

## HSSP Summer 2009 S2439: Biology of Aging and Cancer

### Basic Information:

The class is in room 2-132. It starts at 3:05 and ends at 4:55 every Sunday.

I am a senior in biological engineering at MIT.

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### Course Outline, Part A:

These are the topics we will be covering during the first part of the course. Some of these topics may seem familiar from biology classes you have already taken. Others may not, as many of them are things not generally covered in high school biology classes. The topics will be covered with an emphasis on problem-solving and understanding their medical significance.

1. Introduction
  - (a) Hello and all that
  - (b) What is aging/senescence?
  - (c) What is cancer?
  - (d) Relationship between aging and cancer
  - (e) Tumor suppressors and oncogenes
2. Molecular biology
  - (a) Introduction – what's important?
  - (b) The Central Dogma
  - (c) Gene expression and the regulation thereof
    - i. The RNA polymerase holoenzyme
    - ii. Promoters and transcription factors
    - iii. Cell/tissue specificity of promoters
    - iv. Promoter mutations
  - (d) Protein synthesis
    - i. Start/stop mutations
    - ii. Frame shift mutations
  - (e) Protein function
    - i. Folding
    - ii. Ligand binding
    - iii. Enzymatic activity
    - iv. Post-translational modification
    - v. Aggregation and dominant negative phenotypes
3. DNA replication and repair
  - (a) Chromatin structure
    - i. DNA double helix
    - ii. Histones, heterochromatin and euchromatin
    - iii. Chromosome structure – sister chromatids, centromere, telomeres
  - (b) DNA replication
  - (c) DNA damage → repair
    - i. Base modification
      - A. Base excision repair
      - B. Nucleotide excision repair
    - ii. Single strand break → ligation
    - iii. Double strand break
      - A. Homologous recombination
      - B. Non-homologous end joining

- C. Telomere depletion
- iv. Chromosomal abnormalities
- (d) Mitosis

**Course Outline, Part B:**

After we have covered the topics from part A, we will cover some of the following topics. There is not enough time to cover all of them, so we will do a few based on student interest.

- The RTK pathway
- Mitochondria and apoptosis
- Sirtuins
- Tumor development
- Wingless/hedgehog signaling
- Stem cells
- Free radicals and anti-oxidants