global cooling. According to a new analysis, biomass burning increased only between AD1750 and 1870, when the climate started to become warmer, populations grew rapidly, land use changed as agriculture intensified, and the industrial revolution raised atmospheric levels of carbon dioxide.

Jennifer Marlon at the University of Oregon, Eugene, and her colleagues used records of charcoal in sediments from 406 lakes, bogs and small hollows across six continents to reconstruct trends in wildfires. Wildfires declined again after 1870 as a result of landscape fragmentation and of fire management in the twentieth century.

The increase in wildfire frequency that has been observed during the past three decades — attributed to current global warming — is not yet represented in the sediment record.

NEUROSCIENCE

Sweet connections

Science **321,** 1690–1692 (2008)

When a lab rat is learning that it will get a sugar treat shortly after a light flashes, the synapses within the dopamine circuitry in its brain become temporarily more efficient.

Antonello Bonci from the Ernest Gallo Clinic and Research Center at the University of California, San Francisco and his colleagues identified this cellular mechanism involved in predicting the availability of a reward. They used, among other methods, new techniques to measure rapid changes in neurotransmitter levels *in vivo* while the rats were actually being trained.

Learning to associate an environmental signal with a reward is critical for survival. Addictive drugs short-circuit this system. They similarly increase synaptic strength, but do so for very long periods.

PALAEONTOLOGY

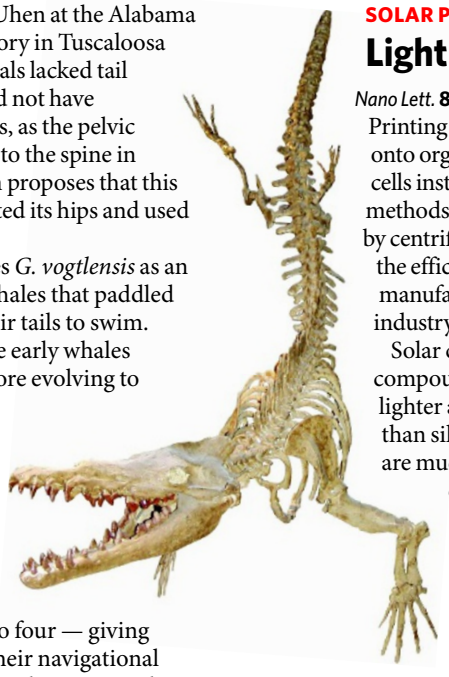
Whale of a tail

J. Vert. Paleontol. **28,** 589–593 (2008)

The ancient whale *Georgiacetus vogtlensis* probably wiggled its hips and used its giant hind feet to propel itself through the water some 40 million years ago.

Examining previously unstudied bones from this species, Mark Uhen at the Alabama Museum of Natural History in Tuscaloosa discovered that the animals lacked tail flukes. *G. vogtlensis* could not have swum by paddling its legs, as the pelvic bones are not connected to the spine in this species, and so Uhen proposes that this whale must have undulated its hips and used its feet for propulsion.

The new find identifies *G. vogtlensis* as an intermediate between whales that paddled and whales that used their tails to swim. It also suggests that some early whales undulated their hips before evolving to undulate their tails.



GEORGIA SOUTHERN MUS.

ANIMAL BEHAVIOUR

Counting bee

Anim. Cogn. **11,** 683–689 (2008)

Honeybees (*Apis mellifera*) can count up to four — giving them another string to their navigational bow. Working at the Australian National University in Canberra, Marie Dacke and Mandyam Srinivasan trained the insects to fly down a tunnel in search of food placed beside one of five identical landmarks positioned at intervals.

When trained bees flew into a tunnel that had no food, they searched most at the previously rewarding landmark — unless it was number five.

Moving the landmarks nearer to or farther away from each other did not fool the bees, showing that they were not relying on distance, but were counting the number of landmarks before the food. Changing landmarks from stripes to spots had no effect either, suggesting that bees can use numbers in an abstract way.

SOLAR POWER

Light work

Nano Lett. **8,** 2806–2813 (2008)

Printing the active coating onto organic photovoltaic solar cells instead of using other methods, such as spreading it by centrifugal force, improves the efficiency of solar-cell manufacture, according to industry scientists.

Solar cells based on organic compounds can be cheaper, lighter and more versatile than silicon-based cells, but are much less efficient at converting sunlight into electrical power.

The printing technique developed by Claudia Hoth and her colleagues at the German arm of Konarka Technologies, a solar materials manufacturer based in Lowell, Massachusetts, allows organic solar cells to be produced more simply and quickly, which might make them commercially viable.

The efficiency of cells made by this method is 3.5%, still lagging behind the 5.21% efficiency of the best organic solar cells produced by more conventional methods.

JOURNAL CLUB

Francisco Azuaje
CRP-Santé, Luxembourg

A bioinformatician considers the general applicability of host-pathogen computer simulations

Computer simulations can help explain evolutionary phenomena such as co-evolution and the emergence of robustness. Unlike traditional methods of analysis, such simulations can incorporate detailed representations of environmental antagonisms — such as the pressure that parasites exert on the evolution of their hosts.

This is what Marcel Salathé of ETH Zurich in Switzerland and Orkun Soyer of the University of Trento, Italy, recently analysed at the molecular level. By using computer simulations based on mathematical models, they showed how robust signalling networks may evolve in parasite-infested cells (M. Salathé and O. S. Soyer *Mol. Syst. Biol.* **4,** 202; 2008). In their simulations, signalling networks exhibited increasing redundancy in response to parasites, to the point that a node could be entirely removed without affecting network function. It seems that network redundancy may be a signature of parasitism present or past.

The paper is an exciting invitation to take a computational approach to evolutionary questions, by including more detailed mathematical representations. One could, for example, extend the host-parasite model to incorporate not just protein sequences, but also the ways in which genomic variation is generated, and see how everything plays out.

The approach could be generalized. National security studies, for example, might examine when and how attempts to infiltrate terrorist networks might actually make them more robust. And perhaps Salathé and Soyer's approach could be used to find ways of using environmental interference to reduce the robustness of disease networks, such as cancer signalling pathways, by examining their antagonistic interactions with therapeutic agents.

Discuss this paper at **http://blogs.nature.com/nature/journalclub**