Environment, Epigenome, and Public Health

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What is epigenetics or epigenomics?

- **Epigenetics**: Heritable changes of gene expression but not due to the changes of DNA sequence.

- **Epigenome**: “-omic” representation of all epigenetic phenomena across the genome.
What are epigenetic mechanisms involved in?

• **Major layers of Epigenetic mechanisms:**
  
  --- Histone modification
  
  --- Positioning of nucleosomes and histone variants
  
  --- DNA methylation

- Gene transcription,
- Genomic imprinting,
- Genome stability,
- X-chromosome inactivation
Why is epigenomics or epigenetics?

- Epigenetics: connecting environment and genotype to phenotype and disease

Asthma
COPD
Lung cancer
Skin cancer
Liver cancer
What do we (epigenomicists) do?

- ChIP-seq:
  - *Cell*, 2007
  - *Nature Genetics*, 2008
  - *Immunity*, 2009
  - *BMC Genomics*, 2009
  - *Cell*, 2009
  - *PNAS*, 2009
  - *Science*, 2010
  - *Nature*, 2010
  - *Cur Environ Health Rpt*, 2014
  - *EMBO Report*, 2014

- Nu-seq:
  - *Cell*, 2008

- BS-seq or mDIP-seq:
  - *Nature*, 2011
  - *G&D*, 2011
  - *Prog Mol Bio Biochem*, 2014
  - *Genome Biology* (revision)

Note, our publications
What biology/problems are we interested in?

**Histone modifying complex:**
Closing chromatin after elongation by deacetyl, demethyl, repositioning of nucleosome

**Fundamental processes**

**DNA methylation**
- On genome stability
- Gene transcription
- Genomic imprinting
- 20 novel DMRs in association with
- 27 common disease

**Biology**
- Endometrial cancer, stomach cancer, colon cancer;
- Inflammation; differentiation
- Early origins of adult disease
- Transgenerational epigenetic inheritance
- Environment on sperm fertility