produce. I am, of course, talking about 'the correlation of parts', 'developmental constraints', 'mutational bias', the 'integration of development with evolution', 'the real reason pigs can't fly' — every generation since Darwin has considered, and failed to solve, the problem, though they've usually given it a new name.

The second question is rather like the first: can we predict the course of cultural evolution in the long term? (One might add: or even in the short term?) Darwin saw the analogy between cultural and organic evolution; theoretical population geneticists worked out the mathematics of the transmission of cultural traits years ago. Despite this, the field really didn't take off. I think it is taking off now. Culture is the New World of evolutionary science. To be sure, anthropologists discovered it long ago, but rather like Vikings in America, they never made much of what they found.

Do you think that ethics and politics have a role in science? Most scientists are funded by taxpayers and so should be bound by the laws, and sensitive to the mores, of the democratic societies in which they live. Sure. But I am haunted by the thought that had not Vesalius robbed graves for corpses, and thereby defied the State, the Church and the mob, we would have no human anatomy. Who among us would do as he did?

You do television. How do the worlds of science and media compare? Referees of scientific manuscripts may, on occasion, be exasperatingly obtuse or cruelly cutting, but they rarely stray into the personal. Not so TV critics who have variously labelled me (in descending order of approbation): "steely gazed", "sexily soulful," "sleek/slap/shiny-headed" and "smug and slightly seedy". And that just covers the letter "S". All you can do is sigh and pour yourself a scotch.

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Humboldt expansion

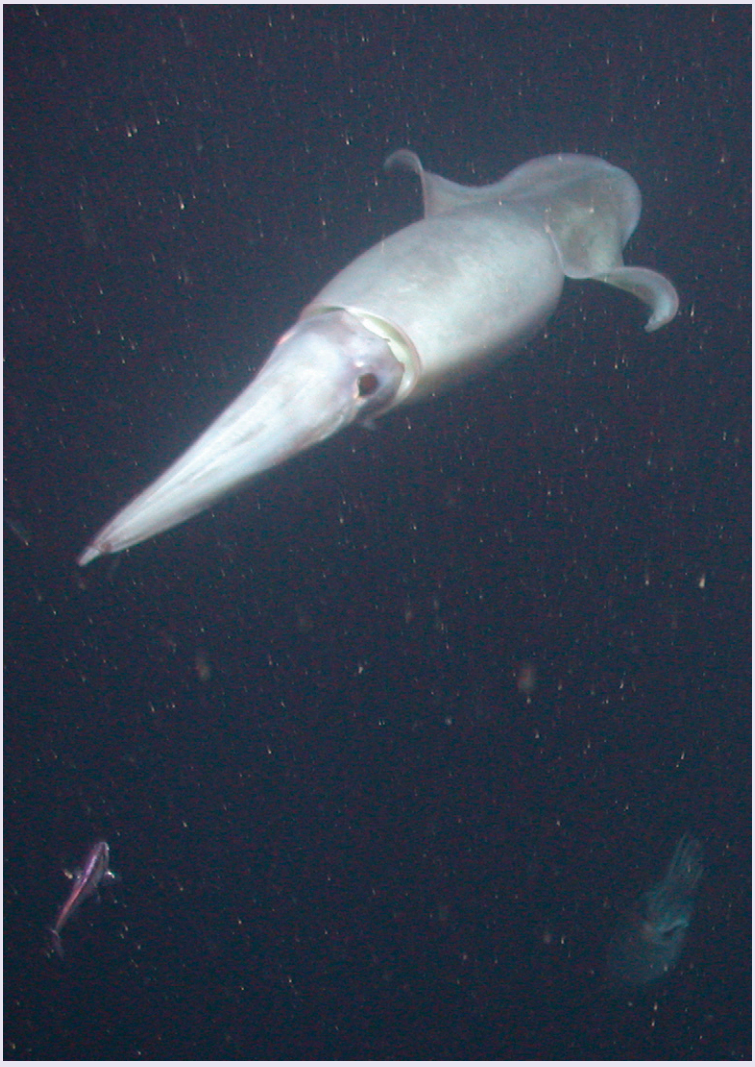
A major Pacific marine predator has expanded its range substantially in recent years raising fears amongst ocean conservation and sustainability researchers about its ecological impact.

A unique 16-year time series of deep video surveys in Monterey Bay, California, reveals that the Humboldt squid has increased its perennial geographical range in the eastern North Pacific by invading the waters off central California.

This expansion coincides with changes in climate-linked oceanographic conditions and a reduction in competing top predators. It also coincides with a decline in the abundance of Pacific hake, the most important commercial groundfish species off western North America.

The Humboldt squid is a large, aggressive, abundant and highly mobile squid. It can reach a length of more than two metres and weigh 50 kg and, remarkably, achieve these sizes very rapidly as the adults are thought to be very short lived.

Its geographical range is centred in the eastern equatorial Pacific. From these warm waters,



Invader: The Humboldt squid (*Dosidicus gigas*) appears to have expanded its range in the eastern Pacific, with a decline in commercially important hake stocks. (Image: © 2003 MBARI.)

its historical range extends along the subtropical coasts of both North and South America with only occasional and temporary appearances at latitudes higher than 40 degrees.

The squid feed opportunistically on a broad range of surface and deep-water fish, crustaceans and squid, many of which undertake vertical daily migrations of several hundred metres pursued through these depths by the Humboldt squid, which shows that it can tolerate the much colder temperatures at these depths. In turn, the squid is favoured prey for tuna, marlins and other billfish, sharks and toothed whales. But numbers of tuna and billfish have declined substantially as a result of fishing pressure.

Reporting in *Proc. Natl. Acad. Sci. USA* online, Louis Zeidberg and Bruce Robison at the Monterey Bay Aquarium Research Institute at Moss Landing, have studied the video observations made during monthly dives of a remotely controlled vehicle. Observations began in 1989 but no squid were observed until 1997, associated with an El Niño event and some persisted until the following year. Very few were then seen until 2002 when they returned in abundance, associated with a small El Niño event, and they have remained there ever since.

Hake were also observed by vehicle cameras in abundance until the arrival of the squid. Numbers now seen are very low, the authors report.

Multiple factors seem to be involved in the squid's range expansion. "The present situation off central California appears to be that of a physiologically tolerant species with a fast generation time that has moved into a new area during a period of substantial, climatic, oceanographic and ecological changes," the authors write.

Nigel Williams

Correspondences

Stepping of the forelegs over obstacles establishes long-lasting memories in cats

David A. McVea and Keir G. Pearson

Although visual input is used heavily during locomotion [1], intermittent visual input is sufficient for most walking tasks. A number of techniques provide evidence that suggests that short-term visual memory is used to fill in the resulting gaps. When stepping over obstacles, for example, humans fixate the obstacle primarily one or two steps before they reach it [2], and removing their vision during the step over the obstacle does not affect their ability to step over it accurately [3]. Walking cats consistently look two or three steps ahead when walking [4], and can continue stepping accurately among obstacles for about four steps when visual input is suddenly removed [5]. This use of short-term memory raises questions pertinent for those interested in the neurobiology of walking as well as those interested in memory in general. Our laboratory has begun to exploit the fact that walking quadrupeds must rely on some form of visual memory to guide their hind legs over obstacles. Our experiments show that stepping over obstacles triggers long-lasting memories in walking cats.

We devised a simple experiment in which we stop cats after the forelegs, but not the hind legs, have stepped over an obstacle (Figure 1A, left). During a delay period (in which the cat is distracted by food) we lowered this obstacle into the walking

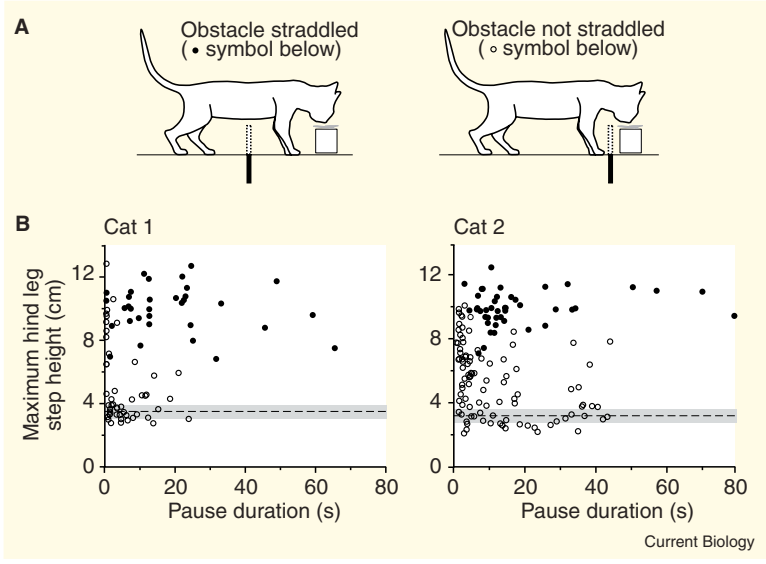


Figure 1. Long-lasting memories are formed when cats step over obstacles with their forelegs.

(A) Cats were stopped either after stepping over (left), or immediately before stepping over (right), an obstacle (height ~7 cm). While distracted by a food dish, the obstacle was lowered into the walking surface (dotted line shows the initial obstacle position). (B) Maximum hind leg step height (measure at the toe) for different pause durations for two cats. When the cats straddled the obstacle (solid circles) the step remained high independent of pause duration, indicating a long-lasting memory of the obstacle. When the obstacle was not straddled (open circles), the step height became more variable and lower after short durations, indicating no consistent memory of the obstacle. Dotted lines in the two panels show the average hind leg step height during steps with no obstacle (standard deviations indicated by width of grey bars).