Abstractions

SECOND AUTHOR

No one knows much about the Arctic Ocean during the Late Cretaceous, a period between 65 million and 99 million years ago when carbon dioxide levels in Earth's atmosphere were higher than they are today. Yet an understanding of conditions during that time might provide scientists with insight into what lies ahead, as CO_2 levels rise as a result of increasing greenhouse-gas emissions.

From analysis of today's oceans, scientists had thought that phytoplankton growth during that era was fuelled by upwelling — the wind-driven movement of nutrient-rich water towards the surface. But Alan Kemp, a palaeo-oceanographer from the UK National Oceanography Centre at the University of Southampton, and his colleagues have found that one of the main types of phytoplankton, diatom algae, became adapted to grow in different layers of ocean temperatures. This stratification let them bloom in spring and through summer when sunlight warmed the sea's upper layers (see page 254). Kemp tells *Nature* more.

Why is this finding important?

We know that the ocean is again becoming more stratified, as it was during the Late Cretaceous. Climatically, that period is an analogue for a warmer time with higher levels of CO_2, a likely scenario in the near future. This evidence of adaptability from the Cretaceous-era diatom fossils could be a clue to how an ocean may behave in the future, with more diatom algae species that can adapt to stratification. Upwelling-adapted diatoms tend to be small and reproduce rapidly, whereas stratified-adapted diatoms are usually larger and grow more slowly.

What does this mean for ocean ecosystems?

There could be a shift in the dominant or more successful species of plankton in the ocean, which is significant because the diatom algae are at the base of the whole food chain. If there are changes in the location of the dominant diatoms, including where they are most abundant, it could affect the fisheries and the entire ecosystem.

Did you go to the Arctic Ocean to get sediment samples?

No. In 1983, a team of Canadian scientists recovered shallow cores from the area's sea bed; incredibly, one contained diatom-rich sediments about 70 million years old. The cores were curated at the Bedford Institute of Oceanography in Nova Scotia, Canada, whose staff let us take samples. We used scanning electron microscopy to identify the types of diatom in these cores. Several genera and even some species from the Cretaceous are still present in the modern ocean, enabling us to make links with that period. ■

MAKING THE PAPER

Neil Ganem

A defect in dividing cancer cells results in a chromosome tug-of-war.

As Neil Ganem spent many hours peering down a microscope in search of dividing cells, his adviser David Pellman at the Dana-Farber Cancer Institute in Boston, Massachusetts, would sometimes joke that he was "looking at his wife's teeth".

Pellman was referring to philosopher Bertrand Russell's words about Aristotle's assertion that women have fewer teeth than men: "Although he was twice married, it never occurred to him to verify this statement by examining his wives' mouths." Ganem was testing, by direct observation, a long-held assumption in cell biology — and, similarly to Aristotle's assertion, it turned out to be wrong.

Most cancer cells have extra centrosomes — small structures that control the formation of the mitotic spindle, which organizes and segregates chromosomes during cell division. Dividing cells normally have two centrosomes, one at each end of the cell, which pull chromosomes towards the poles. If everything works, the cell splits into two daughter cells with equal complements of chromosomes. But many cancer cells are chromosomally unstable, meaning that they often 'missegregate' their chromosomes.

Many scientists assumed that the extra centrosomes in cancer cells generated this instability by giving rise to multipolar cell divisions, resulting in three or more viable daughter cells with abnormal chromosome numbers. "But no one had looked to see if it was really happening," says Ganem.

Using a microscope equipped with an incubator, Ganem watched thousands of cells grow and divide, looking for those with multiple poles and following the fate of their daughter cells — sometimes getting motion-sickness in the process, he laughs.

He found that cells with extra centrosomes rarely produce multipolar divisions. And when they do, the daughter cells typically perish. Having established that extra centrosomes do not lead to chromosome instability through multipolar division, Ganem asked: "Do extra centrosomes contribute to instability at all?"

To address this, he was inspired by the work of his graduate adviser, Duane Compton of Dartmouth Medical School in Hanover, New Hampshire. In normal cell division, one copy of each chromosome attaches to each pole. But sometimes one chromosome copy attaches to both poles — a defect known as merotely. "If not corrected, the chromosome can get stuck in a tug of war, and sometimes ends up going to the wrong daughter," explains Ganem.

Compton showed that merotely was a major cause of chromosome missegregation in cells with chromosome instability. So Ganem decided to test whether having extra centrosomes leads to merotely. He created two sets of cells, one set with extra centrosomes and the other with two centrosomes as normal. Turning to the microscope again, Ganem and colleagues found that cells with extra centrosomes were much more likely to form merotelic attachments and missegregate their chromosomes (see page 278). "Having extra centrosomes is definitely a defect that promotes missegregation," says Ganem.

The finding raises several questions to follow up, such as where the extra centrosomes come from. But for now, Ganem, who undertook the study as a side project, will be turning his attention back to his main research — a genome-wide screen to identify novel tumour suppressors. ■

FROM THE BLOGOSPHERE

The Great Beyond blog recounts how the blogosphere and Internet search engines are being used to debate scientific claims. Reporter Lucas Laursen has been following the activities of several bloggers commenting on the case of UK science writer Simon Singh, who was sued by the British Chiropractic Association (BCA) for libel (http://tinyurl.com/m43bf3).

In *The Guardian* newspaper last year, Singh questioned the scientific validity of using chiropractic techniques to treat children with ailments such as colic and asthma, and chided BCA members for promoting the treatments. (For more on the case, see http://tinyurl.com/m4ejy2 and http://tinyurl.com/maruzn.)

The BCA has now released a list of 29 studies that it says "support the claims which Dr. Singh stated were bogus". But several bloggers, such as Martin Robbins on Lay Scientist (http://tinyurl.com/kj7268), have pointed out some of the list's failings. Laursen notes that some studies "failed to conform to the statistically powerful, randomised, placebo-controlled, double-blind standard to which many medical studies are subject". ■

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