Abstractions

FIRST AUTHOR
The ocean is the ultimate carbon storehouse, and thus an important climate regulator. But in the long term, it is largely the marine sediments that control the amount of carbon returned to the atmosphere or stored in the ocean. On page 407, geochemist Valier Galy, a postdoc at Woods Hole Oceanographic Institution in Massachusetts, and his colleagues show that high levels of erosion in the Himalayan system, which lead to high sedimentation rates in the Bay of Bengal, lead to efficient storage of carbon. Galy spoke to *Nature* about monsoons, mountaineering and climate change.

Did your mountaineering background influence your choice of PhD project?
Yes. I've been interested in the region for a long time, in part because my father climbed Mount Everest and other peaks in the area. The Himalayas have an incredibly fast erosion rate. My adviser, Christian France-Lanord, and I decided to try to determine how this might affect the burial of organic carbon, and compare this with sediment carbon dynamics in the Amazon, a very different system. But after a few months I realized I would be working on the floodplains rather than in the mountains.

Why sample rivers during monsoon season?
Erosion is highest during the monsoon. Previous studies had relied on sediments collected from river surfaces only, and we wanted to sample different depths. It was hard to find boat captains willing to brave the monsoon's rapid currents so that we could collect samples from the middle of rivers. We couldn't have done that without the help of local scientists.

What was the hardest part of sampling?
The strong rains meant it could take a day or two to sample just one river point. On large rivers, rapid currents can make it difficult to get even a weighted sampler to plunge into the water. And because the water has a very low carbon content, we needed up to 200 litres from each point to perform our analyses.

Did you expect the high erosion levels to enhance carbon storage?
Previous studies had shown that the organic carbon budget in the Himalayan region is not like that of other large systems such as the Amazon, which has less erosion and traps much less carbon. In fact, the high erosion rates sustain the efficient carbon storage. The next step is to re-evaluate the link between continental erosion and the carbon cycle. Contrasting the Himalayan and Amazonian systems may allow us to refine our understanding of the global carbon cycle and its long-term effects on climate. ■

MAKING THE PAPER

Stuart West

Cheating bacteria make a useful model for social evolution.

Wasps are social insects. Humans are social animals. But bacteria? Microbes are seldom considered worth observing for their communication, cooperation or propensity to cheat. However, Stuart West, an evolutionary biologist at the University of Edinburgh, UK, thought differently. Having started his career working with wasps, he opted to change direction and observe the social capacities of bacteria.

This switch provided an opportunity to move from observation-driven to theory-driven work. "Most ideas in social evolution were developed to explain behaviours that we already knew existed," West explains. "In this case, we had theories, but no behaviours yet."

Bacteria — in this case *Pseudomonas aeruginosa* — can be easily manipulated experimentally, and mutant strains missing key behaviours exist naturally or can be created. Some mutant strains avoid cooperative behaviours and ignore communication, and West proposed to use them to test ideas he had about social evolution.

He became interested in *P. aeruginosa* when a friend suggested it as a useful study organism for a different set of experiments. For the social study, West and co-author Ashleigh Griffin, also based in Edinburgh, needed various strains of *P. aeruginosa*, so they e-mailed a number of microbiologists. Steve Diggle at the University of Nottingham, UK, responded.

Diggle studies communication in *P. aeruginosa*, which occurs through the release of diffusible signal molecules. These regulate the production of several compounds released from the cells, including virulence factors and chemicals that aid population growth. This process, known as quorum sensing (QS), is thought to allow bacteria to coordinate certain behaviours as a population.

West and his co-workers wanted to better understand why these bacteria behave cooperatively and what would happen if some bacteria were to 'cheat' — either by not releasing these signals or by not responding to them.

First, they examined the consequences of QS gone awry, with one mutant strain unable to send QS signals and another unable to receive them. The researchers put wild-type bacteria and the two mutant strains into different environments to see which would thrive. "We think that QS leads to cooperation, because it stimulates the release of products that can be shared by other cells," says West.

Diggle put the bacteria in a culture medium that simulated a harsh natural environment, where the bacteria would need to release QS signals to proliferate. In separate tubes, wild-type bacteria thrived, but the 'cheats' showed poor growth, even though they were saving energy by not producing signals or products.

Next, they examined what happened when the cheats were mixed in with wild-type bacteria. When cheats of either type were introduced at a low frequency, they rapidly increased in number, despite the fact that they would have been unable to multiply in the medium had they been alone. This demonstrates the social nature of QS, and shows that it can be exploited by cheats (see page 411).

West calls the bacteria "dream tools" for studying social behaviours. But the technique also provides insight into more complex organisms. "Fundamentally, the questions are the same," West says. ■

FROM THE BLOGOSPHERE

In a 1 November Editorial (see *Nature* **450,** 1; 2007) and at Nautilus, *Nature* explores whether co-author accountability can improve research integrity (http://tinyurl.com/3y9fn6). As part of this exercise, we took a snapshot look at the popularity of Author Contributions statements in *Nature*.

We strongly encourage authors to make these statements, specifying the work each author contributed to the paper, but it is not mandatory. Should that change? Part of the answer to this question lies in how useful authors find the idea. In the past three or four issues of *Nature*, about half of the Articles and Letters carried contributions statements.

Here is an example, from the 1 November 2007 issue: "A.C. and J.H.H. conducted the observations at the telescope. A.C. reduced the data, and P.W.L. performed the Monte Carlo modelling. A.C. wrote the main paper, and P.W.L. wrote the Supplementary Information. All authors discussed the results and implications and commented on the manuscript at all stages."

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