Aging

What is Aging?

Def:
- Gradual loss of vitality of cells & tissues
- Organs function less and less efficiently

Why Do We Age?

?????????????
Two current hypotheses:
1. “Programmed Life” Hypothesis
   - Internal biological clock
     • genetic control
     - finite number of divisions
2. “Cumulative Assaults” Hypothesis
   - Ongoing, cumulative damage to DNA
     • Environmental assaults
       - DNA replication and repair
### Aging – Skin

- Epidermal cell division slows
  - Healing slows
- Dermal connective tissue changes
- Loss of fat in subcutaneous layer
- Cutaneous glands break down
- Hair follicles die or less active
- Melanocytes die

Skin → thins, sags & wrinkles
Hair → loss and graying
Ukrainian sunbathers stand in the sun on a crisp, frosty winter day in Kiev, February 22, 2004. REUTERS/Str

Slide 8

Is Sunscreen Overrated?

Skin cancer incidents on the rise

<table>
<thead>
<tr>
<th>State</th>
<th>Cases</th>
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<tr>
<td>California</td>
<td>6,900</td>
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<td>Alaska</td>
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Sunscreens Faulted on Cancer Protection

- UVA – UVB
- Sunscreen
  - Zinc oxide, titanium dioxide, avobenzone
  - how much, how often?
  - “waterproof” & “sunblock”
  - SPF

18 months
Sun damage not yet apparent

4 years old
Early sun damage
Freckling across nose and cheeks
17 years old
Significant sun damage due to deliberate tanning on beaches and in salons

37 years old
Sub-surface damage in UV light

52 years old
Seen in visible and ultraviolet light
64 years old

Beach community resident with dry, inelastic, and heavily mottled skin with wrinkles

Sun-damaged Chest

Aging - Muscle

- Number of skeletal muscle fibers little changed
- Atrophy of skeletal muscle fibers
  - Corresponds to loss of motor neurons
  - Replaced by fat
- General loss of mass and strength
  - 80yo vs 30yo
Arnold Schwarzenegger

Aging - Bones

- Weaker, more porous and brittle
- Calcium loss
  - Osteoporosis
    - Bone production < bone resorption
      - begins ~ 30yo (female)/~ 60yo (male)
- Intervertebral discs deteriorate
- Joint deterioration
  - Osteoarthritis
Aging – Cardiovascular Sys

- Slight atrophy of cardiac muscle
- Changes in Blood vessel walls
  - harden and stiffen
- Narrowing of arteries

→ HBP, atherosclerosis, arteriosclerosis, etc

Aging – Respiratory Sys

- Entire airway less elastic
- Alveolar walls breakdown
  - Less surface area for gas exchange

→ Lung capacities drop
Aging – Nervous System

- Replacement of neurons
  - Brain neurons
    - Compensation by surplus neurons and reconnections
- Alzheimer’s Disease
  - Neurofibrillary tangles and amyloid plaques
- Slower conduction
  - Decreased myelin
  - Slower release of neurotransmitter at synapse
    → Slower movement & reflexes, less coordination
Aging – Female Reproductive Sys

Females

- Menopause
  - Late 40s or early 50s
  - Triggered by drop in estrogen & progesterone secretion
  - Irregularity and ceasing of menstrual periods
  - Ovaries cease endocrine and exocrine functions
  - Declining estrogen levels:
    - Hot flashes
    - Thinning & decreased lubrication of vagina
    - Increases risk of heart disease and osteoporosis
      - Hormone replacement therapy (HRT)
Tina Cade, a 55 year old mother of three, acted as a surrogate for her oldest daughter, Camille Hammond, as she gave birth to triplets on December 28, 2004. Camille suffers from endometriosis, a condition affecting the lining of the uterus that makes it difficult to become pregnant. Hammond and her husband, both doctors at Johns Hopkins University in Baltimore, had tried for four years to become pregnant. Cade approached the couple with the idea of carrying their child and began hormone treatment last winter to turn back her biological clock — she had already entered menopause — and prepare her for pregnancy. Three embryos were implanted and all three survived.

### Aging – Male Reproductive Sys

- **Testosterone level drops**
  - Fewer viable sperm
    - Reproductive capacity
  - Decreased sexual desire (libido)
- **Erectile disfunction (ED)**
- **Prostate enlargement**
  - 2-4X normal size in 30% of all males over 60
    - Urinary frequency, nocturia, bladder infection, etc

### Male Reproductive System

- seminal vesicle
- ejaculatory duct
- prostate gland
- bulbourethral gland
- vas deferens
- epididymis
- testis
- scrotum
- urethra
- penis
- vas deferens
Aging - Immunity

- T and B cells less active and fewer
  - Decreased response to antigens/infections
  - Increased susceptibility to infection
  - Flu shot
Aging – Digestive Sys

- Degeneration of secretory mechanisms
  - Glands in mucous membranes of stomach, SI & LI
  - pancreas
- Fewer calories required
  - Decreased metabolism
    - Weight gain
- Less elasticity of large intestine
- Sphincters can weaken

Aging – Urinary System

- Loss of some nephrons
  - Not usually a problem
- Less elasticity of urinary bladder and urethra
- Sphincter can weaken
Slowing the Ravages of Time

Lifestyle Choices
- Program of regular, moderate physical activity
  - stimulates muscle and bone replacement
  - Helps maintain efficiency of CV and respiratory systems
- Low-fat diet
  - Cardiovascular health
- Not smoking
  - Lung and CV health

Embryonic Stem Cells

Little Nicky

Nine-week-old 'Little Nicky', December 22, 2004 in Texas. The successfully cloned cat was sold by Genetic Savings and Clone for $50,000.
The End