Ice-age tropics revisited

David M. Anderson and Robert S. Webb

MODELS of future climate should be able to simulate the past when boundary conditions were different, a critical test of model reliability. But there has long been a problem with simulating temperatures worldwide during the last glacial period. Models that use the sea surface temperatures derived by CLIMAP (the Climate Long-range Investigation and Mapping programme) as boundary conditions stubbornly refuse to fit palaeoclimate evidence of lowered snowlines and vegetation change — the modelled tropics are too warm. At the American Geophysical

Union Meeting in San Francisco, on 10–11 December 1993, the message was that the sea surface temperatures in the tropics were indeed 5 °C lower than today. Can CLIMAP be wrong?

The evidence comes from corals around Barbados (T. P. Guilderson, Lamont-Doherty Earth Observatory), and matches the cooling (4–7 °C) estimated from terrestrial evidence of lower snowlines and changes in ancient patterns of vegetation at mid- to high elevations. Other marine proxies have indicated less than 2 °C cooling of the tropical ocean, creat-

ing a discrepancy between marine and terrestrial indicators of tropical climate too large to be attributed to estimation errors.

One way to explain the discrepancy would be if the lapse rates (the changes of air temperature with height, assumed to be the same as today) had in fact been steeper in the past. At the conference, this idea was effectively scotched, at least for southwestern North America. The noble gas content of glacial-age aquifers from heights of 200 and 2,000 m indicates that lapse rates in this region were unchanged (M. Stute, Lamont-Doherty Earth Observatory).

The magnitude of change in the tropics is more than a curiosity, for it provides an essential measure of the sensitivity of the

OBITUARY

Lewis Thomas (1913–93)

LEWIS Thomas, the physician, scientist and educator who died on 3 December last year, was one of the foremost essayists of our time. His column, *Notes of a Biology Watcher*, serialized in *The New England Journal of Medicine*, and published as *The Lives of a Cell* in 1974, brought him acclaim far beyond the medical profession and earned a National Book Award in Arts and Letters. Thomas's long career brilliantly combined the two cultures of art and science.

He was born in Flushing, then a quiet suburb of New York City, where he often accompanied his father, a physician, on his daily rounds. It was here that he learned the art of medicine — but of science, as he so often noted, there was precious little. A graduate of Princeton University (where, in 1986, a biomedical laboratory was named after him), he went on to Harvard Medical School and left there in 1937 eager for a career in biomedical science. When war was declared against Japan, Thomas joined The Rockefeller Hospital Naval Unit, served in Guam and later landed on Okinawa clutching a box of fifty mice that would help identify the Japanese B encephalitis virus present on the island. Returning home, he embarked on a medical and scientific career that was as dazzling as it was diverse.

At various times, Lewis Thomas held chairs of paediatrics, pathology, microbiology and medicine. To him they were not different disciplines but all wonderful opportunities to explore the pathogenesis of disease and the mysteries of human biology. Wherever he went and however burdened by administrative responsibilities, whether as dean of the medical school at Yale, or as president of the Memorial Sloan-Kettering Cancer Center, he always

had his own small laboratory where he could dream and puzzle over the significance of bacterial endotoxins and of mycoplasma, problems in microbiology and immunology that particularly interested him. Perhaps his most imaginative conceptual

Lewis Thomas, a poet laureate and statesman of science.

leap was that of immune surveillance, an idea that was popularized by Sir MacFarlane Burnet. It is not fully elaborated, but is central to our understanding of many immunological diseases including cancer and AIDS.

In 1954, Thomas became professor of pathology at New York University School of Medicine, and built an outstanding department there. Emphasizing both research and training, he inspired many younger associates who would rise to positions of great distinction (one of them, Baruj Benacerraf, would receive a Nobel prize). Thomas served on many academic and government

advisory committees, including the President's Scientific Advisory Committee, and to all this work he brought a scholarly viewpoint, a perceptive eye and immense goodwill.

As a spokesman for science, Thomas also had the rare ability to transmit the spirit and wonder of science to those for whom it is not a primary concern. A supporter of the Gaia hypothesis, it was his conviction that the Earth is ultimately sustained by coherence, cooperation and complex self-regulatory systems — as he put it, "the earth is a sort of immense organism".

As well as *The Lives of a Cell*, translated into eleven languages, his published essays include *Medusa and the Snail* (1979), *The Youngest Science* (1983) and *Late Night Thoughts on Listening to Mahler's Ninth Symphony* (1983). His last book, published in 1992, was entitled *The Fragile Species*. His books and graceful writings have enriched the lives of countless people, young and old, for they are enchanting essays that not only inform us but make us more optimistic about the world. Thomas was a member of the National Academy of Sciences, The American Philosophical Society and the American Academy of Arts and Sciences, and received more than 20 honorary degrees, not only in science but in law, literature and music.

In 1993, The Rockefeller University established The Lewis Thomas Award to "honor the scientist as poet". Small wonder that Lewis Thomas, a poet laureate and statesman of science, should receive the first award.

Alexander G. Bearn

Alexander G. Bearn is at The Rockefeller University, 1230 York Avenue, New York, New York 10021, USA.