EFB325 Cell Physiology

Welcome to Cell Physiology

Course organization

- exams
- homework / quizzes
- grading
- extra credit project
- textbook, CD-ROM
- web page (lecture outlines)
- class participation

Instructor, TAs

- Offices/Office hours/e-mail

What are you going to learn in this course and why?

What?

Syllabus-Four sections

Section 1: Building a cell

- describe cells and organelles as an overview-differences between plant cells and animal cells
- describe the major classes of molecules that make up cells - their building blocks and synthesis
- review of fundamentals of chemistry and thermodynamics, especially as they will relate to the biological reactions we will be discussing
- discuss the properties of proteins and enzymes important for further discussion of physiology
- properties of membranes and the movement of molecules across membranes

Section 2: Flow of energy

- enzyme kinetics - how enzymes are regulated
- biochemical pathways involved in the basic metabolism of the cell, breakdown of sugars to produce ATP and for biosynthesis
- processes involved in photosynthetic production of sugars
- these are the fundamental physiological pathways involved in maintaining proper cellular function

Section 3: Flow of information

- discuss the biochemical properties of the informational molecules of the cell-the nucleic acids, including DNA replication during mitosis, the structure of genes
- describe the process of utilizing that genetic information through transcription and translation to produce proteins
- examine the processing and targeting of proteins to their appropriate location in the cell where they function
- talk about the points at which all of those processes may be regulated by developmental, hormonal, or environmental signals

Section 4: Building multi-cellular tissues & organisms

- bring all of the information from the first three quarters together while discussing the interactions

between individual cells and tissues in multicellular organisms
- this will include the functions of tissue systems, regulation of cell physiology by hormones, and the control of gene regulation to ensure proper development
- finally discuss aspects of cell physiology which are disrupted in the progression of cancer

Why?

- in this course, you will learn a major portion of the material covered on the GRE Biology subject exam
- this is a critical prerequisite to many other advanced courses-plant, animal, insect, fungus physiology, molecular biology, immunology, embryology, complements genetics
- there are many jobs in the fields encompassed by cell biology, because there is $ from federal grant agencies, non-gov't organizations, and pharmaceutical companies
- understanding this material is increasingly important in our daily lives-health and human medicine, food production and safety, forensics, environmental science, biotechnology - Try to confer some awareness of the impact on our lives an understanding of cell biology can have and also to bring to light some possibilities ahead of us in terms of advancing our knowledge of biology and the environment.
- this information represents many of the foundations of biology and some of the universal properties among living organisms

As background-look back to the origins of life on Earth

- primordial soup, anaerobic
- atmosphere with ammonia (NH_3), methane (CH_4), CO_2, H_2, high UV light, lightning
- these compounds can react to make amino acids, organic acids, purines, pyrimidines, sugars; eventually polymers

First signs of life:

- self-replicating molecule, RNA world
- evolution of metabolic reactions
- glycolysis=glucose -> lactic acid (anaerobic)
- photosynthesis=capture of light energy to convert CO_2 to organic compounds; produce O_2
- oxidative metabolism=use of oxygen to breakdown organics to produce ATP as the energy currency
- initiation of life=ancestral procaryote (single-celled, no nucleus, DNA genome, plasma membrane and cell wall)

Universality among all organisms because they evolved from a common ancestor

- from that evolved the present-day archaebacteria (prokaryotes in extreme environments), eubacteria (including cyanobacteria, which are photosynthetic), and eukaryotes
- evolution of eukaryotes, including the symbiosis of an ancestral procaryote with a eucaryote to form the mitochondria; association of a cyanobacterium to form the chloroplast
- evolution of plants, animals, fungi, protists

We, as scientists, focus on particular model organisms to learn everything about one species, which should apply to others, for the most part

  - *Escherichia coli*
  - *Saccharomyces cerevisiae* (brewer's yeast)
  - *Caenorhabditis elegans* (nematode worm)
  - *Drosophila melanogaster* (fruit fly)
  - *Arabidopsis thaliana* (thale cress or mouse's ear cress)
  - *Mus musculus* (house mouse)

- *Homo sapiens*

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