Neoplasia III: Epidemiology
Epidemiology Lecture Objectives

- List the most common type of cancer in men and women, and the cancer responsible for the most deaths.
- List the seven most important environmental factors that contribute to the development of carcinoma, and describe a little about each one (e.g., types of associated cancers).
- Define, compare and contrast the three types of hereditary cancer.
- Briefly describe the genetic mutations in Li-Fraumeni syndrome and xeroderma pigmentosum, and explain how they lead to the development of cancer in each disorder.
Epidemiology Lecture Outline

• Cancer facts
• Environmental factors
• Hereditary cancer
Cancer Facts

Every year there are:
1.5 million new cases of cancer
>500,000 cancer deaths

Cancer is the 2\textsuperscript{nd} leading cause of death (after heart disease)

<table>
<thead>
<tr>
<th>Most common cancers</th>
<th>Cancers causing the most deaths</th>
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<tbody>
<tr>
<td>Men: Prostate</td>
<td>Men: Lung</td>
</tr>
<tr>
<td>Women: Breast</td>
<td>Women: Lung</td>
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</tbody>
</table>
WHAT ARE THE MOST COMMON CANCERS IN MEN VS WOMEN?

- Prostate
- Breast
- Lung
- Colorectal
- Urinary Bladder
- Endometrial & Uterus
- Thyroid

10 per 100,000
Cancer Deaths

**Males**
- Lung & bronchus: 27%
- Colon & rectum: 9%
- Prostate: 8%
- Pancreas: 7%
- Liver & intrahepatic bile duct: 6%
- Leukemia: 4%
- Esophagus: 4%
- Urinary bladder: 4%
- Non-Hodgkin lymphoma: 4%
- Brain & other nervous system: 3%

**Females**
- Lung & bronchus: 25%
- Breast: 14%
- Colon & rectum: 8%
- Pancreas: 7%
- Ovary: 5%
- Uterine corpus: 4%
- Leukemia: 4%
- Liver & intrahepatic bile duct: 3%
- Non-Hodgkin lymphoma: 3%
- Brain & other nervous system: 3%
Five-year survival rates

- Glioblastoma Multiforme: 10%
- Lung Cancer: 18%
- Triple-Negative Breast Cancer: 78%
- Pancreatic Cancer: 8%
- Ovarian Cancer: 46%
Environmental Factors

- Infectious agents
- Smoking
- Alcohol
- Diet
- Obesity
- Reproductive history
- Environmental carcinogens
  - UV light (skin)
  - Arsenic (lung, skin)
  - Asbestos (mesothelioma)
  - Benzene (leukemia)
  - Radon (Lung)

“Through most important environmental factor contributing to premature death in the US.”

Lung, but also oral cavity and pancreatic cancers

Liver, oral cavity, breast

“The most overweight people in the US have over 50% higher death rates from cancer”

↑ estrogen exposure

↑ breast and endometrial cancer
Three Types of Hereditary Cancer

• Familial cancers
• Inherited cancer syndromes
• Syndromes of defective DNA repair
Familial Cancers

• Most cases of cancer are sporadic (random)
• A small number are familial (related to specific germline gene mutations)
• Example: certain BRCA1 gene mutations increase risk of breast, colon, ovary, and pancreatic cancers
• Familial cancers occur earlier and are more aggressive than their sporadic counterparts
Inherited Cancer Syndromes

- Usually autosomal dominant
- Each has a specific gene mutation that increases risk of getting *multiple* cancers
- Example: Li-Fraumeni syndrome
  - mutation in p53 gene
  - 25x ↑ risk of sarcomas, breast cancer, leukemia, and brain tumors
  - cancers usually appear before age 50
Syndromes of Defective DNA Repair

• Inherited mutations in genes encoding DNA repair systems
• Greatly enhance the occurrence of mutations in other genes (“genomic instability”)
• Example: xeroderma pigmentosum
  • Mutations in genes in “nucleotide excision repair” pathway (fixes UV-damaged DNA)
  • Extreme sensitivity to sunlight
  • ↑↑↑↑ risk of skin cancer (in childhood!)