What is Cancer?

- Constellation of diseases
- If untreated serious illness & death
- Normal cell becomes abnormal
Normal Cells
- Serve a purpose
- Grow predictably
- Divide predictably
- Die when abnormal or worn out
- "Stay home"

Cancer Cells
- Serve no purpose
- Grow out-of-control
- Divide out-of-control
- Fail to die even when abnormal
- "Leave home" (metastasize to other tissues or organs)

How does cancer begin?

Cellular DNA damage
- DNA "drives" all cell activity
- Healthy DNA:
  - Normal cell activity
- Damaged DNA:
  - Abnormal cell activity
  - Cell grows & divides out of control

Gene mutations cause DNA damage

Inherited gene mutations
- 5-10% of cancers
- Born with the mutation
- Inherited from parent

Sporadic gene mutations
- 90-95% of cancers
- Single cell mutation
- Carcinogen exposure
- Not born with/not inherited/not passed on

Familial tendencies
- Cell division error

5-10% of cancers
Cancer is named…

According to where it begins

When cancer spreads, still named for the location where it began

Are all cancers the same?

- No
- Behave differently
- Grow & respond differently
- Cancers in the same organ in different people can be very different (e.g., breast)

Cancer treatment always targets that particular cancer

How does cancer grow?

Abnormal cell survives → Abnormal cell divides → Multiple abnormal cells form a tumor
How does cancer spread?

**Invasion**
- Cells expand to nearby tissues

**Metastasis**
- Cells spread to other sites (blood stream, lymphatic system)
- New tumors develop away from primary site

Carcinogens

Agents that can cause cancer

- Known carcinogens:
  - Tobacco
  - Radon
  - Asbestos
  - Ultraviolet Rays
- Yet unknown carcinogens

Recognizing carcinogens for what they are…
Cancer is:

A "clonal" disease. It originates from one ancestral cell that, having acquired the capacity of limitless cell division & survival, gives rise to limitless descendants.

A "clonally evolving" disease - Every generation of cancer cells creates cells genetically different from its parents.

When chemotherapy or the immune system attacks cancer, mutant clones resist & grow.

This relentless cycle of mutation, selection, & overgrowth generates cells that more & more adapted to survival.

-- Siddhartha Mukherjee The Emperor of All Maladies

How common is cancer?

Half of men in the US will develop cancer during their lifetime

One-third of women in the US will develop cancer during their lifetime
SKIN & SKIN CANCER:

“A most delicate & intricate cellular world”

Epidermis:
- Squamous Cells
- Basal Cells
- Melanocytes

How common is SKIN cancer?
Skin cancer is the most common cancer

1 in 5 Americans will develop skin cancer in their lifetime
“Benign Skin Growths” ≠ Cancer

- Rarely life-threatening
- Generally can be removed
- Usually don’t grow back
- Don’t invade other tissue
- Don’t spread

Precancerous Skin Conditions

- Actinic or solar keratosis
- Actinic chelitis
- Leukoplakia

“Malignant Skin Growth” = Cancer

Hippocrates (460-370 BC) described cancer using Greek word *carcinos* (crab or crayfish)

- May be life-threatening
- Can often be removed – may grow back
- Can spread to other locations
### Main Types of Skin Cancer

<table>
<thead>
<tr>
<th>NONMELANOMA</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>• Basal Cell Carcinoma</td>
<td></td>
</tr>
<tr>
<td>• Squamous Cell Carcinoma</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>MELANOMA</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>• Most common skin cancer</td>
<td></td>
</tr>
<tr>
<td>• Starts at bottom layer of epidermis</td>
<td></td>
</tr>
<tr>
<td>• Major cause: chronic sun exposure</td>
<td></td>
</tr>
<tr>
<td>• Older people</td>
<td></td>
</tr>
<tr>
<td>• People who work outdoors</td>
<td></td>
</tr>
</tbody>
</table>

Photo alert…
Squamous Cell Carcinoma

- Second most common skin cancer
- Usually confined to outer layer of skin
- But may occur on all areas of body
- Chronic exposure to sun
- May occur where skin has had an injury
Melanoma = “Malignant Melanoma”

- Develops in pigment cells of the skin
- Less common but far more serious
- Curable in early stages
- If left alone, more likely to spread
- Affects all ages
- Any skin surface, but especially:
  - Men: Trunk, head, neck
  - Women: Legs, head, neck
RECOGNIZING The Risks

Risks for Skin Cancer

- Major risk: Ultraviolet radiation (UVA & UVB) from sun or man-made source
- Living at high altitude or near equator
- Severe sunburn at early age
- Occupational hazards/exposures
  - Arsenic
  - Petroleum and coal
Risks for Skin Cancer (continued)

- Genetic factors
  - Tendency to burn
  - Fair skin, red or blonde hair
  - Familial history of melanoma
  - Numerous moles
  - History of skin cancer or pre-cancer
  - Certain autoimmune diseases (Lupus)

The most important, avoidable known risk factor:

**Exposure to UV radiation**
from sunlight or indoor tanning devices

The SUN - a 6 billion year old star

The SUN is good
- Increases our mood
- Increases physical activity
- Increases social activities
- Provides Vitamin D

The SUN presents risks
- Skin & eye damage
- Skin cancer
What is UV Radiation?

• Found in sunlight
• Invisible to naked eye
• 3 wavelengths
  UVA rays – Longest
  UVB rays – Shorter
  UVC rays – Shortest – don’t reach earth

UV Exposure is associated with:

• Premature aging of the skin
• Suppression of the immune system
• Eye damage – cataracts, ocular melanoma
• Skin cancer

*UV radiation damages cellular DNA & produces genetic mutations*

UVA Rays:

• Extensive exposure over lifetime
• Penetrate deeply into skin
• Dominant tanning rays (A = tAn)
• Cumulative damage over time
• Skin aging & wrinkling - PHOTOAGING
• Contribute to & initiate skin cancer
• Penetrate glass
PHOTOAGING
Unilateral
Dermatocheliosis

Truck driver for 28 years
Chronic UVA exposure through driver’s side window – his left side
Skin thickening and destruction of elastic fibers

New England Journal of Medicine 4/19/2012

UVB Rays:

- Damage more superficial skin cells
- Chief cause of sunburn (B = Burn)
- Aging and wrinkling - PHOTOAGING
- Key role in skin cancer
- Do not significantly penetrate glass
SMART MOVES

Decrease exposure to UV radiation

- Avoid sun exposure between 10-4
- Bright surfaces reflect UV & ☼ exposure
- Cover or shade body & eyes
- Know meds that ☼ UV sensitivity:
  Thiazides, diuretics, tetracycline, doxycycline,
  sulfa antibiotics, and nonsteroidal anti-
  inflammatory drugs, such as ibuprofen

Know Ultraviolet (UV) Radiation Index

UV index = ☼ higher risk

Free phone app
http://www.epa.gov/enviro/mobile/
Sunscreen

- Absorbs/reflects UV radiation
- Spray, lotion, cream, stick, powder
- Sun Protection Factor (SPF):
  - SPF 15 at least
  - SPF 30 for extended exposure
- Broad Spectrum

Sun Protection Factor (SPF)

- How well sunscreen deflects UVB rays
- No standard for measuring UVA protection
- How long it takes to sunburn skin treated with sunscreen, compared with non-treated skin
- SPF of 15 = 15 x longer before burning
- Broad spectrum coverage – any one of these:
  - Avobenzone, Cinoxate, Ecamsule, Menthyl anthranilate, Octyl methoxycinnamate, Octyl salicylate, Oxybenzone, Sulisobenzone

Sunscreen

- Apply generously
  - Exposed parts
  - Ears, scalp, lips, neck, tops of feet, backs of hands
- Reapply:
  - Every 2 hours
  - Wet or perspiring
- Replace each year
- Keep handy
- Buy what you will use
Agricultural vulnerabilities…

American Cancer Society:

SLIP, SLOP, SLAP, WRAP

- SLIP on a shirt
- SLOP on sunscreen
- SLAP on a hat
- WRAP on sunglasses

What about moles?

- Most people have moles
- Most moles are harmless
- Normal moles are:
  - Evenly colored
    - Brown, tan, or black
  - Usually smaller than ¼ inch
  - Round or oval shape
  - Flat or dome shaped
What about moles? (continued)

- Most moles appear by age 30
- New moles later in life need checked
- Many moles: greater risk of melanoma
- Recognize changes
- Have changes checked

<table>
<thead>
<tr>
<th>ABCDE Warning Signs for Moles</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
</tr>
<tr>
<td>B</td>
</tr>
<tr>
<td>C</td>
</tr>
<tr>
<td>D</td>
</tr>
<tr>
<td>E</td>
</tr>
</tbody>
</table>

If yes, ask doctor to check it out

Check Your Skin Monthly

- Front
- Back
- Arms
- Scalp
- Feet
- Be suspicious of sores that don’t heal

Consider a professional skin examination yearly
Babies need special protection

THE LURE & THE LIES OF INDOOR TANNING

Indoor Tanning

- Introduced in US - late 1970s
- Coincides with rise in skin cancer rates
- 30 million Americans tan indoors every year
- 71% are girls & women ages 16-29
- Multi-billion dollar industry
Indoor Tanning

Emits primarily UVA (tanning rays; penetrate deeply)
Can emit up to 12 x UVA as sun
People who use tanning beds:
• 2.5 x more likely - squamous cell carcinoma
• 1.5 x more likely - basal cell carcinoma
  First exposure to tanning beds before age 35 increases melanoma risk by 75 percent

Indoor Tanning

Group 1 - “Carcinogenic to Humans”
2009 - International Agency for Research of Cancer (IARC) classified UV-emitting indoor tanning devices to highest level of cancer risk

Indoor Tanning Regulations

• US Food & Drug Association (FDA):
  Regulates manufacturing & labeling of device
• US Federal Trade Commission (FTC):
  Investigates false & deceptive advertising
• States:
  Regulate; issue licenses; inspect; train & employees
Indoor Tanning Regulations

• Currently, 33 states have laws restricting minors’ access under a certain, including bans on access or requiring parental accompaniment or consent.
• New laws make the news
• Nebraska has no such law

Indoor Tanning

Highest prevalence: White women
  Aged 18–21 years (31.8%)
  Aged 22–25 years (29.6%)
  Aged 18–21 years in the Midwest (44.0%)

Vitamin D

• Fat-soluble vitamin
• Present in few foods, added to some & available as supplement
• Produced internally - UVB rays trigger synthesis
• Deficiency:
  • Rickets and Osteomalacia
  • Emerging data on cancer prevention
True or False?
Indoor tanning is a **good** source of vitamin D.

- UV radiation is a carcinogen
- Vitamin D - diet & oral supplements
- Dietary Vitamin D less expensive

True or False?
Indoor tanning devices provide a controlled dose of UV exposure.

- UVA output higher than sunlight
- "High-powered" devices can emit up to 12 x UVA than sunlight

True or False?
Obtaining a “base tan” from an indoor tanning device is a safe way to protect your skin from further damage.

- There is no safe tan
True or False?

Youth are especially susceptible to the lure & risks of indoor tanning.

- Teens reporting indoor tanning:
  - 1998 = 1%
  - 2010 = 27%
- Tanned look glamorized
- "Prep" for special events – prom, weddings
- Teens with a parent using more likely to use
- cumulative exposure over lifetime

True or False?

Youth are especially susceptible to the lure & risks of indoor tanning.

UV Light-Related Addiction

CAGE Questionnaire
Criteria to dx substance abuse

Cut down – Do you feel need to cut down?
Annoyed – Do you feel annoyed by criticism?
Guilt – Do you feel guilty about tanning?
Eye-opener – Do you need to tan 1st thing in AM?
Dear Sixteen Year Old Me

http://www.youtube.com/watch?v=4jqUcMzM

Credible Resources:

Skin Cancer Foundation
American Cancer Society
Center for Disease Control
National Institutes of Health
Environmental Protection Agency
2012 Estimated US Cancer Cases*

<table>
<thead>
<tr>
<th>Site</th>
<th>Men</th>
<th>Women</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prostate</td>
<td>848,170</td>
<td>790,740</td>
</tr>
<tr>
<td>Lung &amp; bronchus</td>
<td>14%</td>
<td>14%</td>
</tr>
<tr>
<td>Colon &amp; rectum</td>
<td>9%</td>
<td>0%</td>
</tr>
<tr>
<td>Urinary bladder</td>
<td>7%</td>
<td>6%</td>
</tr>
<tr>
<td>Melanoma of skin</td>
<td>5%</td>
<td>4%</td>
</tr>
<tr>
<td>Kidney &amp; renal pelvis</td>
<td>5%</td>
<td>3%</td>
</tr>
<tr>
<td>Non-Hodgkin lymphoma</td>
<td>4%</td>
<td>4%</td>
</tr>
<tr>
<td>Oral cavity</td>
<td>3%</td>
<td>3%</td>
</tr>
<tr>
<td>Leukemia</td>
<td>3%</td>
<td>3%</td>
</tr>
<tr>
<td>Pancreas</td>
<td>3%</td>
<td>3%</td>
</tr>
<tr>
<td>All Other Sites</td>
<td>18%</td>
<td>30%</td>
</tr>
</tbody>
</table>

*Source: American Cancer Society, 2013

*Excludes basal and squamous cell skin cancers and in situ carcinomas except urinary bladder.

2012 Estimated US Cancer Deaths

<table>
<thead>
<tr>
<th>Site</th>
<th>Men</th>
<th>Women</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lung &amp; bronchus</td>
<td>29%</td>
<td>26%</td>
</tr>
<tr>
<td>Prostate</td>
<td>9%</td>
<td>14%</td>
</tr>
<tr>
<td>Colon &amp; rectum</td>
<td>9%</td>
<td>6%</td>
</tr>
<tr>
<td>Pancreas</td>
<td>6%</td>
<td>7%</td>
</tr>
<tr>
<td>Liver &amp; intrahepatic bile duct</td>
<td>5%</td>
<td>6%</td>
</tr>
<tr>
<td>Leukemia</td>
<td>4%</td>
<td>4%</td>
</tr>
<tr>
<td>Esophagus</td>
<td>4%</td>
<td>3%</td>
</tr>
<tr>
<td>Urinary bladder</td>
<td>3%</td>
<td>3%</td>
</tr>
<tr>
<td>Non-Hodgkin lymphoma</td>
<td>3%</td>
<td>2%</td>
</tr>
<tr>
<td>Kidney &amp; renal pelvis</td>
<td>3%</td>
<td>2%</td>
</tr>
<tr>
<td>All other sites</td>
<td>25%</td>
<td>24%</td>
</tr>
</tbody>
</table>

Source: American Cancer Society, 2013

The Lifetime Probability of Developing Cancer for Men, 2006-2008*

<table>
<thead>
<tr>
<th>Site</th>
<th>Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>All sites</td>
<td>1 in 2</td>
</tr>
<tr>
<td>Prostate</td>
<td>1 in 6</td>
</tr>
<tr>
<td>Lung and bronchus</td>
<td>1 in 13</td>
</tr>
<tr>
<td>Colon and rectum</td>
<td>1 in 19</td>
</tr>
<tr>
<td>Urinary bladder</td>
<td>1 in 26</td>
</tr>
<tr>
<td>Melanoma</td>
<td>1 in 36</td>
</tr>
<tr>
<td>Non-Hodgkin lymphoma</td>
<td>1 in 43</td>
</tr>
<tr>
<td>Kidney</td>
<td>1 in 51</td>
</tr>
<tr>
<td>Leukemia</td>
<td>1 in 64</td>
</tr>
<tr>
<td>Oral cavity</td>
<td>1 in 69</td>
</tr>
<tr>
<td>Stomach</td>
<td>1 in 91</td>
</tr>
</tbody>
</table>

*Probability is calculated as the percent cumulative probability of developing cancer at the beginning of the age interval.

2/15/2013
# The Lifetime Probability of Developing Cancer for Women, 2006-2008

<table>
<thead>
<tr>
<th>Site</th>
<th>Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>All sites§</td>
<td>1 in 3</td>
</tr>
<tr>
<td>Breast</td>
<td>1 in 8</td>
</tr>
<tr>
<td>Lung &amp; bronchus</td>
<td>1 in 16</td>
</tr>
<tr>
<td>Colon &amp; rectum</td>
<td>1 in 20</td>
</tr>
<tr>
<td>Uterine corpus</td>
<td>1 in 38</td>
</tr>
<tr>
<td>Non-Hodgkin lymphoma</td>
<td>1 in 51</td>
</tr>
<tr>
<td>Urinary bladder1</td>
<td>1 in 87</td>
</tr>
<tr>
<td>Melanoma§</td>
<td>1 in 55</td>
</tr>
<tr>
<td>Ovary</td>
<td>1 in 71</td>
</tr>
<tr>
<td>Pancreas</td>
<td>1 in 69</td>
</tr>
<tr>
<td>Uterine cervix</td>
<td>1 in 147</td>
</tr>
</tbody>
</table>

*For those free of cancer at beginning of age interval.
§ All sites exclude basal and squamous cell skin cancers and in situ cancers except urinary bladder.
† Includes invasive and in situ cancer cases.