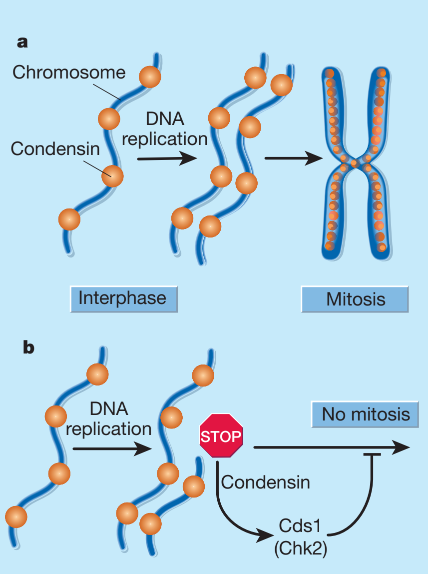

Figure 1 **Dual role of the condensin protein complex during the cell-division cycle.** a, **Condensin is a major component of chromosomes during mitosis (nuclear division; right), and is required for chromosomes to become more compact relative to the looser form they adopt in interphase (the period between nuclear divisions). However, Aono *et al.*[1] now show that some condensin is also present on interphase DNA (left).** b, **These authors find that, in interphase, condensin is important if chromosome replication is blocked. Normally, cells are then prevented from entering mitosis by a cellular response called the replication checkpoint (involving the Cds1/Chk2 protein), as shown here. But fission yeast with a mutation in condensin fail to activate this pathway and begin a fatal mitosis, even if replication is incomplete[1]. Condensin must therefore be important for monitoring chromosome replication.**

initiate a response pathway, the 'replication checkpoint' (Fig. 1b). This pathway will try to get replication going again, and will also prevent cells from dividing until replication is completed[6]. One component of this pathway is an enzyme called Cds1 (also known as Chk2), which is activated when replication stalls. But Aono *et al.*[1] find that their mutant yeast fail to trigger this response. Cds1 is not activated, and the cells enter mitosis even though DNA replication is incomplete — with fatal consequences. So condensin is apparently needed on interphase chromosomes to sense replication blocks and to switch on the replication checkpoint. To make things a little more complicated, the mutant condensin not only results in a failure to respond to replication blocks, but also seems to generate such blocks itself[1].

How does the condensin that is bound to interphase DNA work? Does its role in preventing and sensing replication blocks rely on its ability to help chromosomes to condense, albeit to a lesser extent than in mitosis? Or does it have a second, independent mode of action? Some remarkable hints about how condensin functions have come from *in vitro* studies[7], which showed that this complex can introduce twists in DNA that increase its tendency to fold back on itself. More recently, low-resolution images of the condensin complex have been obtained[8,9]. But the significance of these observations for mitotic chromosome condensation is unclear. And how condensin might help cells to prevent and recognize replication blocks is still more mysterious.

A question that might be easier to answer is whether condensin acts throughout the genome in interphase, or is recruited to specific sites at which replication is blocked or damage is encountered. So far, only a few DNA sites to which condensin binds during interphase have been characterized. One of them is the rDNA in budding yeast[10]. Such rDNA is a repetitive region of the genome that encodes the RNA of ribosomes — cellular protein-synthesizing machines. rDNA also contains sequences that stop DNA replication from moving against the direction in which genes are transcribed. Whether the binding of condensin to such natural replication barriers is related to its role in triggering the replication checkpoint remains to be seen.

Finally, yet another function of condensin during interphase has become clear recently. In fruitflies, condensin binds to chromosomal elements that regulate the transcription of neighbouring genes, and is required to keep these genes 'silent'[11]. Condensin mutants in budding yeast similarly fail to maintain the silent state of a gene that helps to dictate mating type[12]. Do these events reflect the diverse functions of a single complex, or different effects of a single function? Either way, it will be fascinating to work out the molecular mechanisms by which the condensin complex acts to safeguard and shape our precious blueprint — DNA. ■

Frank Uhlmann is at the Cancer Research UK London Research Institute, 44 Lincoln's Inn Fields, London WC2A 3PX, UK.
e-mail: frank.uhlmann@cancer.org.uk

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Daedalus

Brighter clouds

The evidence for global warming is patchy but alarming. By the time we know whether carbon dioxide is the villain it may be too late. Clouds are the natural reflectors of sunlight. Even a small improvement in their reflectivity would save us. An improvement might be made if the top layer of a cloud consisted, not of droplets, but of hollow bubbles about the same size. Each would then have four reflecting surfaces rather than two, and would reflect sunlight much better. A bubble, of course, is lighter than a droplet: so a cloud with both droplets and bubbles should have its bubbles concentrated at the top, just where they are needed. And once a bubble has formed, it won't seal into a solid droplet again. Desorbed air will get into the internal gas-space. Furthermore, says Daedalus, a trace of surface-active solute may form a stabilizing internal monolayer.

One of the sources of CO_2 is the flaring of natural gas that cannot be got to market. Daedalus wants to blow this waste into a detergent solution. With well-designed bubblers, this would produce a mass of bubbles each about the size of a cloud droplet. Methane is lighter than air, so these tiny bubbles would rise. With luck, they would join the world's clouds. A natural thermocline restricts the height of clouds, and should control their bubbly top layer too. Fortunately, the initial methane is only 'catalytic'. The bubbles will soon start to lose it by outward emission, at the same sort of rate as they gain air by absorption and water vapour by internal release. Water vapour, of course, is almost as light as methane. So in due course all the clouds in the atmosphere will be topped, not by water droplets, but by tiny bubbles.

This new cloud cover should reflect sunlight more efficiently than the old one. Even a minor programme of methanation will get the process going, and once methane bubbling has started in earnest, we should soon see the bubbly-top cloud layer growing. The speed and efficiency of the scheme will be confirmed by reflectance measurement from satellites.

Daedalus cannot guess the useful life of hollow cloud droplets. Like normal cloud drops, they may evaporate completely. Or they may accrete together and fall as a fizzy sort of rain. But with luck they should be stable enough, and last long enough, to reduce or reverse the menace of global warming. Luckily, little detergent need be introduced into the hydrological cycle. Last time, non-biodegradable detergents gave problems.

David Jones