

**MCB 5445 Epigenetics and Genome dynamics  
Lectures outline & Class schedule (subject to  
change):**

**Note that there are 9 articles that will be  
discussed in class- see schedule for details-  
readings listed below serve for review and  
background purposes.**

**Legend:**

**E= Epigenetics**

**MB= Molecular Biology**

**MBG= Molecular Biology of the Gene**

**1.Nucleosome structure and positioning.**

- Introduction, syllabus, expectations, presentations and choosing articles.
- What is epigenetics?
- Histones and nucleosomes (Background: MBG pg157-173)
- Nucleosome positioning: random or precise?
- Technique: MNase digestion of chromatin. (MB Ch4 pg122-123; MBG Ch7 pg179-181)

**2.How is DNA accessed in chromatin?**

- Nucleosome unwrapping
- Technique: *in vitro* FRET assay.
- Chromatin remodeling (Background: Review Clapier and Cairns; MB Ch4 pg133-135; MBG Ch7 pg174-178)
- nucleosome stability at promoters

**3.Higher order organization of chromatin.**

- Chromatin compaction
- The 30nm fiber
- Technique: electron spectroscopy imaging (Review by Bazett Jones)

**4.The complex language of chromatin.**

- Histone modifications (E Ch10; Background: MB Ch4 pg128-133; MBG pg 182-187)
- Histone variants (E Ch13).

**5.Inheritance of epigenetic states. (review by  
Whitehouse)**

- Nucleosome re-assembly during DNA replication (MBG pg 187-192)
- Deposition of histone variants: H3.3.

**6.Heterochromatin & silencing.**

- Types of heterochromatin: facultative and constitutive
- Roles of heterochromatin
- Fission yeast centromeric silencing (E Ch6).
- Technique: Chromatin immunoprecipitation (ChIP)

**7.RNAi mediated silencing (E Ch 8).**

- RNAi pathways; *S. pombe* model (Bayne et al; Buhler et al reviews)
- The silencing paradox: transcription of silenced repeats

**8.The problem of transcription through  
chromatin in eukaryotes.**

- Review of transcription
- Pol II
- Activators
- The FACT complex and chromatin remodeling
- The role of histone modifications in modulating gene expression

**9. Chromosome dynamics in mitosis  
(Background: MB Ch7 265-268)**

- The cohesin complex: holding sisters together
- Kinetochore bi-orientation
- The Spindle Assembly Checkpoint and error correction

**10.When chromosome segregation goes  
wrong: aneuploidy. (Review by Santaguida)**

- Aneuploidy and human birth defects
- Aneuploidy and cancer: cause or consequence?

**11.Nuclear organization.**

- Chromosome territories.
- TADs (technique HiC)
- Nuclear bodies, compartments and lamina
- Diseases caused by nuclear defects
- non-genetic functions of the genome (Misteli review)

**12.Students presentations**

<b>Tuesday</b>	<b>Thursday</b>	<b>Week</b>	<b>Topic</b>	<b>Article discussed</b>
8/29	8/31	Week 1	Nucleosome structure & positioning	1. Lowary and Widom
9/5	9/7	Week 2	Access to DNA	2. Li and Widom
9/12	9/14	Week 3	Chromatin compaction	3. Fussner et al. & Ou et al.
9/19	9/21	Week 4	Histone modifications	
9/26	9/28	Week 5	Heterochromatin and silencing	4. Strom et al.
10/3	10/5	Week 6	Inheritance of chromatin states	5. Hansen et al.
10/10	10/12	Week 7	RNAi mediated silencing	
<b>10/17</b>	10/19	Week 8	<b>Exam 1; Transcription through chr.</b>	
10/24	10/26	Week 9	Chromosome dynamics	6. Samwer et al.
10/31	11/2	Week 10	Aneuploidy	7. Silk et al.
11/7	11/9	Week 11	Nuclear Organization	8. Scaffidi
11/14	<b>11/16</b>	Week 12	TADs; <b>Exam 2</b>	
11/21	11/23	Week 13	Thanksgiving	
11/28	11/30	Week 14	Presentations	
12/5	12/7	Week 15	no class	