CELL PHYSIOLOGY review

CELL CYCLE

Discuss how cyclins are involved in control of cell cycle.
What is the mechanism for getting rid of cyclins during the cycle?
What are the check points of the cell cycle? How is p53 involved?
How is phosphorylation and removal important to regulation of cell division. What are some target cell components for the CDCkinases and phosphatases.

DNA CHIPS

How can DNA arrays be used to show a difference in RNA transcription during different phases of the cell cycle?
How do they get the DNA to put on the array and the c-DNA to do the hybridization?

STEM CELLS

What is the difference between adult and embryonic stem cells?
How has recent investigation of chromosomes of stem cells converted to various adult types by progenitor CNS cells cast doubt on the plasticity of adult stem cells? Sci. 295:1989 2002
What is the result of treating embryoid bodies from stem cells with various growth factors?

HORMONES

Contrast the action of peptide versus steroid hormones - give examples.
Give an example of a negative feedback response with the menstrual cycle.
How can the same gene be used to make entirely different hormones in different cells - such as pituitary, neurons, other tissues? (proopiomelanocortin).
What kinds of transduction systems are used by peptide trophic or growth hormone receptors?

METABOLISM

What factors can influence which way a reaction is more likely to go?
Where do fatty acids, amino acids and glycerol enter the oxidative pathways?
Where in the cell does glycolysis take place?
Where are the key control points for metabolism?
Which reactions are essentially irreversible? Which of those have another enzyme to go in the reverse direction?
How are these related to hormones , energy charge (see handout), redox potential ?Give specific examples of enzymes effected.
Use phosphofructokinase and phosphorylase to explain. See p. 84-86.
What is the equation for glucose oxidation?
Where does the water come from in glucose oxidation?
What vitamins are essential to glucose metabolis m?
Why is the citric acid cycle called a cycle?
How many hydrogens must be removed from glucose in its oxidation? Where are they removed? How many are removed in glycolysis? How many in the intermediate step making acetylCoA?
In order to get the CO_2 in the glucose oxidation equation products what has to happen? Does that involve the electron transport system?
What is the ETS used for? Where does the water in the glucose oxidation equation come from?
How are the electron transport systems of plants chloroplasts different from their mitochondria?
Where do the electrons transported in chloroplasts ETS come from?
Where do the electrons transported in ETS in animal cells come from?
How is the proton gradient formed in each case? What is it used for?
What is the function of enzymes at each step of the metabolic pathways?
How can the amount of O_2 available regulate metabolism in animals?
How can the amount of CO_2 available regulate metabolism in plants?
Chloroplasts: how can light and amount of water regulate plant metabolism?
How is the ETS of chloroplasts different from mitochondria?

Metabolic CONTROL MECHANISMS

How do insulin and glucogon effect glycolysis, citric acid cycle?
How can ETS proton gradient across the inner membrane be regulated or uncoupled?.
Hormones, ionophores, uncoupling protein, amount acCoA
What can raise the redox potential of NADH/NAD?
How can you make ATP synthesis match ATP use, and be able to increase 10x in muscle?
the creatine+ATP-to(or reversible) phosphocreatine+ADP equilibrium Creatine crosses memb, get P added and makes ADP which taken up by matrix phosphorylated
How can Ca++ alter metabolism in muscle as well as cause contraction?

IMMUNE SYSTEM:

Which cells of the immune system have receptors for antigens on their surface and how does the response of receptor-antigen complex get transduced to cell action?

What is the clonal selection theory and how does it explain the immune response to foreign antigens?

What is a mitogen and how is the RAS-gene product related to it? How is G-protein and adenyl cyclase involved?

What is the difference between T- and B-cells? Where are they found, how do they function in the immune system, and how can they interact?

What are antigen-presenting cells, and why are they important?

What is the basis for the myriad of different kinds of antibodies able to be made by the immune system? What is recombinase?

How can cells influence the motility or cell division rates of other cells?

What is the MHC and how is it important in distinguishing self and foreign antigens? What kinds of MHC receptors are there and where are they found?

How can secretion of interleukins affect others cells and the cells doing the secreting? What is the function of a helper cell?

How do killer cells work?
2. How can the macrophage;T-cell;B-cell interactions be used as amodel to prove how cellular interactions may involve growth factors, gene activation, receptor synthesis, surface reactions including cell adhesion since these all are involved in causing plasma cell production due to foreign antigen presence?
What is the difference between the functions of MHCI and II?

Cancer:

What is an oncogene? What kinds are there? Why are there certain more frequently found types of oncogenes, as compared to others, do you think? What kinds of things are most frequently out of control in cancer cells?

Why do people with AIDS most frequently die of cancer or infection?

What kinds of control mechanisms could be disrupted in cancer cells so they divide more rapidly and are not influenced by other cells?

Describe Cell control mechanisms, including: a) changes in pH b) changes in amount of free calcium c) phosphorylation of proteins to alter the metabolic activity or structure d) hormone

VESICULAR TRANSPORT AND ENDOCYTOSIS, EXOCYTOSIS

What are the coats on vesicles after endocytosis? What is the difference between constitutive and signaled exocytosis. How is phosphatidyl inositol metabolism involved in signalling for vesicular transport?

APOPTOSIS

How could you test for apoptosis in cells?
Nuclear integrity lost, chromosomes fragment , DNA ladder.
Cells detach and round up, shrink, loss of water. Plasma membrane ruffled and blebbed
What mitochondrial changes occur?

What keeps the Machinery for apoptosis present in normal cells from starting to work?
SODD ;TRAF2 and RIP; NGF ;Integrin; BCl2
What signals from outside can cause it? Tumor necrosis factor receptor. Fas- Fas ligand from Tcell receptor-
Where do you find death domains
How does DNA damage trigger p53 production (tumor suppressor gene?

How does increased Ca++ cause apoptosis?

How does release of Cyt c into cyto plasm cause so much trouble?

How do caspases have their effect. Give specific examples.

Diseases and failure of control systems - Science 26 april 2002 v 296- a whole section on complex diseases, but p 701-3- Maneuvering in the complex path from genotype to phenotype:

Explain how Changes in **metabolism, energy charge, redox potential, phosphorylation** can be involved in disease. Give specific kind of cells and examples

How can ketone bodies restore metabolism in damaged cells

DIABETES - II How can overeating cause it?
What kinds of factors do Fat cells release? **leptin** ,**Resistin Adiponectin** Fatty acid .

How can Uncoupling protein 2 of mitochondria or other possible genes be involved in diabetes?p 688.

How is metabolism and production ATP related to maintaining good healthy neurons and pancreas cells?

What causes **Autoimmune- reactions with** dying cells after prominent tissue damage by T cells.
(Activation of the toll rec can work the same as T helper
What causes some diseases caused by Cell-killing forces used on self.? Arthritis, blood clots, fatigue, heart disease, osteoporosis, cognitive loss due to neuron death. Lupus mainly women, but other autoimmune for men.)
What does presence of **C-reactive protein CRP in blood show?**

(CRP levels are related to inflammation, body/mass index also related to diabetes II, syndrome X- people with high abdominal fat, high blood pressure, cholesterol, blood sugar, TG, low HDL. CRP higher in smokers, nondrinkers, heavy drinkers, hormone replacement, CRP increases with age.)

WATER REGULATION

Quiz from last time - How can apoptosis be initiated or prevented?

Describe ways for water to enter or leave cells.

How can you Measure water movement?

If you Found the ratio of Pd –permeability by diffusion rate: osmosis -Pf is about 5, what does that show about the membrane?

If aquaporins.AQP1 genes are expressed in Xenopus eggs,it increased Pf 30x , what does that show about aquaporins?

How can Aquaporins be controlled?

Can water move through other proteins?

CELL VOLUME CONTROL

Describe two major Transporters or cotransporters used to regulate cell volume.

How can guanylcyclase cause cell swelling.

Describe how you get NaCl influx plus CO2 and H2O out,or the reverse, using carbonic anhydrase.

What is involved in REGULATORY VOLUME DECREASE RVD, **or REGULATORY VOLU me increase** RDI ?