GMS6061 Nuclear Structure and Dynamics

Format
Short ("chalk") talk and discussion.
Your grades will be based on your participation in the review and research paper discussion.

For reviews:
Point of greatest interest
What point/paradigm/model/finding/observation is of most interest to you?

For original research papers:
Hypothesis
What hypothesis do the authors test?
Method
What method is of most interest to you?
Result
Which result is of most interest to you? Does it support the hypothesis and conclusions of the authors?

Opinional:
Form an opinion about the conclusion(s) of the paper.
Your experiment
Propose one (or more) experiment to extend or further support the conclusions of the paper.

Faculty
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Date	Topic	Faculty
1-8	Nuclear domains/Methods in nuclear organization	Ishov
1-13	PML NB's/ND10 assembly and function	Ishov
1-15	Nuclear dynamics, chromosome territories and genome organization	Ishov
1-20	DNA damage and repair foci	Ishov
1-22	Transcription: spatiotemporal aspect	Ishov
1-27	Centromere/kinetochore	Ishov
1-29	nuclear pore complexes -kinetochore	Roux
2-3	LINC-complex	Roux
2-5	Laminopathies	Roux

1. Thursday, January 8

Topic:
Nuclear domains/Methods in nuclear organization study (FRAP, FRET, BiFC).
Introduction into nuclear architecture, overview of nuclear domains and methods used in nuclear study.

Review:
Dundr M, Misteli T.
Functional architecture in the cell nucleus.
Biochem J. 2001 Jun 1;356(Pt 2):297-310.

Nuclear bodies and compartments: functional roles and cellular signalling in health and disease.
Zimber A, Nguyen QD, Gespach C.
Cell Signal. 2004 Oct;16(10):1085-104.

Toward a high-resolution view of nuclear dynamics.
Trinkle-Mulcahy L, Lamond AI.
Science. 2007 Nov 30;318(5855):1402-7.

Paper:
De Novo Formation of a Subnuclear Body. Kaiser TE, Intine RV, Dundr M. Science. 2008 Oct 23.

Optional:
Bubulya PA, Spector DL.
"On the move"ments of nuclear components in living cells.
Exp Cell Res. 2004 May 15;296(1):4-11.

2. Tuesday, January 13

Topic:
PML NB's/ND10 assembly and function.

Review:
Structure, dynamics and functions of promyelocytic leukaemia nuclear bodies.
Bernardi R, Pandolfi PP. Nat Rev Mol Cell Biol. 2007 Dec;8(12):1006-16.

Paper:
Dynamics of component exchange at PML nuclear bodies. Weidtkamp-Peters S, Lenser T, Negorev D, Gerstner N, Hofmann TG, Schwanitz G, Hoischen C, Maul G, Dittrich P, Hemmerich P. J Cell Sci. 2008 Aug 15;121(Pt 16):2731-43

Arsenic degrades PML or PML-RARalpha through a SUMO-triggered RNF4/ubiquitin-mediated pathway. Lallemand-Breitenbach V, Jeanne M, Benhenda S, Nasr R, Lei M, Peres L, Zhou J, Zhu J, Raught B, de Thé H. Nat Cell Biol. 2008 May;10(5):547-55.

Optional:
Everett RD, Chelbi-Alix MK. PML and PML nuclear bodies: Implications in antiviral defense. Biochimie. 2007 Jan 27

3. Thursday, January 15:

Topic:
Nuclear dynamics, chromosome territories and genome organization

Review:
Misteli T. Beyond the sequence: cellular organization of genome function. Cell. 2007 Feb 23;128(4):787-800.

Chromosome territories--a functional nuclear landscape.
Cremer T, Cremer M, Dietzel S, Müller S, Solovei I, Fakan S.
Curr Opin Cell Biol. 2006 Jun;18(3):307-16.

Paper:
Chromatin position in human HepG2 cells: Although being non-random, significantly changed in daughter cells. Cvacková Z, Masata M, Stanek D, Fidlerová H, Raska I. J Struct Biol. 2008 Nov 12.

Global chromosome positions are transmitted through mitosis in mammalian cells. Gerlich D, Beaudouin J, Kalbfuss B, Daigle N, Eils R, Ellenberg J. Cell. 2003 Mar 21;112(6):751-64.

Chromosome order in HeLa cells changes during mitosis and early G1, but is stably maintained during subsequent interphase stages. Walter J, Schermelleh L, Cremer M, Tashiro S, Cremer T. J Cell Biol. 2003 Mar 3;160(5):685-97. Epub 2003 Feb 25.

Optional:
Taddei A, Hediger F, Neumann FR, Gasser SM.
The function of nuclear architecture: a genetic approach.
Annu Rev Genet. 2004;38:305-45.

4. Tuesday, January 20:

Topic:
DNA damage and repair foci: formation, dynamics and function.

Review:
Beyond repair foci: subnuclear domains and the cellular response to DNA damage.
Dellaire G, Bazett-Jones DP. Cell Cycle. 2007 Aug 1;6(15):1864-72. Epub 2007 Jun 11.

Chromatin challenges during DNA replication and repair.
Groth A, Rocha W, Verreault A, Almouzni G. Cell. 2007 Feb 23;128(4):721-33.

DNA damage: a histone-code mediator leaves the stage. Lukas J, Bartek J. Nat Struct Mol Biol. 2008 May;15(5):430-2.

Paper:
Activation of the cellular DNA damage response in the absence of DNA lesions.
Soutoglou E, Misteli T.
Science. 2008 Jun 13;320(5882):1507-10.

Spatial organization of the mammalian genome surveillance machinery in response to DNA strand breaks. Bekker-Jensen S, Lukas C, Kitagawa R, Melander F, Kastan MB, Bartek J, Lukas J. J Cell Biol. 2006 Apr 24;173(2):195-206.

Optional:
Lisby, M., Barlow, J.H., Burgess, R.C. and Rothstein, R., 2004. Cell **118**, pp. 699–713

5. Thursday, January 22:

Topic:
Transcription: spatiotemporal aspect. Novel approaches that allow visualization of transcription dynamics in cell.

Review:
Chromatin dynamics and gene positioning. Kumaran RI, Thakar R, Spector DL. Cell. 2008 Mar 21;132(6):929-34.

Paper:
Janicki SM, Tsukamoto T, Salghetti SE, Tansey WP, Sachidanandam R, Prasanth KV, Ried T, Shav-Tal Y, Bertrand E, Singer RH, Spector DL.
From silencing to gene expression: real-time analysis in single cells.
Cell. 2004 Mar 5;116(5):683-98.

Transcriptional repression mediated by repositioning of genes to the nuclear lamina.
Reddy KL, Zullo JM, Bertolino E, Singh H. Nature. 2008 Mar 13;452(7184):243-7.

A genetic locus targeted to the nuclear periphery in living cells maintains its transcriptional competence. Kumaran RI, Spector DL. J Cell Biol. 2008 Jan 14;180(1):51-65.

Optional:

Actin-dependent intranuclear repositioning of an active gene locus in vivo.
Dundr M, Ospina JK, Sung MH, John S, Upender M, Ried T, Hager GL, Matera AG.
J Cell Biol. 2007 Dec 17;179(6):1095-103.

6. Tuesday, January 27:

Topic:
Centromere/kinetochore: An overview of centromere/kinetochore structure/replication and epigenetic modifications of centromeric chromatin

Review:
Epigenetic regulation of centromeric chromatin: old dogs, new tricks?
Allshire RC, Karpen GH. Nat Rev Genet. 2008 Dec;9(12):923-37.

Paper:
Dynamics of inner kinetochore assembly and maintenance in living cells.
Hemmerich P, Weidtkamp-Peters S, Hoischen C, Schmiedeberg L, Erliandri I, Diekmann S. J Cell Biol. 2008 Mar 24;180(6):1101-14.

Centromeric chromatin exhibits a histone modification pattern that is distinct from both euchromatin and heterochromatin.
Sullivan BA, Karpen GH. Nat Struct Mol Biol. 2004 Nov;11(11):1076-83.

7. Thursday, January 29:

Topic:
NPC-kinetochore: An overview of nuclear pore complexes (NPCs) with a discussion of how NPC constituents serve double duty at the kinetochore during mitosis.

Review:
Antonin W, Ellenberg J, Dultz E. Nuclear pore complex assembly through the cell cycle: regulation and membrane organization. FEBS Lett. 2008 Jun 18;582(14):2004-16. Epub 2008 Mar 6.

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

Roux KJ, Burke B. From pore to kinetochore and back: regulating envelope assembly.
Dev Cell. 2006 Sep;11(3):276-8.

Paper:
Salina D, Enarson P, Rattner JB, Burke B. Nup358 integrates nuclear envelope breakdown with kinetochore assembly. J Cell Biol. 2003 Sep 15;162(6):991-1001. Epub 2003 Sep 8.

Rasala BA, Orjalo AV, Shen Z, Briggs S, Forbes DJ. ELYS is a dual nucleoporin/kinetochore protein required for nuclear pore assembly and proper cell division. Proc Natl Acad Sci U S A. 2006 Nov 21;103(47):17801-6. Epub 2006 Nov 10.

Optional:
Resendes KK, Rasala BA, Forbes DJ. Centrin 2 localizes to the vertebrate nuclear pore and plays a role in mRNA and protein export. Mol Cell Biol. 2008 Mar;28(5):1755-69. Epub 2008 Jan 2.

8. Tuesday, February 3:

Topic:
LINC-complex: An overview of this newly discovered structure in the nuclear envelope and its implications to cell biology.

Review:
Stewart CL, Roux KJ, Burke B. Blurring the boundary: the nuclear envelope extends its reach. Science. 2007 Nov 30;318(5855):1408-12.

Tzur YB, Wilson KL, Gruenbaum Y. SUN-domain proteins: 'Velcro' that links the nucleoskeleton to the cytoskeleton. Nat Rev Mol Cell Biol. 2006 Oct;7(10):782-8. Epub 2006 Aug 23.

Paper:
Crisp M, Liu Q, Roux K, Rattner JB, Shanahan C, Burke B, Stahl PD, Hodzic D. Coupling of the nucleus and cytoplasm: role of the LINC complex. J Cell Biol. 2006 Jan 2;172(1):41-53. Epub 2005 Dec 27.

Stewart-Hutchinson PJ, Hale CM, Wirtz D, Hodzic D. Structural requirements for the assembly of LINC complexes and their function in cellular mechanical stiffness. Exp Cell Res. 2008 May 1;314(8):1892-905. Epub 2008 Mar 12.

Nery FC, Zeng J, Niland BP, Hewett J, Farley J, Irimia D, Li Y, Wiche G, Sonnenberg A, Breakefield XO. TorsinA binds the KASH domain of nesprins and participates in linkage between nuclear envelope and cytoskeleton. J Cell Sci. 2008 Oct 15;121(Pt 20):3476-86. Epub 2008 Sep 30.

Optional:
Wilhelmsen K, Litjens SH, Kuikman I, Tshimbalanga N, Janssen H, van den Bout I, Raymond K, Sonnenberg A. Nesprin-3, a novel outer nuclear membrane protein, associates with the cytoskeletal linker protein plectin. J Cell Biol. 2005 Dec 5;171(5):799-810.

9. Thursday, February 5:

Topic:
Laminopathies: How a class of diverse diseases has shed light on unexpected roles for the nuclear envelope.

Review:
Dechat T, Pfleghaar K, Sengupta K, Shimi T, Shumaker DK, Solimando L, Goldman RD. Nuclear lamins: major factors in the structural organization and function of the nucleus and chromatin. Genes Dev. 2008 Apr 1;22(7):832-53.

Worman HJ, Bonne G. "Laminopathies": a wide spectrum of human diseases. Exp Cell Res. 2007 Jun 10;313(10):2121-33. Epub 2007 Mar 30.

Paper:
Scaffidi P, Misteli T. Lamin A-dependent misregulation of adult stem cells associated with accelerated ageing. Nat Cell Biol. 2008 Apr;10(4):452-9. Epub 2008 Mar 2.

Lammerding J, Schulze PC, Takahashi T, Kozlov S, Sullivan T, Kamm RD, Stewart CL, Lee RT. Lamin A/C deficiency causes defective nuclear mechanics and mechanotransduction. J Clin Invest. 2004 Feb;113(3):370-8.

Optional:
Pendás AM, Zhou Z, Cadiñanos J, Freije JM, Wang J, Hultenby K, Astudillo A, Wernerson A, Rodríguez F, Tryggvason K, López-Otín C. Defective prelamin A processing and muscular and adipocyte alterations in Zmpste24 metalloproteinase-deficient mice. Nat Genet. 2002 May;31(1):94-9. Epub 2002 Apr 1.