

strings are thought to form, we get the helium analogy — vortices. Bingo.

Meanwhile, your domestic equilibrium has been upset by contemplating our temerity in extrapolating a few millilitres of superfluid to the scale of the Universe. It seems only our duty to put minds at rest and restore conjugal bliss. Right, point out to him — very gently — that when the Universe underwent this transition, it was probably no bigger than a golfball.

C. Bäuerle

Yu. M. Bunkov

S. N. Fisher

H. Godfrin

CNRS Centre de Recherches sur les

Très Basses Températures,

BP 166,

38042 Grenoble Cedex 9, France

G. R. Pickett

School of Physics and Chemistry,

Lancaster University,

Lancaster LA1 4YB, UK

Costing the Earth

SIR — Caldeira¹ criticizes the Economic-Damage Index² for using discounting to compare the monetary value of damages incurred at different times. Although discounting can appear easy to ridicule, one must account for the opportunity cost of resources³.

When investment opportunities exist, society can reallocate social costs over time. Consider Caldeira's second example: if, as implicitly assumed in the example, the value of an extinction V (the maximum value of resources society would willingly sacrifice to prevent it) is independent of the date, number and identity of species lost, and additional investments yield 3% per year social return, the time path of social costs associated with losing 10 species in 78 years can be exchanged for a path where a cost of $10V(1.03)^{-78} = 0.997V$ is incurred today for investment, with the proceeds used to offset the value of the species loss in 78 years. In these conditions, losing 10 species in 78 years is not worse than losing one today, as the timing and magnitude of social costs of the former can be made equal to those of the latter if desired.

Conversely, if one refuses to save one species today because the resources so used could be invested to save 10 species 78 years later, should not one subsequently refuse to save the 10 species because the resources could then be reinvested to allow 100 species to be saved in another 78 years?⁴

Discounting is properly applied to the monetary value of changes⁵ and is not applicable when tradeoffs cannot be made between environmental damages and other resources. One might choose to put biodiversity outside the bounds of economic analysis, setting constraints on species loss

that may not be violated regardless of the cost in other resources, but such an approach leaves open the question of how to set the constraints.

James K. Hammitt

Center for Risk Analysis &

Department of Health Policy
and Management,

Harvard School of Public Health,

718 Huntington Avenue,

Boston, Massachusetts 02115, USA

Atul K. Jain

Donald J. Wuebbles

Department of Atmospheric Sciences,

University of Illinois,

105 South Gregory Avenue,

Urbana, Illinois 61801, USA

John L. Adams

RAND Corporation,

1700 Main Street,

Santa Monica, California 90407, USA

1. Caldeira, K. *Nature* **383**, 214 (1996)
2. Hammitt, J. K., Jain, A. K., Adams, J. L. & Wuebbles, D. J. *Nature* **381**, 301–303 (1996).
3. Arrow, K. J. et al. in *Climate Change 1995: Economic and Social Dimensions of Climate Change* (eds. Bruce, J. P., Lee, H. & Haites, E. F.) 125–144 (Cambridge Univ. Press, 1996).
4. Keeler, E. B. & Cretin, S. *Management Science* **29**, 300–306 (1983).
5. Hammitt, J. K. *J. Health Econ.* **12**, 117–120 (1993).

corres@nature.com

Letters submitted for Correspondence can be e-mailed to **corres@nature.com**, but please send only items intended for the Correspondence section to this address.

Does your automated DNA sequencer leave you guessing? If so, chances are it's primarily designed for high throughput sequencing. Why be uncertain of your sequencer's accuracy, when ALFexpress™ is providing researchers with the full genetic stories of their DNA.

ALFexpress: for more accurate readings

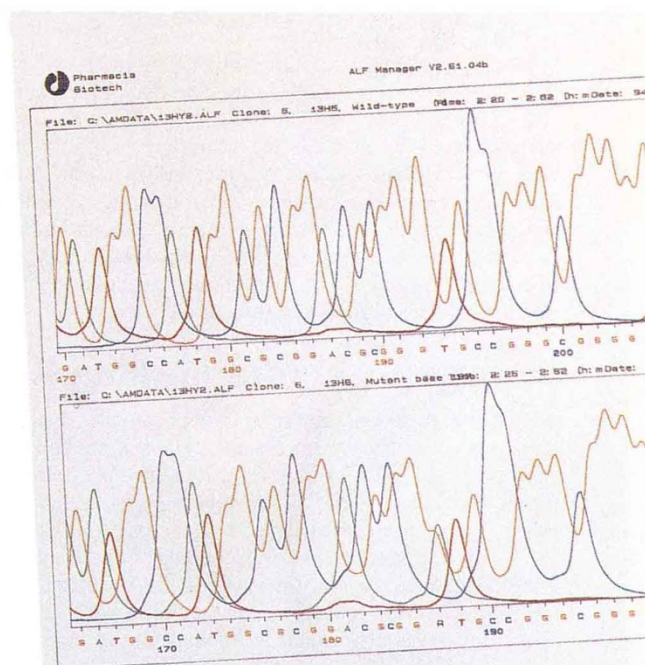
In the largest clinical study using automated DNA sequencing, the technology behind ALFexpress proved exceptional (see caption). That's one of many examples of ALFexpress offering unrivaled accuracy during automated confirmatory sequencing. Further, its readings are so accurate that ALFexpress can unambiguously identify heterozygous point mutations—as proven in many clinical research applications, such as analysis of tumor genes and high-resolution HLA typing. What's more, Pharmacia Biotech has dedicated software programs to support these applications.

For the full story, call us: 1 (800) 526-3593 from the U.S.; +81 (0)3 3492 6949 from Japan; or + 46 (0)18 16 50 00 from Europe and the rest of the world. Or visit us on the Internet: <http://www.biotech.pharmacia.se>.



Uppsala, Sweden. (And the rest of the world)

READER ENQUIRY NO. 155



The p53 gene from 316 breast cancer patients was sequenced using ALF automated sequencing technology. (Bergh J., Norberg, T., Sjögren, S., Lindgren A., Holmberg, L. "Complete Sequencing of the p53 Gene..." *Nature Medicine* 1995; 10:1029-1034.)

