100 YEARS AGO

Among many other papers in the *Proceedings* of the Indiana Academy of Science, dated 1894, but only just received, is one by Mr. D. T. MacDougal, showing that various species of Cypripedium have an irritant action upon the human skin. It was found that when the leaves of *C. spectabile* were rubbed lightly upon the skin of the wrist, arm, face, or ear, the person experimented upon was usually "poisoned" in a degree corresponding to the manner of application, and in a time varying from ten to twelve hours. There could be no doubt about the unpleasant effects produced by the leaves, for Mr. MacDougal soon found that he could not obtain subjects willing to sacrifice their feelings upon the altar of scientific knowledge. … To ascertain whether the effect was due to the mechanical injury resulting from piercing the skin by the pointed hairs upon the leaves, or to the corrosive action of the secretion found on the outside of the globular tips of the glandular hairs … the hairs of each kind were taken from the leaf by means of a fine pair of forceps, and the tip pressed against the skin. Irritation was found to result from the contact of the glandular hair only.

From *Nature* 2 September 1897.

50 YEARS AGO

It is common knowledge that open coal fires radiate only a small fraction of the heat available from bituminous coal, most of the rest being carried up flues to the outside air. In many countries climatic conditions or the need for thrift enforce various means to avoid waste of fuel. Independent stoves are placed in living-rooms or heat is distributed throughout buildings by means of warm water or air propelled either mechanically or by gravitational action. To-day circumstances are compelling Britain increasingly to adopt similar methods. The growing use of closed stoves is a familiar example whereby 65 per cent of the heat of combustion can be distributed in a simple manner, at the cost of losing, wholly or partly, the heating by radiation from the glowing fuel. … The widespread construction of new houses offers advantages in such methods, advantages which are being taken.

From *Nature* 6 September 1947.

Climate change

Icy message from the Antarctic

Eugene Murphy and John King

Historically, much of the whaling in the Antarctic occurred in the vicinity of the ice edge where the whales congregated to feed on krill. During the austral spring, the whalers tracked the animals as they moved south with the edge of the sea ice, and their records of harvesting position thus provide proxy data for ice extent before monitoring by satellite began. An analysis of those records by de la Mare, published on page 57 of this issue[1], suggests that there was a large and rapid decrease in Antarctic summertime sea-ice extent between the 1950s and 1970s. The cause of this inferred decrease is unknown. But it will be sadly ironic if the human slaughter of the great whale populations reveals something of the Earth's climate system that may have dramatic implications for our own long-term future on the planet.

Such a change in sea-ice extent would have global significance, because ice cover of the polar oceans is an important component of the Earth's climate system. It exerts strong controls on the exchanges of energy between atmosphere and oceans at high latitudes. Sea ice has a higher albedo than the open ocean and thus modifies the energy balance of polar regions. It also acts as an insulating blanket, reducing the transfer of heat from the underlying oceans to the cold polar atmosphere.

These processes introduce a positive feedback into the climate system, making the climate naturally variable in polar regions and, potentially, making them particularly sensitive to changes in forcing such as those caused by increasing anthropogenic emissions of greenhouse gases. From the data available so far[2], and some modelling studies[3], it seems that the Antarctic sea ice may be relatively insensitive to climate change compared with that in the Arctic, because of different potential physical feedbacks. But we know so little, and any evidence that can contribute to the debate is of great value.

Much of our thinking on the stability of Antarctic sea ice is based on the comprehensive observations of its extent that have been available only since 1973, when satellite monitoring began. That record[2] does not reveal any significant overall trend, but it does show a great deal of regional variability[4,5]. Such behaviour makes it difficult to reconstruct overall Antarctic sea-ice coverage, and de la Mare has been careful to address this problem by including confounding effects in his statistical analyses.

There is little other information with which to compare his conclusions. Work[6] published in 1981, based on the first few years of satellite data and earlier ship-based records, suggested that there was only a modest decline in summer sea-ice extent. Regional studies can give a very different view. Earlier this year, for example, a detailed analysis[7] of the sea ice in the Bellingshausen Sea area to the west of the Antarctic Peninsula highlighted the coupled nature of the ocean–ice–atmosphere system generating the variation, and found that there has been a reduction in sea-ice extent in the past couple of decades.

One of the expected consequences of a summer sea-ice retreat would be an increase in atmospheric and oceanic temperatures at high latitudes, yet a study[8] of Southern Ocean sea-surface temperatures measured by Japanese whaling ships failed to detect any significant warming in the 60 °S–70 °S latitude band over the period 1946–84. However, if the whalers followed the ice edge, and hence remained in waters of a similar temperature, then the observation is not inconsistent with a southward shift in sea ice.

Of other approaches, climate-model experiments[9,10] involving reductions in sea-ice extent or percentage cover indicate the consequences of small warmings and increased precipitation over continental Antarctica, along with increasing wind stress which could affect the strength of the Antarctic Circumpolar Current and other aspects of the ocean circulation. The relevant data are again limited. Temperature records from most Antarctic stations show small (and generally statistically insignificant) warming trends[11]; and the growing evidence[12] that there have been increases in precipitation in parts of Antarctica over the past few decades cannot yet tell us much about the larger-scale and longer-term picture.

Sea ice might have a further effect on ocean circulation through its possible role in the formation of so-called bottom water. As sea water freezes, brine-rich water is rejected and sinks to form a dense water mass over the continental shelf. Subsequent mixing of this water with surrounding water masses produces Antarctic Bottom Water (AABW), which is a major component of the global deep-ocean circulation. The chain of processes leading to bottom-water formation is complex, but it is likely that a reduction in the rate of winter sea-ice production would affect it.

In this context, a 1996 analysis[13] of the characteristics of the AABW entering the Argentine Basin has indicated that there are changes between years, which are penetrating to lower latitudes and may therefore

BRITISH ANTARCTIC SURVEY

Figure 1 **Has the whales' tale got a sting in it — that of a large and rapid decrease in Antarctic summer sea-ice coverage in the mid-twentieth century?**

affect global climate. These effects have been explained by changes in the circulation pattern in the Weddell Gyre where much of the AABW is formed. The improvement of sea-ice models, and the representation of processes occurring in the Southern Ocean in general, remain a priority for climate modellers.

The main value of de la Mare's work is in further highlighting the issue of the mechanisms involved in generating variation and potentially rapid change in the Southern Ocean. It is ten years since Broecker[14] pointed out that we should expect "Unpleasant surprises in the greenhouse" as a result of rapid changes in climate systems. There is now increasing evidence globally supporting the view that such rapid changes in the Earth's climate systems can occur naturally, and indeed such changes have probably taken place in the past in the Southern Ocean[15].

This evidence indicates that the variability inferred by de la Mare may be natural and not connected to any human-induced changes. But as yet we do not know. With the characterization[4,5] of the spatial and temporal coherence of the interannual and subdecadal cyclicity of the sea ice, ocean and atmosphere in the Southern Ocean, variability in physical and ecological systems has rightly become the subject of a great deal of research attention. In particular, the question of whether there are several steady states between which these systems can jump needs to be addressed sooner rather than later.

Is there a message in all this for the management of large ecological systems in general, and the whales of the Southern Ocean in particular? Perhaps, but we may find it unpalatable. The decline in Antarctic sea ice, inferred by de la Mare, occurred at the time of the final reduction in whale numbers. There could therefore have been irreversible shifts in this system and the recovery of whale populations to pre-exploitation levels may not now be possible. There may well have been dramatic changes in the rest of the ecosystem, for instance in the pattern of primary production, krill recruitment and the distribution and abundance of higher predators. We might just have to accept that rapid changes can occur, making the management of marine systems a short-term task in which we must be prepared to manage change rather than expecting to maintain a status quo. Setting out the criteria for management in such circumstances will be an interdisciplinary task, and a challenge for both scientists and politicians. □

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Epidemiology

A human germ project?

John Danesh, Robert Newton and Valerie Beral

Infectious agents that lead to chronic diseases or cancer tend to persist silently for many years before causing disease in a small proportion of their hosts. There is now much interest in the possible link between coronary heart disease and one such infectious agent, *Chlamydia pneumoniae*, an intracellular bacterium. Studies published in the *Lancet*[1] and in *Circulation*[2] report the first randomized trials of antibiotics in the prevention of coronary heart disease. Their findings — that antibiotics with activity against *C. pneumoniae* may prevent further heart attacks in people suffering from heart disease — were based on only a small number of patients, so they are prone to chance fluctuations. But these studies have prompted the start of large-scale clinical trials, and they highlight a larger trend in clinical research, towards the identification of new associations between common infectious agents and chronic disease (Table 1, overleaf).

Interest in infections as potential causes of human cancer and other chronic disease has waxed and waned for almost a century, since F. P. Rous demonstrated the carcinogenic effects of chicken sarcoma virus. The search for human 'cancer viruses' intensified in the 1960s, culminating in President Nixon's National Cancer Act in 1971. But only limited success followed and, by the early 1980s, interest began to fade. In retrospect, progress may have been hindered by technical limitations. Now, molecular technologies such as the polymerase chain reaction (PCR) can both identify previously unrecognized infections and indicate the presence of recognized organisms in unexpected tissues. And epidemiological methods, such as large observational studies and clinical trials, provide a way of distinguishing between causal and coincidental associations.

Microbiologists have traditionally tried to isolate and then multiply organisms in culture. But only a few per cent of all bacteria and viruses can be cultured by standard methods[3], so this approach has revealed only a small sample of microbial life. Instead, improved microscopy has opened new possibilities: the Epstein–Barr virus (Table 1) was discovered in 1964 when it was directly seen by electron microscopy (EM) in cells from Burkitt's lymphoma; EM studies indicated the presence of curved bacteria in stomach mucosa nearly a decade before the viability of *Helicobacter pylori* was established by culture[4]; and herpesviruses and *C. pneumoniae* were first detect-