

Journal club



NEW TEMPTATIONS IN SMC RESEARCH

“Life offers you many tempting projects. Try many, but focus eventually if you don’t want to get stuck.” This is what my mother used to say, and I have found the advice applicable for scientific endeavours as well. At some point the focus will change, however, and such a transition is underway in the field of SMC (structural maintenance of chromosomes) complex research.

SMC complexes were recognized early on for their essential role in chromosome segregation. But the number of so-called non-canonical functions is steadily increasing, and SMC complexes have now been reported to function in DNA repair, transcription and replication. This shifts the focus from “what does an SMC complex do?” to “how can a few structurally similar complexes be connected to so many, apparently different processes?”. There are, of

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course, numerous excellent publications that contribute to this transition, and the following four papers regarding the SMC complex cohesin make up a particularly telling entity.

The most established function of cohesin is in sister chromatid cohesion, which allows correct chromosome segregation. In 1998, Uhlmann and Nasmyth provided the first evidence that cohesin is created during replication. Intriguingly, more recent work by Guillou *et al.* indicates that cohesin also controls replication. A similar reciprocity is found for cohesin and transcription: Lengronne *et al.* showed that transcription regulates the chromosomal localization of cohesin in yeast, and Wendt *et al.* found that human cohesin controls transcription. In moments of enthusiasm, an exciting new picture unfolds, with cohesin acting as a chromosome organizer that mediates a crosstalk between replication and transcription. On more critical days, my conclusion is that much more

information is needed before the picture becomes clear. However, other SMC complexes have also been found to have roles in transcription, replication and chromosome segregation. As DNA is the common denominator of all SMC-handled processes, a key to SMC function might lie within structural changes in the DNA double helix. Regardless, the focus of SMC research is changing, and new temptations are waiting.

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ORIGINAL RESEARCH PAPERS Uhlmann, F. & Nasmyth, K. Cohesion between sister chromatids must be established during DNA replication. *Curr. Biol.* **8**, 1095–1101 (1998) | Guillou, E. *et al.* Cohesin organizes chromatin loops at DNA replication factories. *Genes Dev.* **24**, 2812–2822 (2010) | Lengronne, A. *et al.* Cohesin relocation from sites of chromosomal loading to places of convergent transcription. *Nature* **430**, 573–578 (2004) | Wendt, K. S. *et al.* Cohesin mediates transcriptional insulation by CCCTC-binding factor. *Nature* **451**, 796–801 (2008)