Stem Cell Research Needs United Support

THE CONTROVERSY OVER THE USE OF HUMAN embryonic stem cells has received renewed public attention as the current administration debates whether to allow federal funds for this biomedical research. Scientists naturally worry that federal guidelines will be overturned and researchers will be barred from the use of federal money. In their Editorial "Disappearing stem cells, disappearing science" (27 Apr., p. 601), Irving L. Weissman and David Baltimore address the implications that such a reversal would have and highlight the reasons for scientists' concern.

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As the Editorial indicates, this research has vast potential with regard to human health issues. On the policy side, however, there is room for improvement. Clear National Institutes of Health guidelines are crucial to allow scientists to proceed with pluripotent stem cell research, which offers hope to millions of U.S. citizens who suffer from debilitating and deadly diseases. Such guidelines would provide appropriate public oversight for stem cell research and offer the best assurance that the research will be of the highest quality. Congresswoman Carolyn Maloney (D-NY) and I have introduced a resolution expressing the sense of Congress that federal funding for pluripotent stem cell research should be allowed to move forward (*1*).

As a community, scientists have a great deal of influence, but only if they choose to wield it. Both politicians and the public need to hear from the scientific community: I urge you to speak out. Together, we can find support for this research and forge policies that recognize the moral, ethical, and societal concerns without handicapping the science.

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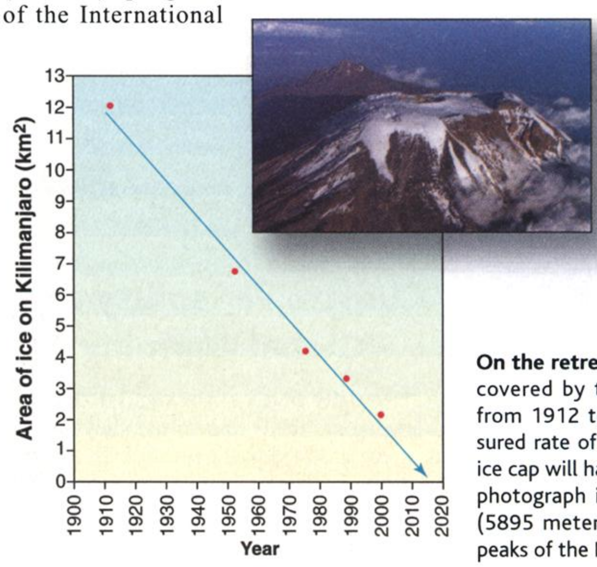
A Global Paleoclimate Observing System

A MAJOR OBSTACLE TO PRODUCING RELIABLE predictions of climate change and its impacts is a lack of data on time scales longer than the short instrumental record. Recently initiated climate observation programs will need to be continuously operated for at least 50 years before they begin to provide information that is relevant to this problem. In contrast, natural archives of past climate variability can provide relevant information now. Unfortunately, some of the most valuable paleoclimate archives are being rapidly destroyed, largely as a result of human influences (see the related News of the Week article in this issue by Koenig). We cannot afford such an irreversible loss. The Past Global Changes (PAGES) program of the International Geosphere–Biosphere Programme therefore calls for scientists, funding agencies, and institutional partners to establish immediately a coordinated international Global Paleoclimate Observing System (GPOS) to complement the Global Climate, Terrestrial, and Ocean Observing Systems (GCOS, GTOS, and GOOS, respectively) that focus only on contemporary observations.

An example of the loss of paleoarchives is the rapid retreat of alpine glaciers in the tropics and temperate latitudes. Ice cores from such glaciers have been used to reconstruct temperature, precipitation, and atmospheric dust levels, and to provide records of changes in the strength of the Asian monsoon and El Niño–Southern Oscillation (*1*). As shown in the figure, the total area of the summit glacier on Mt. Kilimanjaro decreased by 82% between 1912 and 2000. Soon, the only information left from the Kilimanjaro ice will be what is contained in the cores extracted last year and stored in freezers at Ohio State University. The situation on Kilimanjaro is not unique. Tropical warming is causing the rapid retreat of ice caps and glaciers at high elevations in the tropics and subtropics around the world (*2*).

A second example of paleoarchives that are being lost is the widespread damage to tropical corals. Measurements in corals have been successfully used to reconstruct sea surface temperature, salinity, and the surface circulation of the tropical oceans for the past several hundred years, and for isolated windows in the more distant past (*3*). Large living corals (more than 100 to 200 years old) suitable for climate reconstruction purposes are relatively rare in most reef areas of the world. These



On the retreat. The plot shows the total area covered by the ice cap on Mt. Kilimanjaro from 1912 to the present. Should the measured rate of retreat continue unchanged, the ice cap will have vanished by around 2015. The photograph is the view southeast over Kibo (5895 meters) and Mawenzi (5149 meters) peaks of the Kilimanjaro massif.

CREDIT: CAPTAIN G. MAZULA

corals are under intense pressure from a myriad of localized stresses related to coastal development and population pressure. In addition, widespread bleaching and mortality of corals are occurring with increasing frequency as the consequences of rising temperatures. Furthermore, studies indicate that corals and other calcifying marine organisms are subject to geochemical stresses from rising CO_2 concentrations in seawater (*4*).

Another biological source of paleoclimate records are tree rings, which have the potential to yield information on many aspects of tropical climate, from the Asian monsoon and El Niño to the factors controlling the storage of carbon in tropical forests (*5*). The use of tree rings from tropical trees is relatively new, but is moving into the phase where continental-scale collections must be made and analyzed. Massive felling of the commercially valuable timber of old-growth timber such as teak raises the possibility that, by the time scientists are able to sample them, many of the old trees containing the most valuable information will already have been sent to the sawmills.

Paleoarchives provide a wealth of information about past variability of the climate system relevant to future concerns. Thus, we call for an internationally coordinated effort designed to rescue endangered natural archives of past environmental variability and initiate large-scale observational and experimental campaigns to investigate the processes recorded in these natural archives.

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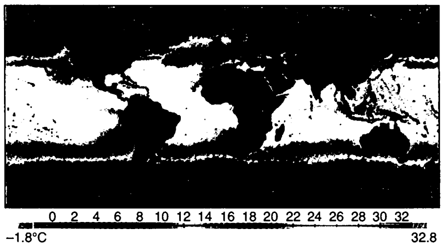
Climate Variability and Global Warming

ALTHOUGH UNCERTAINTIES IN GLOBAL warming are many and varied, they are not as great as stated in the recent U.S. National Research Council (NRC) report (*1*). As Richard A. Kerr notes in his News of the Week article, President George W. Bush seized upon these uncertainties to justify the administration's limited response ("Bush backs spending for a 'global problem,'" 15 Jun., p. 1978). Specifically, Bush "emphasized that the contribution of natural climate variability to the past century's warming is uncertain," to quote Kerr.

Unfortunately, in the NRC report, two aspects of natural climate variability are conflated. First, there is natural variability that is tied to external forcings, such as variations in the Sun, volcanoes, and the orbital variations of Earth around the Sun. The latter is the driving force for the major ice ages and interglacial periods. Second, there is natural variability that is internal to the climate system, arising, for instance, from interactions between the atmosphere and ocean, such as El Niño. This internal variability occurs even in an unchanging climate.



Sea surface temperature anomalies recorded in maps such as this color-enhanced one from 23–26 June 2001 reveal El Niño events, which are part of a natural variability that is internal to Earth's climate system.

CREDIT: NOAA/NESDIS

In the NRC report and in its summary, natural variability is said to be "quite large," but both kinds of variability are treated as if they are internal. Glacial to interglacial swings are discussed without mention of the known causes. Several lines of evidence, from the instrumental and paleoclimate records (*2*) and from climate models (*3*), strongly suggest that the recent increase in global mean temperature is beyond that possible from internal processes and thus must be caused by an increase in heating. This reasoning also puts limits on how large aerosol cooling could be. Further, known causes such as changes in the Sun and volcanic activity in the past 50 years have, if anything, led to cooling in this interval, leaving only the human-caused increase in greenhouse gases as the culprit. This reasoning has also been quantitatively confirmed with climate models (*3, 4*).

A consequence of mistreatment of natural climate variability in the NRC report is that the caveats are overstated. Natural climate variability is dealt with much more thoroughly in the recent Intergovernmental Panel on Climate Change (IPCC) assess-