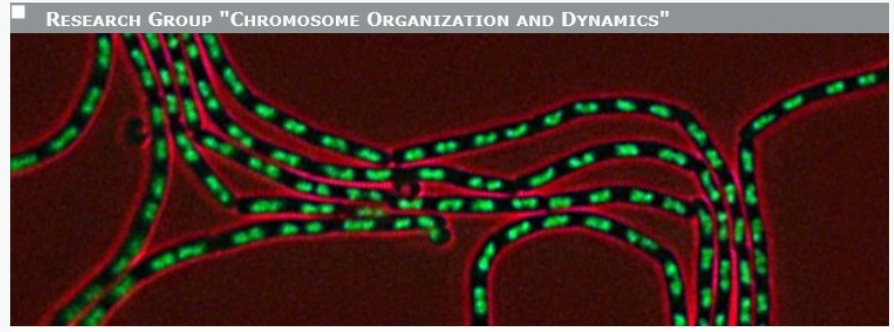


Stephan Gruber

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Chromosome Organization and Dynamics

How do chromosomes take shape?

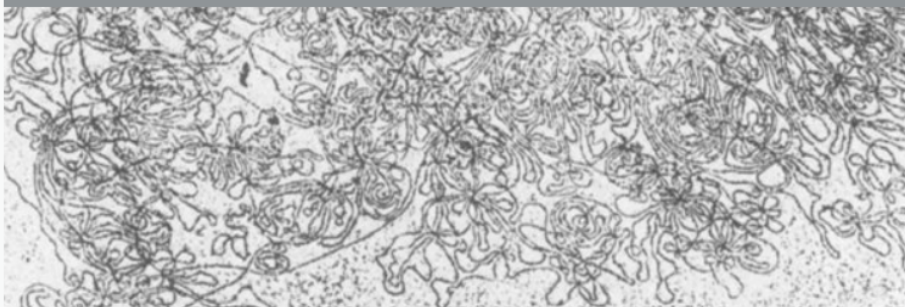
Failures in chromosome segregation give rise to cells or gametes with abnormal numbers of chromosomes. Aneuploidy is a common cause of genetic disorders and aneuploid cells likely serve as precursors in the development of many cancers, highlighting the importance of genome maintenance.

A set of structural maintenance of chromosomes (SMC) protein complexes help transform chromosomes into distinctive, compact shapes during mitosis allowing them to be faithfully segregated before cell division. Cohesin specifically links sister chromatids together. Condensin is thought to preferentially or exclusively build intra-chromatid tethers thereby promoting length-wise condensation of chromatids. Our lab is studying the bacterial and archaeal ancestor of cohesin and condensin, called **prokaryotic SMC complex** or **Smc-ScpAB**, with the aim to shed light on fundamentally conserved aspects of the structure and biochemical mechanism of action of SMC protein complexes.

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RESEARCH



What holds a chromosome together at its core?

Chromosomes contain up to a few billion nucleobases that are spliced into extraordinarily long, interwound strands of DNA. Before a cell divides, these tangly molecules must be confined to (much) less than half of the volume of the cell and fully separated from their identical copies. SMC protein complexes form highly elongated, **ATPases** with a ring topology that play key roles in the shaping of chromosomes in all branches of life. **Condensin** is pivotal for the striking reorganization of chromosomes during mitosis and ensures timely separation of sister chromatids during anaphase. Similarly, in bacteria **Smc-ScpAB** promotes efficient segregation of chromosomes in rapidly dividing cells, presumably by compacting and resolving sister DNA molecules.

Our goal is to uncover basic mechanisms by which molecular machines help to disentangle and compact giant chromosomal DNA molecules to enable their proper segregation. We are focussing on the molecular architecture, biochemical activity and cellular function of SMC protein complexes using for most of our studies bacteria and yeast as tractable model systems.

For our research we are utilizing live cell imaging, chemical biology, biophysical analysis of protein-DNA interactions, structural biology and chromosome conformation capture, which represent a powerful combination of methods to investigate the biology of chromosome dynamics.

ARCHITECTURE OF PROKARYOTIC CONDENSIN



Model of chromosomal DNA entrapped by prokaryotic condensin rings.

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CURRICULUM VITAE



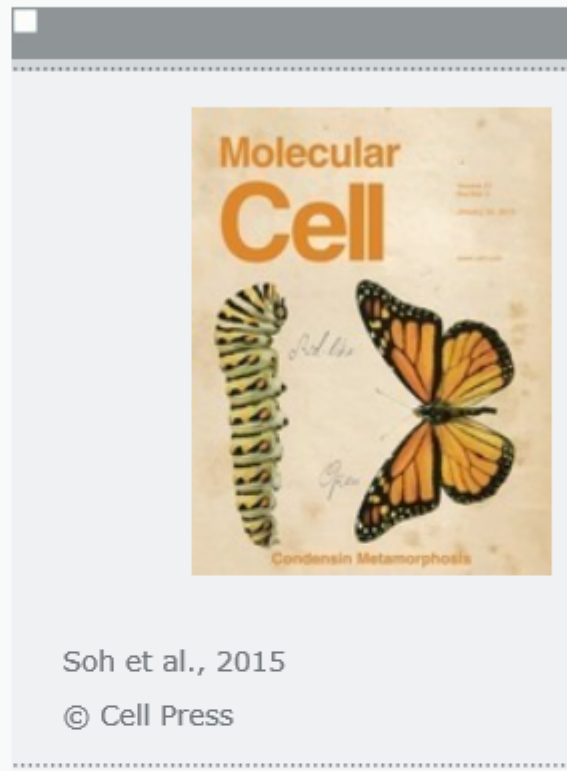
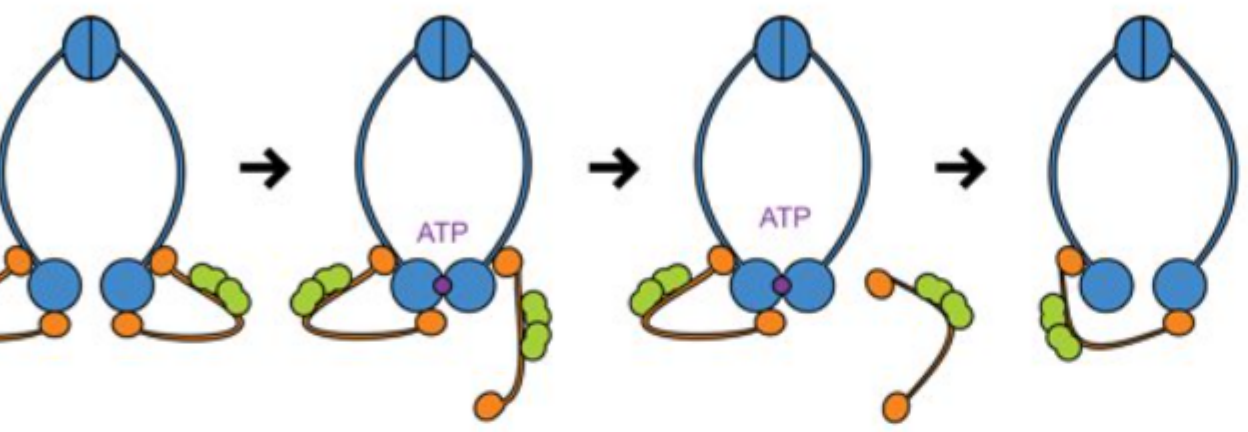
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- 2006-2010 Postdoctoral Fellow with Jeff Errington, **CBCB**, Newcastle University, Newcastle upon Tyne, UK
- 2001-2006 Ph.D. with Kim Nasmyth, Research Institute of Molecular Pathology (**IMP**), Vienna, Austria
- 2001 Diploma (Chemistry), University of Vienna, Vienna, Austria

Honors

- 2010 European Research Council (**ERC**) Starting Grant
- 2008 Human Frontier Science Program (**HFSP**) Postdoctoral Fellowship
- 2007 **EMBO** Long Term Fellowship

ICATIONS



Soh et al., 2015
© Cell Press

nnen^o, F. Bürmann^o, L. Wilhelm, A. Anchimiuk, M.-L. Durand-Diebold, S.
er*

**Control of Smc Coiled Coil Architecture by the ATPase Heads Facilitates
Binding to Chromosomal ParB/*parS* and Release onto Flanking DNA**

Reports 2016; doi:10.1016/j.celrep.2016.01.066

Haering*, S. Gruber*

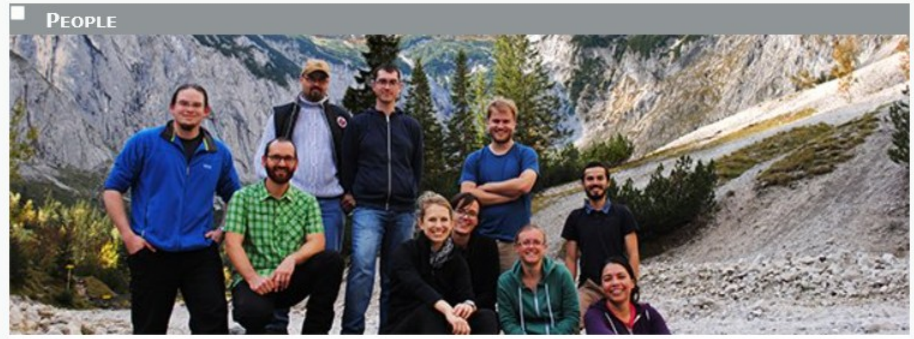
Shot: SMC Protein Complexes Part II

2016; doi:10.1016/j.cell.2016.01.052

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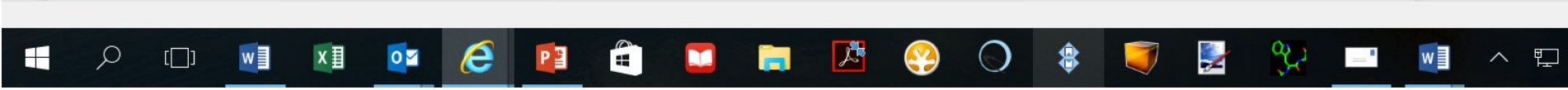
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