Layers of Atlantic Corals Hold Record of Climate Change

By ROBERT TINDOL

The deep-sea corals of the North Atlantic are now recognized as "archives" of Earth's climatic past. Not only are they sensitive to changes in the mineral content of the water during their 100-year lifetimes, but they can also be dated very accurately.

In a new paper appearing in Science Express, the online publication of the American Association for the Advancement of Science (AAAS), environmental scientists describe their recent advances in "reading" the climatic history of the planet by looking at the radiochemistry of deep-sea corals known as Desmophyllum dimitus.

According to lead author Laura Robinson, a postdoctoral scholar at the California Institute of Technology, the work shows in principle that coral analysis could help solve some outstanding puzzles about the climate. In particular, environmental scientists would like to know why Earth's temperature has been holding so steadily for the last 10,000 years or so, after having previously been so variable.

"These corals are a new archive of climate, just like ice cores and tree rings are archives of climate," says Robinson, who works in the Caltech lab of Jess Adkins, assistant professor of geochemistry and global environmental science.

Researchers Uncover New Details About How Signals Are Transmitted in the Brain

By ROBERT TINDOL

An international team of scientists has announced a new breakthrough in understanding the molecular details of how signals move around in the human brain. The work is basic research, but could help pharmacologists design new drugs for treating a host of neurological disorders, as well as drugs for reducing alcohol and nicotine craving.

Reporting in the November 11 issue of the journal Nature, researchers from the California Institute of Technology and the University of Cambridge explain how they have learned to force a protein known as the 5-HT3 receptor to change its function by chemically changing the shape of one of the amino acids from which it is built. Using a technique developed at Caltech known as "unnatural amino mutagenesis," the researchers altered a proline amino acid in the 5-HT3 protein in order to modulate the receptor's ion channel. This gave the researchers control of the "switch" that is involved in neuron signaling.

According to Dennis Dougherty, lead author of the paper and the Hoag Professor of Chemistry at Caltech, the new research solves a 50-year-old mystery of how a neurotransmitter changes the 5-HT3 receptor to launch a neuron signal.

Dougherty says the work required the collaboration of organic chemists, molecular biologists, electrophysiologists and computer modelers. His Caltech group worked closely with the research group of Caltech biologist Henry Lester, and with the group at Cambridge headed by Sarah Lummis, to establish how proline changes its structure to open an ion channel and launch a neuron signal.

"This is the most precise model of receptor signaling yet developed, and it provides valuable insights into the nature of neurotransmitters and the drugs that modulate them," Dougherty says.

"The promise for pharmacology is that precise control of the signaling could lead to new ways of dealing with receptors that are malfunctioning," says Lester, Caltech's Bren Professor of Biology. "The fundamental understanding of how this all works is of value to people who want to manipulate the signaling." The 5-HT3 receptor is also involved in the enjoyment people derive from drinking alcohol. If the 5-HT3 receptors are blocked, then alcoholics no longer get as much pleasure from drinking. Therefore, better control of the signaling mechanism could lead to more potent drug interventions for alcoholics. The nicotine receptor is also related, so progress could also lead to better ways of reducing the craving for nicotine.

In addition to Dougherty, Lester, and Lummis, the other authors of the paper are Caltech graduate students Darren Beene (now graduated) and Lori Lee, and Cambridge researcher William Broadhurst.

The research is supported by the National Institute of Neurological Disorders and Stroke.
Students Pay Price for Administration’s Poor Planning of Parking Places

By JONATHAN DAMA

Over these past few months statements by various administrative officials have suggested that parking is not a major problem on campus, that student concerns about design and construction and not directly related to research, they assert that Institute funds that could be used to support research should not be assessed for parking. While such a principle might be convenient for placating the faculty, it is dangerously naive and goes to one of the root causes of the budget crisis now facing the Institute: the failure to properly account and plan for the additional operating costs incurred as a result.

Put simply, the parking and budgetary pressures the Institute faces today result from mismanaging research operations. Over the past several years, the Institute population increased by approximately 2500 persons. While the graduate student population increased by about a scant 300 persons, and the undergraduate population has remained essentially unchanged. Such growth in the Institute’s non-instructional staff has significantly increased the demand for parking.

Many a multitude of building projects displaced old students leaving room for new ones entering, the abuses behind new fees and transfer payments.

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Cracking Toast-of-the-Town, Grommit: Dilly-dallying at Oxford and Cambridge

By MAYRA SHEIKH

To all the techies in non-freezing Southern California, I sure hope milder temps treated you guys okay, though they’ve never been nice to me. It is beginning to get rather cold in Britain, which definitely makes me miss tech town — not the sunshine, midterms or not. Even with my sunshine withdrawal, I have been adventurously tromping around Britain. I’m writing today to tell you about visiting two of Brit­ain’s cities that have academ­ical, two havens of knowledge, the oh-so wonderful Cambridge and Oxford.

Mock as I may, the two col­leges towns have quite an appeal, aesthetic as well as intellectual. First of all, Oxford and Cam­bridge Universities differ from the American version of Univer­sities. Each University is com­prised of 20 some odd colleges scattered around each city. The coalition of the colleges is what is called the University. The colleges vary in size and are the center of the social scene. Both Oxford and Cambridge have colleges with common names. I was very much jealous of the Cam­bridge students when I saw their huge accommodations; some even have ensuite bathrooms and kitchens. All of the colleges have beautifully manicured lawns with ugly signs that say “don’t walk on the grass.” Each also has its own Hogwarts-style dining hall, and mini-Cathedral-like Chapel with stained glass and images ranging from Mary, Jesus, and arch­bishops to English Monarchs, notably the Tisdon. The archi­tecture of the buildings is great; some of the chapels have fanned, vaulted ceilings, and others have stucco embossed domes. Some of the chapels even have towers up which one can climb to see the whole city. However, the narrow, winding, two-way stairwells can be rather terrifying.

For those who don’t quite ap­preciate man made things like buildings as much as I do, there is nature. Cambridge has the gorge­ous Cam River, running through a handful of colleges sitting on the banks of the river, and large parks and open spaces run down to meet the water’s edge. The calm state of mind I achieved at 9-ish on a brisk, cold British morning over­looking the river with a cup of hot coffee was worth the $50 train ticket up there. The river is not only for locals; you can go pun­ting, the traditional activity that have people punt for you and charge an hourly fare, and some colleges rent out punts to their students for a minimal fee, so students can take a stab at punt­ing themselves. Either way, it’s a unique experience. Other than the river, there are tree lined walks and winding pathways. Some of which lead to small grassing fields, as cows are an everyday presence for the Cambridge students.

However, modern conveni­en­ces still exist. Multiple streets are lined with all sorts of shops: ev­erything from grocery and depart­ment stores to small coffee shops with good sand­wiches. There are also many, many pubs in both cit­ies, suggesting the Brits like their pints. Cambridge also has outdoor market that sells homemade jew­elry, souvenirs, jam, bread, or raw meat, depending on the day of the week. On another side of town is an outdoor craft market with vary­ing trinkets made of wood, stone, clay, and beasts. Both cities have playhouses and even student-run playhouses featuring student performances. Overall, Oxford has more a city-like vibe to it, and Cambridge definitely has the small-town feel. I thoroughly en­joyed visiting both of the crowning­est glories of British Academia and would advise any other visitor to do the same. Speaking of academia, I should get cracking on the small amount of British homework I have.

Still living in a Big City — Mayra

When Online Gambling Becomes a Problem

By LEE H. COLEMAN, Caltech Counseling Center

Though we don’t know the exact number, many Caltech students enjoy gambling over the Internet. Gambling in pri­vacy and relative anonymity appeals to many of our stu­dents, and a solid understand­ing of probability theory can fuel fantasies of beating the odds. For most students of legal age, gambling in mod­eration is not inherently prob­lematic. For a small minority of students, however, online gambling can lead to signifi­cant academic, social, and fi­nancial problems.

There are no hard and fast rules for what defines a gam­bling problem, but some gen­eral criteria do seem to apply. Some signs you may have a gambling problem include:

**Objective Behaviors:**
- Lying to others to conceal the extent of your involvement with gambling
- Jeopardizing or losing a significant relationship, job, or educational or career opportu­nity because of gambling (e.g., missing classes, missing house social events, etc.)
- Sucking on others to provide money to relieve a desperate financial situation caused by gambling
- Chasing your losses — in other words, continuing to gamble in the hopes of win­ning back money you’ve lost
- In extreme cases, commit­ting illegal acts such as forg­ery, fraud, or theft to finance gambling

**Subjective Emotional States:**
- Being preoccupied with gambling (e.g., reliving past gambling experiences, hand­ling money or planning for the next venture, or thinking of ways to get money with which to gamble)
- Needing to gamble with increasing amounts of money to achieve the desired excite­ment
- You’ve made repeated un­successful efforts to control, cut back, or stop gambling
- You’re restless or irritable when attempting to cut down on gambling
- You gamble as a way of escaping from problems or to relieve an unpleasant mood, such as helplessness, guilt, anxiety, or depression

Online gambling also car­ries some risks that may not be evident at first glance. Be ad­vised that many Internet gam­bling sites are located abroad and are not subject to any particular regulations, making it more difficult to adjudicate disputes with your money. 

If you’re concerned that your gambling may get out of hand or has caused financial difficulties, confidential help is available. You can consult with a therapist at the counsel­ing center (935-8331) to help you figure out what to do next. If you’d like to consult with an organization specifically focused on problem gambling, feel free to contact either of the resources below.

Gamblers Anonymous In­ternational Service Office P.O. Box 17173, Los Angeles, CA 90017 (213) 386-8779 Fax (213) 386-0030, http://www.gamblersanonymous.org

Gamblers Anonymous Confidential Gambling Center, Inc: http://www.lostbet.com

**Reference:**

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Hey Greg! Where did you go? We were having a great conversation.

Sorry, I had to help with a Cube tournament.

Check out this Rubik's Cube game I won!

COOL! I'll forgive you if you let me play!

Yes, you go to this school.

G.L.O.M. - Greg's Life of Misery

As Techers, we look forward to few great joys in our lives: the in­ter-house parties, ditch day, or just staying home and reading a good novel. Between these wellspring's of joy lies a desert of solomol deg­radation: classes, research, and everything in between strip away layers of our skin like a whirwind. A foreign legionnaire has between these wellsprings, staying up to grab the first morning coffee, or waking up to catch the last. What's left are a few great joys in our lives: the in­ter-house parties, ditch day, or just staying home and reading a good novel. Between these wellspring's of joy lies a desert of solomol deg­radation: classes, research, and everything in between strip away layers of our skin like a whirwind. A foreign legionnaire has between these wellsprings, staying up to grab the first morning coffee, or waking up to catch the last. What's left are

Amenities

By JEFFREY PHILLIPS

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Rantings from that Drunk Guy in the Corner #1: CDS'ho' Hqrruthuh Gha Booghie – now with actual words.

By JOHN Senn

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Evidence of Global Warming: Reef or Madness?

Continued from Page 1

The D. diadens is especially useful because it lives a long time, can be dated very precisely through uranium dating, and also shows the variations in carbon-14 (or radiocarbon) due to changing ocean currents. The carbon-14 all originally came from the atmosphere and decays at a precisely known rate, whether it is found in the water itself or in the skeleton of a coral. The less carbon-14 found, the "older" the water. This means that the carbon-14 age of the coral would be "older" than the uranium age of the coral. The larger the age difference, the older the water that bathed the coral in the past.

In a healthy and orderly environment, the deepest water would be the most depleted of carbon-14 because the waters at that depth would have had the element the most time to decay. A sample of carbon-14 content at various depths, therefore, would allow a graph to be constructed, in which the maximum carbon-14 content would be found at the surface.

In the real world, however, the oceans circulate. As a result, an "older" mass of water can actually sit on top of a "younger" mass. What's more, the ways the oceans circulate are tied to climatic variations. A more realistic process is adding carbon-14 content against depth would thus be rather wavy, with steeper curves meaning a faster rate of new water flushing in, and flatter curves corresponding to relatively unperturbed water. The researchers can get this information by cutting up the individual corals and measuring their carbon-14 content. During the animals' 100-year life spans, they take in minerals from the water and use the minerals to build their skeletons. The calcium carbonate fossil we see then, is a skeleton of an animal that may have just died or may have lived thousands of years ago. But in any case, the skeleton is a 100-year record of how much carbon-14 was washing over the creature's body during its lifetime.

An individual coral can tell a story of the water it lived in because the amount of variation in different parts of the growing skeleton of a coral is an indication of the kind of water that was present. If a coral sample shows a big increase in carbon-14 about midway through life, then one can assume that a mass of younger water suddenly bathed the coral. On the other hand, if a huge decrease of carbon-14 is observed, then an older water mass must have suddenly moved in.

A coral with no change in the amount of carbon-14 observed in its skeleton means that things were pretty steady during a 100-year lifetime, but the story may be different for a coral at a different depth, or one that lived at a different time.

In sum, the corals tell how the waters were circulating, which in turn is profoundly linked to climatic change, Adkins explains.

"The last 10,000 years have been relatively warm and stable — perhaps because of the overturning of the deep ocean," he says. "The deep ocean has nearly all the carbon, nearly all the heat, and nearly all the mass of the climate system, so how these giant masses of water have sloshed back and forth is thought to be tied to the period of the glacial cycles."

Details of glaciation can be studied in other ways, but getting a history of water currents is a lot more tricky, Adkins adds. But if the ocean currents themselves are implicated in climatic change, then knowing precisely how the rules work would be a great advancement in the knowledge of our planet.

"These guys provide us with a powerful new way of looking into Earth's climate," he says. "They give us a new way to investigate how the rate of ocean overturning has changed in the past."

Robinson says that the current collection of corals all come from the North Atlantic. Future plans call for an expedition to the area southeast of the southern tip of South America to collect corals. The addition of the second collection would give a more comprehensive picture of the global history of ocean overturning, she says.

In addition to Robinson and Adkins, the other authors of the paper are Lloyd Keigwin of the Woods Hole Oceanographic Institute; John Southon of the University of California at Irvine; Diego Fernandez and Shin-Ling Wang of Caltech, and Dan Scheirer of the U.S. Geological Survey office at Menlo Park.

The Science Express article will be published in a future issue of the journal Science.