

If the basic tenants of eukaryotic molecular biology have followed the prokaryotic paradigm (DNA makes RNA makes protein) established decades ago, the diverse ways in which our genes are regulated continue to surprise. In particular, the extent to which eukaryotic genomes are transcribed but not translated contributes to the growing appreciation of RNA as a regulatory molecule. Using articles from the recent scientific literature, this course will focus on topics such as: the diverse roles of micro RNAs in regulating gene expression; the extent and possible function of “antisense” transcripts; modification of RNA transcripts (including those not encoding protein) by alternative splicing and editing; and the role of non-coding RNAs in X chromosome inactivation and other epigenetic phenomena.

Syllabus:

Meetings, by week:

1. DR Overview
2. What fraction of our genome is transcribed? What fraction is under evolutionary selection?

Small non-coding RNAs

3. Early observations of RNAi: effects on mRNA translation and stability
4. miRNA and siRNA, enzymology of synthesis and action
5. miRNA effects, cont: mRNA activation, target selection, global changes
6. Effects upon chromatin, transcription
7. Genome Defense against transposition, by piRNA

Large non-coding RNAs

8. Role in X chromosome inactivation: XIST, TSIX, Xite
9. Epigenetic effects
10. HAR1 and human uniqueness
11. Alternative splicing/Editing of ncRNA
12. Toxic RNA, triplet repeat disease

13. Student presentations of independent research. Research papers will be due at the end of the examination period.

Grading: Course grades will be based upon your contributions to our weekly discussions, your leading of some of those discussions, and the final papers. I imagine assigning roughly equal weight to the three components.