloading the new **American Museum of Natural History Explorer App,** a groundbreaking enhanced navigation tool available for free from the App Store on iPhone and iPod touch or at iTunes.com/appstore. The Explorer pinpoints your location within the Museum and offers turn-by-turn directions through permanent exhibition halls, and features customized tours, a fossil treasure hunt, and social media links for posting to Facebook and Twitter.

Follow
Become a fan of the Museum on Facebook at facebook.com/naturalhistory, or visit twitter.com/AMNH to follow us on Twitter.

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No. 180

Facts About The Brain

AMERICAN MUSEUM of NATURAL HISTORY

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November 2010

FACTS ABOUT THE BRAIN FROM
THE AMERICAN MUSEUM OF NATURAL HISTORY

Introduction

- A human brain weighs about 3 pounds (1.4 kilograms) and is mostly made of water.
- Every second, a single neuron in your brain may send as many as 1,000 signals. These signals can zip from neuron to neuron at speeds of up to 250 miles an hour.
- Neurons are the building blocks of the nervous system and come in many shapes and sizes. Some stretch from the spinal cord all the way to the toes and can be more than three feet long.
- The brain and the rest of the nervous system run on electricity, but at low levels. Brain signals involve less than one-tenth the voltage of an ordinary flashlight battery.
- If the 100 billion neurons in your brain were each the size of a marble, they would fill the main building of the New York Public Library.
- Since a single neuron can connect to at least 1,000 other neurons, a single brain may have at least 100 trillion connections in all.

Sensing Brain

- When you smell something sweet, spicy, or rank, your nose is sensing chemicals in the air. It sends messages to a brain area called the olfactory cortex, which can distinguish between about 20,000 scents.
- Your visual cortex, the "seeing" part of your brain, combines visual cues such as shapes and colors to help you recognize objects in about one-fiftieth of a second.
- A particular part of your brain called the fusiform face area helps you recognize faces. People without a functioning fusiform face area cannot recognize their own families or even their own faces in a mirror.

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Emotional Brain

- The brainstem, cerebellum, and basal ganglia are parts of the brain that handle basic body functions like breathing, balance, feeding, mating, and defense. These parts are evolutionarily very old and are related to brain regions found in lizards and fish.

- Humans belong to a group of primates called hominids. Over the past 2 million years, the hominid brain gradually tripled in size, and our cortex, the outer layer that produces advanced thought, is so large it requires numerous folds and wrinkles to fit inside the head.

- Your brain can modulate the response of neurons to make them more, or less, sensitive. When your brain senses danger, for example, your brain floods certain regions of the brain with the neurotransmitter epinephrine (adrenaline) to make you react faster.

- Many living animals, such as jellyfish, have no brains, just a network of neurons with no central hub or command center.

- In1845, an explosion sent an iron rod through the front of American railroad worker Phineas Gage's brain. Gage survived, but his personality changed. Before the injury, he was polite, respectful, and hardworking. Afterward, he became impulsive, irresponsible, and rude—revealing the role of the prefrontal cortex in controlling emotional behavior.

- Caffeine works by blocking the effect of a brain neurotransmitter called adenosine, which makes you sleepy.

- Studies suggest that men with lower levels of the neurotransmitter oxytocin are less likely to marry.

- People with Parkinson's disease often have too little dopamine in their brains, while people with schizophrenia often have too much.

Thinking Brain

- Your brain is key to your intelligence, but there's no single "intelligence" region in the brain. Intelligence depends on processing speed, memory, empathy, creativity, and connectivity—and the ability to knit these together.

- Some abilities are encoded in your DNA at birth. But your brain is also shaped by individual experiences: the interaction between your genes and your environment.

- Different parts of the brain specialize in understanding the speech of others and producing speech of your own.

- There are language areas on both the right and left sides of the brain. In most people, the left side handles the literal meaning of words and the right side handles subtle cues such as tone of voice, metaphors, humor, and sarcasm.

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- Brain scans show that children and adults learn second languages differently. Children process another language in the same part of their brain as their first language, but adults process it in a different place—which can make learning a new language more difficult.

- Your short-term memory lets your brain remember things for around a minute or so—just long enough to think about them. Most people can keep about six or seven items in their mind at once.

- The basal ganglia help store procedural or "how-to" memories. With this type of memory, you can do certain things without conscious thought and without having to recall the specific moment when you first learned it.

- The amygdala makes sure highly emotional moments are "burned into" your memory.

- The hippocampus—a part of the brain that is used to form long-term memories and mental maps—can actually grow with constant use.

- A particular network of interconnected regions in the brain may help you think about situations other than what is occurring in front of you, allowing you to envision the future, remember the past, consider the ethics of various options, imagine what others are thinking, and so on.

- Specialized neurons called "mirror neurons" help you understand what others are doing by firing as if you were doing it yourself.

Changing Brain

- Before a child is born, his or her brain cells multiply rapidly. On average, half a million neurons form every minute during the first five months in the womb.

- During childhood, brain cells grow by sprouting branches called dendrites, making more connections than the brain will ever need. As a child grows up, connections that are used often are reinforced, while unused connections wither away.

- Your brain matures when you become an adult, but it doesn't stop changing. Tiny connections keep shifting with all that you do and every experience leaves its mark on the brain.

- After a peak in brain functioning in your 20s, the number of neural connections gradually declines, and over time, your memory may become a bit less reliable.

- Studies suggest your brain will stay healthy longer if you keep it engaged with mental and physical exercise.

21st-Century Brain

- Functional magnetic resonance imaging (fMRI) has revolutionized brain science in the last two decades. An fMRI measures changes in oxygen levels in the blood so that scientists can "see" what parts of the brain are active during different activities.

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- Doctors can now activate—or deactivate—certain brain regions by surgically inserting a wire into the brain and sending in pulses of electricity, with what's called deep brain stimulation (DBS). Over 80,000 people have already used DBS to treat Parkinson's disease, and it has also been used to treat obsessive-compulsive disorder.

- Using powerful magnets, doctors can stimulate your brain electronically without surgery, and without touching neurons directly at all. By creating a rapidly pulsing magnetic field outside your head, the procedure known as transcranial magnetic stimulation (TMS) can create electric pulses *inside* your brain. These electric pulses cause neural activity only in carefully targeted areas.

To learn more about the brain, visit the special exhibition ***Brain: The Inside Story*** at the American Museum of Natural History, November 16, 2010 to August 14, 2011. For more information, visit amnh.org.

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Science And Art In *Brain: The Inside Story*

AMERICAN MUSEUM OF NATURAL HISTORY

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November 2010

SCIENCE AND ART IN *BRAIN: THE INSIDE STORY*

The American Museum of Natural History has a long tradition of using art in the service of science—from enlisting some of last century's finest painters to complete the backdrops in the Museum's animal habitat dioramas to employing sculptors, illustrators, and other skilled artisans to find compelling ways to convey complicated scientific concepts to the public today.

For the American Museum of Natural History's exhibition ***Brain: The Inside Story***, the Museum commissioned two independent artists—Daniel Canogar of Madrid, Spain, and Toronto, Canada, and Devorah Sperber of Manhattan and Woodstock, N.Y.—to represent various brain functions in unique works of art.

Daniel Canogar found a vivid way to evoke the human brain's 100 billion or so neurons—specialized cells that allow us to think, feel, and move—that connect through long, spidery arms and communicate with each other through electrochemical signals at speeds up to 250 miles per hour. On entering the exhibition, visitors walk through Canogar's massive work in which recycled electrical cables, illuminated by racing beads of lights, mimic electrochemical activity in the brain. Further on in the exhibition, a second Canogar installation illustrates the exponential growth of neurons in a developing brain.

Canogar is drawn to what he calls e-waste—discarded circuit boards, computer screens, and cables made obsolete by newer technologies—which has, for him, a poignant resonance with the neural circuitry of the human brain as well as with the larger "brain" of a networked society. Canogar went "dumpster diving" in New Jersey and Connecticut over the summer to find materials for his installations.

In her piece, **Devorah Sperber** harnesses the mechanics of human sight and what scientists call "neurobiological priming"—the tendency of the brain to recognize familiar images. Seen through a special glass sphere, her work—an amorphous arrangement of nearly 1,500 colorful spools of threa—is revealed to be a world-famous work of art.

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