Journal club

A RED LIGHT IN MITOSIS

Conly Rieder, one of the leading members of the mitosis community, closed his laboratory last year. He has left a big hole in the field, partly because of his larger-than-life persona, but more importantly because of the unique character of his science: designing deceptively simple experiments to give definitive answers to important questions. These aspects are beautifully illustrated in a paper from 1995 that, to me, is a classic in modern cell biology; its subject is the spindle assembly checkpoint (SAC), which prevents sister chromatid separation (anaphase) until all the chromosomes are attached to the mitotic spindle.

This paper followed on from the previous observation by the same laboratory that cells wait until all their chromosomes have attached to the spindle before they begin anaphase, and that even a single unattached

“
designing
deceptively
simple
experiments to
give definitive
answers to
important
questions”

kinetochore is sufficient to delay sister chromatid separation. Two models could account for this observation: either a positive signal is generated when all the chromosomes are attached to the spindle, or unattached chromosomes generate a signal to prevent sister chromatid separation. Rieder *et al.* provided an answer by using live-cell microscopy to identify rat kangaroo PtK1 cells in which just one sister chromatid had yet to attach to the spindle. They chose PtK1 cells because these cells have 11 chromosomes, making it possible to see how many chromosomes are attached to the spindle, and to visualize the central constriction of the chromosome containing the kinetochore, which is the multiprotein complex that binds to microtubules. Once they had located such a cell, the authors used a laser to ablate the central constriction on the last unattached chromatid and thereby to destroy the unattached kinetochore. As a result, this cell separated its sister chromatids about 23 minutes later, which is about the same time as it normally takes for a cell to begin anaphase after all its chromosomes have attached.

Thus, this study provided a clear answer: a single unattached chromosome is able to prevent sister chromatid separation by generating a signal to ‘stop anaphase’. The nature of this signal is now gradually being elucidated by a combination of yeast genetics, biochemistry and molecular and structural biology, but I do not think any of these papers will quite match the impact of the paper from Rieder *et al.*: solving an important question by zapping a single chromosome with a laser — how cool is that?

Jonathon Pines
The Gurdon Institute, Tennis Court Road,
Cambridge CB2 1QN, UK.
e-mail: jp103@cam.ac.uk

The author declares no competing financial interests.

ORIGINAL RESEARCH PAPERS

Rieder, C. L. *et al.* The checkpoint delaying anaphase in response to chromosome monoorientation is mediated by an inhibitory signal produced by unattached kinetochores. *J. Cell Biol.* **130**, 941–948 (1995) | Rieder, C. L. *et al.* Anaphase onset in vertebrate somatic cells is controlled by a checkpoint that monitors sister kinetochore attachment to the spindle. *J. Cell Biol.* **127**, 1301–1310 (1994)