

O brave new words...

SIR — Recent work on the development of a UK licensing procedure for the use of bioremediation products in marine ecosystems shows that the term 'bioremediation' has been adopted by many groups to describe and promote their work and products. Conventional meanings have been swept aside. The time has come to establish an acceptable definition for the term.

The following are examples of the range of definitions in common usage in the literature:

"Bioremediation is the act of adding materials to stimulate the natural rate of biodegradation."¹

"Bioremediation is the application of biological process principles to the treatment of groundwater, soil, and sludges contaminated with hazardous chemicals."²

"Bioremediation is a managed or spontaneous process in which biological, especially microbiological, catalysis acts on pollutant compounds, thereby remedying or eliminating environmental contamination."³

These different ideas lead to confusion about the action of bioremediation agents. We have been approached by companies selling nutrients, bacterial preparations, surfactants and sorbents, all purporting to be bioremediation products. The UK licensing procedure will require a clear definition of bioremediation products, as this will determine both which products require testing, and the nature of the efficacy and toxicity tests that need to be applied. The crucial point of the science behind bioremediation has been the addition of materials to stimulate the natural biodegradative process (including co-metabolism)⁴. The added materials, whether nutrients, microorganisms or surfactants, are therefore the bioremediation products. Materials that do not stimulate the natural biodegradative processes should be called something different. As bioremediation agents can stimulate co-metabolic processes, we propose the following definition:

"Bioremediation is the act of stimulating the metabolism or co-metabolism of contaminants."

Note that the term 'intrinsic bioremediation', which has been used to mean "the study of the natural biodegradation rate"⁵, is wholly inaccurate, as nothing is done to stimulate contaminant biodegradation; it

merely involves monitoring natural processes. We suggest 'intrinsic biodegradation' as a more appropriate label.

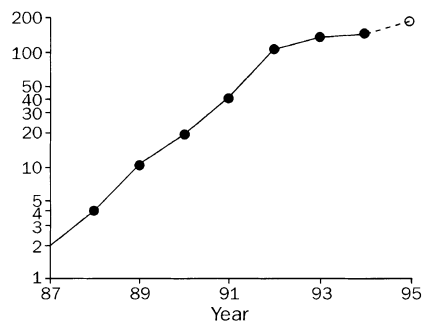
R. P. J. Swannell

D. J. Mitchell

M. A. Engelhardt

*AEA Technology,
353 Harwell,
Didcot, Oxon OX11 0RA, UK*

SIR — Since the term 'biodiversity' first entered the scientific literature in 1987 its use has continued to increase. As P. J. Hogarth has pointed out (*Nature* **364**, 664;



Number of papers with 'biodiversity' in the title. The 1995 total is extrapolated from data to October.

1993), until 1992 this rise was exponential, with a mean annual growth rate of more than 2. But a search of the BIDS ISI citation index shows that the annual rate of increase has slowed considerably since 1992 (see figure).

These data indicate that there will probably be an equilibrium density of around 250 papers a year with 'biodiversity' in the title compared with nearly 400 a year for '*Arabidopsis*' or more than 1,000 a year for '*Drosophila*'. Does biodiversity deserve even more attention from the scientific community?

Calvin Dytham

*Department of Biology,
University of York,
York YO1 5YW, UK*

Party line?

SIR — Your article on a recent speech by Sir Michael Atiyah, the president of the Royal Society, refers to a Labour Party science document that comments on the election of women fellows (*Nature* **378**, 525; 1995).

I should like to point out that the document referred to is not Labour Party policy. It was in fact written by the independent Science and Engineering Technology Forum, and was submitted to Labour as part of our Science 2000 consultation exercise, a focus for a long-term consultation process that Labour has been conducting with members of the science community. It is one of a number of

documents received, but the views and proposals it expresses are completely independent of myself and the Labour Party.

We shall publish our conclusions in due course at the end of the consultation process. Any policy that emerges will go through the usual policy-making channels of the Labour Party.

Adam Ingram

*(Shadow Minister for
Science and Technology)
House of Commons,
London SW1A 0AA, UK*

□ The phrase "a Labour Party document" was contained in the president's speech. The document in question was the only one presented at the launch of the Labour Party's Science 2000 exercise. — Editor, *Nature*.

Blood products

SIR — Your News article about my involvement in the debate about the safety of Armour's blood products¹ needs to be corrected. The article states that Armour continued to market Factorate "despite research showing that not all traces of HIV were destroyed by heat treatment". It quotes Corey Dubin as attacking my integrity more directly by stating that "[t]hey had virus [in the product] and Prince knew it; that is not a grey area". Both statements are untrue. In my letter to *The Lancet* published in early 1986² I expressed concern about the limited efficacy of dry heat inactivation, particularly when carried out for 10 hours at 60 °C. But I stressed that "this finding does not mean that dry-heat treated products are unsafe" as purification, processing and lyophilization steps may have efficiently removed or inactivated HIV.

I have been led to believe that Armour relied heavily on having been granted a licence for its product by the Food and Drug Administration (FDA), which in turn based its decision on the report from the Centers for Disease Control indicating that the Armour process was highly efficacious (~20 logs) in inactivating HIV³. Our work, whose results were reported to Armour, showed this report to be methodologically flawed.

Dubin is quoted as saying I should have communicated my results immediately to the FDA. But I believed that Armour was responsible for doing this. Lastly, Harold Sox's conclusion deserves to be emphasized; although companies hope to make a profit, none is so venal as to distribute HIV-contaminated products *knowingly*.

Alfred M. Prince

*Lindsley F. Kimball Research Institute
of the New York Blood Center,
310 East 67th Street,
New York, New York 10021, USA*

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2. Prince, A. M. *Lancet* **i**, 1280-1281 (1986).
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2. Cookson, J. T. *Bioremediation Engineering — Design and Application* (McGraw-Hill, New York, 1995).

3. Johnson, M. B. & Larkin, M. J. presented at 132nd Ordinary Meet. Soc. gen. Microbiol. Poster 9 (Aberdeen, 1995).

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5. Hinchee, R. E. et al. *Intrinsic Bioremediation* (Battelle Memorial Institute, Columbus, 1995).