No clear forecast for climatic stage

How global warming will affect weather conditions is a question that matters to everybody, says
s ananthanarayanan

Pedro N DiNezio.

Jessica E Tierney.

THAT the weatherman cannot be relied upon to say if the rest of the day will be good as the morning is a slur that the weather forecast community has become used to. But the weather is still vital to commerce and industry and it is thanks to the weatherman's watch that international shipping, airlines, power supply and food production are able to function. And, by extension, the survival of social and ecological systems would depend on making the right moves in response to global warming.

Predicting the weather is difficult because of the huge number of factors. The *butterfly effect*, a concept in *chaos theory*, is a case of how a very slight action (a butterfly flapping its wings) could have enormous effects on the weather at the other end of the world. And still, the world's weather-watchers collect and share wind and temperature data of almost the entire globe to get the right trends and help bustling citizens get through the day. But doing the same thing to predict the climate of a region a century from now not only has more uncertainty but would also have more serious consequences. Pedro DiNezio of the University of Hawaii and Jessica Tierney of Woods Hole Oceanographic Institution, Massachusetts, report in the journal *Nature Geoscience* their work to verify which of the current models of climate change fit the changes in climate during ups and downs in earth's geological past.

DiNezio and Tierney consider the behaviour of the body of warm water stretching along the equator from the Indian Ocean, through the waters off Sumatra, Java, Borneo and New Guinea to the western Pacific Ocean – an area called the *Indo-Pacific Warm Pool*, the weather dynamo that dominates the tropics. The surface temperature in this area is now at a warm 28? Celsius and it sustains ocean and wind currents that make for ample rainfall and low salinity, hence density. And variations, which bring about effects like *El Niño* or the *Southern Oscillation*, have an impact on climate worldwide.

This balance, which has been established in the IPWP, is likely to change under external forcing, such as global warming. What these changes may be and how it would affect world climate is of evident importance. There are many ways of considering what the changes may be. One of the features of the IPWP, and a driving force for much of the world's weather, is that the warm surface temperature creates a "temperature slope" and cool water is pushed down to "well up" at other places. This effect is likely to get stronger with global warming, or weaken with cooling. But studies have shown that it is not that simple and there are other factors of equal importance. Different rates of change in rainfall and moisture as a result of warming, for instance, would weaken the seawater circulation, to keep the balance. On the other hand, rainfall may increase in areas that are moisture-rich, as a result of warming – a case of "wet-get-wetter".

These are the geology-weather features that are all made use of in modelling the climate behaviour, both of past periods as well as the future. But they remain the subject of conjecture as none of them has been tested because historical records do not have the extent of data to observe and pinpoint the difference in changes brought about by forcing, such as warming or cooling.

DiNezio and Tierney made use of the data of the *Last Glacial Maximum*, a period between 25,000 and 19,000 years ago, when ice sheets covered much of the continents and there was a dramatic drop in sea levels. Naturally, this resulted in more land being exposed and there was a profound impact on climate. Data regarding water levels, salinity and temperature during the period is captured in geological or biological records – the so-called *proxy data* – that allows for testing of the different climate models. Land-based proxies used included *speliothems*, which are mineral deposits in caves, charcoal, the abundance of plant material, lake levels or the nature of the beds of dried lakes.

The content of radioactive oxygen in these snapshots of the periods when they were formed indicate the level of the isotope in seawater and in rainwater, to show relative abundance. Salinity levels were assessed by derivation from seawater data or from plankton fossil data. The collection of data resulted in a network of 53 land locations representing 61 proxy records of rainfall and 54 locations of the sea, representing 66 proxy records of sea surface salinity.

Using the pattern of changes recorded in the *proxies*, DiNezio and Tierney tried out how well they compared with the results of the 12 recognised models of the Last Glacial Maximum climate changes. Rigorous statistical methods were necessary, as also careful selection of what simplifications to make in the comparisons. A method to see how well the model and the data of the proxies compare is the *Cohen kappa statistic*. This method is used, for instance, to see how equally two examiners rate a given performance. Given sufficient data, agreement of the ratings in a good number of cases would validate the process. This could be used, for instance, when different examiners are needed to rate a large numbers of samples, like student projects. With a sample of projects that are given to two or all examiners, one could check for uniformity of the rating, or even decide on a factor by which to equalise their standard of marking.

The result of the exercise, remarkably – or, perhaps, significantly — was that only one of the 12 models corresponded with the data of the proxies. This model was the HadCM3, or the Hadley Centre Coupled Model No 3, a coupled *Atmospbere-Ocean General Circulation Model* developed at the Hadley Centre in the UK. The result of the HadCM3 simulation is that with the effect of a landmass that was exposed with falling sea level, it was the sea level, and that means the ice sheet extent, which was the first driver of climate. The result has its importance not in this fact – for the mechanism is not transferable to a global warming picture and we do not expect that it is sea level variation that will be the driver of tropical circulation change. But the value of the result is that it brings home the fact that mechanisms at work are not simple and, in the words of the authors, "the fact that only one out of the 12 models simulates a response in Last Glacial Maximum hydroclimate in agreement with the proxies presents a clear challenge for model simulations of tropical climates, both past and future, and also reflects the fact that both proxies and models are highly uncertain renditions of climate history. A multi-proxy, multi-model approach is arguably the most effective way to both understand past climates and improve future climate change projections".

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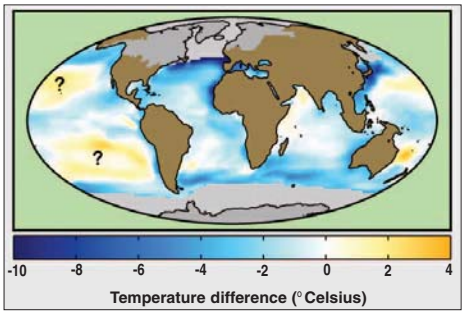


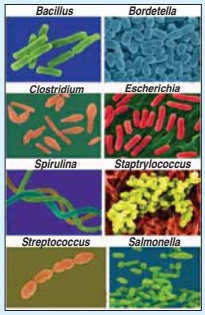
Some of the primary results of the Climate: Long range Investigation, Mapping and Prediction project undertaken in the 1970s and '80s. Shown is the outline of the continents after a sea level reduction of 130 metres, the positions of continental ice sheets and winter sea ice, and the change in sea surface temperatures across the oceans. All three of these are depicted as they are believed to have appeared roughly 18,000 years ago during the Last Glacial maximum of the present ice age. The average cooling of oceanic areas not covered with sea ice is 1.75° Celsius. On the basis of this and the distribution of ice sheets, it is estimated that earth as a whole cooled 3.0 ± 0.6° Celsius during the last glacial maximum (Hoffert and Covey 1992). As most of the climate change in the tropics during this time is believed to have been caused by natural changes in greenhouse, this estimate provides a constraint on the radiative forcing associated with those gases and helps to calibrate the amount of change that might be expected from global warming. The estimate of three degrees implies a climate sensitivity to carbon dioxide changes at the low end of the range proposed by the Intergovernmental Panel on Climate Change.

Characteristic features

tapan kumar maitra explains the transmission routes of microbes

DURING the development of the infectious process, microbes from the primary focus can enter the bloodstream and be carried through the whole body. This condition is known as *bacteraemia*; and during viral diseases as *virusaemia*. Bacteraemia occurs with enteric fever, paratyphoid, brucellosis and other diseases.

In a number of infectious diseases, *sepsis* or *septicaemia* (Greek: *septikos*, putrid; *haima*, blood) may occur with the infestation of many organs and tissues of the body by microbes (anthrax, plague, pyogenic and other septic diseases). Sepsis is characterised not only by the presence of pathogenic microbes and bacterial toxins in the organs and tissues but by reactive phenomena accompanied by the inflammation and degeneration of cells. A characteristic feature of sepsis is that it occurs in the same clinical picture independent of the species of causative agent, which makes it difficult to establish a diagnosis of the disease according to its clinical course. The septic process accompanied by the production of purulent foci in different organs and tissues is known as *septicopyaemia*.



Some pathogenic (toxigenic) microbes that have become embedded in the skin integuments, mucous membranes, tissues and organs act on the organism predominantly with their *exotoxins* (causative agents of tetanus, botulism, diphtheria). This is known as *toxaemia*. Bacteraemia, septicaemia, septicopyaemia and toxaemia are sometimes accompanied by different changes in the tissues, particularly in the skin (rashes of different morphology).

Pathogenesis of the infectious process (mechanism of the origin and development of the disease) depends not only on the mass of bacterial cells and toxins but also on the sum total of irritations caused by them. During hibernation of rodents (gophers, tarbagans, susliks, hamsters, bats, etc) all the life processes are slowed down, physiological depression ensues and a reactivity of all tissues and organs occurs. This provides for the resistance of animals to infection with pathogenic causative agents and tolerance to the action of different toxins.

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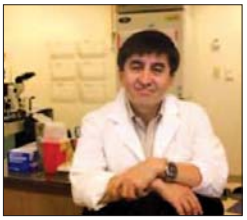
Breakthrough in human cloning

This raises hopes for treatment of Parkinson's, heart disease and a range of other debilitating disorders, writes steve connor



Shoukhrat Mitalipov.

SCIENTISTS have finally made the long-awaited breakthrough in human cloning by turning skin cells into early-stage embryos that were then used to create specialised tissue cells for transplant operations, it has been revealed. For the first time, researchers have unequivocally created human embryonic stem cells using the cloning technique that led to the birth of Dolly the sheep. However, unlike Dolly, the human embryos were destroyed when their stem cells were extracted.

This scientific milestone, which comes 17 years after the birth of Dolly, represents a major turning point in human cloning research which could now lead to new tissue-transplant operations for a range of debilitating disorders such as Parkinson's disease, multiple sclerosis, heart disease and spinal cord injuries.

However, the breakthrough will also raise serious ethical concerns about the creation of human embryos for medical purposes and the possible use of the same technique to produce IVF embryos for couples wanting their own cloned babies — which is currently illegal in the UK.

The scientists who made the advance emphasised that the work was designed to produce replacement tissue for transplant operations from a patient's own skin cells, rather than to improve the chances of so-called "reproductive cloning". However, other scientists said the achievement would inevitably bring the prospect of cloned babies a step nearer.

Generating a plentiful supply of embryonic stem cells from a patient's own skin cells has been one of the holy grails of medical science. Although the procedure has been achieved in laboratory animals — such as mice and monkeys — it has until now alluded several attempts on human material.

Shoukhrat Mitalipov, who led the research team at the Oregon Health and Science University in Portland, said that he added caffeine to his cell cultures to create viable embryonic stem cells from just a small number of human eggs. "It was thought that to make (it) work many thousands of human eggs would be needed. We were able to produce one embryonic stem cell line using just two human eggs which would make this approach practical for widespread therapeutic use."

"Our finding offers new ways of generating stem cells for patients with dysfunctional or damaged tissues or organs. Such stem cells can regenerate and replace those damaged cells and tissues and alleviate diseases that affect millions of people," Dr Mitalipov said.

In 2004, scientists led by the disgraced Woo Suk Hwang of Seoul National University claimed to have produced the first cloned human embryos, and later said they had extracted embryonic stem cells, but they were forced to retract the research after a scandal over fraudulent results and unethical practices.

Other researchers also claimed to have produced cloned human embryos but none had been able to show definitively that they could generate plentiful supplies of embryonic stem cells that could be converted in the laboratory into fully specialised tissue cells, such as beating heart muscle.

Dr Mitalipov made important technical advances that enabled the cloned human embryos to survive to the 150-cell stage, known as a *blastocyst*, when embryonic stem cells can be extracted for growing in the laboratory into specialised tissue cells, such as nerve cells or cardiac muscle.

"A thorough examination of the stem cells derived through this technique demonstrated their ability to convert just like normal embryonic stem cells, into several different cell types, including nerve cells, liver cells and heart cells," Dr Mitalipov said.

"Furthermore, because these reprogrammed cells can be generated with nuclear genetic material from a patient, there is no concern of transplant rejection. While there is much work to be done in developing safe and effective stem-cell treatments, we believe this is a significant step forward in developing cells that could be used in regenerative medicine."

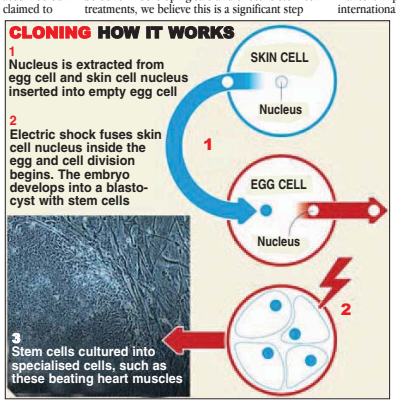
The research was directly aimed at generating embryonic stem cells for treating serious disorders from a patient's skin cells, and not at improving the chances of producing cloned babies, he said. "This is not our focus, nor do we believe our findings might be used by others to advance the possibility of human reproductive cloning."

However, David King, director of the pressure group, Human Genetics Alert, said, "Scientists have finally delivered the baby that would-be human cloners have been waiting for: a method for reliably creating cloned human embryos. This makes it imperative that we create an international legal ban on human cloning before any more research like this takes place. It is irresponsible in the extreme to have published this research."

Paul De Sousa of Edinburgh University said the breakthrough meant that a technique that was once considered impractical could now be used to generate plentiful supplies of human embryonic stem cells for future transplant operations. "They have shown it to be a very efficient procedure based on a relatively small number of eggs. It indicates that the procedure is clinically transferable. It's an important step," he said.

Professor Mary Herbert of Newcastle University, said, "Provided that the experiments are reproducible in the hands of others, the findings offer the potential to accelerate progress towards the development of patient-specific embryonic stem cells to treat a range of degenerative diseases."

The study is published in the journal *Cell*.



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