SYLLABUS

Bi 424/524 Advanced Molecular Genetics: Epigenetics Winter, 2008

Instructor: Eric Selker email: selker@molbio; office: 355D Streisinger; phone: 346-5193
Mondays and Wednesdays 10:00-11:20 (102 Peterson); office hours: Fridays 11-12 and by appt.

Jan. 7 (M) Lecture: **Epigenetics – overview**
Optional reading: Ptashne, M. (2007). On the use of the word 'epigenetic'. Curr Biol 17, R233-236.

Jan. 9 (W) Lecture: **Chromatin structure**
General background: van Holde, K. C. (1989) Chromatin (Springer);
Recent reviews: Kornberg, R. D., and Lorch, Y. (2007). Chromatin rules. Nat Struct Mol Biol 14, 986-988; Bhaumik, S. R., Smith, E., and Shilatifard, A. (2007). Covalent modifications of histones during development and disease pathogenesis. Nat Struct Mol Biol 14, 1008-1016; Latham, J. A., and Dent, S. Y. (2007). Cross-regulation of histone modifications. Nat Struct Mol Biol 14, 1017-1024.

Jan. 14 (M) Discussion of: **Lan, F., Bayliss, P. E., Rinn, J. L., Whetstine, J. R., Wang, J. K., Chen, S., Iwase, S., Alpatov, R., Issaeva, I., Canaani, E., et al. (2007). A histone H3 lysine 27 demethylase regulates animal posterior development. Nature 449, 7163**.
Background: Schwartz, Y. B., and Pirrotta, V. (2007). Polycomb silencing mechanisms and the management of genomic programmes. Nat Rev Genet 8, 9-22.

Jan. 16 (W) Guest Lecture: **Gene silencing by RNAi** (Dr. Kristy Henscheid)
Optional reading: Meister, G., and Tuschl, T. (2004). Mechanisms of gene silencing by double-stranded RNA. Nature 431, 343-349; Zaratiegui, M., Irvine, D. V., and Martienssen, R. A. (2007). Noncoding RNAs and gene silencing. Cell 128, 763-776; Buhler, M., and Moazed, D. (2007). Transcription and RNAi in heterochromatic gene silencing. Nat Struct Mol Biol *14*, 1041-1048.

Jan. 21 (M) MLK day (no classes)

Jan. 23 (W) Lecture **: DNA methylation**
Optional reading: Freitag, M., and Selker, E. U. (2005). Controlling DNA methylation: many roads to one modification. Curr Opin Genet Dev 15, 191-199; Li, E. and Bird, A. (2007) DNA methylation in mammals. *In:* "Epigenetics" edited by Allis, Jenuwein & Reinberg. CSH Press pp.341-356. (Note: copy of this book is on reserve in Science library)

Jan. 28 (M) Discussion of: **Luff, B., Pawlowski, L., and Bender, J. (1999). An inverted repeat triggers cytosine methylation of identical sequences in Arabidopsis. Mol Cell *3*, 505-11.** *Background paper:* Bender, J., and Fink, G. R. (1995) Epigenetic control of an endogenous gene family is revealed by a novel blue fluorescent mutant of Arabidopsis. *Cell* **83**: 725-34.

Jan. 30 (W) Lecture: **Gene silencing in filamentous fungi**
Optional reading: Allshire, R.C. & Selker, E. U. (2007) Fungal Models for Epigenetic Research: *Schizocaccharomyces pombe* and *Neurospora crassa*. *In:* "Epigenetics" edited by Allis, Jenuwein & Reinberg. CSH Press pp. 101-126; Galagan, J.E. and E.U. Selker (2004) RIP: The high cost of genome defense. *Trends in Genetics*, **20**: 417-423; Selker, E. U. (2004). Genome

defense and DNA methylation in *Neurospora*. *Cold Spring Harbor Symp*. *Quant.Biol*., (2004) LXIX: 119-124.

Feb. 4 (M) Discussion of: **Shiu, P. K., Raju, N. B., Zickler, D., and Metzenberg, R. L. (2001). Meiotic silencing by unpaired DNA. Cell *107*, 905-16.** *Background paper*: Aramayo, R., and Metzenberg, R. L. (1996) Meiotic transvection in fungi. *Cell* **86**, 103-113.

Feb. 6 (W) Lecture: **PEV (position effect variegation) in Drosophila**
Optional reading: Schotta, G., Ebert, A., Dorn, R., and Reuter, G. (2003). Position-effect variegation and the genetic dissection of chromatin regulation in Drosophila. *Semin Cell Dev Biol 14*, 67-75.

Feb. 11 (M) Discussion of: **Dorer, D. R., and Henikoff, S. 1994. Expansions of transgene repeats cause heterochromatin formation and gene silencing in Drosophila. *Cell* 77: 993-1002.**

Feb. 13 (W) Lecture: **Gene silencing in yeasts**
Optional reading: Rusche, L.N., A.L. Kirchmaier, and J. Rine. (2003) The establishment, inheritance, and function of silenced chromatin in *Saccharomyces cerevisiae*. *Annu Rev Biochem* **72**: 481-516; Martienssen, R. A., Zaratiegui, M., and Goto, D. B. (2005). RNA interference and heterochromatin in the fission yeast *Schizosaccharomyces pombe*. *Trends Genet 21*, 450-456.

Feb. 18 (M) Discussion of: **Sugiyama, T., Cam, H. P., Sugiyama, R., Noma, K., Zofall, M., Kobayashi, R., and Grewal, S. I. (2007). SHREC, an effector complex for heterochromatic transcriptional silencing. Cell 128, 491-504.**

Feb. 20 (W) Lecture: **Imprinting and X-inactivation**
Optional reading: Wilkins, J. F., and Haig, D. (2003) What good is genomic imprinting: the function of parent-specific gene expression. *Nat Rev Genet* **4**: 359-368; Delaval, K. and R. Feil. (2004) Epigenetic regulation of mammalian genomic imprinting. *Curr Opin Genet Dev* **14**: 188-95; Morison, I. M., Ramsay, J. P., and Spencer, H. G. (2005). A census of mammalian imprinting. Trends Genet *21*, 457-465.

Feb. 25 (M) Discussion of: **Bourc'his, D. and T.H. Bestor. 2004. Meiotic catastrophe and retrotransposon reactivation in male germ cells lacking Dnmt3L. *Nature* 431: 96-9.** *Background paper:* Bourc'his, D., G.L. Xu, C.S. Lin, B. Bollman, and T.H. Bestor. (2001) Dnmt3L and the establishment of maternal genomic imprints. *Science* **294**: 2536-9.

Feb. 27 (W) Lecture: **Epigenetics and Human Disease**
Optional reading: van Vliet, J., Oates, N. A., and Whitelaw, E. (2007). Epigenetic mechanisms in the context of complex diseases. Cell Mol Life Sci *64*, 1531-1538; Zoghbi, H.Y. & Beaudet, A.L Epigenetics and Human Disease (2007) *In:* "Epigenetics" edited by Allis, Jenuwein & Reinberg. CSH Press. pp. 435-456; Bayln, S.B. & Jones, P.A. Epigenetic Determinants of Cancer (2007) *In:* "Epigenetics" edited by Allis, Jenuwein & Reinberg. CSH Press. pp. 457-476. (Note: copy of this book is on reserve in Science library.)

March 3 (M) Discussion of:. **Horike, S., S. Cai, M. Miyano, J.F. Cheng, and T. Kohwi-Shigematsu (2005) Loss of silent-chromatin looping and impaired imprinting of DLX5 in Rett syndrome. *Nat Genet* 37: 31-40.**

March 5 Student talks

March 10	Student talks
March 12	Student talks
March 19	Term papers due at 5 PM (Selker's mailbox or office)