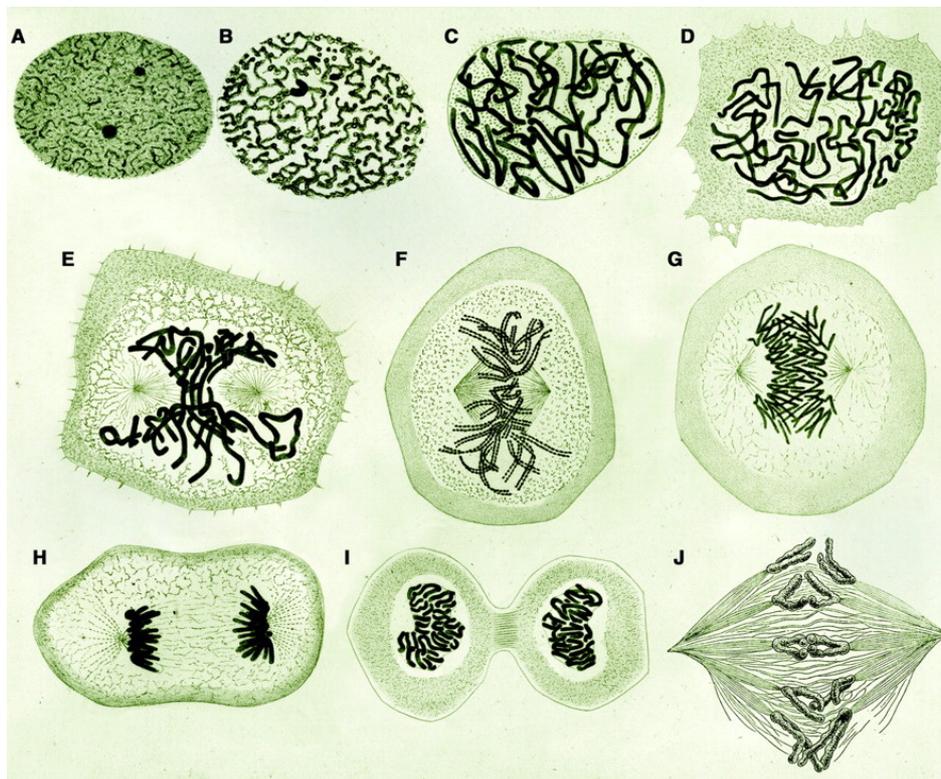


Cell Division & Differentiation

January 31- February 11, 2011



Course Coordinator: Helder Maiato



Objectives

In this course, students will be exposed to key lectures on leading-edge, cell division-related topics by world-renowned experts. These lectures will cover fundamental concepts but will be specially oriented towards the identification of present challenges in the field and how they are being experimentally addressed. Lectures will be complemented with a short microscopy overview and research seminars on topics under development in IBMC laboratories. From the first day of the course, groups of 2 students will team up with a teaching assistant and will be assigned a research project to be carried out during the nearly two weeks of the course. This includes the preparation of the necessary reagents, design and execution of experimental work, interpretation of the data, public discussion of the results and peer-review. The project work will represent the main student evaluation procedure for this course.

Program

Week 1 (Jan 31- Feb 4)

	Monday	Tuesday	Wednesday	Thursday	Friday
9:00-10:00	<i>Course overview & Project assignment</i>	Eukaryotic Cell division <i>Helder Maiato</i>	The Centrosome <i>Mónica Bettencourt-Dias</i>	Prokaryotic Cell Division <i>Adriano Henriques</i>	Stem Cell regulation during development and regeneration Shahragim Tajbakhsh
10:00-12:00	Cell Cycle Regulation & Checkpoints <i>Claudio Sunkel</i>	Research Seminar 1 <i>Lars Jansen</i>	Research Seminar 2 <i>Patrick Heun</i>	Research Seminar 3 <i>Raquel Oliveira</i>	IBMC Seminar: Biased DNA segregation in muscle stem cells Shahragim Tajbakhsh
12:00-13:00					
13:00-14:00	Lunch break	Lunch break	Lunch break	Lunch break	Lunch break
14:00-15:00	Microscopy Overview <i>Paula Sampaio</i>	Projects			
15:00-16:00	Visit microscopes				
16:00-19:00	Special Seminar: "You can observe a lot by watching": The charm of live cell imaging in the study of mitosis Kip Sluder				

Week 2 (February 07-11)

	Monday	Tuesday	Wednesday	Thursday	Friday
10:00-12:30	<h1>Projects</h1>				Projects discussion
12:30-14:00					IBMC Seminar: <i>Maintaining Genomic Stability: How Mitotic Kinases Regulate Chromosome Segregation</i> Geert Kops
14:00-16:00					Projects discussion
16:00-18:00					Projects discussion
18:00-19:00					Closing session and course evaluation
					Beer party

Microscopy Overview

Monday 31/01, 15:00-16:00 (visit to the microscopes: 2 groups, 2x 30 min rotations)

Scanning confocal, Spinning-disk confocal

Paula Sampaio

Laser microsurgery, wide-field/3D-deconvolution,

António Pereira

Research Seminar 1

Tuesday 01/02, 12:00-13:00

The centromere: A showcase for epigenetic inheritance

Lars Jansen

Research Seminar 2

Wednesday 02/02, 12:00-13:00

An unexpected role of the *Drosophila* dosage-compensation protein MSL-1 in mitosis

Patrick Heun

Research Seminar 3

Thursday 03/02, 12:00-13:00

Building mitotic chromosomes and splitting them apart

Raquel Oliveira

Recommended reading

Cell Cycle

Murray and Hunt. The cell cycle. Oxford University Press 1993.

Hartwell LH, Weinert TA (1989). Checkpoints: controls that ensure the order of cell cycle events. *Science*, 246: 629-34.

Mitosis

Rieder CL (2006) "Mitosis". Chapter 10 in the Textbook "Cells", B. Lewin, L. Cassimeris, V.R. Lingappa, and G. Plopper, Eds. Jones and Bartlett, Boston. pp 438-487.

Mitchison TJ, Salmon ED (2001) Mitosis: a history of division. *Nat Cell Biol.* 3: E17-21.

Centrosomes

Bettencourt-Dias M, Glover DM (2007) Centrosome biogenesis and function: centrosomes brings new understanding. *Nat Rev Mol Cell Biol.* 8:451-63.

Tsou MF, Stearns T (2006) Controlling centrosome number: licenses and blocks. *Curr Opin Cell Biol.* 18:74-8.

Chromosomes & Centromeres

Ekwall, K. (2007) Epigenetic Control of Centromere Behavior. *Annu. Rev. Genet.* 41:63–81.

Loyola, A. and Almouzni, G. (2007) Marking histone H3 variants: How, when and why? *Trends Genet.* 32: 425-433.

Gerlich D. and Ellenberg, J. (2003) Dynamics of chromosome positioning during the cell cycle. *Curr. Opin. Cell Biol.* 15:664–671

Mitotic Spindle & Kinetochores

O'Connell CB, Khodjakov AL (2007). Cooperative mechanisms of mitotic spindle formation. *J Cell Sci.* 120: 1717-22.

Maiato, H, DeLuca, J, Salmon, ED, and Earnshaw, WC. (2004) The dynamic kinetochore-microtubule interface. *J Cell Sci.* 117: 5461-5477.

Cheeseman IM, Desai A. Molecular architecture of the kinetochore-microtubule interface. *Nat Rev Mol Cell Biol.* 2008 Jan;9(1):33-46.

Spindle checkpoint

Nezi L, Musacchio A. Sister chromatid tension and the spindle assembly checkpoint. *Curr Opin Cell Biol.* 2009 Dec;21(6):785-95.

Musacchio A, Salmon ED. The spindle-assembly checkpoint in space and time. *Nat Rev Mol Cell Biol.* 2007 May;8(5):379-93.

Prokaryotic Cell Division

Rothfield L, Taghbalout A, Shih YL. Spatial control of bacterial division-site placement. *Nat Rev Microbiol.* 2005 Dec;3(12):959-68.

Adams DW, Errington J. Bacterial cell division: assembly, maintenance and disassembly of the Z ring. *Nat Rev Microbiol.* 2009 Sep;7(9):642-53.

Stem Cell Division and Differentiation

Tajbakhsh S, Gonzalez C. Biased segregation of DNA and centrosomes: moving together or drifting apart? *Nat Rev Mol Cell Biol.* 2009 Nov;10(11):804-10.

Tajbakhsh S, Rocheteau P, Le Roux I. Asymmetric cell divisions and asymmetric cell fates. *Annu Rev Cell Dev Biol.* 2009;25:671-99.

Faculty & Invited Speakers

<p>Claudio Sunkel Instituto de Biologia Molecular e Celular Instituto de Ciencias Biomedicas de Abel Salazar, Universidade do Porto (cesunkel@ibmc.up.pt)</p>	<p>Helder Maiato Instituto de Biologia Molecular e Celular Faculdade de Medicina, Universidade do Porto (maiato@ibmc.up.pt)</p>
<p>Monica Bettencourt-Dias Instituto Gulbenkian de Ciência (mdias@igc.gulbenkian.pt)</p>	<p>Adriano Henriques Instituto de Tecnologia Química e Biológica (aoh@itqb.unl.pt)</p>
<p>Lars Jansen Instituto Gulbenkian de Ciência (ljansen@igc.gulbenkian.pt)</p>	<p>Patrick Heun Max-Planck Institute of Immunobiology Freiburg, Germany (heun@immunbio.mpg.de)</p>
<p>Geert Kops University Medical Center Utrecht, The Netherlands (g.j.p.l.kops-at-umcutrecht.nl)</p>	<p>Raquel Oliveira University of Oxford Oxford, UK (raquel.oliveira@bioch.ox.ac.uk)</p>
<p>Kip Sluder University of Massachusetts Medical School Worcester, MA, USA (greenfield.sluder@umassmed.edu)</p>	<p>Shahragim Tajbakhsh Institut Pasteur Paris, France (shaht@pasteur.fr)</p>
<p>Ana Pereira Instituto de Biologia Molecular e Celular Universidade do Porto (ana.lpereira@gmail.com)</p>	<p>Paula Sampaio Instituto de Biologia Molecular e Celular Universidade do Porto (sampaio@ibmc.up.pt)</p>
<p>Irina Matos Instituto de Biologia Molecular e Celular Universidade do Porto (irina.matos@gmail.com)</p>	<p>Jorge Ferreira Instituto de Biologia Molecular e Celular Faculdade de Medicina, Universidade do Porto (jferreir@med.up.pt)</p>
<p>Cristina Ferrás Instituto de Biologia Molecular e Celular Universidade do Porto (cristinaferras@gmail.com)</p>	<p>António Pereira Instituto de Biologia Molecular e Celular Universidade do Porto (apereira@ibmc.up.pt)</p>
<p>Tatiana Moutinho Instituto de Biologia Molecular e Celular Universidade do Porto (tmoutinh@ibmc.up.pt)</p>	<p>Filipa Sousa Instituto de Biologia Molecular e Celular Universidade do Porto (filipa@ibmc.up.pt)</p>