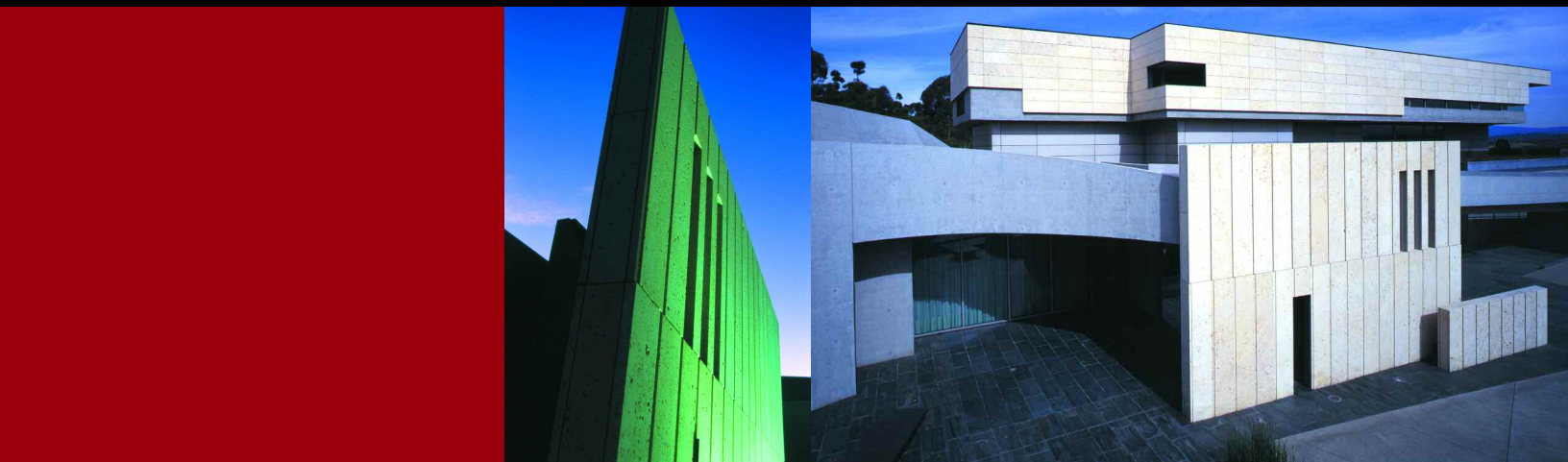




BRAIN MATTERS

2004 YEAR IN REVIEW



The NEUROSCIENCES INSTITUTE



"The study of the brain is fascinating to me, for it's impossible not to wonder how it all works and sorts things out logically. I am especially interested in the study of the relationship between music and language and how they interact with one another."

— ESTHER BURNHAM



"I support the Institute, both with my contributions and with my encouragement to others to do the same, because I believe so deeply in its fundamental premise that intellectual freedom leads to astonishing discoveries."

— LEWIS CULLMAN



"Since my first visit to the Institute more than three years ago I have been impressed with the dedication of the research scientists and their efforts to unravel the secrets of the brain. In addition, the acoustically perfect Auditorium has been provided as a venue for performing arts groups in the area. This Auditorium is provided at no cost, and I consider that a very real gift to the community!"

— ELISABETH "JINX" ECKE



"Seldom in a lifetime does one come face to face with an effort that can so profoundly change our understanding of the human experience as the work of The Neurosciences Institute. I feel fortunate to be involved in this effort, and am continually astounded at its implications. The brain truly is the new frontier."

— BILL WALSH



"By determining how human brains give rise to emotions, thought, language, memory, and ideas, the scientific theory under development at the Institute is deepening and extending the understanding of what it means to be human. It gives me great joy and satisfaction to support this remarkable, ramifying voyage of discovery."

— SUSAN BORDEN

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From THE DIRECTOR



At the end of a year of accomplishment, it is a gratifying exercise to take stock, to summarize achievements, and to look forward to further efforts in the future.

Thoughts of our past accomplishments can be categorized in a variety of ways. The one that comes to my mind at this time has been applied to notions of drama. It has been said that the categories of drama are scene, act, agents, agency, and purpose. As I reminisce, I shall rearrange the order of these categories. First, purpose: the purpose of scientific efforts at the Institute is to understand how the human brain works. The way we have approached this goal involves, above all, a set of remarkable agents: our scientists in both theoretical and experimental domains. Their acts, some of which I shall mention later, are truly creative. And the agency by which they have accomplished so much is in fact the Institute itself, considered as physical and spiritual. The

physical Institute is our scene and numerous architectural prizes attest to its beauty and utility. It has been an item of great pride amongst our fellowship that we can carry out our exertions in so beautiful a place. We offer that beauty along with our best wishes to the community itself in the form of our auditorium, which is used increasingly for many purposes: social, educational, and artistic. The recent great success of our *Minding the Arts* program attests to the valuable linkages we have made with many individuals and organizations in the La Jolla and San Diego communities.

Before mentioning some of our scientific highlights, I want to describe again the special nature of our organization. I do so because as a factor in our success, our organizational structure is second only to the remarkable talent of our young scientists. It has been noted that the greatest biomedical breakthroughs of the last century came from organizations which were relatively small, freely funded, and diverse in their scholarly range, but not too diverse. The Institute has exactly these characteristics and, as in the past, they have proven to be highly effective in producing important and exciting scientific discoveries. Science is imagination in the service of the verifiable truth. Notice that imagination is an essential ingredient. The organization of the Institute encourages imagination at its widest reach while applying the strongest standards of verifiability to our work.

The results have been most gratifying. They range from original studies on the genetics of sleep, to the demonstration that invertebrate species sleep, to the deep problem of how we control our motions and actions, and even to examination of brain states that are correlated with consciousness. Amongst the most exciting developments are the construction of brain-based devices that, in a defensible sense, can be considered to be the first non-living things that learn. The most recent of these devices, Darwin X, has even incorporated a brain region—the hippocampus—that is responsible for episodic memory, the memory of sequences of events located in various places. Indeed, Darwin X can locate itself in a room based on cues it receives from its visual experience.

We have recently published our *Scientific Report* which describes these developments in greater detail. I want here to mention what has struck me on first viewing of this report. It is that, for a research organization with no more than forty scientists at any one time, the range across biology of the various research efforts is truly stunning. I have pondered on this and have come to the conclusion that this range reflects the imagination of our young scientists who labor mightily, but who are wise to avoid labor-intensive, “big science” projects. Those projects are carried out very well in large institutions. In contrast, what distinguishes us is the opportunity to try out new and unusual ideas. The scientific research based on these ideas is eminently practical: we have not neglected their importance to disease nor have we ignored the practical applications of our inventions.

This work embeds all of the signs of progress. One of the key characteristics of the idea of progress is the steady accretion of new knowledge useful to humanity. But there is another kind of progress which we continually strive to realize. It is to increase the understanding of persons in our non-scientific community so that we may share the benefits of our insights with the generous donors and witnesses of our work. I take this opportunity to thank them for all their efforts and support.

Gerald M. Edelman, M.D., Ph.D.
Director

STRUCTURE *and* Organization

Great science depends as much on organization and environment as it does on the brilliance of the scientist.

In the world of major academic and scientific institutions, it is often difficult for truly independent thinkers to pursue flashes of insight while remaining members in good standing of their scholarly communities. While such communities are typically devoted to observing standards of excellence, they may often do so in rigidly defined ranking systems. Is there an alternative road to the pursuit of excellence?

This was the question facing Institute Founder and Director Dr. Gerald M. Edelman when he first envisioned The Neurosciences Institute over two decades ago. In his research training at The Rockefeller Institute (now University), Dr. Edelman saw an institution where basic inquiry in biomedical science was encouraged in a flexible and relatively unconstrained atmosphere. He was aware that only a few research organizations had consistently produced major breakthroughs in biomedical research. Among them were the early Rockefeller, the early California Institute of Technology, and certain contemporary colleges in the University of Cambridge, England. Rockefeller alone was responsible for more breakthroughs than any other similarly committed organization during the twentieth century.

With these organizations in mind, Edelman decided to create a “scientific monastery” where researchers could study the brain and its complex functions such as perception, learning, sleep, and consciousness. The key features of the organization he envisioned included maximum freedom for Institute scientists to explore whatever they believed would lead to an increased understanding of the human brain. This is one reason why the Institute remains independent and relies primarily upon private philanthropy. It only seeks government grants when they are without programmatic constraints.

At the Institute, no scientist is intellectually subordinate to any other, and Institute scientists are free to pursue apparently “outlandish” questions, the answers to which

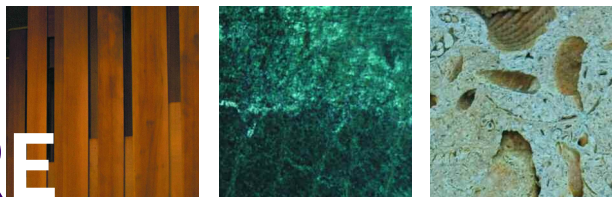


may lead to new insights and breakthroughs. Members of the small but broadly interdisciplinary scientific staff can range across both experimental and theoretical approaches, leading to new directions in research.

After spending time studying the Institute, J. Rogers Hollingsworth, Ph.D., a professor of sociology, history, and industrial relations at the University of Wisconsin-Madison, believes that it shows high potential for creative breakthroughs. After his recent analysis of nearly 300 major biomedical breakthroughs produced at 200 research institutions over the period from 1900 to 1950, Dr. Hollingsworth was able to identify common characteristics in the most productive institutions. They shared small size, free funding without bureaucracy, and subject interests that were diverse but not too diverse. These characteristics promoted research that ultimately led to major scientific breakthroughs. Hollingsworth also identified certain characteristics—ever-increasing size and burgeoning bureaucratization—that can be impediments to effective scientific communication and integration.

In commenting on The Neurosciences Institute, Hollingsworth said “The Institute reminds me very much of the Rockefeller in its early, formative years. While, perhaps, it has not yet produced the major breakthroughs of the kind that win Nobel prizes, it is still a relatively young organization. Given the Institute’s high potential, I believe it is only a matter of time.”

ARCHITECTURE



“The Neurosciences Institute is a serene cloister that supports brain research with remarkable architecture that fuses intellect and intuition.”

— Architecture Magazine

It is striking, even breathtaking at times. It engages the eye, fascinates the mind, and inspires the souls who pursue scientific breakthroughs within its walls.

From the moment you enter the campus in La Jolla, the unique architecture of The Neurosciences Institute lets you know you're in a very special place.

It was intended that way. Dr. Edelman sought an architectural style that would reflect his vision of a scientific monastery where creative study of the brain could be conducted with few constraining rules and unlimited opportunities for discovery and communication.

New York architects Tod Williams and Billie Tsien turned Edelman's vision into a poetic reality with a design that for nearly a decade has nurtured scientific inquiry in an environment conducive to both private reflection and interactive exchange among scientists from different disciplines.

The Institute's 56,000 square-foot complex is divided into three discrete buildings—the Theory Center, The Walsh Family Laboratories, and the Auditorium—each with its own fascinating design but all complementing and connecting with each other by walkways.

They frame a spacious central plaza with a sculptural water feature, Italian serpentine stone, and landscaping that provides a visual counterpoint to the horizontal and vertical lines of the surrounding buildings.

The overall effect is magical. So is the effect on the scientists. Almost to a person, the researchers praise the architecture, remarking that it has created a wonderful and inspirational environment that plays an important role in their ability to unravel the mysteries of the brain.



Completed in 1995, the Institute's architecture has received accolades from around the world, including a national Honor Award from the American Institute of Architects.

The Neurosciences Research PROGRAM

Every so often in the history of science there is a moment when great minds come together and what is born forever alters the way we look at the world.

Such a moment came in 1962. The idea was simple: a small group of brilliant scientists from diverse backgrounds but all interested in brain function would meet regularly to share ideas about the brain.

Their driving motivation was the recognition that traditional barriers between scientific disciplines must be broken if research on higher brain functions was ever to be successful.

What emerged from this gathering of giants was momentous, for it was the genesis of an entirely new field of scientific endeavor we know today as the neurosciences.

With the leadership of Francis O. Schmitt, a true scientific impresario at MIT, this informal college of scholars and research scientists was organized as the Neurosciences Research Program (NRP). NRP encouraged interdisciplinary studies of the brain.



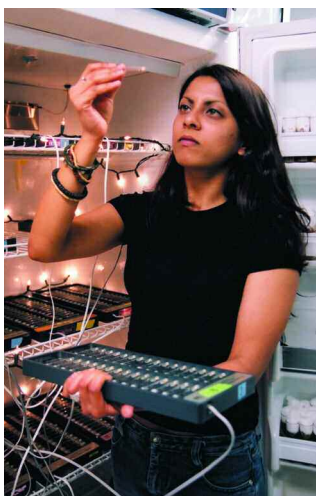
The informal college of Associates of the NRP includes 36 scientists at any one time, and each individual serves for a seven-year term. Over the past four decades, the list of current and former Associates is a veritable “who’s who” of neuroscience and includes seventeen Nobel laureates. Through its over 250 meetings and 125 scientific publications, the NRP developed innovative formats for intellectual exchange and disseminated knowledge to the worldwide scientific community.

The Neurosciences Institute itself developed from NRP as an independent entity on the campus of The Rockefeller University in New York in 1981, and the NRP moved to New York from Boston in 1983 and became part of the Institute. The group of Associates continues to meet annually in La Jolla.

Nothing shows the vibrancy of the neurosciences better than the NRP’s annual meeting. For three days, the Associates eagerly share their latest research, and guest speakers spark the imagination with presentations providing views of the brain and its function.

Perhaps most exhilarating are the informal discussions that break out among Associates on far-flung topics. Observing, even participating, are the bright young scientists who work at the Institute; they are thrilled to rub shoulders with these scientific leaders. NRP Associates also provide a valuable information resource for the Institute’s Fellows throughout the year.

Recent Research DISCOVERIES



- ◆ Developed a testable theory about how brain functions lead to human consciousness, the most immediate yet least understood human brain function.
- ◆ Constructed one of the most advanced explanations of how the brain assembles our various sensory inputs to generate a unified "picture" of the world around us.
- ◆ Formulated viable mathematical definitions of complexity, representing an objective measure of how the brain is composed of functionally specialized parts that work together in an integrated fashion. This has important applications in determining causation and assessing risk involving such diverse subjects as environmental pollution, origins of cancer, aerospace design, and economic markets.
- ◆ Formulated theories and models of how value systems (globally acting brain systems that are stimulated by reward or punishment) shape learning and adaptive behavior.
- ◆ Designed and built brain-based devices. These are sophisticated robot-like machines that are controlled by realistic central nervous systems and are capable of learning through experience. Simulations in these devices are used to investigate how brain activity gives rise to behavior as well as learning.
- ◆ Developed the principles underlying some of the world's most advanced prototypes of prosthetic devices that are "wired" into the brain. This work may ultimately help amputees and paraplegics live more normal lives.
- ◆ Demonstrated for the first time that fruit flies sleep, providing a better understanding of the influence of genes on the crucial role of sleep in human life and health. As a result, researchers can now use fruit flies to test potential drugs and genetic treatments for aiding sleep and drowsiness. This work may lead to improved treatments for many people afflicted with sleep and vigilance disorders.
- ◆ Developed a new strategy for rapidly charting gene networks related to human disease genes and drug responses.
- ◆ Demonstrated for the first time that perception and natural motor behaviors can be transplanted between species of higher animals (chicken and quail). This finding helps identify the location of brain cells that control specific behaviors.
- ◆ Discovered that the firing sequences of neurons in the human brain's auditory cortex reflect the patterns of pitch in musical melodies and speech intonation. This finding may lead to a better understanding of the neural basis of disorders such as autism and certain types of dyslexia.
- ◆ Demonstrated that human speech and bird songs are produced by exactly the same physical mechanisms. This discovery establishes the relevance of birds as a biological model for many aspects of human vocal learning.
- ◆ Found that the brain's treatment of speech and music has greater similarity than previously thought, suggesting why music has such special significance in childhood brain development.

The Institute's *Scientific Report* describes the research in more detail and is available upon request.

DO *Fruit Flies* Sleep?

It was around noon at one of The Neurosciences Institute's remarkable collegial lunches.

At that lunch Ralph Greenspan, Ph.D., and Giulio Tononi, Ph. D., pursued the question “Do fruit flies sleep?” Greenspan, a Dorothy and Lewis B. Cullman Senior Fellow and one of the world’s leaders in the study of fruit fly genetics and behavior, had recently moved to the Institute from New York University.

The query—and the answer, “I don’t know”—set off a chain reaction of innovative research at The Neurosciences Institute that has vastly expanded our knowledge of how brains work and may well lead to effective new treatments for sleep-related disorders.

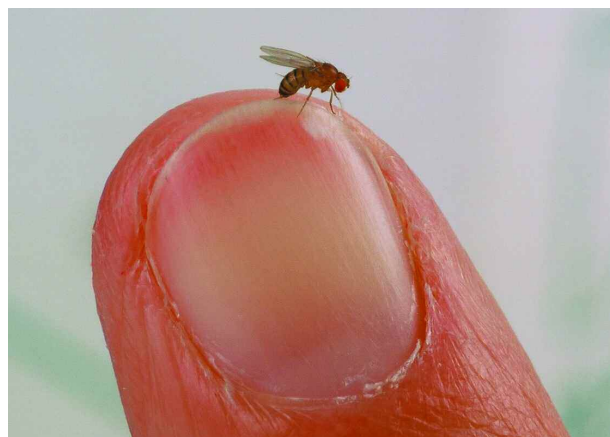
That question, like so many others at the Institute, was posed during one of the lunches held daily to



foster the lively and creative interchange among colleagues with training in diverse scientific disciplines.

Greenspan and several other scientists at the lunch table were so fascinated by the question

they decided to launch an immediate study to find the answer. Fortunately, the unique organization and culture of The Neurosciences Institute allowed them to do that. The fruit fly currently is the subject of intense scientific study because many of its genes have counterparts in humans, because there is a century’s worth of genetic information on mutants, and because a rapid breeding cycle allows genetic manipulations to be practicable.



“Thanks to that initial challenging question, we now have a fast, high-volume first-round screening process for testing potential drugs that might play a role in curing sleep and attention-deficit disorders.”

Here’s what they learned and published in *Science*: Fruit flies do indeed sleep. This is important: It lays the groundwork for a better understanding of genetic influences on the critical role of sleep in human life and health.

This development means that researchers can employ fruit flies to test potential drugs and gene-based treatments for modulating sleep and drowsiness, which may lead to improved treatments for many people afflicted with sleep and vigilance disorders.

That study gave birth to a number of additional studies, each breaking new ground. One was the result of another lunchtime exchange. Only half serious, a researcher said to Doug Nitz, Ph.D., that he should be recording brain activity in fruit flies instead of rats (see story page 9).

Nitz took it on as a challenge and along with Bruno van Swinderen, Ph.D., developed microelectrodes so tiny they could in fact measure brain activity in fruit flies. Remarkably, the very first recordings were made with Nitz handholding the probe inside the fly’s brain.

Meanwhile, Greenspan was working on a virtual reality setup in which flies in a fixed position could look at moving items on a screen and react to them as if they were actually flying. When van Swinderen combined this setup with the recording device, it gave the scientists a detailed model for analyzing what happens in the fly brain when it perceives something and responds to it.

HOW *Do We* Navigate?

Go for an early morning jog. Surf the web. Drive to the store. Tie your shoe. Prepare a holiday dinner. Walk the dog.

Those and the countless other movements we make during the day are pretty much second nature. Inside the brain, however, an amazing series of complex neurobiological processes must occur for those movements to be carried out successfully.

Thanks to the groundbreaking research of scientists at The Neurosciences Institute, we're getting an unprecedented look at how those processes work—and the possible reasons they occasionally break down or never function properly in the first place.

"We're really beginning to understand exactly how animals and humans navigate, from setting a goal, to recognizing signals of how the movement is progressing, to analyzing whether the navigation was successful," says Douglas Nitz, Ph.D., an Institute Fellow.

Key to the research is a unique recording device Nitz developed to get a high-resolution picture of how the brain organizes information to produce complex behaviors. The device, which can measure individual cell activity in multiple regions of the brain in real time, is attached to rats as they navigate through a maze to reach a food reward.

"To navigate properly, the rat must know where it is, what direction it's facing, where it came from, where the reward might be, and given all of this information, what to actually do," Nitz says. "It's a tall order, but we've discovered that rats are able to accomplish this regularly by allocating different problems to different brain regions."

For example, Nitz has found that the activity of cells in the hippocampus informs the rat about its exact location at any given time. A region called the subiculum contain cells that let the animal know the direction its

"But once we understand exactly how the brain works to make those decisions, we may find ways to improve that function in people suffering from Alzheimer's disease or any number of brain disorders."

facing. And, he says, there is one area of the brain—the parietal cortex—where all the information comes together.

"It's there that all the neural signals flowing in from other regions are combined to give the rat all the pertinent information it needs concerning a given situation" Nitz says. "For instance, one cell may only respond if the rat is making a right turn in the northwest corner of the maze, and then only if it has just previously made a left turn. It is that complex, but so is the behavior."

Nitz believes the research may show that patients with brain diseases like Parkinson's and other movement disorders have a severe disruption in these processes. If so, it could lead to drug therapies or surgical techniques that might help restore some of the processes and help afflicted patients regain some or all of their normal movement ability.

Looking to the future, Nitz plans to use his research techniques to understand more fully how these multi-region brain processes drive behavioral choices.

"When we make highly informed decisions, we look like geniuses," he says.



LEARNING *with* NOMAD



Every day it grows smarter. Every day its ability to learn from its mistakes increases. Every day it behaves more like a living, thinking organism.

With those rapidly expanding skills, NOMAD is one of the most amazing mechanical devices ever created. It was developed in the late 1980s by Dr. Edelman and his colleagues to test pioneering theories of how the brain works.

Since then, several generations of NOMADs have evolved into a new and powerful class of intelligent machines (Brain-Based Devices, or BBDs), with simulated, biologically based brains and nervous systems that can sense the environment and learn from experience.

NOMAD may look like a robot, but don't be deceived. It's many times more sophisticated and complex. This is partly because its behavior is not controlled or restricted by a set of computer software instructions as true robots are. Instead, NOMAD was designed using the principles of neuroanatomy and neurophysiology derived from knowledge of real brains. With its array of sensing devices, NOMAD not only perceives its environment, but it also learns and retains for future decision-making whatever it sees, feels, touches, or hears.

The government agency DARPA is extremely interested in BBDs and has given the Institute a grant to assist in their development. Part of the grant includes a special scientific version of the two-wheeled Segway Human



Transporter (HT) with its innovative balancing technology. The Segway Robotic Mobility Platform (RMP) is a highly mobile and rugged platform that will allow the team to take a BBD outdoors for the first time.

One of the goals is to participate in robotic soccer competitions with teams from around the world. The rules so far dictate that each team consist of an autonomous Segway RMP and a human on a Segway HT. The RMPs must have the ability to both catch and kick a ball. All sensing, actuating, and computing are local to the device. The Neurosciences Institute and Carnegie Mellon University have each put together teams and demonstrated their robotic soccer-playing capabilities at the U.S. Open RoboCup Championships in New Orleans last April. It is hoped that Segway Soccer will be an official RoboCup league in 2005.

The BBD using the Segway platform is specifically designed to play soccer. It has a video camera to recognize objects on the field (e.g., balls, teammates, goals, etc.), infrared sensors to detect the ball and obstacles, and mechanical devices to capture and kick the ball. The output of the simulation generates motor signals to the Segway's wheels.

The neural simulation has control areas based on color and shape processing areas in the primate visual cortex, motor areas, and a brain value system that responds to salient objects. It uses the same principles of image processing, visual categorization, reentrant signaling, and value-dependent learning as the previous NOMAD devices.

The soccer-playing BBD successfully learned key elements of soccer playing: ball chasing, passing back and forth between itself and a human teammate on a Segway HT, and goal kicking. Video clips of the device's soccer-playing capabilities can be found at <http://www.nsi.edu/nomad/segway>.

For researchers at The Neurosciences Institute, the development of BBDs offers an unprecedented opportunity to explore how brain activities influence behavior and learning. And for the rest of the world, the ability of BBDs to someday go where humans can't—and to think and react on their own to what they encounter—make their future development truly mind-boggling.

OTHER Ongoing Research

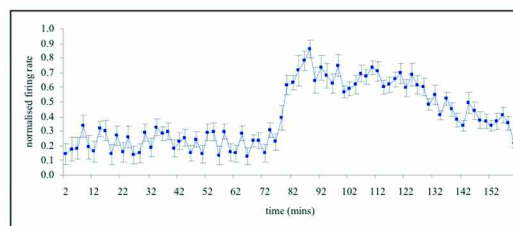
Music...A Unique Window into the Brain

Listening to a symphony, pop ballad, a children's choir, or any other form of music is one of life's greatest pleasures. That intricate process we take for granted also delights researchers at The Neurosciences Institute because it provides a treasure trove of exciting new insights into how the brain works.

By studying how the brain processes rhythm and melody in music, Institute scientists are able to examine the intimate relationship between auditory and motor systems as well as study music's relationship with language. One example: researchers showed how the firing sequences of neurons in the human auditory cortex reflect the patterns of pitch in musical melodies. They also found that the neural systems the brain uses to process speech and music have greater similarities than previously thought.

Thanks to real-time measurement of brain activity of people listening to music, scientists now have a much better understanding of how different brain areas interact in perception and behavior.

Ultimately, this research may lead to development of new techniques to address how the brain processes patterns in time, which in turn could lead to a better understanding of the biological bases of autism, dyslexia, and auditory processing disorders.



Caffeine stimulates the firing of striatal neurons



Caffeine and the Brain

We all know that a cup of coffee, thanks to caffeine, provides a lift that helps us get going in the morning. Researchers at The Neurosciences Institute have discovered the stimulant may have potentially more significant value, including its role in eliminating the involuntary tremors that plague patients with Parkinson's disease.

The scientists have shown that caffeine can regulate the number of dopamine receptors that are produced in the basal ganglia, a brain region involved in the control of voluntary and involuntary movements. The dopamine receptor is a molecule on certain neurons that responds to the neurotransmitter dopamine, a key player in regulating motivation and movement. Institute researchers also showed for the first time that the expression of a dopamine receptor is increased in female but not male mice upon administration of caffeine.

One of the primary targets for the action of caffeine in the basal ganglia is a region called the striatum, which has a large concentration of dopamine receptors. When Parkinson's disease occurs, the amount of dopamine produced in the brain decreases, resulting in less activity in the striatum. The research at the Institute provides new information for understanding how caffeine and similar drugs may protect neurons and ameliorate movement disorders in Parkinson's disease.

The study shows promise for understanding why humans become tolerant to the effects of caffeine and why withdrawal may be difficult and even painful.

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Library ROUNDTABLES



The Neurosciences Institute presents its own community lecture series, the Library Roundtable program. Offered 2-3 times per year at no charge to the public, these lectures are delivered by leading figures in science and technology as well as in other fields that pertain to brain science. The lectures are followed by question-and-answer sessions moderated by Dr. Edelman. Following the discussion, guests enjoy the opportunity to engage in stimulating conversation over drinks and hors d'oeuvres. Past Library Roundtable programs include:

Time Flies Like an Arrow, but Fruit Flies Like a Banana*

Ralph J. Greenspan, Ph.D.

Dorothy and Lewis B. Cullman Senior Fellow
in Experimental Neurobiology
The Neurosciences Institute
February 28, 2001

Music and the Brain*

Aniruddh D. Patel, Ph.D.

Esther J. Burnham Fellow
in Theoretical Neurobiology
The Neurosciences Institute
April 25, 2001

**Creativity, Nobel Prizes,
and Major Discoveries***

J. Rogers Hollingsworth, Ph.D.

Professor of Sociology, History and Industrial Relations
Chairperson, Graduate Program
in Comparative History
University of Wisconsin-Madison
June 19, 2001

How Did Things Ever Get So Darned Complicated?*

Nicholas C. Spitzer, Ph.D.

Professor and Chairman,
Department of Neurobiology
University of California San Diego
Associate, Neurosciences Research Program
November 7, 2001

**Once More With Feeling: The Return
of the Science of Emotion***

Antonio R. Damasio, M.D., Ph.D.

Van Allen Professor and Head
Department of Neurology
University of Iowa College of Medicine
Associate, Neurosciences Research Program
February 4, 2002

**The Cosmos and the Brain: Exploring
Our Final Frontiers**

The Honorable Daniel S. Goldin

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July 11, 2002

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June 14, 2004

**CD audio recordings are available for
these presentations upon request.*

Performing Arts *at* The Neurosciences Institute

The relationship between music and the human brain represents a special focus of research at The Neurosciences Institute. Although innovative and unique, our work in understanding those brain functions that enable us to create and appreciate music is only in its infancy. We believe that the quality of human life can be substantially enhanced by furthering research about how the brain perceives and conceives music and art.

In keeping with our commitment to research in this important arena, the Institute's Auditorium is made available without charge to many distinguished arts and educational organizations for concerts and educational presentations. This program, "Performing Arts at The Neurosciences Institute," represents a service to the local community that is designed both to encourage and support the performing arts and to underscore the special relationship between the arts and the human brain.

"Performing Arts at The Neurosciences Institute" effectively saves our local arts organizations over \$300,000 per year. Since the program's inception, over 50 organizations have held over 250 performing arts and educational events at the Institute.



Organizations who used the Institute's facilities in 2003-2004 include:

*American Harp Society
Athenaeum Music & Arts Library
California Institute of Music
Camarada
Center for World Music
Girls Scouts, San Diego
The Hutchins Consort
IMAGES Theatre
La Jolla Country Day School
La Jolla Music Society
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San Diego Opera
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THE
NEUROSCIENCES
INSTITUTE'S

Minding the Arts

A GALA EVENT to *Benefit*
Performing Arts
at THE NEUROSCIENCES
INSTITUTE

On Sunday, September 12, The Neurosciences Institute's second annual *Minding the Arts* fundraising event was held. A magnificent success, the event raised over \$185,000 for the Institute's performing arts program, in which the acclaimed auditorium is made available at no charge to local non-profit arts and educational organizations. The Institute incurs costs of over \$300,000 per year to continue providing this community service—which many local arts groups have come to rely upon in order to continue their programming. These expenses include energy for lighting and climate control, maintenance, cleaning, security, and program management.

Chaired by Linda Satz of Mainly Mozart, with Institute Trustee Jinx Ecke as Honorary Chair, the organizing committee planned this extraordinary event for over 300 guests.

Minding the Arts' unique afternoon format began with a lovely outdoor cocktail reception amidst the stunning architecture of the Institute's campus, featuring a tempting array of gourmet food and beverages from San Diego's finest purveyors. Guests were further indulged with a private concert in the Auditorium that included performances by the remarkable

Hutchins Consort, the noted Paul Sundfor jazz trio, and the talented San Diego Opera Ensemble.

Ian Campbell, General Director of San Diego Opera and the evening's Master of Ceremonies, brilliantly provided music/science anecdotes during the transition periods, providing fascinating insights about the performances.

Minding the Arts is an annual event that helps cover the costs to the Institute of providing this unique venue free-of-charge. *Minding the Arts* 2005 will be held on September 25, 2005 and is once again being chaired by Linda Satz. For more information, email Rachel Jonte at jonte@nsi.edu.



The reception is graced by the sounds of a string quartet provided by the California Institute of Music



Toni Bloomberg, Veryl Mortenson, John Bloomberg and Cherie Halladay

Minding the Art

Sunday, September 12, 2004

We'd like to give special thanks to all of the generous sponsors, entertainment donors, and catering donors whose generosity made this event a success!

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Event Chair Linda Satz with Institute Founder and Director Dr. Gerald Edelman and Honorary Chair Jinx Ecke



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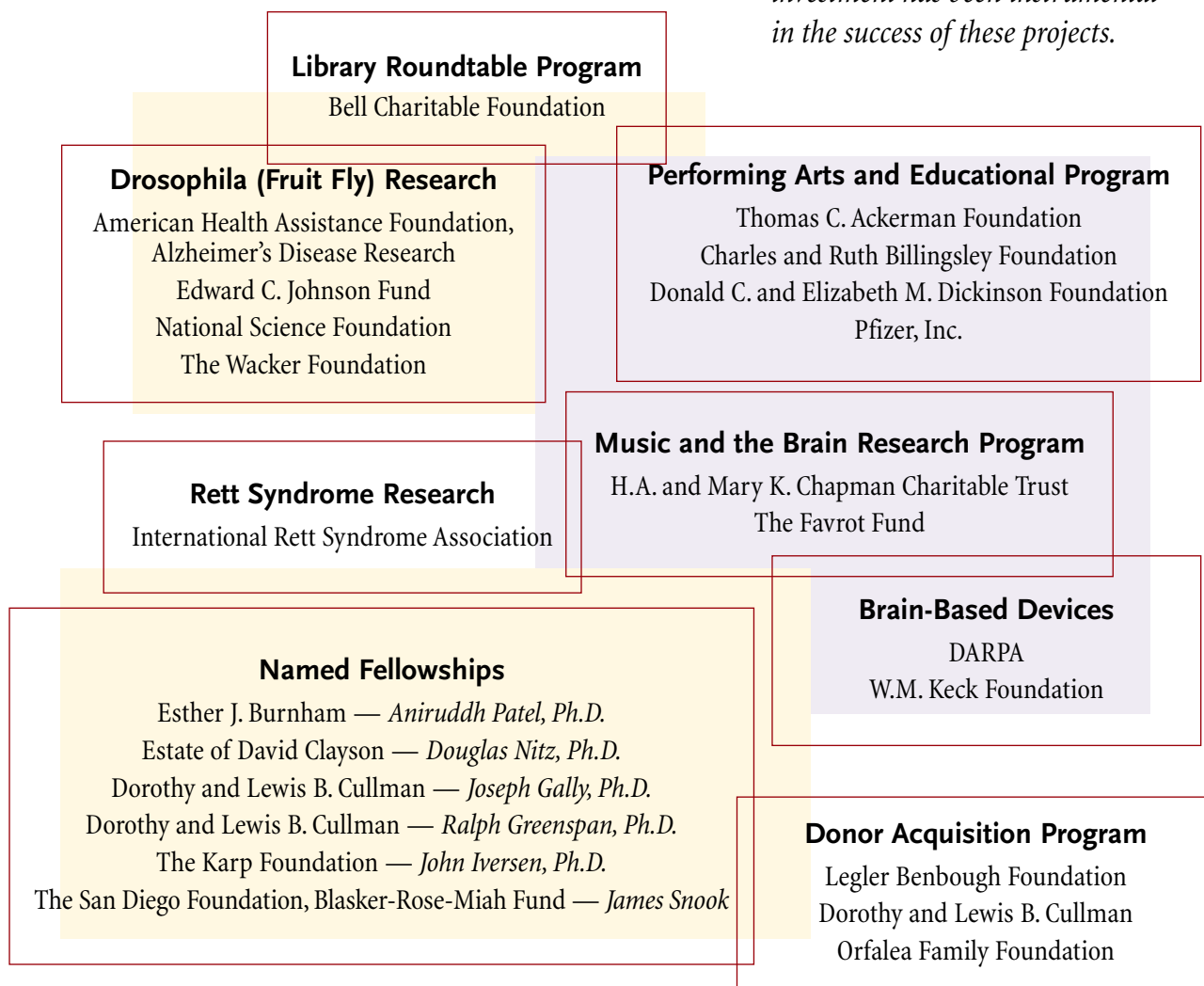
John Hardy and Jean Hahn Hardy with Audrey Geisel and Alexander Butterfield



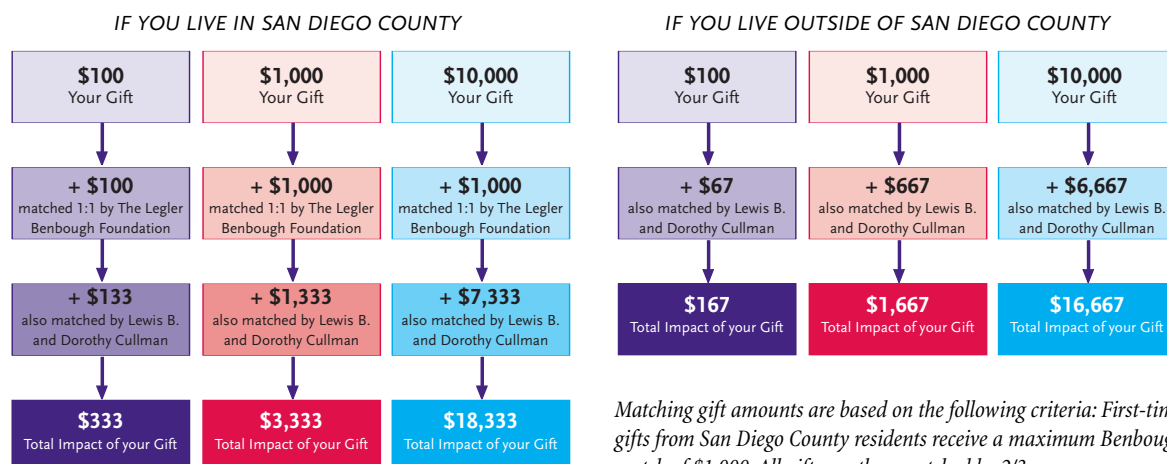
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Photograph of a prototype of the Institute's new Donor Recognition Wall

As an expression of our gratitude and appreciation for the generous contributions of our supporters, we are excited to announce that we are commissioning a donor recognition wall. The wall will be installed in the outdoor loggia of our Auditorium and will be unveiled in March, 2005.

Donors who have given a cumulative total of at least \$2,500 to the Institute will be listed on the wall. The wall will be updated annually based on each donor's total contributions through the end of each calendar year.

We will be reserving a special section of the wall for donors who have made us aware of gifts through their will or estate. If you have made such arrangements or would like more information about doing so, please contact Jo Ann Anderson at (858) 626-2020 or by e-mail at anderson@nsi.edu.

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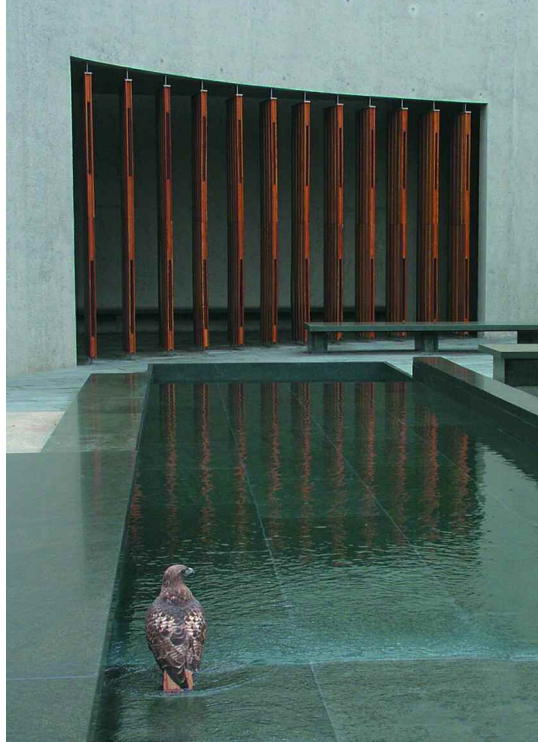
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Arts & Ideas

SATURDAY, MARCH 23, 2002

The Brain? It's A Jungle in There

Only the Fittest Neurons Survive

By EDWARD BROTENIN

LA JOLLA, Calif.

Spend enough time talking with Dr. Gerald M. Edelman, and eventually his theory about how consciousness develops will seem confirmed by experience. Sometimes, out of anecdotes about Andy Warhol, Friedrich von Hayek, Jascha Heifetz and Linus Pauling, out of free-floating riffs, vaudevilian jokes, recollections, citations, arguments and patient explanations, out of the excited explosions of example and counterexample, associations develop, mental terrain is reoriented, and ever greater patterns emerge. The immensity of Dr. Edelman's project — explaining the development of the human mind — seems to be happening in the hum and current of your own brain, in the excited state brought on by Dr. Edelman's volatile mixture of calculation, charisma, enterprise and brilliance.

This is metaphor, of course, but as Dr. Edelman says, "The brain is a confabulator." It associates diverse sensations, seeks explanations for its own coherence. It even seeks coherence.

At 74, Dr. Edelman is one of the most renowned neuroscientists as well as one of the more controversial. Some have hailed his views about neurobiology and consciousness as revolutionary and unclear. With his maverick stance, immense ambitions and proven accomplishments, the man himself has inspired similarly polarized reactions.

Speaking in his office at the Neurosciences Institute here, Dr. Edelman is reluctant to talk too much about himself, but his effort to understand the brain had to have been inspired by the wandering passions of his own. He grew up in Ozone Park, Queens, and Long Beach, N.Y., and trained to be a concert violinist. After getting an M.D. from the University of Pennsylvania in 1954, he worked as a doctor for the United States Army in France. In 1960 he received his Ph.D. from the Rockefeller Institute (now Rockefeller University), where his work on immunology won him the Nobel Prize in 1972 (he was just 43). Dr. Edelman showed how the body produces precisely the right antibodies to fend off cellular assaults. "But I don't get very excited, so he soon left immunology, and in 1981 founded the Neurosciences Institute (www.nsi.edu). It began as an independently supported part of Rockefeller University, moved here in 1993 and now



Logan Jenkins

Searching fruit-fly brains for clues to our thinking



You never know who is that other car brainier looking like him.

It was just a spooky way to close out a cab ride.

As you might recall, a mid-decade Del Mar man went haywire after teenagers in a Nissan Pathfinder threw an egg at his Volvo in December 2000. Michael Slater wound up on top of the SUV, like mad. Andy Dick, he fell from the moving vehicle, suffering head injuries. Last month, the book "To Herman Dierck, a neuroscientist" by Dr. Edelman, a neuroscientist in La Jolla, my question that drives his life is "What goes on in a brain? You go crazy like that?" Unlike those of us who complain about the human mind, he does anything about it, and his fellow scientists at one of San Diego's

deepest brightest secrets — are studying a provocative slice of the question that first drew the 38-year-old Belgian native to biology. "Why are we the way we are?"

As Dr. Edelman's theory of the "neurosciences" — the description of the brain's Prosopopeia — the Dierck's work with fruit flies, reproduce in days. Technical, but only for those who bother to read. Dierck told me, "I added a short film. Dierck demonstrated how typical fruit flies are 'vicious' and, in fact, the Casper Miquel, a doctoral fellow at the Neurosciences Institute in La Jolla, my question that drives his life is "What goes on in a brain? You go crazy like that?" Unlike those of us who complain about the human mind, he does anything about it, and his fellow scientists at one of San Diego's

In addition, where contests among the original population lasted 10 to 20 seconds, the gladiators he created were willing to go toe-to-toe for 2½ minutes.

To a visitor off the street, the transformation is impressive in itself. But now comes the heavy changes in the brain. That's where the neurons hit the road, so to speak.

I'm interested in what's going on in the fly's brain to make it aggressive," Dierck said. "Ultimately, the goal is to determine before they die, if they are genetically predisposed, all sorts of hairy issues must be raised, which in the rule aggression plays in Darwinian survival."

As Edelman, a heavyweight might say (and a recent *New York Times* article on Edelman in fact said in a headline): It's a jungle in there.

Dierck's inquiry into aggressive fruit flies is itself a revelation — similar to the way the brain works. Others

been staged at Harvard — but what's evidently rare is the freely without the pressure of a seeking grant.

On the scene Neurosciences Institute campus — it's a Salt Institute and exudes "a sort of coolness," Dierck says — the operative theme is not most universities.

I have been here 3½ years," Dierck said, "and I have not published anything."

Such is the sheltered life of Edelman's "poets," as the No. 1 laureate likes to call him as well as of whom arrive with big credentials and such small, intimate, private and diverse structures are the ideal incubators for scientific creativity.

The 40 Institute fellows — they are from around the world, not one San Diego native among them — live into the brain from wildly different directions.

Some work on computer-driven robots that simulate the way the brain works. Others

study how the brain experiences music. Or sleep. Others, like Dierck, ground rarefied theory in the rare meat of real, minute, brains.

After lunch with Edelman and several of his colleagues, I walked to my car with a new respect for the modesty of neuroscience, a slowly evolving discipline, a slowly evolving discipline, an extraordinary cluster of institutions on Torrey Pines Mesa — Salt, Scripps Research Institute, U.C. San Diego, The Burnham Institute.

Over cherry pie, Ralph Greenpan, a senior fellow, offered what sounded like a working hypothesis for scientific immortality. "The more profound a discovery is, the more it becomes assimilated and becomes an underlying assumption rather than something that is admired."

As is one of his joys in life, Edelman, a violinist and poet, teased the solemn observation into a concise, mordant licker. "We forget as an artist. We end as a paragraph."

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LA JOLLA TODAY

M a g

Winter 2004

MUSIC NEUROSCIENCE

Coming at the Neurosciences Institute

- 8 p.m. Friday, Nov. 28
The Hudson Consort
- 2 and 7:30 p.m. Saturday, Dec. 11
Pacific Coast Harmony
- 2 p.m. Sunday, Dec. 12
Seagula Concerts Inc. presents Westwind Brass
- 7 p.m. Monday, Dec. 13
Westwind Brass
- 2 p.m. Sunday, Jan. 16, 2005
Seagula Concerts Inc. presents Mike Peel Jazz Ensemble
- 8 p.m. Friday, Jan. 21
The Hudson Consort
- 8 p.m. Sunday, Jan. 23
Cinamanda
- 7:30 p.m. Thursday, Jan. 27
Agency for Jewish Education lectures by archaeologist William G. Deor
- 3 p.m. Sunday, Jan. 30
La Jolla Music Society presents Inari Winds (details www.nsi.edu)

FIRST UP: The Cat in the Hat

CENTERPIECE: Music

FEATURES: Holiday

PREMIER: QUARTERLY ISSUE
Published by La Jolla Today Magazine

By Christine Holbridge
Photos by Paul Heston

Those who labor there call it The Maus. It's that vast network of underground tunnels north of the Village and a half mile from the University of California, San Diego (UCSD). There, researchers of various technical natures, if humanoid in form, they are it, and they are glorious.

What sets the Neurosciences Institute apart from the others is its extraordinary 302-seat auditorium, called by association Cyril Harris the nation. Because of its proximity to allowing non-profit arts organizations use of this especially dear to arts lovers, that is, it is because of the accessible and humane activities who work there.

An arts center may go to the Neurosciences Institute feeling deficient scientifically, but semi-hand solder other thanks to Dr. W. Edgar Gall, Ph.D., research director and CEO, a copy of "Wider Than the Sky: the phenomenal gift of consciousness," courtesy of author Dr. Gerald Edelman, M.D. and Ph.D., founder and director of the Institute, and a lay-language explanation of groundbreaking research into how the brain perceives and processes music, edited by Dr. Paul Heston, the Institute's Edgar J. Burnham Fellow in theoretical neuroscience.

"It's very unusual in the world to have a program of interest to the arts, but a major building program to study music and the brain," said Paul, a native of Bingham brought to America.

The striking modern architecture of the Neurosciences Institute (top) complements the advanced research being done there. A dancer from Malaysia (bottom) gets ready to take the stage at the Institute's auditorium.

THE
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