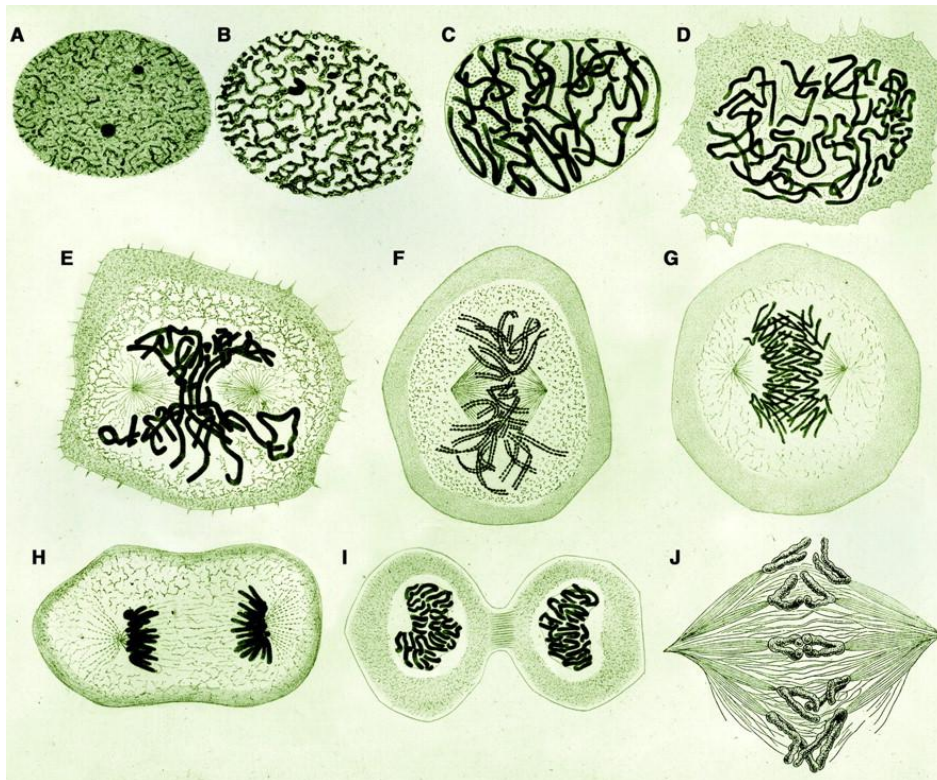


Cell Division & Differentiation

January 30- February 10, 2012



Course Coordinator: Helder Maiato



IBMC

INSTITUTO DE BIOLOGIA MOLECULAR E CELULAR
INSTITUTE FOR MOLECULAR AND CELL BIOLOGY



Objectives

In this course, students will be exposed to key lectures on leading-edge, cell division/differentiation-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 30- Feb 3)

	Monday	Tuesday	Wednesday	Thursday	Friday
9:00-10:00	<i>Course overview & Project assignment</i> (Main Audit)	The Centrosome Mónica Bettencourt-Dias (Main Audit)	Eukaryotic Cell division Helder Maiato (Audit B)	Prokaryotic Cell Division Adriano Henriques (Main Audit)	Projects
10:00-12:00					
12:00-13:00	Cell Cycle Regulation & Checkpoints Claudio Sunkel (Main audit)	Research Seminar 1 Sara Morais da Silva	Research Seminar 2 Elsa Logarinho	Research Seminar 3 Michael Schrader	IBMC Seminar: "Mechanisms of formation and correction of kinetochore misattachments" Daniela Cimini (Main Audit)
13:00-14:00	Lunch break	Lunch break	Lunch break	Lunch break	Lunch break
14:00-15:00	Microscopy Overview Paula Sampaio (Audit B)	Visit microscopes	Projects		Mechanisms of nuclear positioning during cell migration and muscle formation Edgar Gomes (Main Audit)
15:00-17:30	Special Seminar: "Mitotic spindle assembly in 3-D: Spatial constraints and facilitating mechanisms" Alexey Khodjakov (Main Audit)				

Week 2 (February 06-10)

	Monday	Tuesday	Wednesday	Thursday	Friday
10:00-12:30	<h1>Projects</h1>				Projects discussion (Main Audit)
12:30-14:00					Lunch break
14:00-16:00					Projects discussion (Main Audit)
16:00-18:00					Projects discussion (Main Audit)
18:00-19:00					Closing session and course evaluation (Main Audit)
					Beer party

Microscopy Overview

Tuesday 31/01, 14:00-15:00 (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 31/01, Main Audit, 12:00-13:00

Tumorigenesis in the absence of the spindle assembly checkpoint

Sara Morais da Silva

Research Seminar 2

Wednesday 01/02, Audit B, 12:00-13:00

Mechanism of multipolar spindle formation in the absence of centrosome amplification

Elsa Logarinho

Research Seminar 3

Thursday 02/02, Main Audit, 12:00-13:00

Organelle partitioning during cell division

Michael Schrader

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.

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.

- Magidson V, O'Connell CB, Lončarek J, Paul R, Mogilner A, Khodjakov A. The spatial arrangement of chromosomes during prometaphase facilitates spindle assembly. *Cell*. 2011 Aug 19;146(4):555-67.

Spindle checkpoint

- Musacchio A, Salmon ED. The spindle-assembly checkpoint in space and time. *Nat Rev Mol Cell Biol*. 2007 May;8(5):379-93.
- Khodjakov A, Rieder CL. The nature of cell-cycle checkpoints: facts and fallacies. *J Biol*. 2009;8(10):88.

Error correction

- Gregan J, Polakova S, Zhang L, Tolić-Nørrelykke IM, Cimini D. Merotelic kinetochore attachment: causes and effects. *Trends Cell Biol*. 2011 Jun;21(6):374-81.
- Matos I, Maiato H. Prevention and correction mechanisms behind anaphase synchrony: implications for the genesis of aneuploidy. *Cytogenet Genome Res*. 2011;133(2-4):243-53.

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.

Organelle partitioning

- Schrader M, Yoon Y. Mitochondria and peroxisomes: are the 'big brother' and the 'little sister' closer than assumed? *Bioessays*. 2007 Nov;29(11):1105-14.

Nuclear Positioning and Muscle Cell Differentiation

- Gomes ER, Jani S, Gundersen GG. Nuclear movement regulated by Cdc42, MRCK, myosin, and actin flow establishes MTOC polarization in migrating cells. *Cell*. 2005 May 6;121(3):451-63.
- Starr DA. A nuclear-envelope bridge positions nuclei and moves chromosomes. *J Cell Sci*. 2009 Mar 1;122(Pt 5):577-86.

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>Mónica 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>Alexey Khodjakov Wadsworth Center Albany, NY , USA (khodj@wadsworth.org)</p>	<p>Daniela Cimini Virginia Tech Blacksburg, Virginia, USA (cimini@vt.edu)</p>
<p>Edgar Gomes Institute de Myology Paris, France (er.gomes@gmail.com)</p>	<p>Paula Sampaio Instituto de Biologia Molecular e Celular Universidade do Porto (sampaio@ibmc.up.pt)</p>
<p>António Pereira Instituto de Biologia Molecular e Celular Universidade do Porto (apereira@ibmc.up.pt)</p>	<p>Elsa Logarinho Instituto de Biologia Molecular e Celular Universidade do Porto (elsa.logarinho@ibmc.up.pt)</p>
<p>Michael Schrader Universidade de Aveiro mschrader@ua.pt</p>	<p>Sara Morais da Silva Instituto de Biologia Molecular e Celular Universidade do Porto (sara.silva@ibmc.up.pt)</p>
<p>Marin Barisic Instituto de Biologia Molecular e Celular Universidade do Porto (marin.barisic@ibmc.up.pt)</p>	<p>Olga Afonso Instituto de Biologia Molecular e Celular Universidade do Porto (olga.afonso@ibmc.up.pt)</p>