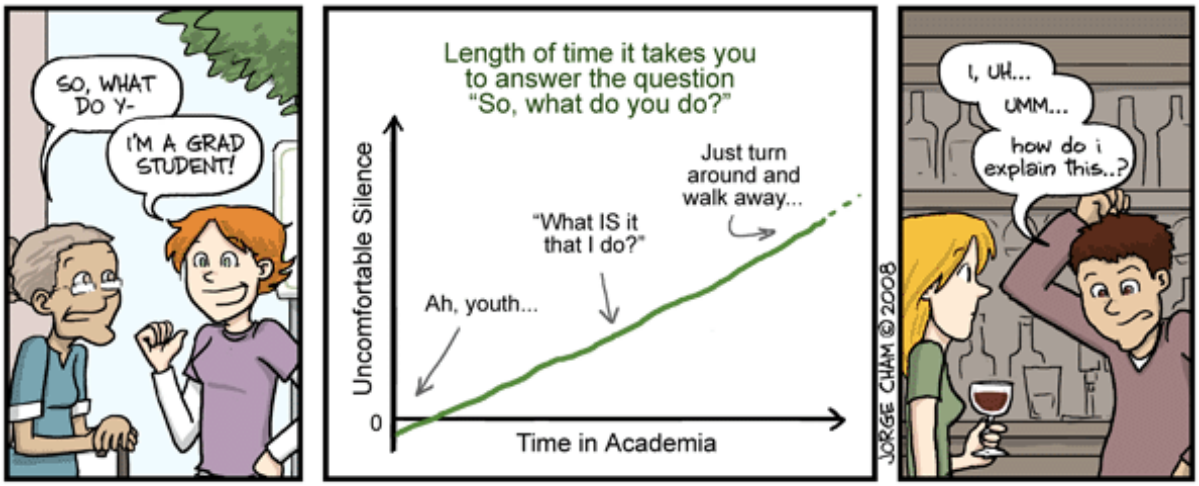
SO, WHAT DO Y-
I'M A GRAD STUDENT!
Length of time it takes you to answer the question "So, what do you do?"
Uncomfortable Silence
0
Time in Academia
Ah, youth...
"What IS it that I do?"
Just turn around and walk away...
I, UH...
UMM...
how do i explain this..?
JORGE CHAM © 2008
WWW.PHDCOMICS.COM

Lesson Two in class presentation:

What is a lede?

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An effective lead makes a promise to the reader or viewer: I have something important, something interesting, to tell you. A good lead beckons and invites. It informs, attracts, and entices.
—Chip Scanlon

"Don't bury your lead…The hook, the thing that makes the reader interested in reading the story. Hit them with the news, the peg. Why are you writing this story? What's it all about?"
—Mark Fritz, The Associated Press

"I look at leads as my one frail opportunity to grab the reader. If I don't grab them at the start, I can't count on grabbing them in the middle, because they'll never get to the middle. Maybe 30 years ago, I would give it a slow boil. Now, it's got to be microwaved.

I don't look at my leads as a chance to show off my flowery writing. My leads are there to get you in and to keep you hooked to the story so that you can't go away."
—Mitch Albom, Detroit Free Press

If there's any poetry in journalism, it's most often found in the lead, as in the classic opening of what could have been a mundane weather forecast:

    Snow, followed by small boys on sleds.

Potter Wickware:
A spectacular example of bad writing is in a recent issue of *Science*. Here's the first paragraph (don't read too closely: you'll get a headache):

Although many results from in vitro and in vivo models that express mutant Huntingtin, a-synuclein, tau, superoxide dismutase-1, amyloid-b peptide, or prion proteins are consistent with the proposal that non-native species can form toxic folding intermediates, oligomers, and aggregates, distinct mechanisms for toxicity have been proposed for each.

(T. Gidalevitz et al., Progressive Disruption of Cellular Protein Folding in Models of Polyglutamine Diseases, *Science*, 10 Mar 2006, p. 1474 ff.)

A [lede] is an invitation to the reader. [This} invitation is like one to an unruly house where you arrive to find the light in the entryway burned out, a bicycle negligently left on the threshold, the front hall dark, narrow and unwelcoming. As you make your way through the disorder, you say, I wish they had cleaned this place up. They should have taken out the trash.

JERUSALEM, Nov. 4 —A right-wing Jewish extremist shot and killed Prime Minister Yitzhak Rabin tonight as he departed a peace rally attended by more than 100,000 in Tel Aviv, throwing Israel’s government and the Middle East peace process into turmoil.

“Israeli Prime Minister Yitzhak Rabin is Killed” by Barton Gellman
The Washington Post, Sunday, November 5, 1995

KARBAMBA, Rwanda—Nobody lives here anymore.

Not the expectant mothers huddled outside the maternity clinic, not the families squeezed into the church, not the man who lies rotting in a schoolroom beneath a chalkboard map of Africa.

Everybody here is dead. Karubamba is a vision from hell, a flesh-and-bone junkyard of human wreckage, an obscene slaughterhouse that has fallen silent save for the roaring buzz of flies the size of honeybees.

"Only Human Wreckage Is Left in Karubamba" by Mark Fritz
Associated Press, May 12, 1994

"Two people. Two continents. One chance to change lives."

It was about 8:45 Thursday morning when I walked into the Hermosa Beach Police Department with two dozen Krispy Kreme doughnuts and a 12-pack of Coors Light.

"A few Coors Lights might blur the truth" by Steve Lopez
Los Angeles Times, June 29, 2001

"A 10-year-old girl and her bed-ridden grandmother escaped death yesterday after a woodsman hacked open a cross-dressing wolf that swallowed them whole."—David Cohn

---

Gary Robinson died hungry.
—Edna Buchanan, Miami Herald

David Bayer plays squash in an eight-dimensional court. David and Gregory Chudnovsky chase infinity, tracking down a billion digits of a number that never ends. Joan Birman untangles knots that would drive sailors mad.

As mathematics researchers at Columbia, they explore strange, fascinating worlds where ordinary rules do not apply and where the terrains are difficult to experience with jus the five senses. The marvelous thins in their worlds must often be imagined, not seen, so they are as difficult to explain to the uninitiated as a rainbow to a blind person. Yet these mathematicians nurture conceptions of great precision and beauty, some of which have enormous practical applications in the quotidian world.

The Global Fish Crisis: Still Waters

Republished from the pages of National Geographic magazine
Written by Fen Montaigne
April 2007

No more magnificent fish swims the world's oceans than the giant bluefin tuna, which can grow to 12 feet (3.7 meters) in length, weigh 1,500 pounds (680 kilograms), and live for 30 years. Once, giant bluefin migrated by the millions throughout the Atlantic Basin and the Mediterranean Sea, their flesh so important to the people of the ancient world that they painted the tuna's likeness on cave walls and minted its image on coins.

The giant, or Atlantic, bluefin possesses another extraordinary attribute, one that may prove to be its undoing: Its buttery belly meat, liberally layered with fat, is considered the finest sushi in the world. Over the past decade, a high-tech armada, often guided by spotter planes, has pursued giant bluefin from one end of the Mediterranean to the other, annually netting tens of thousands of fish, many of them illegally. The bluefin are fattened offshore in sea cages before being shot and butchered for the sushi and steak markets in Japan, America, and Europe. So many giant bluefin have been hauled out of the Mediterranean that the population is in danger of collapse. Meanwhile, European and North African officials have done little to stop the slaughter.

"My big fear is that it may be too late," said Sergi Tudela, a Spanish marine biologist with the World Wildlife Fund, which has led the struggle to rein in the bluefin fishery. "I have a very graphic image in my mind. It is of the migration of so many buffalo in the American West in the early 19th century. It was the same with bluefin tuna in the Mediterranean, a migration of a massive number of animals. And now we are witnessing the same phenomenon happening to giant bluefin tuna that we saw happen with America's buffalo. We are witnessing this, right now, right before our eyes."

"The Physics of Bras: Overcoming Newton's second law with
better bra technology" by Anne Casselman, Discover, 22 November, 2005.
http://discovermagazine.com/2005/nov/physics-of-bras/

'One side effect of the obesity epidemic in America is rarely noted: Women's chests are expanding nearly as fast as their bellies. Poor eating habits, as well as breast implants and the estrogens in birth-control pills, have led to an increase in the past 15 years of more than one bra size for the average American woman—from a 34B to a 36C. For many women, this has been a burdensome trend. A pair of D-cup breasts weighs between 15 and 23 pounds—the equivalent of carrying around two small turkeys. The larger the breasts, the more they move and the greater the discomfort. In one study, 56 percent of women suffered from breast pain when jogging.

'Women will limit themselves from doing exercise because of their breasts,' says Deirdre McGhee, a sports physiotherapist and graduate student in biomechanics at the University of Wollongong in Australia. 'They actually deprive themselves.'

For most women, a good bra is still the best remedy. According to the American Apparel and Footwear Association, nearly 500 million bras were sold in the United States in 2001; last year, sales totaled more than $5 billion. As breasts have grown, so have the demands of customers, the scientific sophistication of bra design, and the competition among bra manufacturers. 'Women like their bras to be sexy and sensual and comfy and supportive,' McGhee says. 'And to get all that is rare.' Yet after nearly a century of experimentation, the perfect bra may well be in sight."

Climate change to create African 'water refugees' - scientists
22 Mar 2006
Megan Rowling

REUTERS/Antony Njuguna LONDON - Climate change is expected to shrink many African rivers dramatically, triggering massive refugee movements and even war, according to scientists at the Africa Earth Observatory Network.

Researchers calculate that a predicted drop in rainfall will significantly reduce water supplies across a quarter of Africa by the end of this century, in a study published in the journal Science.

"Future climate change poses one of the greatest threats to poverty eradication on this continent, and related changes in surface water supply will exacerbate this," they warn.

Climate Change Hitting the Sea's Little Guys Too
Graeme Stemp-Morlock
for National Geographic News
February 29, 2008

When it comes to climate change, polar bears and sharks may grab the bulk of the headlines—but it's the threat to the sea's tiniest creatures that has some marine scientists most concerned.

Malformed seashells show that climate change is affecting even the most basic rungs of the marine food chain—a hint of looming disaster for all ocean creatures—experts say.

Climate change could drastically reduce sea urchin populations in particular, according to Gretchen Hofmann, a marine biologist at the University of California, Santa Barbara.

The purple sea urchin is commonly found off the coast of Australia and Antarctica. It is an essential food source for many marine animals such as cod or lobster, as well as a common ingredient in sushi.

Hofmann is concerned because increasing amounts of atmospheric carbon dioxide are also raising the amount of the gas dissolved in ocean water. This makes the seas more acidic, decreasing the available amount of shell-forming calcium carbonate.

Future Ocean in a Box

To test the theory, Hofmann tested sea urchins in highly acidic water similar to what is predicted for the oceans.

"We checked if they can make the skeleton that forms their bodies, and yes it is formed," Hofmann said. "But it was shorter and stumpier—not the same shape—so they swim and move differently. Plus it comes at a cost, which is they are more sensitive to temperature."

Hofmann refers to this malformed skeleton and sensitivity to heat as "double jeopardy."

She went further than any previous research by analyzing the recently sequenced sea urchin genome to find out what genes were turning off and on under this new environmental stress.

"We wanted to ask them how they were doing and get a sense of their health and physiology," Hofmann said. "We found it caused their

shell-forming genes to go up threefold, so their developing system was having to put more energy into making the skeleton and less into other things."
Hofmann presented her findings at the recent meeting of the American Association for the Advancement of Science in Boston, Massachusetts.

"Sea Butterflies" Next?
Scott Doney, a chemical oceanographer at Woods Hole Oceanographic Institute, said that Hofmann may have done "the same type of experiments [as previous researchers], but went beyond looking at the physiological impact of acidification on organisms.
"[Hofmann] used molecular biological tools to see what proteins are turned on or off as they experienced stress if the waters become really acidic," Doney said. "It is a validation in many ways of the physiological experiments others had done."
Doney compared sea urchins to homeowners who use all their cash to build the dwellings but don't leave any money for furniture.

↑ Carbon Dioxide = ↑ Acidic Ocean = ↓ Marine Life
Lonny Lippsett (*Oceanus*, 2005)
http://www.whoi.edu/oceanus/viewArticle.do?id=7486

The buildup of carbon dioxide in the atmosphere not only warms the planet, it also leads to ocean acidification. That threatens to corrode the shells of corals and of tiny marine organisms that provide essential food for fish, whales, and other ocean life.

“We’ve increased the carbon dioxide in the atmosphere, and that’s driving it into the ocean and changing the ocean's chemistry,” said Scott Doney, a marine geochemist and Fellow of the WHOI Ocean and Climate Change Institute. Chemically, the carbon dioxide (CO2) reacts with water (H2O) to form carbonic acid (H2CO3).

“A large number of marine plants and animals, including corals, sea urchins, phytoplankton, and tiny snails called pteropods use calcium carbonate to build shells,” he said. “When the ocean gets more acidic, they have a harder time building those shells.”

Doney was part of an international team of 27 marine chemists and biologists who analyzed recently compiled global ocean carbon data and computer models to study potential carbon-dioxide-related changes in the ocean. In a report published in the Sept. 29, 2005, issue of the journal Nature, the team predicted that the oceans—especially in fertile high-latitude regions—will become more acidic “within decades.” That is much sooner than expected and too fast for marine organisms to adapt to the new ocean chemistry.

Polar pteropods are a diet staple of animals ranging from zooplankton to commercial fish like salmon and baleen whales. A decline or relocation of the pteropod population could spark a calamitous chain reaction throughout marine ecosystems.

Tree from 2,000-year-old seed is doing well

By RANDOLPH E. SCHMID, AP Science Writer /1 hour, 34 minutes ago/

WASHINGTON - Just over three years old and about four-feet tall, Methuselah is growing well. "It's lovely," Dr. Sarah Sallon said of the date palm, whose parents may have provided food for the besieged Jews at Masada some 2,000 years ago.

The little tree was sprouted in 2005 from a seed recovered from Masada, where rebelling Jews committed suicide rather than surrender to Roman attackers.

Radiocarbon dating of seed fragments clinging to its root, as well as other seeds found with it that didn't sprout, indicate they were about 2,000 years old — the oldest seed known to have been sprouted and grown.

Sallon, director of the Louis L. Borick Natural Medicine Research Center at Hadassah Medical Organization in Israel, updates the saga of Methuselah in Friday's edition of the journal Science.

One thing they don't know yet is whether it's a boy or girl. Date palms differ by sex, but experts can't tell the difference until the tree is six or seven years old, Sallon said.

She hopes there's a chance to use it to restore the extinct Judean date palm, once prized not only for its fruit but also for medicinal uses.

The researchers have had a look at the plant's DNA, however, and found it shares just over half its genes with modern date cultivars.

"Part of our project is to preserve ancient knowledge of how plants were used," Sallon said in a telephone interview. "To domesticate them so we have a ready source of raw material."

Her Middle Eastern Medicinal Plant Project is working to conserve and reintroduce plants to the region where they once lived.

"Many species are endangered and becoming extinct. Raising the dead is very difficult, so it's better to preserve them before they become extinct," she said.

The oldest documented seed to be grown previously was a 1,300-year-old lotus, Sallon said.

'Methuselah' tree grows from ages-old seed

By Kelli Whitlock Burton, Boston Globe Correspondent | June 16, 2008

The 4-foot-tall sapling looks just like any other young date palm. But the tree, growing in a laboratory in Jerusalem, is anything but ordinary. Named "Methuselah" by one of its cultivators, the sapling grew from a 2,000-year-old seed - the oldest scientifically dated seed to ever be germinated.

In a study reported last week in the journal Science, a team of Israeli researchers confirmed the seed's age using radiocarbon dating, which determines age by measuring levels of a type of carbon found in all living organisms that decays at a specific rate.

The Methuselah seed, named after the oldest person in the Bible, was recovered 40 years ago, along with other seeds, from an archeological dig at Masada, an ancient stronghold where nearly 1,000 Jewish zealots are said to have committed suicide rather than be captured by Roman soldiers around AD 70.

The seeds sat in a drawer until 2005, when Israeli scientist Dr. Sarah Sallon procured them for study. She and botanist Elaine Solowey planted three seeds and held their breath. Eight weeks later, the first shoots poked through the soil.

"Elaine called and said, 'The earth has cracked in one of the flower pots. Something is growing,' " recalls Sallon, a pediatric gastroenterologist who led the study. Sallon also serves as director of the Louis L. Borick Natural Medicine Research Center, which she started 13 years ago after becoming ill in India with a severe intestinal illness that only an herbal potion from a local doctor could cure.

The herbs did more than restore Sallon's health. Since then, she has spent more than a decade studying the medicinal properties of plants, most of which are found in the Middle East. Many of the region's plants historically noted for healing properties are extinct. Such was the case with the Judea date palm, until Methuselah. Sallon and her colleagues are

waiting now to see whether the tree will produce fruit in another few years. If Methuselah turns out to be female, the scientists could use it to grow more Judea date palms.

"That this plant is doing so well is wonderful," says Jane Shen-Miller, a research biologist at the University of California, Los Angeles. Until this latest study, the oldest germinated seed was a sacred lotus tree grown by Shen-Miller, which in 2005 was reported to be 1,300 years old.

Studies of ancient seeds such as these could give scientists a look at mechanisms that protect the seeds for thousands of years. Shen-Miller is particularly interested in understanding how these ancient seeds repair age-related cellular damage, which they must do to sprout.

Beyond the scientific advances that studies of ancient seeds might provide, Sallon notes the potential for medicinal uses of plants grown from these seeds. That was, after all, what inspired Sallon to start this research in the first place.

She and her colleagues have a plantation of about 300 plant species that they hope will yield remedies for malaria, bacterial infections, even cancer. History has recorded many instances of these and other plants' use for medical treatment, Sallon says, noting that religious tomes such as the Bible, Koran and Talmud offer some of the best evidence of plants' medicinal uses over the ages. These texts are also a reminder of the spiritual meaning many plants hold for cultures around the world. Take, for example, the Judea palm now growing in her lab.

"This tree once had enormous significance as a symbol of life and peace," Sallon says. "And it can again."

PZ Myers on the process that prompts the growth of all vertebrates from embryos to unspecialized segments to multicellular animals.

by PZ Myers • Posted October 17, 2007 06:33 PM
Seed Magazine

One of the fundamental features of the organization of multicellular animals is segmentation: We are initially built by subdividing a relatively undifferentiated embryonic tissue into smaller, repeated elements, like a stack of mostly identical building blocks. Look at an earthworm or a caterpillar or a maggot, and the organization is clear, with the wormlike animal showing the obvious seams and subdivisions that constitute its assembly from rings of similar chunks of tissue. Another property of this pattern of organization is that individual segments can then acquire specializations. In a caterpillar, the front end is modified with mouthparts and sense organs to form a head, while other segments will bear stubby limbs or be festooned with bristles or colored spots and patterns. Specialization is carried further when a maggot

becomes a fly. Segments become much more obscure, retaining their visible identity in the abdomen, but are otherwise fused, elaborated upon, and display new features, such as wings or legs or mouthparts, that make the segments, ultimately, look very different from one another.

Meet the Intraterrestrials
Olivia Judson (NY Times)
http://judson.blogs.nytimes.com/2008/06/10/meet-the-intraterrestrials/

Some weeks ago, I wrote about microbes in the air and their possible role in helping clouds form, in causing rain and in altering the chemistry of the high atmosphere. This week, I want to go in the opposite direction and plunge down into the earth. For many bacteria live deep in the oceans and deep in the earth, far from light, far from what we normally think of as good, comfortable places to live.

For example: the bottom of the Mariana Trench. This is a seam on the sea floor in the northwestern Pacific, not far from the island of Guam; it's where the Pacific plate is sliding under the Philippine plate. The ocean is deeper here than anywhere else in the world: the seabed is 11 kilometers (almost 7 miles) below the surface of the sea. Yet even here, where the pressure of the water would crush you or me, there are bacteria. Some of them won't grow at all unless the atmospheric pressure is at least 50 megapascals (around 7,000 pounds per square inch), and they grow better if the pressure is greater — 70 megapascals (more than 10,000 pounds per square inch). For comparison, the pressure at sea level — the pressure we have evolved to bear — is 700 times less.

Then there are the "intraterrestrials" — the organisms that live in rocks deep in the earth, the creatures of the "deep subsurface biosphere." Bacteria have been found in rock samples taken several hundred meters below the sea floor, even when the sea floor itself is 4 kilometers (2.5 miles) below sea level.

We don't know how many organisms are living in this (to us) alien environment. But based on what's been found in rock samples so far, the numbers are likely to be gigantic. One recent study found between 1 million and 1 billion bacteria per gram of rock (a gram is 1/28 of an ounce). It may be that a large proportion — perhaps as many as a third — of all bacteria on Earth live in rocks below the floor of the sea. That would be a lot of bacteria.

Until recently, it was assumed that the chemical alteration and decomposition of rocks in the ocean crust was due purely to elemental forces — the circulation of seawater, the grinding of rocks against one another. But increasingly, intraterrestrial bacteria are suspected of making a contribution, too. Shards of volcanic glass from basaltic rocks hundreds of meters beneath the seabed show grooves and etchings that appear to have been made by bacteria.

Volcanic glass? When molten basaltic rock wells up from deep in the earth and meets cold water at the bottom of the ocean, the heat is quenched and the rock hardens. As it does so, it forms a characteristic shape known as a pillow basalt — for it looks as though someone has stacked up a pile of rocky pillows. (Every year, around 20 cubic kilometers — around 5 cubic miles — of new basalt forms at the mid-ocean ridges — the places where the sea floor is spreading apart as tectonic plates move away from each other.) Glass forms when the rock cools so fast that crystals don't have time to take shape. Thus the edges and rims of pillow basalts are often highly glassy; indeed basaltic glass is an important component of the top layers of the oceanic crust.

Bacteria of the deep biosphere can't get energy directly from sunlight, but they can get energy from a surprising array of other sources, including iron, manganese, sulfur or nitrogen compounds, methane and hydrogen. Indeed, bacteria collected from the deep biosphere show an enormous diversity of metabolic activities. And in chiseling away at rocks, in leaching out minerals to consume, and by excreting waste products, they alter the chemical composition of rocks — and also the composition of the seawater that circulates through the pores and fractures in them. Perhaps — though no one yet knows for sure — they do so on a grand scale, contributing substantially to the composition of rocks and oceans. Experiments suggest that deep biosphere bacteria may accelerate the weathering of basalt rocks by a factor of six compared to physical or chemical forces, especially at the low temperatures that prevail in much of the seabed.

And here's something nifty. By altering the chemical composition of rocks, the bacteria may alter the magnetic properties of rocks as well.

Basaltic rocks newly arrived at the sea floor give off a strong magnetic signal. This is due to titanomagnetites — iron oxides that contain some titanium — that are present in the rocks. As a result, the mid-ocean ridges often feature a zone of high magnetization known as the central anomaly magnetization high. The strength of the magnetic signal fades as you move away from the newest rocks — as you move from the mid-ocean ridges towards the coasts. (The new rocks are gradually pulled away from the ridge by the spreading apart of the ocean plates; a rock's distance from the ridge is thus a reflection of its age.) Soon after basalts arrive at the sea floor, then, they lose some of their magnetism. Why?

A recent series of experiments that looked at the loss of magnetism of young basaltic rocks shows that bacteria may greatly accelerate the loss. Rock slices were kept for 355 days in vials of seawater with or without bacteria. The bacteria in question were strains of Desulfovibrio — bacteria that give off hydrogen sulfide much as we give off carbon dioxide. Hydrogen sulfide interacts with the iron in the rocks to form iron sulfide; in doing so, it destroys the magnetic signal. And after 355 days, the rocks kept with bacteria gave off a lower signal than the rocks kept in seawater alone. Bacteria, it seems, can efficiently reduce the magnetic signal of young rocks.

No one knows, yet, how significant such effects are. Moreover, we're only beginning to make an inventory of who's down there — the identity of most intraterrestrials remains mysterious. But given their vast numbers, and the range of their activities, these small organisms from the weird world of the rocks below the sea will probably turn out to have a big-time influence on the composition of the oceans and the rocks of the seabed.

Scientist using ferry for sea research

AARON GOUVEIA

WOODS HOLE - The Katama is no longer simply a ferry from Woods Hole to Martha's Vineyard. It's a lean, mean, 235-foot data-gathering machine.

The freight ferry has been outfitted with sensors by Woods Hole Oceanographic Institution scientists to measure water quality and photograph plankton.

The ferries are perfect for the task because they make several trips a day through Nantucket Sound on a year-round basis, said Scott Gallager, associate scientist of biology at WHOI.

Scientists will soon mount similar sensors on another ferry, the Eagle, so the waters between Hyannis and Nantucket can be monitored as well.

The Nantucket Sound Ferry Scientific Environmental Monitoring System began in May. By studying the results over many years, Gallager hopes scientists can better understand how water quality and ocean life change.

The sensors, which cost $18,000 and can fit into a suitcase, are placed in a cavity in the hull of the ship. They collect water samples and take photographs of plankton 30 times per second.

The data is transferred back to WHOI via an onboard computer stored in the engine room, and results are released in real time on the Internet.

The sensors measure water temperature, salinity, oxygen, chlorophyll and water clarity.

Gallager is especially interested in nutrients from coastal embayments and their impact on plankton in Nantucket Sound.

Nutrients are known as primary producers and are necessary for algae to

grow. Zooplankton, a secondary producer, feeds off the algae, then fish and shellfish dine on the zooplankton.

Since the availability of plankton could mean the difference between healthy or undernourished commercial fishing stock, Gallager wants to quantify nutrient sources so he can see how much is coming from onshore run-off and what's generated within the water column.

"This is the basis for the entire food chain," Gallager said.

Nantucket Sound, the triangular area of coastal ocean between Cape Cod, Martha's Vineyard and Nantucket, is known for variable water conditions and diverse marine life. As water shifts with the winds and tides, warm- and cold-water species are forced to share the same space.

This study, Gallager said, will help build an understanding of the area and how the sound changes over time.

The project has been approved by the Woods Hole, Martha's Vineyard and Nantucket
Steamship Authority and does not negatively affect the operation of the ship, Gallager said.

Scientists will spend 15 minutes once a week cleaning the microbial film and algae from the sensors.

Although he is funded by the Woods Hole Sea Grant program for sensors on two ships over two years, Gallager hopes to put more sensors on ferries going from Boston to Provincetown and New Bedford to Martha's Vineyard.

"We're looking for long-term trends because issues like these can't be solved in one, two or three years, but a minimum of 10 or 50 years," Gallager said. "The reason for making lots of measurements over a long period of time is to understand the source of variability."

Military Supercomputer Sets Record

By JOHN MARKOFF
Published: June 9, 2008

SAN FRANCISCO — An American military supercomputer, assembled from components originally designed for video game machines, has reached a long-sought-after computing milestone by processing more than 1.026 quadrillion calculations per second.

The new machine is more than twice as fast as the previous fastest supercomputer, the I.B.M. BlueGene/L, which is based at Lawrence Livermore National Laboratory in California.

The new $133 million supercomputer, called Roadrunner in a reference to the state bird of New Mexico, was devised and built by engineers and scientists at I.B.M. and Los Alamos National Laboratory, based in Los Alamos, N.M. It will be used principally to solve classified military problems to ensure that the nation's stockpile of nuclear weapons will continue to work correctly as they age. The Roadrunner will simulate the behavior of the weapons in the first fraction of a second during an explosion.

Before it is placed in a classified environment, it will also be used to explore scientific problems like climate change. The greater speed of the Roadrunner will make it possible for scientists to test global climate models with higher accuracy.

To put the performance of the machine in perspective, Thomas P. D'Agostino, the administrator of the National Nuclear Security Administration, said that if all six billion people on earth used hand calculators and performed calculations 24 hours a day and seven days a week, it would take them 46 years to do what the Roadrunner can in one day.

The machine is an unusual blend of chips used in consumer products and

advanced parallel computing technologies. The lessons that computer scientists learn by making it calculate even faster are seen as essential to the future of both personal and mobile consumer computing.

The high-performance computing goal, known as a petaflop — one thousand trillion calculations per second — has long been viewed as a crucial milestone by military, technical and scientific organizations in the United States, as well as a growing group including Japan, China and the European Union. All view supercomputing technology as a symbol of national economic competitiveness.

By running programs that find a solution in hours or even less time — compared with as long as three months on older generations of computers — petaflop machines like Roadrunner have the potential to fundamentally alter science and engineering, supercomputer experts say. Researchers can ask questions and receive answers virtually interactively and can perform experiments that would previously have been impractical.

"This is equivalent to the four-minute mile of supercomputing," said Jack Dongarra, a computer scientist at the University of Tennessee who for several decades has tracked the performance of the fastest computers.

Each new supercomputing generation has brought scientists a step closer to faithfully simulating physical reality. It has also produced software and hardware technologies that have rapidly spilled out into the rest of the computer industry for consumer and business products.

Technology is flowing in the opposite direction as well. Consumer-oriented computing began dominating research and development spending on technology shortly after the cold war ended in the late 1980s, and that trend is evident in the design of the world's fastest computers.

The Roadrunner is based on a radical design that includes 12,960 chips that are an improved version of an I.B.M. Cell microprocessor, a parallel processing chip originally created for Sony's PlayStation 3 video-game machine. The Sony chips are used as accelerators, or turbochargers, for portions of calculations.

The Roadrunner also includes a smaller number of more conventional Opteron processors, made by Advanced Micro Devices, which are already widely used in corporate servers.

"Roadrunner tells us about what will happen in the next decade," said

Horst Simon, associate laboratory director for computer science at the Lawrence Berkeley National Laboratory. "Technology is coming from the consumer electronics market and the innovation is happening first in terms of cellphones and embedded electronics."

The innovations flowing from this generation of high-speed computers will most likely result from the way computer scientists manage the complexity of the system's hardware.

Roadrunner, which consumes roughly three megawatts of power, or about the power required by a large suburban shopping center, requires three separate programming tools because it has three types of processors. Programmers have to figure out how to keep all of the 116,640 processor cores in the machine occupied simultaneously in order for it to run effectively.

"We've proved some skeptics wrong," said Michael R. Anastasio, a physicist who is director of the Los Alamos National Laboratory. "This gives us a window into a whole new way of computing. We can look at phenomena we have never seen before."

Solving that programming problem is important because in just a few years personal computers will have microprocessor chips with dozens or even hundreds of processor cores. The industry is now hunting for new techniques for making use of the new computing power. Some experts, however, are skeptical that the most powerful supercomputers will provide useful examples.

"If Chevy wins the Daytona 500, they try to convince you the Chevy Malibu you're driving will benefit from this," said Steve Wallach, a supercomputer designer who is chief scientist of Convey Computer, a start-up firm based in Richardson, Tex.

Those who work with weapons might not have much to offer the video gamers of the world, he suggested.

Many executives and scientists see Roadrunner as an example of the resurgence of the United States in supercomputing.

Although American companies had dominated the field since its inception in the 1960s, in 2002 the Japanese Earth Simulator briefly claimed the title of the world's fastest by executing more than 35 trillion mathematical calculations per second. Two years later, a supercomputer created by I.B.M. reclaimed the speed record for the United States. The

Japanese challenge, however, led Congress and the Bush administration to reinvest in high-performance computing.

"It's a sign that we are maintaining our position," said Peter J. Ungaro, chief executive of Cray, a maker of supercomputers. He noted, however, that "the real competitiveness is based on the discoveries that are based on the machines."

Having surpassed the petaflop barrier, I.B.M. is already looking toward the next generation of supercomputing. "You do these record-setting things because you know that in the end we will push on to the next generation and the one who is there first will be the leader," said Nicholas M. Donofrio, an I.B.M. executive vice president.

By breaking the petaflop barrier sooner than had been generally expected, the United States' supercomputer industry has been able to sustain a pace of continuous performance increases, improving a thousandfold in processing power in 11 years. The next thousandfold goal is the exaflop, which is a quintillion calculations per second, followed by the zettaflop, the yottaflop and the xeraflop.

The New York Times

February 19, 2008
Revealed: Secrets of the Camouflage Masters
By CARL ZIMMER

WOODS HOLE, Mass. — The cuttlefish in Roger Hanlon's laboratory were in fine form. Their skin was taking on new colors and patterns faster than the digital signs in Times Square.

Dr. Hanlon inspected the squidlike animals as he walked past their shallow tubs, stopping from time to time to ask, "Whoa, did you see that?"

One cuttlefish added a pair of eye spots to its back, a strategy cuttlefish use to fool predators. The spots lingered a few seconds, then vanished.

When Dr. Hanlon stuck his finger into another tub, three squirrel-size cuttlefish turned to chocolate, and one streaked its back and arms with wavy white stripes.

"Look at the pattern on that guy," he said with a smile as they lunged for his finger.

In other tubs, the cuttlefish put on subtler but no less sophisticated displays. Dr. Hanlon's students had put sand in some tubs, and there the cuttlefish assumed a smooth beige. On top of gravel, their skins were busy fields of light and dark.

Dr. Hanlon likes to see how far he can push their powers of camouflage. He sometimes put black and white checkerboards in the tubs. The cuttlefish respond by forming astonishingly sharp-edged blocks of white.

"We can give them any hideous background," he said, "and they will try to camouflage."

Cuttlefish and their relatives octopus and squid are the world's camouflage champions. But Dr. Hanlon and his colleagues have just a rough understanding of how these animals, collectively known as cephalopods, disguise themselves so well.

Dr. Hanlon, a senior scientist at the Marine Biological Laboratory here, has spent much of the last three decades studying them in his laboratory and on thousands of ocean dives. He said he believed that he finally had a theory for how they achieve their magic.

In fact, he said it could account for all the camouflage patterns made by animals like katydids and pandas. For all the variety in the world of camouflage, there may be a limited number of ways to fool the eye.

Dr. Hanlon's scientific career was a foregone conclusion. At age 18, he took his first dive in Panama and spotted an octopus hiding on a coral reef. After serving as an Army lieutenant for two years, he entered graduate school at the University of Miami, where he began to study cephalopod camouflage.

He has spent much of his career underwater, swimming around coastal reefs and rocky coastal waters from the Caribbean to South Africa to Australia.

Typically, Dr. Hanlon and his colleagues follow a single cephalopod, filming for hours as it shifts its skin. On some dives, Dr. Hanlon uses a spectrometer to obtain precise measurements of the light in the water and the reflections from the animal. The tedium is interrupted now and then by acts of spectacular deception. Cephalopods do not just mimic the colors of the sea floor or coral reefs. Sometimes, they make their arms flat and crinkled and wave them like seaweed.

Dr. Hanlon has watched octopuses perform what he calls the Moving Rock Trick. They assume the shape of a rock and move in plain sight across the sea floor. But they move no faster than the ripples of light around them, so they never seem to move.

Dr. Hanlon's jaw-dropping footage has appeared on a number of documentaries. One pirated segment has wound up on YouTube, where it has been viewed hundreds of thousands of times.

Dr. Hanlon approaches normal-looking coral at Grand Cayman Island. When he is a few inches away, half the coral suddenly becomes smooth and white. An eye pops open, and an octopus that has been clinging to the coral shoots away.

Despite thousands of dives, Dr. Hanlon still considers himself a novice in spotting cephalopods. Once, after following an octopus for an hour and a half, he looked away a moment to switch cameras. When he looked back, the animal was gone.

He and his colleagues swam for 20 minutes before realizing it was right in front of them, exactly where they had seen it before. "I was really angry," Dr. Hanlon said. "They still fool me, even though I think I know what I'm looking at."

In recent years, Dr. Hanlon has been spending much of his time diving along southern Australia, where a colleague discovered the only major spawning grounds for cuttlefish ever found. Every year, hundreds of thousands of Australian giant cuttlefish gather there to mate and lay eggs. "I'd been searching for a place like that for 25 years," he said. "The first time I stuck my head in the water, I said, 'I've died and gone to cuttlefish heaven.' "

In his cuttlefish heaven, Dr. Hanlon has discovered new dimensions to camouflage. Curious to observe the animals at night, he and his colleagues used an underwater robot to film them in dim red light. The footage revealed something never seen before, cephalopods disguising themselves at night.

"This was stunning to us," Dr. Hanlon said. "They were perfectly camouflaged no matter where they were."

Evidently, they have to hide even in darkness from dolphins and other predators.

Cuttlefish can also use camouflage to deceive other cuttlefish, Dr. Hanlon and his colleagues have found. A male cuttlefish will typically guard several females from other challengers. He does not often have physical fights. It is enough for him to put on a powerful visual display.

But if another male disguises its skin to look female, he can sneak up to the guarded female and mate. The sneaky male's disguise may be so good that the other male may try to guard him as part of his harem.

Beyond documenting the varieties of camouflage, Dr. Hanlon also wants to understand how the animals produce them. At his lab, he studies the powerful visual system of cuttlefish. Cephalopods have huge eyes, and much of their brain is dedicated to processing visual information. They use this information to control their disguises through a dense network of nerves running from the brain to the skin.

The animals use a number of strategies to alter appearances. The skin layers can swell and contract, changing the reflected colors. At the same time, the cuttlefish can also control millions of pigment-filled organs, causing them to flatten like pancakes to add patterns to their skin.

"It's smart skin," Dr. Hanlon said. "It's all wired up."

Edwin Thomas, an engineer at the Massachusetts Institute of Technology, was so impressed by Dr. Hanlon's work on cuttlefish skin that he decided to mimic it. Dr. Thomas and his colleagues created a thin layer of gel that changes colors when it swells with water and shrinks. "Roger's animals can also do that," Dr. Thomas said, "but they're doing it without scientists involved."

For all the complexity of their skin, Dr. Hanlon suspects that the cephalopods also use mental shortcuts. "They don't have time to analyze all this visual information," he said.

A clue to how cephalopods disguise themselves so quickly came to Dr. Hanlon when he and his colleagues reviewed thousands of images of cuttlefish, trying to sort their patterns into categories. "It finally dawned on me there aren't dozens of camouflage patterns," he said. "I can squeeze them into three categories."

One category is a uniform color. Cephalopods take on this camouflage to match a smooth-textured background. The second category consists of mottled patterns that help them hide in busier environments. Dr. Hanlon calls the third category disruptive patterning. A cuttlefish creates large blocks of light and dark on its skin. This camouflage disrupts the body outlines.

To test this hypothesis, Dr. Hanlon and his colleagues have been giving cuttlefish carefully controlled background patterns to match, natural patterns like sand and gravel as well as artificial ones like checkerboards. The researchers film the cuttlefish and classify them with image-processing software.

The three-category hypothesis has been holding up, Dr. Hanlon said. He illustrates it in spectacular fashion with a cuttlefish sitting on sand. If he drops a few white rocks into the water, the cuttlefish immediately inspects them and adds what looks like a white rock to its skin, disrupting its outline.

Innes Cuthill, an expert on camouflage at the University of Bristol, called Dr. Hanlon's research fascinating and inspiring. Dr. Cuthill agreed that cuttlefish had limits to its camouflage. "It can't reproduce the Mona Lisa on its back," he said.

But he still considers it an open question how much the constraints come from cuttlefish brain wiring and how much from the limited range of backgrounds that cuttlefish encounter.

What he learned from cephalopods may apply throughout the animal kingdom. The fact that cephalopods may need just three camouflage categories could mean that there are just a few basic ways to fool predators.

Recently, Dr. Hanlon and students sorted through thousands of pictures of other camouflaged animals and found that they appeared to fall into the same three categories. A frog may have drab skin to blend into the drab forest floor. A bird may have mottled plumage, so that it matches the leaf and branch pattern surrounding it.

Dr. Hanlon argues that the black and white patches on a giant panda are a form of disruptive camouflage. If a panda is up in a tree, the chunks of black and white blend into the sunlight and shadows. It may be able to hide on a snowy landscape this way, as well.

Cephalopods are singular for changing quickly among all three categories. Chameleons can change between them, too, but they shift slowly, as hormones spread across their skin.

Dr. Hanlon is looking for more evidence for his three categories by figuring out the rules that cuttlefish use to decide how to hide themselves. Although he says he has found some rules, there is much to figure out.

To use disruptive patterning, cuttlefish need to make sure that their color blocks are on the same scale as the objects around them. Dr. Hanlon has yet to figure out how they measure that.

"They're doing it in some magical way we don't yet understand," he said.

Dr. Hanlon and his colleagues are also puzzled by the many camouflage colors of the cuttlefish, which have a single type of pigment in their eyes. Humans have three.

Experiments in Dr. Hanlon's lab have shown that they are color blind. They see a world without color, but their skin changes rapidly to any hue in the rainbow. How is that possible?

"That's a vexing question," he said. "We don't know how it works."

Despite opposition, ocean iron fertilization forging ahead
June 10, 2008 - Exclusive
By Carli Ghelfi, Cleantech Group

In the face of continued international opposition toward ocean iron fertilization (OIF), advocates are apparently damning the torpedoes.

Those advocates include San Francisco-based Climos, which today reaffirmed it plans to continue with its controversial stated business goals of testing and commercially developing OIF to assist in carbon sequestration.

Delegates to both the U.N. conference on biological diversity (CBD) and the London Convention, a group which oversees dumping at sea and is part of the International Maritime Organization (IMO), have been vocal in calling for more research before companies, such as Climos and Australia's Ocean Nourishment, move forward with ocean carbon sequestration projects.

At respective meetings in recent weeks, countries pursuing a moratorium on OIF at CBD's meeting in Bonn, Germany didn't quite achieve one, despite reports, but resolved that OIF should only continue on the level of small scale, coastal operations for now.

Separately, the London Convention requested nations pay attention to a statement the IMO is to release later this year on the topic.

While these two groups represent almost three hundred countries formally expressing caution about OIF (CBC: 191, London Convention: 88) [ed.: and note the U.S. is not one of them], American startup Climos says it's undeterred.

"Our plans haven't changed at all," Climos CEO Dan Whaley told Cleantech Group today. "Our goals have always been to fund a demonstration of this technique with some of the leading oceanographers and a world-class research vessel in an open and transparent way."

While Whaley reiterated he understands the concerns of the greater international scientific community, he said Climos' plans to obtain a permit and to continue to seek funding are still on course, and he expects to execute a demonstration in the next year and a half.

"I don't want to be flip with my answer in terms of our actions," said Whaley. "We'll seek a permit under the [London Convention]. This statement does not affect us not doing that."

Discovered almost 20 years ago by scientist John Martin, ocean iron fertilization uses photo plankton as a conduit for sequestering carbon. In the process, the plankton bloom, mature and die, and then supposedly sink to the ocean, carrying carbon with them.

Critics worry that seeding the ocean with large volumes of iron could have unintended consequences. In a special report, the Intergovernmental Panel on Climate Change (IPCC) called OIF 'speculative and unproven, and with the risk of unknown side effects.'

According to Ken Buesseler, a senior scientist of marine chemistry and geochemistry at Woods Hole Oceanographic Institution in Massachusetts, scientists have been clear on the fact that the next experiments need to be bigger and larger, regardless if they are commercially funded.

Buesseler is the main scientist who organized meeting last November to provide an update on the science of OIF. Buesseler said he was trying to be a neutral ground to discuss the issues.

As a scientist, Buesseler is interested in how the scientific community can play its part and help reduce uncertainties of technology like OIF. "As a scientist, we can answer these questions. There's potential," he told the Cleantech Group.

"Some people seem philosophically opposed form the start," continued Buesseler. "I think it's an open question."

According to Buesseler, so far there have been 12 open ocean experiments, ranging from 1-4 weeks, with 1-2 tons of elemental iron, and over approximately 10 x 10 km in the ocean.

Buesseler said the scientific community would like to expand the experiments to 100 x 100 km, using 10-20 tons of iron so they can see the full growth cycle of plankton and find out where the carbon actually ends up (the bottom of the ocean, or at the surface).

When asked who the people are who have voiced their opposition to OIF, Buesseler said they are the ones who are fundamentally opposed to doing anything to the ocean, which is something he personally disagrees with.

"We're already changing the ocean," said Buesseler. "You can't avoid altering the ocean by continuing to drive cars and emitting CO2. The ocean will change no matter what."

"One argument against OIF is if you take to the extreme and take every square inch of the ocean and alter it. That's unacceptable."

Conversely, Buesseler said he wouldn't argue that we shouldn't take any fish out of the ocean to explore the possibilities, but there are still people who are fundamentally opposed to this.

"There's no evidence either way, but the next large experiments won't likely [take fish out of the ocean] either."

Buesseler said he fears that if we don't explore all the possibilities for reducing emissions, we'll continue on the carbon heavy path we're already on. "We know we're already changing the ocean. That's not acceptable."

Buesseler reiterated the likely disagreement from the IMO is the immediate granting of carbon credits based on experiments. "What concerned people was that there were companies that didn't have any interest in real science. That's some of the negative view."

"You can't sell offsets until you measure the risk and the benefits."

In an interview with Cleantech Group this January, Climos' Whaley said he believes the carbon trading markets can finance fertilization projects (see Plankton to the rescue).

In the meantime though, Whaley said Climos is set on finding private funding and will continue with its plans of another round of funding in 2009.

Now-defunct Planktos was pursuing a business plan similar to Climos

Salty Mars Looking Bad for Life

By Richard A. Kerr
ScienceNOW Daily News
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NASA's "follow the water" approach to exploring Mars has led to tantalizing clues that microbial life may have existed at some point on the Red Planet. But any organisms would have to have been extremely hardy to survive, according to new calculations. At the places visited so far, at least, it may have been too salty for any Earth-like life at all.

Here on Earth, life seems to have permeated every nook and cranny, from temperate oceans to million-year-old permafrost. But not every environment is hospitable. Curiously enough, it is the food industry that has explored these most extreme conditions. Cram the maximum amount of salt or sugar into a water solution--as in salting meat or making strawberry preserves--and microbes are hard-pressed to survive, much less grow. That's because the ions of dissolved salt hold on to so many water molecules that few are left to support microbial life.

So was early Mars a warm bath or salt pork? Geochemist Nicholas Tosca of Harvard University and his colleagues calculated the salinity of long-gone waters from the composition of the salts left behind both at Meridiani Planum, where the Opportunity rover found the remains of salty groundwater, and at Gusev crater, where Spirit found volcano-related hydrothermal deposits. They also looked at subsurface rocks blasted off Mars that became meteorites collected on Earth.

Even the most salt-loving organisms of Earth couldn't handle the most concentrated martian brines of 4 billion years ago, Tosca and his colleagues report tomorrow in Science. By then, martian waters were 10 to 100 times more saline than Earth's seawater, they found. What's more, the high acidity and chemically oxidizing conditions of the time--previously inferred from mineral compositions--made these waters even more inhospitable. "Our paper compresses the window of opportunity [for life] to a very short span very early in Mars's history," says Tosca, when water may have been far fresher.

"Tosca et al. are making some very good points," writes planetary geochemist Jeffrey Kargel of the University of Arizona, Tucson, in an e-mail, but "they carry it too far." Perhaps early

exploration has been drawn to the most saline and therefore most obvious sites, he writes, missing more hospitable places. Microbiologist Kenneth Nealson of the University of Southern California in Los Angeles also holds out hope for life. Faced with greater challenges, martian life may have evolved even better ways to cope with salty water than Earth's microbes have devised. "Keep on following the water" is the message, say these optimists--and the Phoenix lander is doing just that (ScienceNOW, 27 May). Within weeks, it will be analyzing far younger and presumably far fresher water in the martian arctic.