50 YEARS AGO

A REPORT entitled *The Supply of Science Teachers in England and Wales* ... states that, immediately, there is need for an increase of between 28,000 and 34,000 over the present number of graduate science teachers in schools, technical colleges, training colleges and universities, which stands to-day at about 20,600 ... The shortage of science teachers is seen to be one part of the general teacher shortage, but many reasons are given for regarding it as a separate and specially urgent problem.
From *Nature* 18 August 1962

100 YEARS AGO

In 1904 Dr. J. R. Ashworth and I published ... observations on aged individuals of *Sagartia troglodytes* then and still in the possession of Miss Jessie Nelson in Edinburgh. After eight years these anemones are still in excellent health, having been in captivity for considerably more than half a century. In one respect I fear we did them an injustice, namely in attributing cannibalism to them, the error being probably due to the observation of the birth of young from a parent the tentacles of which were not fully expanded. Recently I chanced to notice a young Sagartia attached to a small piece of seaweed floating free in the aquarium. A slight agitation of the water was sufficient to bring the young anemone in contact with the tentacles of one of the patriarchs of its own species. They immediately closed round it and a small part of the disk became emarginate. The greater part, however, was not sensibly affected, and the mouth remained closed. In less than two minutes the folded-in tentacles uncurled and the young anemone was thrust away with some force ... Neither the young one nor the tentacles that held it were apparently affected in any way.
From *Nature* 15 August 1912

made use of an existing transgenic mouse strain, the 'monoclonal nose' mouse, in which almost all olfactory sensory neurons express the same odorant receptor. In these animals, most mitral cells receive similar inputs (regardless of their glomerular association) and would therefore be expected to show similar sag levels. Indeed, Angelo *et al.* found that randomly selected pairs of mitral cells in these mice showed much less diversity in sag magnitude than did equivalent pairs in control animals, consistent with the hypothesis that sag variation reflects heterogeneity in cellular activity.

One crucial question that the authors did not address is: what is the functional role, if any, of neuronal diversity? Theoretical studies have demonstrated that diversity could enhance information coding[2,5] and neural synchronization[6]; such studies provide valuable guidance for understanding how cellular diversity might support, or impair, brain function. This may tempt us to think that the robustness and power of brains as computational devices derive in part from the bespoke nature of individual neurons. However, a definitive answer to the question of whether neural variability is functionally important, or simply an unavoidable consequence of the imprecision of biological systems, awaits future experiments in which diversity can be controlled while probing behaviour. ■

Nathaniel Urban *and* **Shreejoy Tripathy** *are in the Department of Biological Sciences and Center for the Neural Basis of Cognition, Carnegie Mellon University, Pittsburgh, Pennsylvania 15213, USA.*
e-mail: nurban@cmu.edu

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OCEANOGRAPHY

The trouble with the bubble

Past studies have suggested that the ocean's nitrogen budget has a deficit of fixed nitrogen. This view may now change, thanks to upward revisions of the rate of nitrogen input through biological activity. SEE LETTER P.361

ANGELICQUE E. WHITE

As is the case for gardens, forests and fields, the availability of fixed nitrogen (such as nitrate and ammonia) can limit the productivity of our seas. Oceanographers are therefore interested in the relative magnitudes of sources and sinks of fixed nitrogen as dynamic controls of ocean fertility. The trajectory of the oceanic nitrogen inventory has been a long-debated and contentious topic: direct rate measurements of biologically mediated nitrogen fluxes suggest that the ocean is currently being depleted of this resource, whereas geochemical evidence indicates a steady-state, balanced nitrogen budget[1]. On page 361 of this issue, Großkopf *et al.*[2] report that applying a new twist to an old method may reconcile these views and lead to a revision of our understanding of the present-day oceanic fixed-nitrogen budget*.

Unlike other elemental cycles, which are predominantly influenced by riverine, atmospheric or sedimentary fluxes (such as the iron and phosphorus cycles), the oceanic inventory of fixed nitrogen is largely set by the push and pull of two biological processes. First, fixed nitrogen is added to the oceans by microorganisms known as diazotrophs, which convert the nearly limitless supply of atmospheric nitrogen gas (N_2) dissolved in sea water to ammonia. Second, in sediments and in oxygen-depleted zones of the ocean, fixed nitrogen is chemically reduced to N_2 by the microbial processes of denitrification and anaerobic ammonia oxidation. Understanding the relative balance of the fluxes of fixed nitrogen in the ocean requires the rate measurements of these competing processes to be accurate and well constrained.

On the source side of this nitrogen budget, the majority of published estimates of marine N_2-fixation rates[3] are based on a fairly straightforward protocol[4]: add a bubble of isotopically labelled nitrogen gas ($^{15}N_2$) to a sample of sea water; calculate the initial enrichment of $^{15}N_2$ in the sample using the ideal-gas law; incubate the sample for a specified period of time; and then measure the

*This article and the paper under discussion[2] were published online on 8 August 2012.