A list of published papers is no measure of value

The present system rewards quantity, not quality — but hasty changes could be as bad.

Sir — The choice of performance indicators sends a powerful message to those being evaluated, and when those measures are linked to the distribution of research funds, academics are quick to respond. Our analysis of Australian university publications shows clearly how the sector has reacted to funding formulae that reward quantity rather than quality.

A large part of the government funds that support the research activities of Australian universities is allocated on the basis of formulae that comprise three elements: research income, postgraduate students and publications[1]. Data on the third element have been collected annually since 1993. When this element was incorporated into the funding formulae in 1995, universities and researchers were quick to calculate the 'value' of a publication.

Between 1995 and 2000, this figure varied from A$761 (US$415) to A$1,089, influenced by the publication types included and the total funds allocated. After a review of higher-education research in 1999, the amount to be distributed via formulae increased significantly, to more than half of the funding specifically targeted to research and research training through the Education, Science and Training portfolio. As a result, a published paper is now 'worth' more than A$3,000 to a university. The value to individuals or departments can be appreciably higher.[2] Some universities distribute these funds internally using the same formula, but giving more weight to publications — up to three times the sector value.

We have quantified the apparent effect of this policy. We have distributed all journals from the Institute for Scientific Information's (ISI) *Science Citation Index* (*SCI*) into quartiles, using journal impacts calculated on the basis of five-year citation means, and have tracked the presence of Australian universities in these four journal sets over time (Figure 1).

The response of the academic community was predictable and clear. Until the 1989–93 period, there had been virtually no movement in the institutions' presence in the *SCI* journal sets. Subsequently, university output jumped noticeably, even though funds remain extremely tight and academic staff numbers stable. The most striking feature of that increase has been its lack of uniformity. The sector's share of publications in the top two quartiles rose by around 20%, but in the third quartile its share increased by over 50%, and it doubled in the bottom quartile.

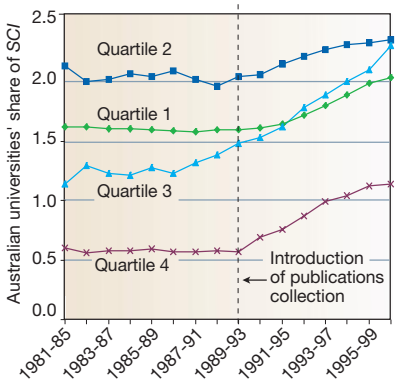

Figure 1 **Australian universities' share of publications in the *SCI*, by journal impact quartile: five-year windows, 1981–1985 to 1996–2000.**

With no differentiation between the quality or impact of the publications, there is little incentive to strive for placement in a prestigious journal. Whether a publication is a groundbreaking piece in *Nature*, or a pedestrian piece in a low-impact journal, the rewards are identical. And with the recent trebling in the 'value' of a publication unit, the pressure to focus on this will not diminish.

Concerns that this component of the funding formula was not measuring the characteristic that it was designed for — quality — were raised soon after its introduction. However, not all universities were keen to see it removed or replaced. For smaller institutions, this particular element was more rewarding, and easier to improve, than the others.

These concerns are now re-surfacing in the context of the latest review of the Australian higher education system[3]. A number of submissions to recent ministerial discussion papers have suggested the removal or modification of the publications component. The difficulty is that suggested alternatives are as problematic as the one they seek to replace. It is to be hoped that time will be taken to analyse the likely effects of any alternative measures before they are introduced.

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1. http://www.detya.gov.au/highered/research/index.htm
2. http://www.avcc.edu.au/policies_activities/resource_analysis/key_stats/kstats.htm
3. http://www.detya.gov.au/crossroads

Realistic attitude takes postdocs a long way

Sir — Compared with other countries in Asia, Japan is often described in discouraging terms with respect to foreign researchers working there (see, for example, *Naturejobs* 4–5, 8 August 2002). I have just completed four years' post-doctoral work in Japan, and agree that it is more difficult for Japan than for the United States or Europe to attract young foreign researchers. This is a great pity, as both the country and its science have a lot to offer postdoctoral fellows.

One of the greatest obstacles is the image that Western scientists have of Japan. At a recent conference, numerous graduate students and postdocs asked me questions about my experience, almost always starting out with whether it is difficult to live there. No, it is not difficult — not least because the financial support provided by institutions such as the Japan Society for the Promotion of Science (JSPS) is very generous.

Two critical elements for a successful stay are the attitudes of the researcher and of the laboratory head. Foreign researchers should develop at least basic Japanese language skills and not expect the lab to burst into English for every detail. Although good speakers may come to the institution, Japan is geographically distant from countries in which most scientific meetings are held, so visiting postdocs should make the most of the grants offered by the JSPS for travel to conferences.

The wonderful time I experienced in Japan was largely due to the supportive nature of the lab I worked in. Frequently, however, one hears stories where this is not the case. If the *sensei* (lab head) is unenthusiastic or is prejudiced against foreign researchers, conflicts arise. In my view, it is crucial for a researcher to meet his or her prospective lab head before deciding to move.

As PhD graduates rarely have the funds to travel at the end of their studies, a programme (perhaps funded by JSPS) to allow a visit to a prospective lab, with no commitment on either side, would be useful in establishing regular successful working relationships between foreign and Japanese researchers. Preparedness and

flexibility are the key to finding success and happiness while working in Japan.

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Science, conservation and fox-hunting

Sir — Much evidence on the issue of fox-hunting with hounds is either speculative, being based on questionnaire surveys, or contradictory, particularly where funds are provided by special-interest groups. The recent study done at Bristol University (P. J. Baker, S. Harris & C. J. Webbon, *Nature* **419,** 34; 2002) is noteworthy for attempting an experimental approach.

Baker *et al.* found that the temporary cessation of fox-hunting in Britain during the foot-and-mouth disease outbreak of 2001 had no impact on fox population density, and concluded that a permanent ban on hunting is unlikely to result in a dramatic increase in fox numbers. However, motor vehicles are the greatest killer of foxes in Britain, accounting for some 25% of deaths. Hunting with hounds accounts for only 6.3% of the 400,000 foxes killed annually. More than five times as many are killed by shooting and snaring as by hunting with hounds in lowland hunting areas (L. Burns, V. Edwards, J. Marsh, L. Soulsby & M. Winter. *Report of the Committee of Inquiry into Hunting with Dogs in England and Wales*, Stationery Office, London; 2000; see www.hunting-inquiry.gov.uk). Fox-hunting is an ineffective method of population control .

Instead, these data suggest that fox-hunting harvests a sustainable off-take, which might represent a traditional form of community-based conservation. Such projects improve local tolerance towards wildlife and maintain biodiversity without statutory regulation and recurrent public funding. The British government has supported many such projects in developing countries, and is committed to doing the same in Britain as a signatory to the Convention on Biological Diversity.

The defence of fox-hunting on conservation grounds relies on two main predictions in the event of a ban: first, that voluntary maintenance of biodiversity-rich fox habitats such as woodlands and hedgerows by landowners involved in hunting would decline; second, that landowners' tolerance of foxes would decline, increasing their persecution by other potentially less humane methods and so reducing fox numbers. Landowners may have the potential to reduce fox densities by shooting and snaring (M. Heydon & J. Reynolds, *J. Zool.* **251,** 265; 2000), but using these results to predict changes after any ban remains problematic.

The best way to test these predictions would be to build on the opportunistic approach attempted by Baker *et al.* by imposing a temporary, medium-term ban in randomly chosen areas and conducting independently funded research into its effects on a range of factors. This adaptive management approach would satisfy Lord Burns's recent recommendation not to rush a decision on whether to ban hunting. Although this approach has its pitfalls, we believe that, with careful planning, it would provide a firmer scientific basis for legislation than existing evidence.

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Culture gap: in biology, what works, continues

Sir — Despite the arguments reported in your News Feature "Bridging the culture gap" (*Nature* **419,** 244–245; 2002), biologists already have a simple unifying rule, without the help of physicists. It is 'what works, continues' — usually stated in terms of the survival and reproduction of the fittest.

In answer to a posed question: phosphate is used to activate and deactivate proteins, as are methyl and ethyl groups and various saccharides, for the same reason that I currently use green and orange highlighters. At some time in the past they were there and functioned, and were incorporated into the system. Applied maths has its place in biology, especially where simple rules apply, in detecting signal in noise and defining practical limits.

Mendel was the first and most influential in this regard. His work was so clever, or so arcane, that it took 35 years to work out what he had discovered, and another 50 years for molecular genetics to explain the mechanism that causes dominance. Typically, Mendel's laws underestimate reality. The effects of most alleles on most characters are quantitative, polygenic and multi-factorial, rather than qualitative — tall versus short.

Compare an organism to an automated factory. Physics can explain all of the functions from electrons in transistors to computers in robots to metal-forming stresses and welding, but it has trouble with company balance sheets and share prices. In business, the overriding factor is market share; in biology, habitat occupation.

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Culture gap: physics still seeks its unifying theory

Sir — I was somewhat bemused when reading your News Feature (*Nature* **419,** 244–246; 2002). The view that "biology today is where physics was at the beginning of the twentieth century" misses a critical difference between the two disciplines. Biology has a grand unifying theory: it was published in 1859 by Charles Darwin as *On the Origin of Species by Means of Natural Selection*. The same cannot be said of physics, which continues to search for its theory of everything.

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Patents limit medical potential of sequencing

Sir — In your interesting Nature Science Update[1] "24-hour genome dawns", you report on the prospect of a personal sequence in minutes, for less than $1,000. Patents will present at least two major problems to the timely adoption of these technologies[2,3].

First, some US companies will not license 'their' genes for testing by others, so any diagnostic chip would have to skip the patented gene estate of Myriad Genetics and similar outfits. Second, for those willing to license their genes non-exclusively for inclusion in diagnostic gene chips and similar tools, the stacked royalties payable on all the patented genes will make the tests prohibitively expensive.

Technological advances will benefit patients only if owners of diagnostic gene patents permit the technologies to be used and are reasonable in their demands for royalties, such as by limiting their expectations to a small fraction, say 1–3%, of the marginal cost allocable to their genes[4].

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1. http://www.nature.com/nsu/020923/020923-2.html; 24 September 2002.
2. Schissel, A., Merz, J. F. & Cho, M. K. *Nature* **402,** 118 (1999).
3. Merz, J. F., Kriss, A. G., Leonard, D. G. B. & Cho, M. K. *Nature* **415,** 577–579 (2002).
4. Merz, J. F. *Clin. Chem.* **45,** 324–330 (1999).