health-care database through the democratic process". But important changes were made to the bill in parliament, without debate. For example, the bill now allows the licensee to connect the medical database to a genetic database, without requiring informed consent. The warnings of nearly all the independent expert groups that were asked to comment on the bill were ignored[3]. Our small society was not able to withstand deCODE's expensive information campaign.

Now the state-controlled banks have purchased almost half of the US venture capitalists' original investment in deCODE, increasing concern about the close ties between deCODE and the government.

The European Union's Data Protection Commissioners recommended that the Icelandic authorities should reconsider the project in the light of the European Convention on Human Rights. This was not done, and the consequences are lack of consent, lack of traditional ethics control and lack of freedom to withdraw information entered into the database.

More than 11,000 Icelanders have opted out of the HSD database. Many doctors have promised not to send information about patients to the database, so we believe it will not be created as originally envisaged. Sweden's UmanGenomics seems to be doing a much better job.

Pétur Hauksson
Mannvernd, Association for Ethics in Medicine and Science, PO Box 94, Reykjavik 112, Iceland

Sir — Gulcher and Stefansson's letter[2] is a striking demonstration of the corporate culture of companies such as deCODE Genetics and British Biotech, and their difficulty in telling the story straight[5].

To assert that the HSD law was approved through a democratic process underestimates the steamrollering power of a large government majority. Warnings from the Icelandic Medical Association, local and international geneticists, and privacy experts were ignored. The speed of the Icelandic legislative process precluded balanced and informed analysis of a complicated issue. It is sheer spin-doctoring to suggest that this over-speedy, ill-thought-through legislation expresses informed community consent.

Using encrypted identifiers for a comprehensive dynamic database describing the health status, genealogy and genotype of a population without informed consent opens up an ethical Pandora's box.

Skúli Sigurdsson
Institute of Cultural Studies, Humboldt University, Sophienstrasse 22a, 10178 Berlin, Germany

1. Abbott, A. *Nature* **400,** 3 (1999).
2. Gulcher, J. R. & Stefansson, K. *Nature* **400,** 307–308 (1999).
3. http://www.mannvernd.is/english
4. Anderson, R. *Br. Med. J.* **319,** 59 (1999).
5. *Nature Biotechnol.* **16,** 491 (1998).

Corals resist extinction by global warming

Sir — Coral reefs form complex ecosystems that easily reflect changes in environmental conditions. It is therefore alarming that many reefs show signs of bleaching, which can be interpreted as the beginning of degeneration. Peter Pockley reports that experts ascribe the degeneration to global warming, and predict the disappearance of most reefs within a century (*Nature* **400,** 98; 1999). This prediction may be based on biological considerations, but it seems to contradict geological data.

Coral reefs have survived geological periods with considerably higher — and others with considerably lower — temperatures than we face now or in the near future. The reefs also survived sea level fluctuations between more than 10 metres above the present level and more than 100 metres below. So it appears from geological history that corals — like most organisms — are well capable of adapting to changing environments, even though they may be less flourishing during a period of change.

The geological past shows that global warming in itself is not a threat to reefs.

A. J. (Tom) van Loon
Geocom, P. O. Box 336, 6860 AH Oosterbeek, The Netherlands

'Snowball Earth' theory still stands

Sir — George Williams[1] defends the high-obliquity hypothesis for low-latitude glaciation near sea level during the Proterozoic[2]. He criticizes the 'snowball Earth' hypothesis[3] on the grounds that global glaciation would be accompanied by drastic lowering of sea level. Sea level is lowered when ocean water is sequestered as land ice, but the volume of land ice that would exist in a 'snowball Earth' is uncertain because the hydrologic cycle would be severely reduced if the oceans were frozen over[4].

There is clear evidence for emergence and hiatus during the Marinoan glaciation (~600 Myr ago) in Australia[5], "expressed by an erosional disconformity, in places with large-scale channelling". The incised channels are ~150 metres deep[6], which would represent a minimum for the lowering of sea level assuming the land was depressed by glacial ice. This exceeds the lowering of sea level accompanying any Phanerozoic glaciation.

Williams[1] points to the presence of seasonal freeze-thaw structures[7], which he says could not form near the Equator because of low seasonal temperature variation. In fact, periglacial ice-wedge structures occur at 20 °N latitude in Hawaii[8] and near the Equator on Mount Kilimanjaro in Tanzania[9]. They are attributed to diurnal freeze-thaw cycles and may be shallower than those associated with the Marinoan glaciation[7]. Ice-wedge polygons are less well developed than linear ice wedges in the mountains because of surface slopes.

The 'snowball Earth' theory accounts for other features of the Neoproterozoic sedimentary record[3] — banded iron formations, post-glacial cap carbonates, and large carbon-isotopic variations. The high-obliquity hypothesis provides no explanation for these features.

Paul F. Hoffman
Department of Earth Sciences, Harvard University, Cambridge, Massachusetts 02138, USA

1. Williams, G. E. *Nature* **398,** 555–556 (1999).
2. Williams, G. E. *Earth Sci. Rev.* **34,** 1–45 (1993).
3. Hoffman, P. F. *et al. Science* **281,** 1342–1346 (1998).
4. Hoffman, P. F. & Schrag, D. P. *Science* **284,** 1087a (1999).
5. Preiss, W. V. *Geol. Surv. S. Aust. Bull.* **53,** 438 (1987).
6. Dyson, I. A. & von der Borch, C. C. in *Incised-valley Systems: Origin and Sedimentary Sequences* (eds Dalrymple, R. W. *et al.*) 209–222 (Soc. Sediment.Geol. Spec. Publ. 51, Tulsa, OK, 1994).
7. Williams, G. E. *Precambrian Res.* **32,** 233–242 (1986).
8. Gregory, H. E. & Wentworth, C. K. *Bull. Geol. Soc. Am.* **48,** 1719–1742 (1937).
9. Downie, C. & Wilkinson, P. *The Geology of Kilimanjaro* (Dept Geol., Univ. Sheffield, Sheffield, 1972).

Visit heaven and hell ahead of schedule

Sir — It is surprising to read that creationists in Kansas are lobbying the state board of education to include their views in school science teaching[1]. A literal reading of the Bible can sometimes be absurd, and it contains many numerical data that reflect only the views of an earlier age. These numbers can be the origin of funny calculations[2]. A colleague and I published a squib in which, using paragraphs from the biblical books of Isaiah and Revelation, the temperatures of heaven and hell were calculated as 504.5 and 716.6 K respectively[3].

The calculation was discussed widely in the media. In the UK *Sunday Times* (9 August 1998), a geophysicist suggested possible locations, based on our results. Hell might be the hydrothermal vents on the bottom of the ocean, and heaven could be the thermosphere. It must be satisfying for creationists that such places can now be reached, thanks to the work of scientists.

Jorge Mira-Pérez
Departamento de Fisica Aplicada, Universidade de Santiago de Compostela, E-15706 Santiago de Compostela, Spain

1. Dalton, R. *Nature* **398,** 453 (1999).
2. Peil, K. *Nature* **399,** 522 (1999).
3. Mira-Pérez, J. & Vina, J. *Physics Today* **51 (7),** 96 (1998).