**The Biology of Cancer – Week 2**

Genetics of Cancer

Genes contribute to the risk and growth of cancer

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Oncogenes and Tumor Suppressor Genes

Cancer is caused by an accumulation of detrimental variation in the genome.

A single mutation is not sufficient to induce cancer formation.

Gene – discrete unit of heredity of a living organism.

Gene – region of DNA that encodes for a functional product (RNA or protein)

Humans have ~25,000 genes

The DNA contained in a single human cell is 5-6 feet long

DNA is packed into chromosomes. Humans are diploid. Two copies of every gene: maternal and paternal.

Central dogma of molecular biology: DNA -> RNA -> Protein

-Section B: Genetic Variation and Mutation

99.5% of genomes are the same person to person. 0.5% is variable in the human population

Most variation is small: only one or a few bases of DNA vary at one location. SNPs

Even your alleles my differ: maternal copy diff from paternal copy

A mutation is detrimental genetic variation that increases the risk of developing a disease, or in rare diseases, causes the disease. Cancer gene -> mutation that increases risk.

Oncogenes -> promotes cancer

Tumor suppressor -> protects against cancer

In cancer cells, these are both misregulated.

Activating Mutation – gene expressed at the wrong time, wrong level, or w new function. Tumorigenic

Inactivating – reduced function

Mutation: somatic or germline (inherited)  
Somatic (body cells, non reproductive) 1 mutation every 10 billion base pairs   
Risk: UV damage, smoking, hepatitis and alcohol abuse

Germline mutations: germline varation accouts for offspring variation in looks.

When cancer runs in families, it may be due to inherited mutations.

Not all women who inherit BRCA1/2 mutation develop breast cancer. Cancer is caused by an accumulation of detrimental variation in the genome.

Biggest risk factor is age. We accumulate mutations over time.

Two-Hit Hypothesis: Humans are diploid, For a gene to be cancer inducing, both copies of the gene must be affected. The second “hit” may alter the DNA directly (mutation) or alter the expression of the DNA (epigenetic).

Cancer cell most overcome: proliferation, survival, communication.

Cancer cells a great deal of genomic instability. This is how cells survive and divide with higher rates of mutation than normal cells.

Cancer: as mutations in these repair pathways accumulate, the frequency of mutations in the cancer cell genome increases.