

**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 though
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

Tuesday	Thursday	Week	Topic	Article discussed
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	
10/17	10/19	Week 8	Exam 1; Transcription through chr.	
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	11/16	Week 12	TADs; Exam 2	
11/21	11/23	Week 13	Thanksgiving	
11/28	11/30	Week 14	Presentations	
12/5	12/7	Week 15	no class	