

Review of main topics for Final exam – BIO 345 Spring 2008

Some final reminders:

- Tuesday April 22 guest lecture on whale metabolism. Be aware that there will be questions on the final exam about this lecture, and in addition, there will be a bonus assignment associated with this lecture, which you will not be able to pick up or complete if you do not attend!
- Thursday April 24 no class. Review session scheduled for this date moved to April 29.
- Tuesday April 29 Review session for final exam from 2-3 pm in Dobo 134.

Our final exam is Tuesday May 6th from 11:30-14:30 in Dobo 134 (our regular classroom).

YOU WILL NEED A CALCULATOR for the final exam.

The exam will be a mix of question types – a few multiple choice, a few fill-in-the-blank, some definitions, diagram labeling and some short answers, with one or two longer answers. There will also be a few bonus questions for extra points. This exam will be worth 35% of your final grade for this course.

Below is a list of the main topics we have covered since the second exam. This list is meant to help guide you as you study, but IT IS NOT THE ENTIRE SET OF MATERIALS THAT WILL BE COVERED ON THE EXAM. **Anything** that we have talked about in class since the second exam is fair game on the final exam. Although the final exam will not be cumulative, keep in mind that there are some concepts that we learned early in the semester that apply to topics we have discussed in this final section.

A. Hormones

- definition and characteristics of hormones; neurohormones vs neurotransmitters vs hormones
- classes of hormones (peptide, steroid, amines) and their various features (half life, solubility, etc)
- mechanisms of action of hormones (membrane receptor/secondary messenger pathway vs. receptor inside cell or nucleus), resulting effects and timeframes of those effects
- feedback: positive and negative
- ADH and how it works
- regulation of blood glucose levels via insulin and glucagon, and the interplay between them
- specific role of insulin
- hormones of the human female menstrual cycle, feedback and control, events in the hypothalamus, ant. pituitary, ovaries, follicles, corpus luteum and endometrial lining and how these all correspond to hormonal levels over the cycle. Know hormones (GnRH, LH, FSH, estrogen, progesterone, inhibin) and this system well.
- hormones associated with moulting and development in insects (another example of antagonistic hormones).

B. Metabolism

- what is metabolism?
- metabolic rate, how to define it under different conditions, and how to measure it
- respiratory quotient
- isometry and allometry
- how body mass affects metabolic rate (whole-animal and mass-specific)
- principles of aerobic metabolism – glycolysis, Krebs's/citric acid cycle, electron transport chain, oxidative phosphorylation, role of oxygen, how ATP is made, what happens when oxygen is absent
- brown fat and UCP1

- anaerobic metabolism in vertebrates – limitations (ATP made at rapid rate, but not much made and can only sustain for brief period) and how to rid the body of lactic acid
- phosphagens – structure, function and limits, as well as reversible reactions
- relative value of lipids as energy source
- muscle fuels during activities of different durations, muscle fatigue
- muscle fibre types and relationship between aerobic and anaerobic activities
- source of ATP varies with exercise duration
- dealing with hypoxia in invertebrates – metabolic depression, production of acetic and propionic acids
- adaptations to low oxygen conditions in some species (the darters)
- cost of locomotion – different forms of locomotion, effects of body size.
- theoretic (and real) relationships between increasing speed and increasing MR in swimmers, flyers and walkers/runners
- comparative costs of swimming, flying and running
- VO₂ max – definition, variation, effects of training
- energetic extremes: fasting vs starvation
- phases of fasting (I, II, III) and associated physiology
- use of fuels, production of ketone bodies, protein sparing/protein use
- the emperor penguin and its amazing ability to fast and recover
- phocid seals and fasting
- energetic extremes: the shortest lactation period of all mammals: the hooded seal (it's all about fat!)

C. Thermoregulation

- definition of thermoregulation
- thermal classifications of animals (homeotherm, poikilotherm, endotherm, ectotherm)
- heterotherms
- effect of temperature on MR in non-thermoregulators, sensitivity to temperature (Q₁₀)
- adaptations for cold environments (e.g. antifreezes)
- adaptations for hot environments
- the thermoneutral zone
- insulation (fur, blubber)
- counter current heat exchangers
- heat generation: brown fat, shivering, modified muscles
- the special case of the camel (haven't we seen this before??)

D. Right whale lipid metabolism

- right whale populations and why they are endangered
- how right whales feed and what they eat
- types of storage lipids (waxes vs. triacylglycerols)
- lipids in copepods
- lipid digestion in typical mammals vs. right whales
- how to determine assimilation of ingested prey components