



Career Cornerstone News

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Career Cornerstone News is a Publication of the Sloan Career Cornerstone Center, the Premier Online Resource for Exploring Career Paths in Science, Technology, Engineering, Mathematics, Computing, and Medicine.

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The Evolution of Immunity

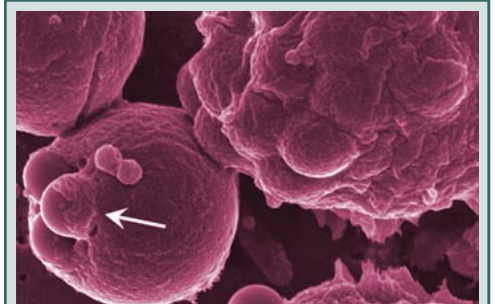
Researchers from the University of Pennsylvania School of Veterinary Medicine have discovered a unique evolutionary link between the most primitive innate form of immune defense, which has survived in fish, to the more advanced, adaptive immune response present in humans and other mammals.

In the adaptive immune system in mammals, B cells produce antibodies to fight infection. In the more-primitive innate immunity in fish, the scientists found that B cells take part in a process known as

phagocytosis, by which immune system cells ingest foreign particles and microbes.

In modern mammals, the B cell is a highly adapted part of the immune system chiefly responsible for, among other things, the creation of antibodies that tag foreign particles and microbes for destruction.

The findings are important for not only understanding the evolution and function of immune cells in fish but also may point to novel



The trout cell in the lower left is in the process of engulfing tiny latex beads (arrow).

Credit: J. Oriol Sunyer, School of Veterinary Medicine, University of Pennsylvania.

roles of B cells in mammals. The finding also offers a potential new strategy for developing much-needed fish vaccines.

Find out more at www.upenn.edu.

Uncle Sam is Hiring

A study by the Partnership for Public Service, which surveyed Federal department and agency hiring needs, found that most of the new hires in the Federal Government will come in 5 major areas. They are: security, enforcement, and compliance (37,515 new hires); medical and public health fields (25,756 new hires); engineering and the sciences, including microbiologists, botanists, physicists,

chemists, and veterinarians (23,806 new hires); program management and administration (17,373 new hires); and accounting, budget, and business, which includes revenue agents and tax examiners needed mainly by the Internal Revenue Service (12,959 new hires). The Department of Health and Human Services will need health insurance specialists and claims and customer service representatives to



implement the Medicare Prescription Drug benefit.

The government will be competing with private sector firms for engineers, doctors, and other skilled workers. Find out more about working in the government sector at www.careercornerstone.org/industries.htm.

Frontiers in Integrative Biological Research

How do environmental changes cause organisms to evolve, and how, in turn, do evolving organisms change an ecosystem? How does the brain control complex behaviors? What are nature's rules for encoding a protein structure by its DNA sequence? To tackle these major questions in biology, the National Science Foundation has awarded new grants in its Frontiers in Integrative Biology (FIBR) program.

The goal of the FIBR program is to encourage investigators to identify major understudied or unanswered questions in biology, and to use innovative approaches to address these questions by integrating

scientific concepts and research tools across disciplines that include biology, mathematics and the physical sciences, engineering, social sciences and the information sciences.

Through one of the awards, a team of researchers led by David Reznick, an evolutionary biologist at the University of California at Riverside, will study of how ecology and evolution interact. The findings will help explain how environmental changes influence an organism's evolution as



FIBR scientists will study how ecology and evolution interact in Trinidad streams.
Credit: David Reznick, University of California at Riverside

well as how the evolving organism, in turn, changes the ecosystem in which it lives. Find out more at www.biology.ucr.edu/people/faculty/Reznick.html.

Degree Profile: Actuarial Science

One of the main functions of actuaries is to help businesses assess the risk of certain events occurring and to formulate policies that minimize the cost of that risk. Actuaries assemble and analyze data to estimate the probability and likely cost of the occurrence of an event such as death, sickness, injury, disability, or loss of property. Actuaries also address financial questions, including those involving the level of pension contributions required to produce a certain retirement income and the

way in which a company should invest resources to maximize its return on investments in light of potential risk.

Most actuaries are employed in the insurance industry, specializing in life and health insurance or property and casualty insurance. They produce probability tables which determine the likelihood that a potential future event will generate a claim. From these tables, they estimate the amount a company can expect to pay in claims. Actuaries ensure that the price, or premium, charged for such insurance will enable the company to cover claims and other expenses. Within the life and health insurance fields, actuaries are helping to develop long-term-care insurance

and annuity policies, the latter a growing investment tool for many individuals.

Actuaries in other financial services industries manage credit and price corporate security offerings. They also devise new investment tools to help their firms compete with other financial services companies. Actuaries working in government help manage social programs such as Social Security and Medicare.

Find out more about careers in actuarial science at www.careercornerstone.org/actuarialscience/actuarialscience.htm.



Engineering the Future

Addressing the need for a high school engineering curriculum for all Massachusetts students, the Museum of Science, Boston has created a year-long freshman-level course that develops technological literacy and expands the pool of students interested in pursuing technical careers. Engineering the Future (EtF) (www.mos.org/etf) engages high schoolers in hands-on design and building challenges reflecting real engineering problems.

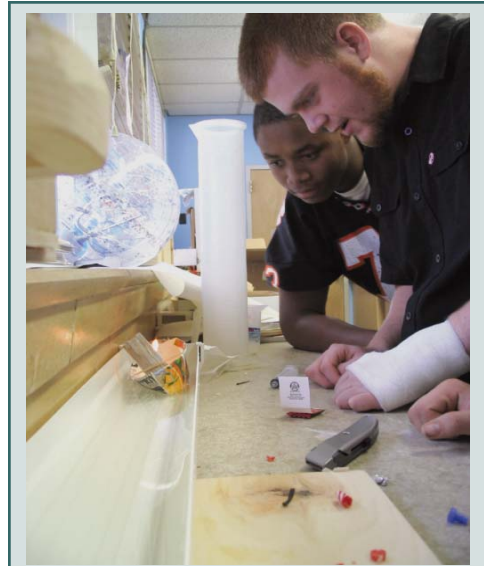
EtF is aimed at the seven Massachusetts K-12 technology/engineering framework strands and the ITEA Standards for Technological Literacy, while also introducing key physics concepts. Students develop products that solve problems involving power systems, communications, manufacturing, and construction.

Students also analyze the effects of technologies on society and the environment. The course textbook

is written by engineers who tell what it is like to be an engineer -- from designing a running shoe to building a bridge. Students become "engineers" themselves by designing, building, and testing prototypes in teams.

Engineering the Future is part of the museum's strategy to foster technological literacy through its National Center for Technological Literacy (NCTL) (www.nctl.org). NCTL's goal is to introduce engineering as early as elementary school and continue it through high school, college, and beyond. The museum has been working with education, government, and industry leaders to integrate engineering as a new discipline in 28 states.

The NCTL's Massachusetts efforts have involved 219 schools, 685 teachers, and 15,425 students. In addition to Engineering the Future, the NCTL is developing both elementary and middle school



High school students in Arlington, MA, field-test the Engineering the Future course developed by the Museum of Science, Boston. Photo courtesy of Ted Fiust.

curricula, and many teacher professional development resources.

The Sloan Career Cornerstone Center provides links to hundreds of museums and science centers across the United States, including the Museum of Science, Boston. Find a center near you at www.careercornerstone.org/muscenters.htm.

Career Cornerstone Explores Career Paths in...

- Actuarial Science
- Aerospace Engineering
- Agricultural Engineering
- Architectural Engineering
- Bioengineering
- Biology
- Chemical Engineering
- Chemistry
- Civil Engineering
- Computer Engineering
- Computer Science
- Dentistry
- Electrical Engineering
- Engineering Technology
- Environmental Engineering
- Geosciences
- Industrial Engineering
- Manufacturing Engineering
- Materials Science and Engineering
- Mathematics
- Mechanical Engineering
- Medicine
- Mining Engineering
- Nuclear Engineering
- Nursing
- Petroleum Engineering
- Physics
- Software Engineering
- Statistics
- Veterinary Science
- - - and more to come...



Find out more at www.careercornerstone.org

Physicist's Snowflake Images Get Stuck

Physicist Kenneth Libbrecht's snowflake images have gotten stuck -- on a stamp. Recently, the United States Postal Service issued four new 39-cent commemorative postage stamps based on Libbrecht's high-resolution microscope images of snowflakes.

Snowflake crystals begin as a water droplet inside a cloud that freezes into a tiny ice particle. As water vapor gathers on the ice particle, the particle spreads out and becomes a small prism with six sides. As it gathers more vapor, the prism sprouts branches and starts to look more like a crystal. Inside the cloud, the newly born snowflake crystal is bounced around amid temperature and humidity changes that can affect its shape. "This is why no two snowflakes are alike," says Libbrecht.

According to Libbrecht, there are 35 different types of snowflake crystals, but the stamps feature two specific types: stellar dendrite

snowflake crystals (upper left, upper right, and lower right stamps), which are plate-like and have branches. These are the most popular snow crystal type. The other stamp is a sectorial plate snowflake crystal (lower left stamp) that has broad branches with prominent, distinctive ridges.

Ironically, Libbrecht is based at the California Institute of Technology in Pasadena, CA -- a place that almost never sees snow. Libbrecht's images were taken from snowfalls in Michigan, Alaska, and Ontario.

Collecting the fragile snowflake crystals to photograph is a delicate business. After gathering the crystals, Libbrecht uses a small paintbrush to carefully transfer the snowflake crystals onto a glass slide. Then he captures the images using a digital camera attached to a high-resolution microscope. In order to keep the snowflake



crystals from melting, Libbrecht does most of his work outside.

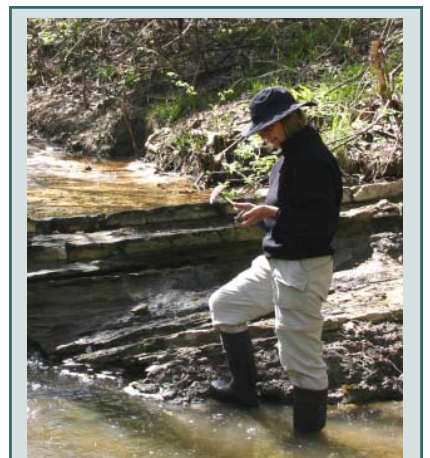
With Libbrecht's stamps, anyone can get stuck on snowflake crystals -- even if you've never seen snow.

Source: American Institute of Physics' Inside Science News Service. Find out more at www.snowcrystals.com.

More Than a Meteor!

Growing evidence shows that the dinosaurs and their contemporaries were not wiped out by the famed Chicxulub meteor impact alone, according to a paleontologist who says multiple meteor impacts, massive volcanism in India and climate changes culminated in the end of the Cretaceous Period. The Chicxulub impact may have been the lesser and earlier of a series of meteor impacts and volcanic eruptions that pounded life on Earth for more than 500,000 years, say Princeton University paleontologist Gerta Keller and her collaborators.

A final, much larger and still unidentified impact 65.5 million years ago appears to have been the last straw, said Keller, exterminating two-thirds of all species in one of the largest mass extinction events in the history of life. It's that impact - not Chicxulub - that left the famous extraterrestrial iridium layer found in rocks worldwide that marks the impact that finally ended the Age of Reptiles, Keller believes. Find out more at <http://geoweb.princeton.edu/people/faculty/keller>.



Geologist Gerta Keller looks at sediment samples along the Brazos River in Texas. Credit: Gerta Keller