Accurate radiometers should measure the output of the Sun

Sir — We should make use of new technology to improve on the poor state of knowledge of the constancy of the Sun's output. In 1994, the National Research Council of the US National Academy of Sciences called for improved accuracy in measurements that monitor the Sun's output. In its report[1], the council stated that, between 1980 and 1986, an estimated 0.1% decrease in the output of the Sun as part of the 11-year cycle just cancelled the effect on the climate produced by anthropogenic greenhouse-gas emission in the same period. This highlights the accuracy required to separate long-term anthropogenic effects from natural ones.

In the past, accurate absolute radiometry, even on the ground, was difficult, and the spread of the results from different satellite radiometers over the 20 years that total solar irradiance has been monitored from space is nearly 0.5% (Fig. 1a). These differences are consistent with an uncertainty of about 0.4% associated with each radiometer[2]. No useful measurements were obtained from the one set of radiometers recovered after flight (from the SOVA satellite). In trying to interpret these data, the experimenters took the only route possible and applied adjustments to the various data sets to normalize their absolute levels. Figure 1b shows the resulting self-consistent data set, which appears to show that the underlying output of the Sun has remained stable to within 0.02% over the past 20 years. But how reliable is this conclusion?

It is well known in metrology that it is not possible to say by how much a measured quantity is drifting over a long period unless measurements are made at the beginning and end of the period relative to a standard that is demonstrably stable, that is, one directly linked to the fundamental constants of physics. From the data in Fig. 1, taking account of the uncertainties in the calibration of the radiometers and those inherent in the normalization procedures, we believe that an uncertainty of not less than 0.3% must be associated with the apparent null underlying variation in the output of the Sun shown in Fig. 1b. In view of the sensitivity of climate change to systematic variations in solar output, such an uncertainty is not good enough.

Although national metrology institutes now have absolute radiometers using new technology with accuracies below 0.01%, they have not been used for these important measurements. We call on the solar physics and Earth resources communities to collaborate with these institutes to draw up a long-term programme of absolute radiometry in space, using the best technology, with the aim of improving the accuracy of these crucial measurements by at least an order of magnitude. We owe this to future generations, especially to climatologists and those who will use the results of climate studies.

We must be able to rely on the results of all measurements related to climate studies. They provide the essential basis for advice to governments in formulating policy, the financial and human consequences of which will be enormous. Such measurements must be made in SI units, which are firmly linked to the constants of physics.

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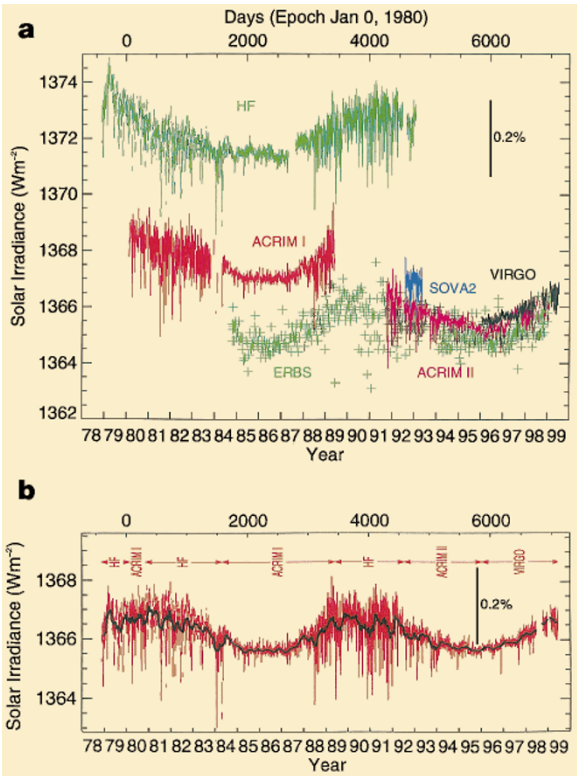

Figure 1a, **Data from measurements of total solar irradiance made from satellites.** b, **Composite total solar irradiance obtained from the data shown in** a **by making adjustments to normalize the absolute levels of successive data sets. For details see ref. 2.**

Finding the complete bioinformaticist

Sir — The UK Biotechnology and Biological Sciences Research Council (BBSRC) does seem to share Peter Campbell's view that interdisciplinary research teams are a good way to drive bioinformatics forward (*Nature* **401,** 321; 1999). Indeed, over the past few years, it has supported just this kind of research through a joint initiative with the Engineering and Physical Sciences Research Council. The reviewing panel has typically assigned high weightings to projects that represent collaborations between biology and computer-science departments.

The conclusion reached by Campbell, and perhaps by the BBSRC — that it is difficult to find researchers adept in both computer science and biology — is puzzling. I would consider myself as just such a person: a scientific 'jack of all trades'. No doubt, to most biologists I appear to be a computer scientist, and to most computer scientists I appear to be a biologist. I believe that I know at least enough about both fields to understand some of the important problems in biology and which computational methods might be most appropriately applied to at least some of them.

But are people like me as hard to find as Campbell believes? Certainly, in other fields, such as mathematics, physics, chemistry or astronomy, there is no shortage of scientists with skills in their own subject and in computation. Of course, there is still a wealth of opportunity for collaboration between these fields and the computer sciences.

So, are 'all-in-one bioinformaticists' really in such short supply? I did a straw poll of the software packages that my colleagues and I use regularly. I found 20 bioinformatics packages to be particularly vital to our research projects, ranging from sequence

alignment programs to molecular graphics software. The principal or sole authors of 18 of them are computer-savvy biologists. Although this is an inconclusive experiment in statistical terms, the message is clear. Biologists with strong computer skills are certainly out there somewhere. So funding bodies should finance interdisciplinary research in bioinformatics, but must not forget the 'jacks of all trades' who have already made such a useful contribution.

David Jones
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Pasadena pranks

Sir — I take exception to your unflattering characterization of the California Institute of Technology on the occasion of its being ranked the top US university by *US News & World Report* (Opinion, *Nature* **400,** 801; 1999). This ranking is not a fluke, even if caused by an arbitrary change in the criteria — the previous criteria were equally subjective.

The ranking signifies that Caltech, even though it is very small, has been, and will be, a power to reckon with. We have remained small by choice (only some 290 professors and 900 undergraduates) and do not aspire to the breadth of a larger university. But we do what we do extremely well, and manage to have a rich cultural life (and fun) while doing it.

That the magazine "had to delve back 15 years for an example of interesting non-curricular activity" is a failing of its research, not of the institute. A third of our students participate in intercollegiate sports, and student enterprises abound in music, theatre and the arts. Beyond such regular scientific visitors as Stephen Hawking, our campus has hosted recent visits by Tom Stoppard, Seamus Heaney, Walter Cronkite, Oliver Stone, Jonathan Miller, Beverly Sills and Warren Buffett.

The spectacular pranks that are part of our lore (such as changing the Hollywood sign to read "Caltech", or the Rose Bowl game prank you mentioned) stem not from football envy, but from the imagination and exuberance of our students, who request the 12 a.m.–2 a.m. recitation you mention to better manage their busy lives.

We are, as you note, listed as a poor "party school" because our students find fun in their own ways. And no one danced in the streets because we were too busy doing what we do best.

Jean-Paul Revel, A. B. Ruddock
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Hospital merger leaves clinical science intact

Sir — The News article by Rex Dalton about the merger between the hospitals of Stanford and the University of California, San Francisco (UCSF) is misleading (*Nature* **400,** 300; 1999).

First, it gives the impression that "faculty leaders" have abruptly changed course and are now calling for dissolution of the merger. Dalton quotes Warren Gold, who has opposed the merger from its outset. But many of our departmental chairs and other leaders of the faculty remain more open-minded about the fate of the merger. In particular, they recognize the substantial disadvantages now posed by dissolution, whatever their original views on the merger.

Second, Dalton appears to blame the merger for the pressures that increasingly impede clinicians from doing scholarly work. This is inaccurate. The pressures arise from the punishing realities of the medical marketplace. They existed before the formation of the merger, and they can be found at academic health centres throughout the United States.

Third, Dalton's article concludes with an undocumented assertion that basic scientists at UCSF are challenging the need for "clinical programmes". But no sensible basic scientist could imagine a medical school or health-science campus without clinical programmes.

I have been a member of the basic science faculty at UCSF for 30 years and know that it recognizes the importance of physician–scientists and clinical research. Indeed, the collegiality between basic scientists and clinicians at UCSF is exceptional.

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Sir — In the article entitled "Merger of top Californian medical schools turns sour", Dalton's suggestions that "the crisis is pitting physicians against basic science researchers" and that "Some basic scientists have even argued that clinical programmes aren't needed" are pure fantasy, as is the headline referring to the fictitious merger of the schools.

Merger of the schools has never been discussed, only merger of the hospitals, and we have not heard any of our basic science colleagues advocate the ludicrous notion of our medical school abandoning its clinical programmes.

Indeed, we basic scientists have been brought together with our clinical colleagues in coping with the national crisis in funding for health care by institutions such as UCSF that are dedicated to the care of all patients, rich and poor, as well as to the creation of knowledge. Our current planning for the future of disease-related research reflects this fusion of interests and experience.

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Freedom to speak or to misinform?

Sir — There is no doubt that freedom of speech as well as freedom of science are values that need to be protected. But the News article about a dispute over freedom of speech at the Institute of Molecular Biotechnology (IMB) at Jena, Germany, seems to give credence to a small group of people whose main aim seems to be to discredit the institute (*Nature* **401,** 201; 1999).

The goal in the present case was not to limit Günter Löber's rights, but to prevent further dissemination of false allegations about his former place of work. It is important to ensure that the many current IMB employees retain the freedom to conduct their research. Löber was not prohibited from criticizing the IMB, but he has agreed not to repeat groundless statements harmful to the institute publicly.

The News article contains other errors. After Manfred Eigen's departure from IMB's supervisory board, for example, the other members did not resign "in sympathy". The only other member who left then had resigned six months previously because of his workload.

Eigen has never been chairman of the supervisory or scientific advisory board of the IMB.

The statement attributed to Eigen — that he was told by the research ministry of the state of Thüringen only to speak to IMB employees in the presence of a ministry representative — is also incorrect. The truth is that the chairman of the supervisory board had expressed his desire to be present at one discussion in June 1996.

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