

## Welcome!


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[Commencement '08](#)
[Advancement](#)
[RPI Alumni](#)
[Campus Events](#)
[RPI Athletics](#)

## Why not change the world?



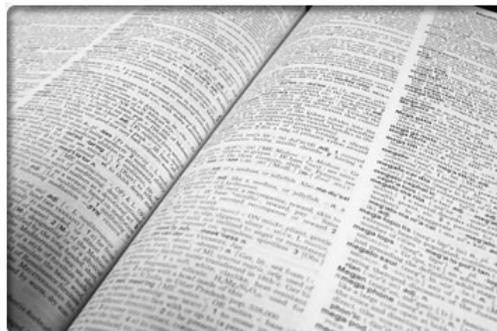
### Undergraduate Research

Rensselaer's undergraduates enjoy the perks of working alongside some of the world's leading researchers.

**Matt Harrigan**, a senior majoring in physics, went looking for research opportunities, and found a program that let him look for something even bigger — tidal streams of stars in the Milky Way.

### RPI Connections

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[Entrepreneurship](#)
[Corporate Relations](#)
[Foundation Relations](#)
[Government & Community Relations](#)
[Human Resources](#)
[Technology Commercialization](#)
[Incubator Program](#)
[Faculty Governance Review](#)

[Audio Podcasts](#)


## Decoding the Dictionary

### A New Study Suggests Our Lexicon Evolved To Fit in the Brain

The latest edition of the *Oxford English Dictionary* boasts 22,000 pages of definitions. While that may seem far from succinct, new research suggests the reference manual is meticulously organized to be as concise as possible — a format that mirrors the way our brains make sense of and categorize the countless words in our vast vocabulary. "Dictionaries have often been thought of as a frustratingly tangled web of words where the definition of word A refers users to word B, which is defined using word C, which ends up referring users back to word A," said Mark Changizi, assistant professor of cognitive science. "But this research suggests that all words are grounded in a small set of atomic words — and it's likely that the dictionary's large-scale organization has been driven over time by the way humans mentally systematize words and their meanings." [Read more](#)



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### On Campus



### 2008 President's Commencement Colloquy

Rensselaer will host the 2008 President's Commencement Colloquy, titled "Leadership for a Sustainable Global Society - Discovery, Innovation, and Citizenship" on Friday, May 16, at 4 p.m. in DCC 308.

### At Rensselaer Polytechnic Institute

#### Commencement 2008: Protecting Those Who Protect and Serve

There are over one million full-time sworn police officers charged with preserving safety and security in the United States. Now, thanks to an invention devised by Class of 2008 graduate Sarah DiNovo, our law enforcement officers can protect themselves while protecting us.

#### Student Start-Ups Win Top Prizes at Innovation Showcase

Rensselaer inventors and innovators were awarded three of the top four student prizes at the CTT Innovation Conference. The \$15,000 gold prize was won by alumni Eben Bayer '07 and Gavin McIntyre '07 who developed an environmentally friendly organic insulation made from waste agricultural materials, water, and mushrooms.

#### 5th Annual Game Festival & Symposium

The 5th Annual Game Festival & Symposium this year was a part of the HASS 50th Anniversary Celebration. With the theme "Influence and Independence: New Faces of Games," the Festival featured 20 student created games and an all-day symposium with a variety of lectures and presentations. [Photo Slideshow](#)

#### President Jackson Joins Government and Research Leaders To Announce New River Research Center

Rensselaer President Shirley Ann Jackson joined state and local legislators and research leaders to announce a historic collaboration between academia, industry, and government to develop an 11,000-square-foot environmental research center on the Hudson River in Troy.

#### Relay for Life 2008

Rensselaer's third annual Relay for Life event to raise funds and cancer awareness drew more than 1,300 participants this year and raised over \$81,000 for the American Cancer Society. The overnight event was held on the Rensselaer '86 Field April 25-26. [Photo Slideshow](#)

#### Rensselaer Launches International Experience for All Engineering Students

Rensselaer Engineering Education Across Cultural Horizons, or REACH, will offer students the opportunity to participate in structured study abroad programs, as well as other international experiences such as internships, exchange programs, or other overseas opportunities.

*Rensselaer Polytechnic Institute educates the leaders of tomorrow for technologically based careers. We celebrate discovery, and the responsible application of technology, to create knowledge and global prosperity.*

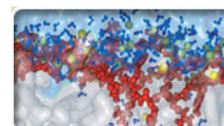


### Research Spotlight



#### The Darkest Material Ever Made

Researchers at Rensselaer and Rice University have created the darkest material ever made by man — a thin coating comprised of low-density arrays of loosely vertically-aligned carbon nanotubes that absorbs more than 99.9 percent of light.



#### HIV Peptide's Possible Pathway Into the Cell

Two theoretical physicists have uncovered what they believe is the long-sought-after pathway that an HIV peptide takes to enter healthy cells.

They've discovered a surprisingly simple mechanism describing how this protein fragment penetrates the cell membrane.

▶ [Video Illustration](#)



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- Academics
- Research
- Student Life
- Admissions
- News & Events

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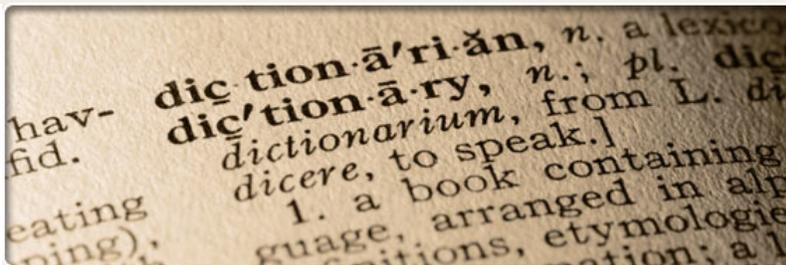


Undergraduate Research

Research isn't just for professors or Ph.D. students. Our undergraduates enjoy the perks of working alongside some of the world's leading researchers. Matthew Pevarnik helped set up one of the largest science experiments of our time at the Large Hadron Collider with the European Organization for Nuclear Research.

RPI Connections

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Deadly Dose: Rensselaer Heparin Expert Helps Uncover Source of Lethal Contamination

The mysterious death of patients following a routine dosage of heparin sent researchers on a search to uncover what could make the standard drug so toxic. Robert J. Linhardt is part of an international team that recently uncovered the source of the deadly contamination.



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It's Not Just for Boys: Girls Are Into Science and Math Too

Nearly 300 11th grade girls from the Capital Region, New York state, and across New England participated in Rensselaer's "Design Your Future Day." The event is designed to engage students in activities to excite them about career opportunities in science, technology, engineering, math (STEM) disciplines, and architecture.



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Research Spotlight



Carbon Nanotubes Outperform Copper Nanowires as Interconnects

Researchers have created a road map that brings academia and the semiconductor industry one step closer to realizing carbon nanotube interconnects, and alleviating the current bottleneck of information flow that is limiting the potential of computer chips.



Physicists Uncover New Solution for Cosmic Collisions

Two theoretical physicists have used what they call "pen-and-paper math" to describe the motion of interstellar shock waves — violent events associated with the birth of stars and planets.

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For Immediate Release  
April 30, 2008Contact: Amber Cleveland  
Phone: (518) 276-2146  
E-mail: [clevea@rpi.edu](mailto:clevea@rpi.edu)**Decoding the Dictionary: Study Suggests Lexicon Evolved To Fit in the Brain**

Troy, N.Y. — The latest edition of the *Oxford English Dictionary* boasts 22,000 pages of definitions. While that may seem far from succinct, new research suggests the reference manual is meticulously organized to be as concise as possible — a format that mirrors the way our brains make sense of and categorize the countless words in our vast vocabulary.

"Dictionaries have often been thought of as a frustratingly tangled web of words where the definition of word A refers users to word B, which is defined using word C, which ends up referring users back to word A," said Mark Changizi, assistant professor of cognitive science at Rensselaer Polytechnic Institute. "But this research suggests that all words are grounded in a small set of atomic words — and it's likely that the dictionary's large-scale organization has been driven over time by the way humans mentally systematize words and their meanings."

Dictionaries are built like an inverted pyramid. The most complex words (e.g., "albacore" and "antelope") sit at the top and are defined by words that are more basic, and thus lower on the pyramid. Eventually all words are linked to a small number of words — called "atomic words," such as "act" and "group" — that are so fundamental they cannot be defined by simpler terms. The number of levels of definition it takes to get from a word to an atomic word is called the "hierarchical level" of the word.

Changizi's research, which was published online this week and will appear in the June print edition of the *Journal of Cognitive Systems Research*, indicates that the dictionaries we use every day utilize approximately the optimal number of hierarchical levels — and provide a visual roadmap of how the lexicon itself has culturally evolved over tens of thousands of years to help lower the overall "brain space" required to encode it, according to Changizi.

Many other human inventions — such as writing and other human visual signs — have been designed either explicitly or via cultural selection over time so as to minimize their demands on the brain, Changizi said.

By conducting a series of calculations based on the estimation that the most complex words in the dictionary total around 100,000 different terms, and that the number of atomic words range from 10 to 60, Changizi was able to devise three signature features present in the most efficient dictionaries — as well as in their human counterpart, the brain.

Most importantly, he discovered that the total number of words across all the definitions in the dictionary (and thus the size of the dictionary) changes in relation to the total number of hierarchical levels present. Optimal dictionaries should have approximately seven hierarchical levels, according to Changizi.

"The presence of around seven levels of definition will reduce the overall size of the dictionary, so that it is about 30 percent of the size it would be if there were only two hierarchical levels," Changizi said.

Additionally, users will find that there are progressively more words at each successive hierarchical level, and that each hierarchical level contributes mostly to the definitions of the words just one level above their own, according to Changizi, who put his three predictions to the test by studying actual dictionaries.

The *Oxford English Dictionary* and *WordNet* — a large, online lexical database of English, developed at Princeton University — were found to possess all three signatures of an economically organized dictionary, and thus were organized in such a way as to economize the amount of dictionary space required to define the lexicon, according to Changizi.

"Somehow, over centuries, these revered reference books have achieved near-optimal organization," Changizi said. "That optimality can likely be attributed to the fact that cultural selection pressures over time have shaped the organization of our lexicon so as to require as little mental space and energy as possible."

Changizi believes his research has potential applications in the study of childhood learning, where scientists could analyze how students learn vocabulary words and possibly develop ways to optimize that learning process.

**About Rensselaer**

Rensselaer Polytechnic Institute, founded in 1824, is the nation's oldest technological university. The university offers bachelor's, master's, and doctoral degrees in engineering, the sciences, information technology, architecture, management, and the humanities and social sciences. Institute programs serve undergraduates, graduate students, and working professionals around the world. Rensselaer faculty are known for pre-eminence in research conducted in a wide range of fields, with particular emphasis in biotechnology, nanotechnology, information technology, and the media arts and technology. The Institute is well known for its success in the transfer of technology from the laboratory to the marketplace so that new discoveries and inventions benefit human life, protect the environment, and strengthen economic development.

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