



FY 2005

# HALLS OF PREMINENCE

## RESEARCH AT CORNELL

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## From the Vice Provost for Research



Robert Richardson

The state of research at Cornell remains vibrant and vital. I could discuss the remarkable new life science research buildings sprouting up on the campus, giving my usual upbeat report about this and other extraordinary research endeavors at Cornell. Instead, I would like to turn to an issue of significant national importance: the role of the research university in the nation's economic health.

Last fall, I participated in a National Academies of Sciences Committee on Prospering in the Global Economy of the 21st Century. We wrote a major report, *Rising above the Gathering Storm: Energizing and Employing America for a Brighter Economic Future* (National Academies Press, Washington, D.C.). The report contains a detailed analysis of the degradation of the United States' competitive position and some suggested remedies.

The report recommends actions that should be taken by U.S. industry and federal agencies, but much of the fundamental remediation needs to occur in our K-12 schools and universities. Our scientific workforce and teaching corps are woefully inadequate, and our university base for performing basic research is underfunded. Many thoughtful economists estimate that about half of U.S. economic growth since World War II has been the result of technological innovation following research. Without a significant renaissance in our own national ability to innovate, the United States is likely to fall further behind other nations.

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## The Role of a Preeminent University in the National Economy



Robert Richardson

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The following are only a few examples of our weakening "competitiveness indicators," quoted from the report:

The U.S. is a net importer of high-technology products, with the trade balance in high-technology manufacturing goods having shifted from a surplus of \$54 billion in 1990 to a deficit of \$50 billion in 2001.

In a recent period, low-wage employers such as McDonald's and Wal-Mart created 44 percent of the new jobs, while high-wage employers created only 29 percent of the jobs.

U.S. scheduled airlines currently outsource significant portions of their aircraft maintenance to China and El Salvador.

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In 2005 American investors put more new money in foreign stock funds than in domestic stock portfolios.

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In 2004 China overtook the United States, becoming the leading exporter of information-technology products.

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The United States ranks only 12th among developed countries in the number of broadband connections per 100 inhabitants.

The report recommends actions that should be taken by U.S. industry and federal agencies, but much of the fundamental remediation needs to occur in our K-12 schools and universities. Our scientific workforce and teaching corps are woefully inadequate, and our university base for performing basic research is underfunded. Many thoughtful economists estimate that about half of U.S. economic growth since World War II has been the result of technological innovation following research. Without a significant renaissance in our own national ability to innovate, the United States is likely to fall further behind other nations.

At Cornell we intend to make significant contributions to the solution of one of the most difficult national problems, which has special national urgency: the development of new energy sources. We have initiated a broad range of new programs, ranging from the development of biofuels to fundamental studies of catalysis at surfaces of fuel cells. The nascent studies in energy research can be found in most of our colleges.

With a unique range of research—in agriculture; ultrahigh technology; medicine; and humanistic, social, and economic studies—across 16 colleges and divisions, Cornell will continue to make distinctive, tangible contributions of far-reaching national importance.

*Robert C. Richardson*

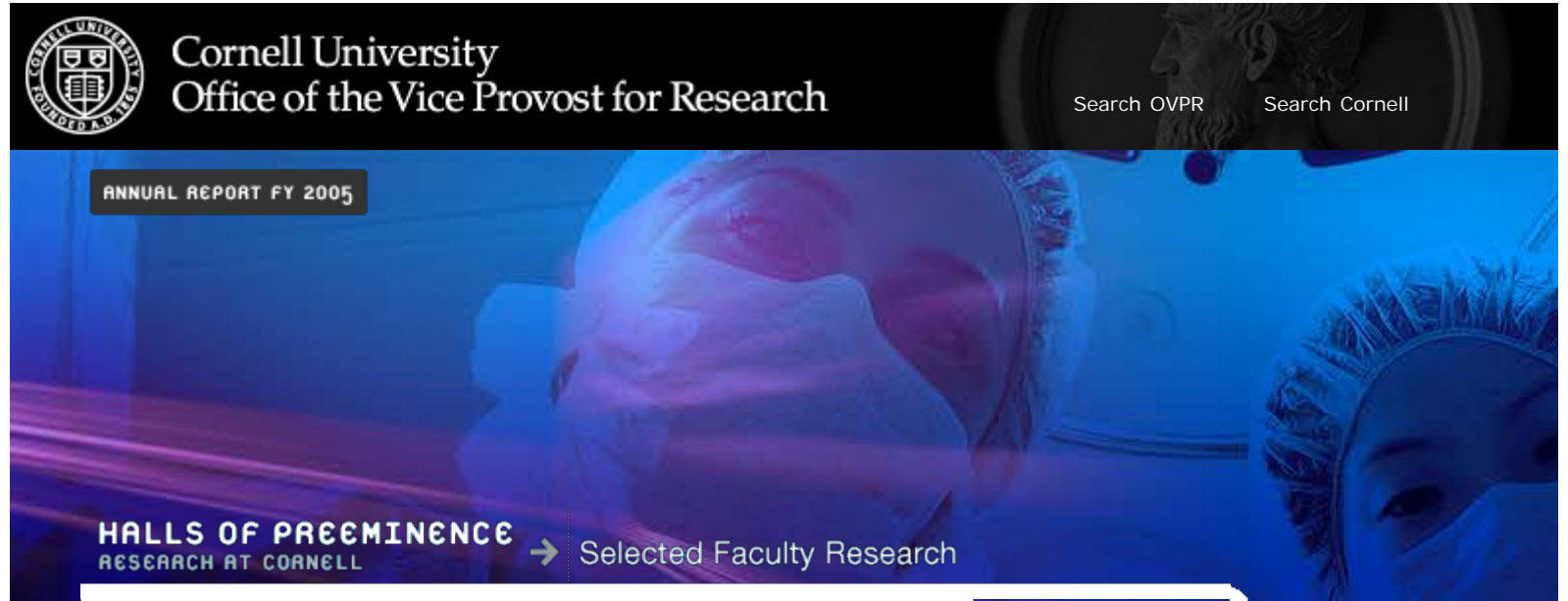


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- 01. [It Takes a Pair](#)**  
Selina Chen-Kiang, Pathology and Laboratory Medicine,  
Weill Cornell Medical College
- 
- 02. [The Work of Scribes](#)**  
John L. Cisne, Earth and Atmospheric Sciences
- 
- 03. [Plastic from Oranges](#)**  
Geoffrey Coates, Chemistry and Chemical Biology
- 
- 04. [Cell Polarity](#)**  
Ruth N. Collins, Molecular Medicine
- 
- 05. [How Flames Burn](#)**  
Terrill A. Cool, Applied and Engineering Physics
- 
- 06. [Eight Rules](#)**  
John B. Corgel, Hotel Administration
- 
- 07. [Extracting Patterns](#)**  
Shimon J. Edelman, Psychology
- 
- 08. [The Economic Scene](#)**  
Robert H. Frank, Johnson Graduate School of Management
- 
- 09. [Searching for the Cause Of Spreading](#)**  
Jun-Lin Guan, Molecular Medicine
- 
- 10. [Wild Salmon vs. Farmed Salmon](#)**  
Barbara A. Knuth, Natural Resources, Steven J. Schwager,  
Biological Statistics and Computational Biology
- 
- 11. [News on PARP-1, Something More to Study](#)**  
W. Lee Kraus, Pharmacology, Weill Cornell Medical College,  
and Molecular Biology and Genetics
- 
- 12. [Comfort Food](#)**  
Jordan L. LeBel, Hotel Administration

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**13. [Renin from Mast Cells: Something Unique](#)**

Roberto Levi, Pharmacology, and Randi Silver, Physiology and Biophysics, Weill Cornell Medical College

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**14. [Self-Replicating Robots](#)**

Hod Lipson, Mechanical and Aerospace Engineering

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**15. [Fluorescing DNA Nanobarcodes](#)**

Dan Luo, Biological and Environmental Engineering

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**16. [Star Watching and Saturn](#)**

Philip D. Nicholson, Astronomy

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**17. [Where Is the Missing CO<sub>2</sub>?](#)**

Karl J. Niklas, Plant Biology

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**18. [The Jantars Mantars](#)**

Barry A. Perlus, Art

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**19. [Away with Resilient Pests!](#)**

Wendell L. Roelofs, Entomology, Cornell Geneva Campus

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**20. [All Hail a Premiere](#)**

Roberto Sierra, Music

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**21. [Not Like a Computer](#)**

Michael J. Spivey, Psychology

---

**22. [A Beetle-Inspired Switch](#)**

Paul H. Steen, Chemical and Biomolecular Engineering

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**23. [All Aboard And Synchronized](#)**

Steven H. Strogatz, Theoretical and Applied Mechanics

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**24. [X-raying Antiquity](#)**

Robert Thorne, Physics, and Kevin Clinton, Classics

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**25. [Curing Crown Gall](#)**

Stephen C. Winans, Microbiology

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### 01. [Samuel Bacharach, Industrial and Labor Relations](#)

*Get Them on Your Side: Win Support, Convert Skeptics, Get Results* (Platinum Press, 2005)

### 02. [Malcolm Bilson, Music](#)

*Knowing the Score* (Cornell University Press, 2005)

### 03. [Kenneth P. Birman, Computer Science](#)

*Reliable Distributed Systems: Technologies, Web Services, and Applications* (Springer, 2005)

### 04. [Charles J. Brainerd and Valerie F. Reyna, Human Development](#)

*The Science of False Memory* (Oxford University Press, 2005)

### 05. [David A. Dunning, Psychology](#)

*Self-Insight: Roadblocks and Detours on the Path to Knowing Thyself* (Psychology Press, 2005)

### 06. [Roger S. Gilbert, ed., English, \(with David Burak\)](#)

*Considering the Radiance: Essays on the Poetry of A. R. Ammons* (Norton, 2005)

### 07. [Isabel V. Hull, History](#)

*Absolute Destruction: Military Culture and the Practices of War in Imperial Germany* (Cornell University Press, 2005)

### 08. [Jan Jennings, Design and Environmental Analysis](#)

*Cheap and Tasteful Dwellings: Design Competitions and the Convenient Interior, 1879–1909* (University of Tennessee Press, 2005)

### 09. [Jon M. Kleinberg and Eva Tardos, Computer Science](#)

*Algorithm Design* (Addison Wesley, 2005)

### 10. [Stephen L. Morgan, Sociology](#)

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*On the Edge of Commitment: Educational Attainment and Race in the United States* (Stanford University Press, 2005)

**11. [Trevor J. Pinch, Science and Technology Studies \(with Harry Collins\)](#)**

*Dr. Golem: How to Think About Medicine* (University of Chicago Press, 2005)

**12. [Steven F. Pond, Music](#)**

*Head Hunters: The Making of Jazz's First Platinum Album* (University of Michigan Press, 2005)

**13. [Steven W. Squyres, Astronomy](#)**

*Roving Mars: Spirit, Opportunity, and the Exploration of the Red Planet* (Hyperion, 2005)

**14. [Robert S. Summers, Law](#)**

*Form and Function in a Legal System: A General Study* (Cambridge University Press, 2006)

**15. [Richard Swedberg, Sociology](#)**

*The Max Weber Dictionary: Key Words and Central Concepts* (Stanford University Press, 2005)

**16. [Shawkat M. Toorawa, Near Eastern Studies](#)**

*Ibn Abi Tahir Tayfur and Arabic Writerly Culture: A Ninth-Century Bookman in Baghdad* (Routledge Curzon, 2005)

**17. [Brian C. Wansink, Applied Economics and Management](#)**

*Marketing Nutrition: Soy, Functional Foods, Biotechnology, and Obesity* (University of Illinois Press, 2005)

**18. [David Wippman, Law, and Matthew Evangelista, Government \(eds.\)](#)**

*New Wars, New Laws? Applying the Laws of War in 21st Century Conflicts* (Transnational Publishers, 2005)

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For an **Energy Recovery Linac (ERL)**, the National Science Foundation awarded \$18 million to a research team at Cornell's Laboratory of Elementary-Particle Physics (LEPP) and Cornell High Energy Synchrotron Source (CHESS) to begin development of this new super-advanced synchrotron radiation x-ray source.

The historic groundbreaking for Cornell's \$146-million **Life Sciences Technology Building** marked the beginning of a new era in life sciences research, education, and outreach. It is the centerpiece of Cornell's \$600-million New Life Sciences Initiative.

Cornell's **Northeast Sun Grant Institute of Excellence**, directed by Larry P. Walker, Biological and Environmental Engineering, is one of five Sun Grant Centers of Excellence. With federal funding of \$8.2 million, Cornell will lead research, education, and outreach activities in the use of plant biomass in energy and chemical production for this regional hub serving 14 states and the District of Columbia.

For a **Cornell Information Campus**, the Bill and Linda Gates Foundation awarded Cornell \$25 million to support the construction of the signature building that will bring together the several units of the Faculty of Computing and Information Science.

Fred B. Schneider, Computer Science, became chief scientist for the **Team for Research in Ubiquitous Secure Technology (TRUST)**. This new nationwide Science and Technology Center funded by the National Science Foundation with \$19 million will develop long-term solutions to computer security problems. TRUST, a consortium of researchers from eight academic institutions (including Cornell), and its industrial and government partners aim to create new technologies to enable the development of secure computer software and networks.

The **Peace Studies Program** received a \$1.86-million

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John D. and Catherine T. MacArthur Foundation award for additional research and training in science and security studies, aiming to expand the base of independent experts who can provide objective technical analysis on international security issues.

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To study *Listeria monocytogenes*, **Martin Wiedmann**, Food Science, is co–primary investigator of a three–university research collaboration awarded \$2 million by the U.S. Department of Agriculture. The project is searching for ways to curtail the pathogen’s spread along the food chain, through comprehensive research and outreach.

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For mosquito control, **Laura C. Harrington**, Entomology, became a member of a global team of scientists granted \$19.7 million by the Foundation for the National Institutes of Health (FNIH). The researchers will develop and implement genetic strategies for controlling the *Aedes aegypti* mosquito that transmits dengue fever. Harrington’s share of the grant enables her lab to assess mating competition and fitness of wild and modified mosquitoes.

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**Thomas Eisner**, Neurobiology and Behavior, a world authority on animal behavior, ecology, and evolution, won the Rockefeller University’s 2005 Lewis Thomas Prize for writing about science. The prize honors “the rare individual who bridges the worlds of science and the humanities.”

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Cornell’s **Laboratory of Ornithology** led the search for the ivory-billed woodpecker after a reported sighting in the Big Woods of eastern Arkansas. The bird, the largest woodpecker in North America, had not been seen for 60 years in the United States. After intensive searches and video documentation and thousands of hours of in-depth acoustics analysis using some of the world’s most advanced natural sounds recording and analysis tools located at Cornell, the evidence is convincingly strong that the bird survives.

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Cornell University Library’s exhibition, “**From Dublin to Ithaca: Cornell’s James Joyce Collection**,” celebrated the spectacular collection of letters, manuscripts, and books documenting the life and work of James Joyce held in the library’s collection. For the first time in 30 years, the library’s Division of Rare and Manuscript Collections exhibited highlights from the Cornell Joyce collection, one of the richest in the world, covering Joyce’s early life and writing career. The 11-case exhibition of more than five dozen artifacts—including letters, first drafts, photographs, postcards, and other documents—were only some of the most prominent items of Cornell’s major collection of Joyceiana.

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#### Pulitzer Prize

- » Steven E. Stucky, Music

#### American Academy of Arts and Sciences

- » Gregory F. Lawler, Mathematics
- » Alison Lurie, English
- » Steven W. Squyres, Astronomy

#### John D. and Catherine T. MacArthur Foundation Fellowship

- » Jon M. Kleinberg, Computer Science

#### National Institutes of Health Method to Extend Research in Time (MERIT) Award

- » William A. Muller, Pathology and Laboratory Medicine

#### Sloan Foundation Research Fellowships

- » Colleen E. Clancy, Physiology and Biophysics, Institute for Computational Biomedicine, Weill Cornell Medical College
- » Brian Crane, Chemistry and Chemical Biology
- » Erich Mueller, Physics
- » Camil Muscalu, Mathematics
- » Anders Ryd, Physics

#### National Science Foundation Faculty Early Career Development Program

- » Marianella Casasola, Human Development
- » Matthew DeLisa, Chemical and Biomolecular Engineering
- » Yong L. Joo, Chemical and Biomolecular Engineering
- » Michal Lipson, Electrical and Computer Engineering

#### Burroughs-Wellcome Fund Investigators in Pathogenesis of Infectious Disease Award

- » John S. L. Parker, Baker Institute for Animal Health

#### Kumho Science International Award

- » Steven D. Tanksley, Plant Breeding and Genetics

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**Fritz London Memorial Prize**

» James C. Seamus Davis, Physics

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**NASA’s Exceptional Scientific Achievement Medal**

» James R. Houck, Astronomy

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**Anthropology in Media Award**

» Meredith F. Small, Anthropology

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Within the \$77-billion semiconductor industry, there is a large and fast-growing \$24-billion custom logic market.

## 02. [Start-Up Company Primet Precision Materials Licenses Cornell Technology, the Basis for the Cornell Fuel Cell Institute](#)

Primet Precision Materials, Inc., is an advanced materials company dedicated to creating better performance in solar cells, fuel cells, and other consumer-friendly industries.

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## From the Vice Provost for Research



Robert Richardson

The state of research at Cornell remains vibrant and vital. I could discuss the remarkable new life science research buildings sprouting up on the campus, giving my usual upbeat report about this and other extraordinary research endeavors at Cornell. Instead, I would like to turn to an issue of significant national importance: the role of the research university in the nation's economic health.

Last fall, I participated in a National Academies of Sciences Committee on Prospering in the Global Economy of the 21st Century. We wrote a major report, *Rising above the Gathering Storm: Energizing and Employing America for a Brighter Economic Future* (National Academies Press, Washington, D.C.). The report contains a detailed analysis of the degradation of the United States' competitive position and some suggested remedies.

The report recommends actions that should be taken by U.S. industry and federal agencies, but much of the fundamental remediation needs to occur in our K-12 schools and universities. Our scientific workforce and teaching corps are woefully inadequate, and our university base for performing basic research is underfunded. Many thoughtful economists estimate that about half of U.S. economic growth since World War II has been the result of technological innovation following research. Without a significant renaissance in our own national ability to innovate, the United States is likely to fall further behind other nations.

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### 01. It Takes a Pair



**Selina Chen-Kiang, Pathology and Laboratory Medicine, Weill Cornell Medical College,** and research colleagues discovered the mechanism that triggers relapse in patients with multiple myeloma. The fatal disease is the second most common blood cancer with a life expectancy of three years after


diagnosis. While available drugs can push the disease into temporary remission, uncontrolled cell division always reemerges. Until now the cellular mechanism driving the relapse has been unclear. Chen-Kiang's group found that specific pairings of cell-cycle regulators—proteins called cyclins and enzymes called kinases—are necessary for driving myeloma cells to uncontrollable cell division. Their discovery is counter to previous beliefs that the overexpression of a particular cyclin called cyclin D1 was all that was needed to trigger the overproliferation of myeloma cells. The researchers found that cyclin D1 or a related regulatory protein, cyclin D2 must first pair up with specific kinase enzymes—CDK4 and CDK6—to drive myeloma cells toward division. Now that the researchers know both are needed, the knowledge can guide the development of new drugs targeted at the enzymes for more effective treatment.



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## 02. The Work of Scribes



John Cisne

**John L. Cisne, Earth and Atmospheric Sciences**, concluded that many more handcopied manuscripts survived the Middle Ages than previously believed. He analyzed the endless process of repetition by which scribes

reproduced manuscripts, changing them slightly each time they were recopied much like a telephone gossip game, before the invention of Johannes Gutenberg's printing technology in the mid-fifteenth century. Treating manuscripts as though they were individuals in a population, Cisne applied mathematical models developed for population biologists to the analysis. Like the replication of biological organisms, the manuscripts had to be copied from a parent template. In order to be copied, one had to already exist, and the more copies in existence, the more copies that could be transcribed. Each handcopied text had a probability of "giving birth" (being copied) and a probability of "death" (being destroyed). Looking at certain factors of a manuscript's survival, one of the texts on which Cisne tested his model was Bebe's De Temporum Ratione, a standard arithmetic text copied repeatedly between the eighth and sixteenth centuries. Cisne's discovery could help researchers understand how science and culture survived the Dark Ages.

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### 03. Plastics from Oranges



Geoffrey Coates

**Geoffrey Coates, Chemistry and Chemical Biology**, and his graduate students discovered how to make polymers using limonene oxide and carbon dioxide as building blocks with the help of a catalyst developed in his

laboratory. Limonene is a carbon-based compound produced in more than 300 plant species, and it makes up 95 percent of the oil in the peel of oranges. In industry, the orange peel oil is extracted for various uses, such as giving household cleaners a citrus scent. The oil can be oxidized to create limonene oxide. Using Coates' catalyst to combine the limonene oxide and carbon dioxide, a waste product, the researchers produced a new polymer—polylimonene carbonate—that has many of the characteristics of polystyrene, a petroleum-based plastic currently used to make many disposable plastics products. Petroleum is used as a building block for nearly all plastics from polyester in clothing to plastics used for food packaging and electronics. A plastic with favorable qualities made using readily abundant and completely renewable, cheap resources will be highly beneficial and necessary for the future.

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## 04. Cell Polarity



Ruth Collins

**Ruth N. Collins, Molecular Medicine**, and her graduate students, setting out to study how yeast establishes cell polarity, discovered a gene, E1p1, that is key in determining the structural and functional asymmetry of cells,

or cell polarity. E1p1 is critical in regulating cell polarity, such as directing growth to the tip of a cell so that a daughter cell can bud off to divide. The discovery provides needed insight into the pathogenesis of familial dysautonomia (FD), a disease of nerve cell failures. FD is manifested soon after birth and results in a life span of less than 30 years. It is caused by a genetic defect in a protein that is the human counterpart to the E1p1 gene in yeast. The disease may arise from a lack of fully developed neurons, which must direct new growth to a tip of the cell in order to make synapses. Collins' discovery gives researchers new insight into basic mechanisms of cell growth and differentiation, with implications for other disease such as cancer. Just as polarity is important for normal cell function, loss of polarity—reversal of the molecular pathway that creates cell polarity—is one of the early steps in the progression to uncontrolled cell proliferation.

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## 05. How Flames Burn



Terrill Cool

**Terrill A. Cool, Applied and Engineering Physics,** and research colleagues discovered compounds in fire that have eluded detection through 150 years of research in flame chemistry. The new compound, enols, are in the alcohol family and have a structure with properties of both alkenes and alcohols. Detection of the compounds had escaped previous discovery because they were obscured by a related compound, isomer, with the same mass, which had long been known to exist in fire. A new technique for studying the compounds in flames, which revealed both the structure and the mass, allowed the researchers to distinguish between the molecules and made the discovery possible. Hundreds of chemical species form and turn into other products when fires burn. Enols are among these intermediary species. To study fire chemistry, scientists use computer models to simulate chemical reactions during combustion flames. The discovery offers new directions in efforts to reduce soot and other pollutants in flames, improve fuel cells, and model planetary atmospheres and other interstellar chemistry.

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## 06. Eight Rules



John Corgel

**John B. Corgel, Hotel Administration**, compiled and analyzed the results of several studies, including his own research, on hotel markets. This consolidation of the knowledge gained from studying hotel

markets over the past two decades, previously scattered across the professional and academic literature, covers hotel space markets, equilibrium in hotel markets, cyclical patterns, leads and lags, overbuilding, hotel capitalization rates, the behavior of transacting parties, and debt-financing alternatives. Corgel developed eight rules for competing in the hotel real estate markets. Rule two, for example, states, "One has to keep the benchmarks handy (including such measurements as market equilibrium)."

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## 07. Extracting Patterns



Shimon Edelman

**Shimon J. Edelman, Psychology**, and colleagues developed a computer algorithm for language learning and processing that can scan text in various languages, including English and Chinese, autonomously and, without previous information, infer the underlying rules of grammar. The new method, automatic distillation of structure (ADIOS), successfully identifies complex patterns in raw text. It can take a body of text, abstract a collection of recurring patterns or rules from it, and then generate new material. The algorithm discovers patterns by repeatedly aligning sentences and looking for overlapping parts. It works for such data as sheet music or protein sequences. The development, which has a patent pending, has implications for speech recognition and other applications in natural language engineering, as well as for genomics and proteomics. It offers new insight into language acquisition and psycholinguistics. The algorithm has been tested on child-directed language, the full text of the Bible in several languages, and musical notation and applied to biological data, including nucleotide base pairs and amino acid sequences.

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## 08. The Economic Scene



Robert Frank

**Robert H. Frank, Johnson Graduate School of Management,** scored a monthly

column, "Economic Scene," in the *New York Times'* business section.

The column focuses on economic issues that relate to policy matters and observations. Frank is one of the rotating contributors, and his column appears every fourth Thursday. He has covered topics such as compound interest as a growth vehicle for individuals who save money; the estate tax, posing many arguments for its continuation; the competition for top students by elite schools and how this competition has altered financial aid packages; the thinking of economist John Kenneth Galbraith and why he did not receive the Nobel Prize; and energy policy issues.

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## 09. Searching for the Cause of Spreading



Jun-Lin Guan

**Jun-Lin Guan, Molecular Medicine**, identified a specific metabolic pathway that allows cancer to spread, which could lead to drugs that will disrupt the process of metastasis. Guan and his graduate student pinpointed how connective tissue holding a cancer cell in place might degrade, disconnecting the diseased cell and allowing it to spread to other parts of the body. Using a cultured cell line from mice to create a model for studying cancer cells, the researchers discovered critical differences in how cancer cells and normal cells let materials enter through the membrane. Transforming a normal cell into one with features of cancer cells with a protein, v-Src derived from an oncogenic virus, the protein attached to an enzyme inside the cell. This set off events that blocked the entry through the cell's membrane of some cell-surface proteins. One protein not allowed entry was MT1-MMP, which accumulated on the cell surface and also activated an enzyme, MMP2; acting together the two substances degraded the connective tissue that holds the cancerous cell in place. These cells float away, spreading around the body. Although v-Src has not been found in human cancer, other viruses—such as herpes and its relationship to cervical cancer—have been linked to cancer. The work offers insight into how cancer might spread. The work could stimulate related research with clinical impacts.

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## 10. Wild Salmon vs. Farmed Salmon



Barbara Knuth

**Barbara A. Knuth, Natural Resources, Steven J. Schwager, Biological Statistics and Computational Biology,** and research colleagues found in a benefit-risk analysis that consumers should choose wild

salmon over farmed salmon unless heart disease is a risk factor. Although farmed salmon has more omega-3 fatty acids, which benefit the heart, it also has much higher levels of chemical contaminants—up to 10 times greater—known to cause cancer, memory impairment, and (in children) neurobehavioral changes. For the person with a history of heart disease, the benefits from eating salmon outweighs the risk of pollutants; however, for children who run the risk of the accumulation of carcinogenic pollutants or for pregnant women who risk damage to the fetus, the risks outweigh the benefits. The researchers found regional differences in contaminants in farmed salmon, with Chilean salmon showing the lowest levels and European (particularly Scottish) farmed salmon showing the highest levels. In general, the net benefits of eating wild Pacific salmon outweigh those of eating farmed Atlantic salmon. The study supports policy and regulatory efforts that would limit pollution of waters, clean up existing pollution to reduce human exposure to contaminants, and require fish to be labeled with the country of origin so that consumers can make informed decisions.

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## 11. News on PARP-1, Something More to Study



(l.) Lee Kraus and  
(r.) research colleague  
Anthony Suave

**W. Lee Kraus, Pharmacology, Weill Cornell Medical College, and Molecular Biology and Genetics,** and his research group discovered that an important cellular enzyme poly (ADP-ribose) polymerase-1 (PARP-1) plays a pivotal role in gene transcription,

which could lead to new cancer and neurological disease therapies. The researchers have characterized a whole new activity for the long-studied protein. They found that PARP-1 converts DNA from an active to a silent state, which brings forth the question of what genes are affected and whether the genes that are up-regulated or down-regulated in a disease can be targeted with PARP-1 to turn the genes on or off. PARP-1 is the most abundantly expressed member of a family of proteins long known to be involved in the metabolism of nicotinamide adenine dinucleotide (NAD<sup>+</sup>), a cellular co-factor involved in both energy use and signaling within cells. By the manipulation of the NAD<sup>+</sup>/PARP-1 mechanism, scientists may find new pharmacological ways of switching genes on and off at will. In addition to the implications that PARP-1 may play a role in cancer, which is driven by genetic abnormalities, recent studies have found that inhibition of PARP-1 activity is associated with neurological and learning impairment, and it also has been implicated in immune responses, diabetes, and aging. There is the possibility that the NAD<sup>+</sup>/PARP-1 system may connect daily diet to genetic activity within cells.

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## 12. Comfort Food



Jordan LeBel

**Jordan L. LeBel, Hotel Administration,** and research colleagues found that while women indulge in comfort foods when feeling down, men indulge as an enhancement when they are feeling their best. Their study confirmed the eating of comfort foods as a strategy to alleviate stress, sadness, and other negative emotions, but the study revealed that pleasure and positive emotions can also determine food choice, particularly in men. Men and older adults are more likely to report higher positive emotions after eating their favorite comfort food than women and younger adults. Comfort foods can produce feelings of guilt, particularly in women. The study also showed that foods high in sugar and fat are more efficient in alleviating negative feelings, while foods with fewer calories are more efficient in increasing positive emotions. Men's comfort foods include protein-dense foods, such as steak, and women and younger adults prefer high-calorie sweet snack foods, like chocolate and ice cream.

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## 13. Renin from Mast Cells: Something Unique



Roberto Levi and  
Randi Silver

**Roberto Levi, Pharmacology, and Randi Silver, Physiology and Biophysics, Weill Cornell Medical College,** discovered that renin, a kidney-secreted enzyme crucial to blood pressure regulation, is also synthesized and

secreted by the heart's mast cells, cells that control many of the body's allergic reactions. Renin breaks down a precursor, angiotensinogen, to form angiotensin, a major culprit in the development of cardiovascular diseases. The discovery that renin is produced outside the kidneys could revolutionize the therapeutic approach to these conditions. Mast cells, normally present in small numbers in all organs, are best known for their role in allergies, shock, wound healing, and defense against pathogens. Increased numbers of mast cells are found in many pathological conditions, including cardiomyopathy and congestive heart failure. The researchers believe these cells may constitute a significant source of renin outside of the kidneys, at the organ level.

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## 14. Self-Replicating Robots



Hod Lipson

**Hod Lipson, Mechanical and Aerospace Engineering**, and his research team created a machine that can reproduce itself. Although the machine's function is only to self-replicate, it is a proof of concept. The basic principle could

be extended to build robots that could replicate or repair themselves while working in hazardous environments or in space. The researchers created robots composed of modular cubes called molecubes, each containing identical machinery and the complete computer program for replication. The cubes have electromagnets on their faces that allow them to selectively attach to and detach from one another. A complete robot consists of several cubes linked together. Because each cube is divided in half along a diagonal, a robot composed of many cubes can bend, reconfigure, and manipulate other cubes. Theoretical discussions about self-replicating machines have been around since the early days of computing and robotics. However, only two previous physical devices that can self-replicate have been reported. One uses Lego parts assembled in a two-dimensional pattern by moving along tracks, and another uses an arrangement of wooden tiles that tumble into a new arrangement when given a shove.

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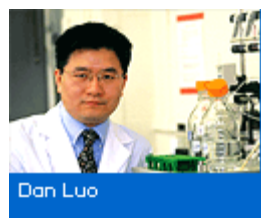
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## 15. Fluorescing DNA Nanobarcodes



Dan Luo

**Dan Luo, Biological and Environmental Engineering**, and his research team created synthetic DNA barcodes, molecular tagging devices, that fluoresce under ultraviolet light in a combination of colors that can be

read by a computer scanner or observed with a fluorescent light microscope. The researchers wanted to provide an inexpensive method of identifying biological molecules that can be used with readily available equipment. The idea is based on an application the researchers found for dendimer-like DNA, which consists of many short strands of Y-shaped DNA linked together in a treelike structure. Ignoring the DNA's genetic coding properties, Luo's research uses DNA as a generic instead of a genetic material. His research team synthesized three short strands of DNA, each of which is complementary to one of the others along half its length, in order to create the Y-shaped structure. Combining several of these structures creates a web with branching loose ends of DNA, to which an antibody that will bind to the molecule to be detected is attached, while molecules of fluorescent dye are attached to the other ends. Up to 1,000 different codes can be created using only three fluorescent dyes. The nanobarcode detection system does not require complex preparation of a sample and can be applied to living cells. The technology could be used in genomic research, clinical diagnosis, drug testing, environmental monitoring, and monitoring for biological terrorism.

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## 16. Star Watching and Saturn



(l.) Philip Nicholson and  
(r.) researcher Matt  
Hedman

**Philip D. Nicholson, Astronomy,** and research colleagues, members of NASA's Cassini-Huygens mission, found the most direct evidence to date of patterns within Saturn's outer rings. These patterns—called gravitational

wakes—are thin, parallel striations (small chunks of water ice) radiating outward like spokes on a pinwheel. Because of their small scale—328 feet wide—they are impossible to see with the spacecraft's high-resolution camera. Nicholson's team used Cassini's visual and infrared mapping spectrometer (VIMS) to take spectra of the star Omicron Ceti as it passed behind Saturn's outer rings during four three-hour intervals, or stellar occultations. With more than 100,000 spectra from each occultation, the researchers analyzed the data, plotting the amount of near-infrared light that filtered through the rings. The patterns have been theorized since the 1970s. This finding gives scientists new information about the rings' microstructure and internal dynamics: how the ice chunks move as they are pulled toward each other and collide and as Saturn's tidal force shears them apart. It also gives researchers a tool for judging the overall thickness of Saturn's rings.

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## 17. Where Is the Missing CO<sub>2</sub>



Karl Niklas

**Karl J. Niklas, Plant Biology,** and a research colleague proposed a mathematical scaling model that can accurately predict size-dependent relationships for small- and intermediate-size plants, from the smallest herbaceous plants to

the world's tallest trees. The model can, therefore, determine the mass of root systems. Root systems provide major storage for carbon dioxide, a greenhouse gas implicated in global warming. Due to the combustion of fossil fuels, the gas has been increasing steadily over the past century and a half. Scientists have attempted to account for the rise in global carbon dioxide by calculating the global balance between photosynthesis and processes that return carbon dioxide to the atmosphere. However, this accounting has revealed an imbalance—a missing bank of carbon. The researchers' new model can make reasonable predictions about how much carbon dioxide is stored underground in root systems. The predictions can be introduced into global climate models to give estimates of various climatological features.

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## 18. The Jantar Mantars



Barry Perlus

**Barry A. Perlus, Art**, developed a multimedia website, Jantar Mantar: The Astronomical Observatories of Jai Singh. This virtual museum and study center for India's eighteenth-century astronomical observatories explores man's profound

relationship with the cosmos. The Jantar Mantars, as the observatories are commonly known, are the largest and most elaborate expression of sight-based astronomical measurement in the world. Each site includes multiple buildings of unique design, with a specialized function for astronomical measurement. The project explores new applications of multimedia and imaging technology, while producing a model of design and representation. Media include plans, drawings, photographs, 3-D models, videos, panoramic images, time-lapse movies, interactive animations, sound, and text. The project serves as a repository of essential information and documentation and aims to provide accessibility for the widest possible audience. It is a significant resource for researchers and educators, but its principal objective is to create a dynamic and memorable experience for visitors of all ages and backgrounds.

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## 19. Away With Resilient Pests!



Wendell Roelofs

**Wendell L. Roelofs,**  
**Entomology, Cornell Geneva**  
**Campus,** and research  
collaborators isolated,  
characterized, and synthesized the  
sex pheromone of the female  
German cockroach, *Blattella*

*germanica*. This work becomes a new tool for controlling  
and managing one of the world's most serious food and  
residential pests. The scientists determined the chemical's  
molecular structure by locating the pheromone-producing  
cells in the female, isolating minute amounts of an unstable  
compound, and then devising an ingenious gas  
chromatograph collection technique for obtaining pure  
samples for nuclear magnetic resonance analysis. The  
pheromone, gentisyl quinone isovalerate, or  
blattellaquinone, has proven to be a highly effective lure in  
field trapping tests. Several companies are interested in  
using the blattellaquinone pheromone in monitoring traps to  
lure these resilient, difficult-to-control pests.

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## 20. All Hail a Premiere



Roberto Sierra

**Roberto Sierra, Music**, premiered the work, *Missa Latina*, for the 75th anniversary of the National Symphony Orchestra at the Kennedy Center in Washington, D.C. The mass, with marimba, maracas, Cuban timbales, and other Caribbean instruments, was hailed as “the most significant symphonic premiere in the District since Benjamin Britten’s stunning *War Requiem* was first performed in the still-unfinished Washington National Cathedral in the late 1960s” (T. L. Ponick, *Washington Times*). Conducted by Leonard Slatkin, the National Orchestra was joined by the Choral Arts Society of Washington, soprano Heidi Grant Murphy, and baritone Nathaniel Webster. Tim Page of the *Washington Post* called the *Missa Latina* “remarkably organic in its expression.” The 75-minute work received standing ovations during the three nights of its premiere.

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## 21. Not Like a Computer



Michael Spivey

**Michael J. Spivey, Psychology,** and his research colleague found evidence that language comprehension is a continuous, dynamic process. The mind processes in shades of gray, as biological organisms do, not in

distinct stages like a computer. Mathematically described, perception and cognition are a continuous trajectory through a high-dimensional mental space. The neural activation patterns flow back and forth to produce nonlinear, self-organized, emergent properties. For decades the cognitive and neural sciences have treated mental processes as though they involved passing discrete packets of information feed-forward from one cognitive module to the next or in a string of individuated binary symbols, like a digital computer. In this study, which supports dynamical-systems approaches to the mind, Spivey gave undergraduate students word prompts and then tracked their computer-mouse movements.

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## 22. A Beetle-Inspired Switch



Paul Steen

**Paul H. Steen, Chemical and Biomolecular Engineering**, and research colleagues designed a new switch that is simple, small, fast, and capable of working by itself or combined in larger arrays for applications, such as powerful

adhesive bonding. Steen's design was inspired by Cornell entomologist Thomas Eisner's lecture on palm beetles. Like the beetle, which clings to a palm leaf at adhesive strengths equal to a hundred times its own body weight, the switch in its most basic form uses surface tension created by water droplets in contact with a surface, like the way two pieces of wet paper cling together. When attacked, the palm beetle attaches itself to a leaf, adhering to it with 120,000 droplets of secreted oil, each making a bridge-like contact between the beetle's feet and the leaf. Each droplet is a few microns wide. Whereas the beetle controls the oil contact mechanically, Steen's switch uses water and electricity. With millimeter-sized water droplets and micron-sized pores, five volts can turn the switch on in one second. Although its uses are not yet understood, this novel switch has enormous potential. The greatest technological advances have depended on switches. This switch bridges the gap between scales as large as the hand and nanoscale.

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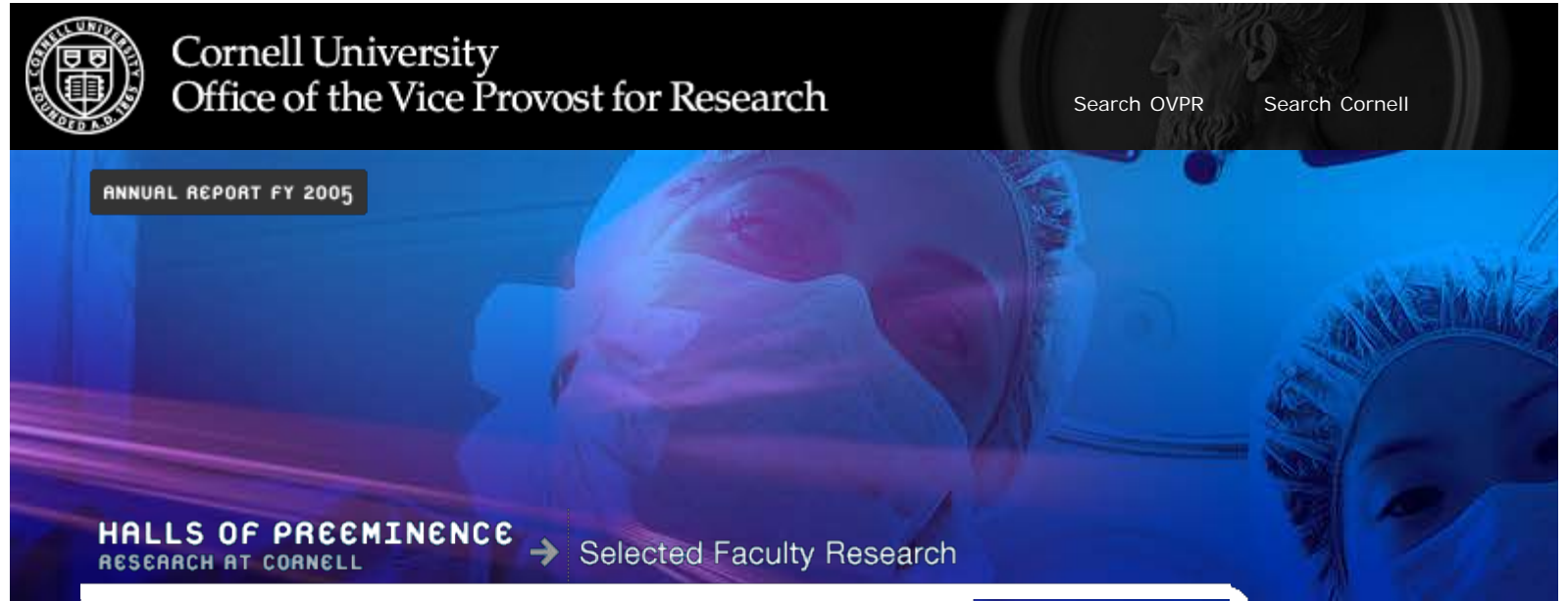
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### 23. All Aboard and Synchronized



**Steven H. Strogatz, Theoretical and Applied Mechanics**, did an analysis to explain why London's Millennium Bridge, hailed by engineers as an "absolute statement of our capabilities at the beginning of the twenty-first century," swayed uncontrollably on its opening day as pedestrians crossed it. When the 320-meter-long lateral suspension bridge across the Thames River connecting London's financial district to Bankside opened on its first day, thousands of pedestrians were there to walk across it. At first, the bridge was still. Then it began to sway slightly. The wobble intensified. People began walking tentatively, planting their feet widely apart with each step in left-right synchronized unison. Strogatz explained the problem as one of crowd dynamics, as much as engineering. Every nonhuman element had been tested, surpassing standards for withstanding weight and wind. Strogatz examined the problem as unintentional synchrony—the phenomenon of people unknowingly working together, simply by walking. The \$32-million design fiasco closed the bridge immediately in 2000, and the bridge reopened in 2002 outfitted with 91 dampers to absorb lateral and vertical oscillations, with modification costs of \$8.9 million. Strogatz's theory could help engineers solve this type of problem before they begin to build.


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## 24. X-raying Antiquity



Robert Thorne

**Robert Thorne, Physics, and Kevin Clinton, Classics,** have demonstrated with research colleagues a method of recovering 2,000-year-old faded text inscriptions on ancient stone using x-ray fluorescence imaging at the

Cornell High Energy Synchrotron Source (CHESS). The researchers applied a nondestructive chemical analysis technique. CHESS' intense x-ray beam was fired at three inscribed marble stones, on loan from the Columbia University's Butler Library, revealing trace-element measurements and producing a map of each element's concentration. The chosen inscription—one in Greek and two in Latin—showed different levels of wear. X-ray fluorescence (XRF) imaging detected minute amounts of iron, zinc, lead, and other elements in the inscribed regions. Usually, iron chisels were used to inscribe the stones, and the letters were painted with pigments containing metal oxides and sulfides. In the most worn stone, the trace elements measured by x-ray fluorescence clearly revealed the contours of the original letters, even where they were no longer visible to the eye. For modestly worn stones, XRF imaging will help to decipher texts and may provide new information on how the inscriptions were made. This was the first successful application of XRF imaging to the study of ancient stone inscriptions between 1,800 and 2,400 years old. Inscribed texts are invaluable to linguists, philologists, historians, archaeologists, art historians, and those who study the ancient world. XRF imaging has the potential to become a major tool in epigraphy.

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## 25. Curing Crown Gall



Stephen Winans with Christine Weingart

**Stephen C. Winans, Microbiology**, discovered how a wound in plants like grapevines develops into a tumor. A soil bacterium, *Agrobacterium tumefaciens*, enters the wound, where it copies the genes required for infection, which can enter the plants' cells and their nuclear DNA causing a cancer-like disease, crown gall. The cells of the crown gall tumor synthesize compounds called opines, which serve as food for the bacterial invaders. Crown gall attacks plants such as cherry and peach trees, raspberries, and chardonnay and cabernet sauvignon grapes. The disease stunts the growth or kills the plant, and there are no controls for it. The discovery leads the way for a cure. The finding could also be used for more effective delivery of DNA for biotechnology applications, since mutant forms of *Agrobacterium* are widely used in agricultural biotechnology for their ability to create transgenic plants containing new genes of scientific or economic interest.

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## 01. Samuel Bacharach, Industrial and Labor Relations



Samuel Bacharach



*Get Them on Your Side: Win Support, Convert Skeptics, Get Results* (Platinum Press, 2005). Business leaders need more than good ideas to get things done in organizations. They need

the ability to win allies and head off resistance when putting together agendas. So maintains Bacharach's book. With chapters ranging from "Anticipate Reactions" to "Lead the Coalition," Bacharach uses examples from business, government, academia, and nonprofit organizations to illustrate how to build political competence and develop specific leadership skills to get results. Fast Company magazine named the book one of 15 best business books for 2005.

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## 02. Malcolm Bilson, Music



score. Bilson's DVD shows how. Using the notation of Mozart, Beethoven, Chopin, Prokofiev, Schubert, and Bartók, Bilson illustrates that there is more expressive information in the scores than one usually presumes. This 90-minute DVD presents a public lecture at which Bilson examines the reading of the texts punctuated with excerpts of Bilson playing a five-octave eighteenth-century Viennese piano and a modern Steinway. He challenges some widely accepted notions of articulation, tempo, and pedaling. The DVD also features an interview with pianist David Owen Norris using several early pianos and discussing diverse topics such as the differences between English and Viennese pianos around 1800 and fingering and bowings in urtext editions. Pianist Stephen Hough hails the project as "an extraordinarily stimulating DVD raising and answering all kinds of questions about how we read and listen to music and how composers transmit their message through both the written text and the instruments on which they played."

*Knowing the Score* (Cornell University Press, 2005). Music performers, music scholars, and music lovers could learn more about getting the best from a classical music

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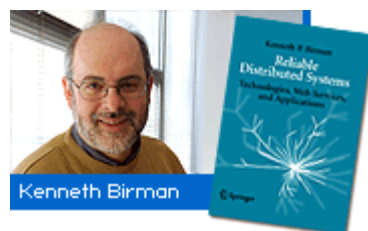
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### 03. Kenneth P. Birman, Computer Science



web services, an understanding of the techniques used to make distributed computing systems and networks reliable, fault-tolerant, and secure will be critical. Reflecting his sweeping knowledge of this area and his experience in teaching, Birman's textbook is an essential and practical resource for advanced students and practitioners in computer, computer networks, and distributed systems. He reviews and describes the key concepts, principles, and applications of modern distributed computing systems and architectures. The book consists of five parts with features including concrete examples drawn from real-world settings to explain fault-tolerance in clear, readily understood terms; a practical focus for building mission-critical networked applications that keep working even when things go wrong; discussions of CORBA, XML, .NET, J2EE, group communication, transactions, peer-to-peer systems, time-critical protocols, scalability, and security; and reviews of more than 25 major research efforts placed in context.

*Reliable Distributed Systems: Technologies, Web Services, and Applications* (Springer, 2005). For those designing and deploying next-generation mission-critical applications and

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## 04. Charles J. Brainerd and Valerie F. Reyna, Human Development



(l.) Charles Brainerd;  
(r.) Valerie Reyna

*The Science of False Memory* (Oxford University Press, 2005). Recalling events that did not happen—false memory—is a phenomenon of great importance to law and medicine. It is a field

that has only been recognized since the early 1990s, with intensive research on the circumstances in which normal people are possessed of positive, confident memories of things that never happened to them. Brainerd and Reyna's book pulls together the research on this hot topic and makes it accessible to the general reader, aiming to further the understanding of the phenomena. The book explores four major topics: theories of false memory, adult experimental psychology of false memory, false memory in legal contexts, and false memory in psychotherapy. Hailed as a "compelling scholarly analysis that ranges from laboratory studies to cases in the courtroom . . . this book is must reading for memory researchers, psychologists, and anyone else interested in understanding why people sometimes remember events that never happened" (Daniel L. Schacter).

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## 05. David A. Dunning, Psychology



David Dunning

*Self-Insight: Roadblocks and Detours on the Path to Knowing Thyself* (Psychology Press, 2005). People base many decisions over a lifetime on impressions of their skill, knowledge,

expertise, talent, personality, and moral character. However, people often hold inflated views of their abilities and character. Dunning's book presents a scientific explanation for the inaccuracies of the impressions people hold of themselves and why it is difficult to form accurate impressions of oneself. The book explores, for example, why people are poor judges of their competencies and skills in social and intellectual areas; how people develop self-perceptions of skill and accuracy, if not taken from performance; why people believe they are ethically superior to others; and why mistaken predictions of the self may have nothing to do with faulty self-knowledge, but rather may be a function of misunderstanding situations. Achieving accurate self-judgment is inherently difficult, but paying close attention to past outcomes and looking to others as a crucial source of information about oneself are tools people can use to evaluate themselves.

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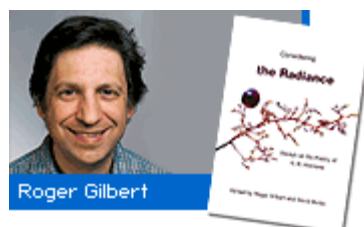
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## 06. Roger S. Gilbert, ed., English, (with David Burak)



contemporary poet in America is likelier to become a classic than A. R. Ammons." Ammons won nearly every major prize for poetry in the United States, including two National Book Awards. In this collection of essays, 22 authors explore every phase of Ammons' work from the beginning in the 1950s to the late masterpieces, "Garbage" and "Glare." Contributors include John Ashbery, Harold Bloom, Alice Fulton, Roald Hoffmann, Kenneth McClane, James McConkey, and Helen Vendler.

*Considering the Radiance: Essays on the Poetry of A. R. Ammons* (Norton, 2005). Harold Bloom said of A. R. Ammons, Cornell professor of English from 1964 to 2001, "No

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## 07. Isabel V. Hull, History



Isabel Hull

*Absolute Destruction: Military Culture and the Practices of War in Imperial Germany* (Cornell University Press, 2005). In this analysis of the rise and development of German

military culture, Hull begins with the war in 1870, which inaugurated the Imperial era in German history, and proceeds up to the end of World War I. She argues that the practices and routines of the Imperial Germany Army, unchecked by civilian institutions, increasingly aimed for absolute destruction of the enemy as the only guarantee of the nation's security. The deeply imbedded logic of "military necessity" was the impetus for extreme destruction of civilian property and lives. The book is called a cautionary tale for today with serious implications for the nature of warmaking in any modern power. It won the 2005 Ralph Waldo Emerson Book Award given by Phi Beta Kappa for scholarly studies that make significant contributions to interpretations of the intellectual and cultural condition of humanity.

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## 08. Jan Jennings, Design and Environmental Analysis



Jan Jennings

*Cheap and Tasteful Dwellings: Design Competitions and the Convenient Interior, 1879–1909* (University of Tennessee Press, 2005). *Carpentry and Building* magazine

launched a competition in 1879 for inexpensive but well-designed houses for ordinary people. Jennings tells the stories of 42 competitions, 86 winning designs, winning designers, near-winners, and losers over a 30-year period, bringing architectural and cultural contexts to bear. The contests illuminated the problem of too few affordable, architect-designed houses for the majority of Americans. The book tells the story of the competitors' attempts to apply architectural theory to designing practical houses with better interiors for ordinary life, with such features as proper working heights for countertops, plenty of natural lighting, and good cross-ventilation. Jennings gives a glimpse of American architectural history never before told.

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## 09. Jon M. Kleinberg and Eva Tardos, Computer Science



that connects algorithmic ideas to real problems. Kleinberg and Tardos introduce algorithms by looking at the real-world problems that motivate them. Using a clear, straightforward style, they teach students to analyze and define problems for themselves and, based on their analysis, to recognize which design principles are appropriate for a given situation. The book encourages a greater understanding of the algorithm design process and an appreciation of the role of algorithms in the broader field of computer science, with problems that are "a teacher's dream."

*Algorithm Design*  
(Addison Wesley, 2005).  
From years of teaching a Cornell undergraduate course on algorithms comes a text hailed as an "incredibly powerful and well done" effort

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## 10. Stephen L. Morgan, Sociology



*On the Edge of Commitment: Educational Attainment and Race in the United States* (Stanford University Press, 2005). A college education is an important predictor for

labor market success, yet social scientists know little about the complex reasons why some students prepare to go to college and some do not. There are theories regarding the predictors for educational attainment, such as parents' education, family income, test scores, family disruptions, neighborhood and school characteristics, and rising tuition costs, but there are no adequate theoretical models for explaining how high school graduates and their parents form beliefs in order to make decisions about college enrollment. Giving scholars a new framework for further research, Morgan explores the kinds of data that need to be collected to evaluate incentive-based explanations, such as shifts in tuition and financial aid. The book uses a model to explain race differences in patterns of high school achievement and subsequent rates of college enrollment.

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## 11. Trevor J. Pinch, Science and Technology Studies (with Harry Collins)



Trevor Pinch

*Dr. Golem: How to Think About Medicine* (University of Chicago Press, 2005). Issues such as the questionable need for tonsillectomies, the powerful but puzzling placebo effect,

bogus doctors, the debatable effectiveness of cardiopulmonary resuscitation (CPR), yuppie flu (chronic fatigue syndrome), alternative medicine, and the rights of parents to avoid vaccinating their children are complexities of modern medicine. The authors explore these and other mysteries and complexities of medicine. They also examine the ethical conflicts inherent in medicine, such as medicine as a science versus as a source of comfort, the interests of an individual versus the group, and the benefits in the short term versus success rates in the long term. Their theme is making medical judgments when faced with uncertainties and tensions—even in the most well-conducted and unbiased of sciences.

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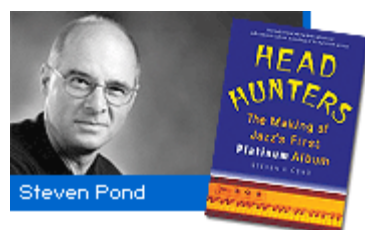
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## 12. Steven F. Pond, Music



*Head Hunters: The Making of Jazz's First Platinum Album* (University of Michigan Press, 2005). When jazz and rock intermingled to create the new and often controversial genre

of fusion jazz, Herbie Hancock ventured into the market with *Headhunters* (1973). It became the first jazz album to go platinum and the best-selling jazz record of all time to that point. This pioneering study examines the aesthetic, cultural, and commercial reasons for the album's rise to platinum. Pond also discusses the impact of this event, such as expanded production and promotion budgets for jazz records and enlarged production roles for musicians. The book presents musicians, styles, histories, and subcultures interacting in a web of affiliations.

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## 13. Steven W. Squyres, Astronomy



of more than 4,000 engineers, scientists, technicians, and support staff who put them there. Scientific rigor, dedication, passion, patience, discovery, and overwhelming success are the making of an incredible mission and a once-in-a-lifetime experience. Squyres tells this story. But the story has not yet ended even after 933 sols of Spirit and 909 sols of Opportunity (August 14, 2006) roving Mars. The mission would have been successful after 90 Martian days. From the proposal-writing days to the discovery of evidence of environmental conditions that could have sustained life on Mars, to more discoveries and questions, the book presents a wealth of new knowledge not only about Mars but also about Earth's inhabitants, who have a passion for exploration. Thirty-two pages of photographs show us wonderment.

*Roving Mars: Spirit, Opportunity, and the Exploration of the Red Planet* (Hyperion, 2005). The story of two rovers on Mars is also the story of a principal investigator and a cast

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## 14. Robert S. Summers, Law



*Form and Function in a Legal System: A General Study* (Cambridge University Press, 2006). What is a legal system? It cannot be reduced to a mere system of rules. In a book ten years in

the making, Summers challenges long-held views on the nature of the law and illuminates neglected issues in jurisprudence. The book addresses three major questions about law and legal systems: What are the defining and organizing forms of institutions, legal rules, interpretive methodologies, and other legal phenomena? How does a systematic focus on these forms advance understanding of such phenomena? What credit should the functions of forms have when such phenomena serve policy and related purposes, rule-of-law values, and fundamental political values such as democracy, liberty, and justice? With insightful answers to these questions, Summers' book is set to become a classic in the field.

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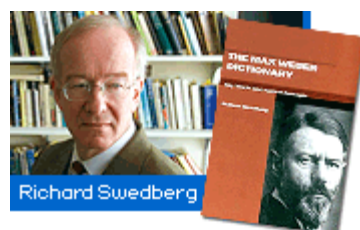
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## 15. Richard Swedberg, Sociology



*The Max Weber Dictionary: Key Words and Central Concepts* (Stanford University Press, 2005). Max Weber (1864–1920) founded the modern study of sociology and

public administration. He is known for emphasizing cultural and political influences on economic development and individual behavior, his ideas about bureaucracy and about the Protestant ethic, his development of a methodology for social science, and his work on the sociology of religion. A German sociologist, economist, and political scientist, he is one of the most challenging theorists to understand. Swedberg sets out to help the general reader, student, and teacher gain a better grasp of Weber's works and theories. The book consists of numerous entries in an approachable dictionary format.

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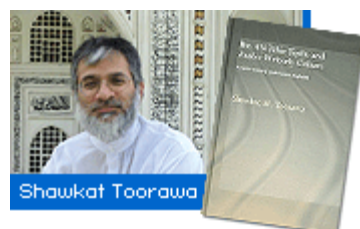
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## 16. Shawkat M. Toorawa, Near Eastern Studies



prose writer, schoolmaster and copyist, independent scholar, member of important literary circles, and significant anthologist and chronicler. Toorawa uses this central but understudied figure as a focal point in his reevaluation of the literary history and landscape of third/ninth-century Baghdad. He demonstrates and emphasizes the significance of the transition from a predominantly oral-aural culture to an increasingly literate and writerly one. This transformation had a profound influence on the production of learned and literary culture; how learning was transmitted; types of literary production; the nature of scholarly and professional occupations and alliances; and the range of meanings of key concepts, such as plagiarism. The book appeals to anyone interested in Arabic literary culture and history and in books, writing, authorship, and patronage.

*Ibn Abi Tahir Tayfur and Arabic Writerly Culture: A Ninth-Century Bookman in Baghdad* (Routledge Curzon, 2005). Ibn Abi Tahir Tayfur (d. 280/893) was an ancient poet and

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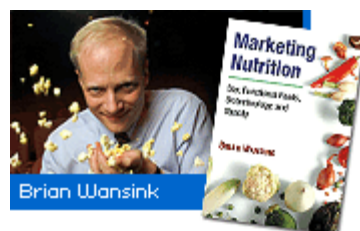
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## 17. Brian C. Wansink, *Applied Economics and Management*



much they know about the benefits of healthy eating—marketing nutritional foods is very different from marketing toothpaste or any other product. Getting people to consume a diet that is heart-healthy and reduces the risks of obesity, diabetes, cancer, and other diseases has not been an easy task for nutritionists and other health professionals. This fact has resulted in erratic sales for soy foods, weak results for expensive Five-a-Day for Better Health programs, and lots of uneaten vegetables in school cafeterias. Wansink identifies 14 problems that interfere with effective nutrition marketing, such as how people ignore good nutrition and their frustration with the recommendations to eat five servings of fruits and vegetables a day. Wansink addresses each problem with research-based solutions, including suggestions about how to change eating habits by targeting cooks, not consumers; the best ways to introduce new foods into a diet; and what types of health information are most effective. The book is intended for brand managers, health professionals, public policy officials, and researchers.

*Marketing Nutrition: Soy, Functional Foods, Biotechnology, and Obesity* (University of Illinois Press, 2005). Because consumers already know what they like—regardless of how

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## 18. David Wippman, Law, and Matthew Evangelista, Government (eds.)



the context of war? To what extent do new wars call for new laws? Wars are more complex today, and adversaries are often members of terrorist groups with no allegiance to a single country, bringing about a change in wartime tactics for countries like the United States. Wippman and Evangelista have brought together experts on laws of war from academia, the military, and the NGO community to examine the issues surrounding September 11th and its aftermath. The authors analyze the definition of armed conflict, the identification of military objectives, the legitimacy of targeted killings, and when to apply the laws of war as opposed to a law enforcement paradigm. They reveal how armed conflicts are changing, pushing the limits of existing international and national laws about how wars are fought.

*New Wars, New Laws? Applying the Laws of War in 21st Century Conflicts* (Transnational Publishers, 2005). Was the 2002 U. S. Predator attack in Yemen part of an international armed conflict or was it outside

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## 01. Achronix Licenses Fast, Flexible Semiconductor Chip



Rajit Manohar

Within the \$77-billion semiconductor industry, there is a large and fast-growing \$24-billion custom logic market. This custom logic market is divided into two major types of devices: application-specific integrated circuits (ASICs) and field-programmable gate arrays (FPGAs). Though ASICs are not reprogrammable like their FPGA counterparts, ASICs have traditionally been the preferred choice for reasons of price, speed, power, and capacity for all types of electronics used every day—until now. Rajit Manohar, Electrical and Computer Engineering, and his group have designed a FPGA chip that is 400 percent faster than any FPGA available today and faster than most ASICs. In addition, the device can be reprogrammed or updated over the internet or telecommunications network. Manohar, in partnership with entrepreneur John Lofton Holt and two Cornell alumni, founded Achronix Semiconductor Corporation to commercialize the technology. The company announced the fastest FPGA in the world by a factor of four. Achronix has been named to the EE Times' 2005 list of companies Shaping Tomorrow's Technology, as well as its list of the Silicon 60, the top 60 emerging global companies in silicon. Achronix expects to ship its first chips in 2007.

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## 02. Start-Up Company Primet Precision Materials Licenses Cornell Technology, the Basis for the Cornell Fuel Cell Institute



The Cornell Fuel Cell Institute group

Primet Precision Materials, Inc., is an advanced materials company dedicated to creating better performance in solar cells, fuel cells, and other consumer-friendly industries. The company's processing technology enables the manufacture of small particles, including nanosized particles, from many diverse materials, such as ceramics and metals. Primet's unique proprietary technology is cost-effective, scalable, and capable of producing materials of exceptionally high purity. Primet came to Ithaca mainly to tap into Cornell's resources—in particular, the Cornell Fuel Cell Institute (CFCI). Primet licensed Cornell technology, which helped the company to raise funds to develop its own technology for fuel cell applications. The technology had resulted from a conversation between Cornell faculty members Hector Abruña and Frank DiSalvo. Abruña had been working on creating catalysts for hydrocarbon fuels with fuel cells in mind. DiSalvo suggested using ordered intermetallic compounds as catalysts. The initial results of the new ordered intermetallics, such as PtBi, PtBi<sub>2</sub>, and PtPb, were extremely promising. The new materials seemed impervious to carbon monoxide poisoning, which quickly renders pure Pt catalysts useless. Based on these results, the Cornell Center for Technology, Enterprise, and Commercialization (CCTEC) filed for patent protection. The Cornell researchers used the exciting results as the foundation for a new center, the CFCI, which launched the work on the technical problems with low-temperature polymer electrolyte membrane fuel cells (PEMFCs) with a \$750,000 grant from the U.S. Department of Energy. The grant was recently renewed for three years at \$3.45 million.

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### 03. Transferring Technology, Statistics FY 2005

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Invention Disclosures	
Disclosures Received	200
U.S. Patents	
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Applications Pending	326
Patents Issued	51
Patents in Force	586
Foreign Patents	
Applications Filed	49
Applications Pending	635
Patents Issued	48
Patents in Force	292
Licenses	
Licenses and Options	77
Total Equity Deals with Startups	47
Active Licenses	538
Number of Companies Started	6
License Revenue	

Sources

License Fees	\$1,230,300
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Patent Reimbursements	\$2,024,300
Royalties	\$2,695,500
Total License Revenue	\$5,950,100

Source: Cornell Center for Technology, Enterprise, and Communications (CCTEC)

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Cornell's Total Research Expenditures, FY 2005		\$561,320
Sources		
By Dollars Expended		Dollars in Thousands
Total Federal Sources		\$386,004
Sponsored		380,975
Budgeted		5,029
Total Non-Federal Sources		175,316
Sponsored Total		88,171
State & Local Governments		13,871
Corporations & Trade Associations		22,903
Foundations		15,688
Non-Profit Organizations		31,082
All Others		4,626
Budgeted Total		87,145
Cornell		54,123
New York State		33,022
Federal Agencies		

<b>DHHS</b> Department of Health & Human Services	195,690
<b>NSF</b> National Science Foundation	116,870
<b>USDA</b> Department of Agriculture	19,871
<b>DOD</b> Department of Defense	16,206
<b>NASA</b> * National Aeronautics Space Administration	13,104
<b>DOE</b> Department of Energy	5,987
<b>AID</b> Agency for International Development	4,588
<b>All Others</b>	8,659

Source: Cornell University, Sponsored Programs Services  
Discrepancies may occur due to rounding.

\* NASA includes JPL funds under subcontract.

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## 02. Expending Research Dollars, FY 2005

Total Research Expenditures, FY 2005		\$561,320
		Dollars in Thousands
By Cornell Divisions		
Endowed Colleges		216,894
Contract Colleges		180,129
Medical College		164,297
By Disciplines		
Medical Sciences		\$164,297
Physical Sciences		88,989
Biological/Life Sciences		75,874
Engineering		68,589
Agriculture		63,722
Veterinary Medicine		26,613
Computer & Information Sciences		24,935
Social Sciences		24,084
Environmental Sciences		5,230
Psychology		4,289
Mathematical Sciences		3,558
Arts, Humanities, & Cultural Studies		1,026

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<i>Nondisciplinary Research Expenditures</i>	
Graduate Student Tuition Support	8,904
Research Administration & Support	1,210
Source: Cornell University, Sponsored Programs Services Discrepancies may occur due to rounding. Disciplines are defined by the National Science Foundation.	

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### 03. Ranking Cornell Nationally

By Research Expenditures, NSF FY 2004	
	Dollars in Thousands
The Johns Hopkins University *	\$1,375,014
University of California, Los Angeles	772,569
University of Michigan	769,126
University of Wisconsin, Madison	763,875
University of California, San Francisco	728,321
University of Washington	713,976
University of California, San Diego	708,690
Stanford University	671,046
Pennsylvania State University	600,139
University of Pennsylvania	596,756
<b>Cornell University</b>	<b>575,554</b>

Source: National Science Foundation

\* The Johns Hopkins University includes the Applied Physics Laboratory, with \$607 million in total R&D expenditures.

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## 04. Ranking Cornell in New York

By Research Expenditures, NSF FY 2004	
	Dollars in Thousands
Cornell University	\$575,554
Columbia University	468,484
University of Rochester	312,303
New York University	259,333
SUNY Buffalo	258,952
SUNY Stony Brook	213,547
Mount Sinai School of Medicine	212,786
SUNY Albany	203,977
Rockefeller University	192,222
Yeshiva University	183,253
Source: National Science Foundation	


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## 01. Crossing Disciplines

### Selected Research Centers at Cornell

#### Nanoscale Science and Technology

- » Center for Nanoscale Systems
- » Cornell Center for Materials Research
- » Cornell NanoScale Science and Technology Facility \*
- » Nanobiotechnology Center

#### Medical Research

- » Abby and Howard P. Milstein Chemistry Biology Center
- » Ansary Center for Stem Cell Therapeutics
- » Arthur and Rochelle Belfer Institute of Hematology and Medical Oncology
- » Center for Aging Research and Clinical Care
- » Center for Complementary and Integrative Medicine
- » Center for the Study of Hepatitis C
- » Center for Vascular Biology
- » Cornell HIV Clinical Trials Unit
- » Dyson Vision Research Institute
- » Hamad bin Khalifa Institute of Genetic Medicine
- » Howard Gilman Institute for Valvular Heart Diseases
- » Institute for Computational Biomedicine
- » Institute for Reproductive Medicine
- » Lehman Brothers Lung Cancer Research Center
- » Sackler Institute for Developmental Psychobiology

#### Life Sciences

- » Agricultural Experiment Stations (Geneva; Ithaca)
- » Baker Institute for Animal Health
- » Cancer Protein Expression Laboratory
- » Center for Life Science Enterprise
- » Center for the Environment
- » Center for Vertebrate Genomics
- » Cornell International Institute for Food, Agriculture, and Development
- » Institute for Genomic Diversity
- » Institute for Biotechnology and Life Science Technologies
- » Institute of Food Science

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- » National Biomedical Center for Advanced ESR Technology
- » Sprecher Institute for Comparative Cancer Research

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**Physical Sciences and Engineering**

- » Center for Applied Mathematics
- » Center for Radiophysics and Space Research
- » Cornell High Energy Synchrotron Source \*
- » Cornell Laboratory for Accelerator-based Sciences and Education
- » Cornell Theory Center
- » Laboratory of Atomic and Solid State Physics
- » Laboratory for Elementary-Particle Physics \*
- » National Astronomy and Ionosphere Center \*

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**Social Sciences and Humanities**

- » Africana Studies and Research Center
- » Bronfenbrenner Life Course Center
- » Center for Analytic Economics
- » Center for the Study of Economy and Society
- » Center for the Study of Inequality
- » Cornell Institute for Research on Children
- » Cornell Institute for Social and Economic Research
- » Cornell Language Acquisition Lab
- » Employment and Disability Institute
- » Institute for the Social Sciences
- » Institute for Women and Work
- » Mario Einaudi Center for International Studies
- » Program on Ethics and Public Life
- » Society for the Humanities

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**Business and Management**

- » Center for Advanced Human Resource Studies
- » Center for Hospitality Research
- » Parker Center for Investment Research
- » Smithers Institute for Alcohol-Related Workplace Studies

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\* National Center

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## 02. Cornell's Colleges and Divisions

- » College of Agriculture and Life Sciences †
- » College of Architecture, Art, and Planning
- » College of Arts and Sciences
- » College of Engineering
- » College of Human Ecology †
- » College of Veterinary Medicine †
- » Division of Nutritional Sciences
- » Faculty of Computing and Information Science
- » Graduate School
- » Johnson Graduate School of Management
- » Law School
- » School of Continuing Education and Summer Sessions
- » School of Hotel Administration
- » School of Industrial and Labor Relations †
- » Weill Cornell Graduate School of Medical Sciences (NYC)
- » Weill Cornell Medical College (NYC)
- † Contract College

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