Biology 7 Study Guide – Exam #4

This is a list of general topics you should be prepared to answer questions on for each chapter. This guide is NOT what you should study but rather is a guide to help organize your studying of the material listed. Your actual studying should involve the Powerpoint slides, your notes and textbook. Keep in mind that you will not be tested on material in the book that was not covered in class, and you should know the new terminology for each chapter (see terms in bold type).

Chapter 35 (Plant Structure & Growth)

- plant organs found in root vs shoot systems – roots, stems, leaves, flowers, fruits
- structures, functions and various evolutionary adaptations of:
  - roots – root hairs, lateral roots, taproots, fibrous roots, adventitious roots
  - stems – nodes, internodes, apical vs axillary buds, rhizomes, stolons, tubers
  - leaves – blade, petiole, simple vs compound leaves, reproductive leaves, tendrils, spines, bulbs
- location and functions of the 3 types of plant tissues:
  - dermal tissue – epidermis, cuticle, trichomes, periderm
  - vascular tissue – phloem, xylem, steles
  - ground tissue – pith, cortex
- characteristics, functions of various plant cell types in:
  - ground tissue – parenchyma, collenchyma, sclerenchyma
  - vascular tissue:
    - xylem – tracheids, vessel elements
    - phloem – sieve cells, sieve tube elements
- determinate growth vs indeterminate growth, primary growth vs secondary growth
- locations, functions of meristem tissue:
  - apical meristem, axial meristem
  - lateral meristem – vascular cambium, cork cambium
- growth in roots:
  - primary growth – root cap, zones of cell division, elongation, differentiation
  - lateral growth – endodermis, pericycle
  - organization of monocot roots vs eudicot roots
- primary growth in shoots, organization of monocot stems vs dicot stems
- leaf structure and function:
  - epidermis, cuticle, guard cells, stomata, palisade & spongy mesophyll, vascular bundles (phloem, xylem), bundle sheath cells
- secondary growth in roots and stems:
  - vascular vs cork cambium
  - how growth rings reveal age of the plant, past climate
  - spring wood vs summer wood, hardwood vs sapwood
  - bark = 2nd phloem and periderm
- advantages of Arabidopsis as a model plant organism
- how Arabidopsis is genetically modified – Agrobacterium tumifaciens, Ti plasmid, T DNA
- importance of asymmetrical cell division in determining cell fate in plants
- the ABC hypothesis of flowering

Sample questions:

1. Describe or diagram the how vascular cambium accomplishes secondary growth in a tree trunk.
2. Describe how mutations in Arabidopsis support the ABC hypothesis of flowering.
Chapter 36 (Transport in Plants)

- the various needed by plants
- leaf arrangement (phyllotaxy) and leaf area index
  - adaptations in leaf structure to maximize photosynthesis and minimize water loss
- symplastic, apoplastic and transmembrane transport
- the various types of molecular transport into/out of plant cells
  - cotransport involving H+ ions
  - ion channels
  - active transport
- concepts of osmosis, water potential and turgor pressure
  - solute potential vs pressure potential
- xylem transport:
  - how water and minerals are taken up by roots
  - the roles of root pressure, transpiration, cohesion and adhesion
  - how guard cells control the opening & closing of stomata
    - roles of H+, K+ and cotransport
    - how guard cell function responds to CO2, light and water loss
- phloem transport:
  - how photosynthetic products (sugars) flow from photosynthetic tissues (e.g., leaves) to sugar sinks (roots, tubers, fruits, etc)
    - roles of symplastic, apoplastic, and transmembrane routes
    - role of cotransport
    - roles of positive pressure and negative pressure

Sample questions:
1. Indicate the differences between symplastic, apoplastic and transmembrane transport.
2. Why does the concentration of sugars decrease near sugar sinks and how does this contribute to the movement of phloem sap toward sugar sinks?

Chapter 51 (Animal Behavior)

- concepts of proximate causation vs ultimate causation of an animal behavior
- the concept of a fixed action pattern
- the variety of cues animals use to initiate and guide migrations
- the concept of behavioral rhythms – circadian, circannual, lunar
- the types of signals used in animal communication – visual, tactile, chemical, auditory – and examples of each
- how honeybees communicate the location of a food source to other honeybees
- the nature of each type of learning – imprinting, spatial learning, associative learning, cognition, problem solving, social learning – and examples of each
- how cognition was demonstrated experimentally in bees
- the optimal foraging model and how it was tested with crows
- the 3 types of mating systems – monogamy, polygamy, polyandry – and their relation to sexual dimorphism
- how the genetic basis of foraging behavior in Drosophila was demonstrated experimentally
- the concept of altruism and why altruistic behavior can be favored by natural selection
  - how Hamilton’s Rule (rB > C) can be used to calculate if altruistic behavior will likely increase the frequency of one’s genetic alleles in the next generation
    - r = degree of relatedness
    - B = benefit of subsequent offspring produced by relative
**C = cost to the altruist** (e.g., chance of dying due to altruistic behavior x subsequent offspring produced by altruist)

sample questions:
1. Define cognition and describe how researchers demonstrated cognition in bees.
2. Use Hamilton’s rule to calculate if saving your sister from imminent death (e.g., a shark attack) would increase your genetic alleles in the next generation assuming the following:
   - you have a 1/3 chance of dying while saving your sister
   - you both would subsequently have the same number of children

**Chapter 52 (An Introduction to Ecology & the Biosphere)**
- the relationship between latitude and sunlight intensity and how this relates to climate
- how the angle of the earth relative to the sun during its annual revolution is responsible for the seasons
- the reasons for the 3 major cells (Hadley, Ferrel & Polar) of global air flow in each hemisphere
- how the Coriolis Effect influences air circulation patterns
- why most deserts are located near 30° north and 30° south
- how ocean circulation patterns affect climate
- how coastal mountains are responsible for rain shadow
- the general characteristics of each terrestrial biome – tropical forest, desert, savannah, chaparral, temperate grassland, temperate broadleaf forest, northern coniferous forests, tundra
- how aquatic biomes differ from terrestrial biomes
- the concept of aquatic zonation and characteristics of each zone – photic, aphotic, abyssal, benthic, intertidal, neritic, littoral, limnetic
  - how marine zonation differs from freshwater (lake) zonation
- the general characteristics of each aquatic biome – lakes, wetlands, streams and rivers, estuaries, intertidal zones, ocean pelagic zones, marine benthic zones, coral reefs
- examples of abiotic and biotic factors that influence the dispersion of a species

sample questions:
1. Explain how the earth’s rotation influences global air circulation.
2. Indicate how temperate grasslands differ from savannah.

**Chapter 53 (Population Ecology)**
- the concepts of a population, population density and population dispersion
- 3 types of population dispersion – uniform, random, and clumped and reasons for each
- factors that affect population size/density – births, deaths, immigration, emigration
- the concepts of demographics, semelparity, iteroparity
- how a survivorship curve reveals a species’ reproductive strategy and how this correlates with semelparity and iteroparity
- reproductive rates focus on females
- concepts of per capita birth and death rates
- how to calculate growth rates
- exponential (J-curve) growth vs logistic (S-curve) growth
  - general reasons for each type of growth
- concept of environmental resistance:
density dependent vs density independent resistance factors and examples or each
- reasons for the human population explosion
- the concept of demographic transition and the reasons behind it
- how age structures can be used to predict future population growth
- the concept of an ecological footprint and its relation to affluence or how developed a country is

**Sample questions:**
1. If the annual per capita birth and death rates in a population are 0.05 and 0.03, respectively, how big will the population be in one year? What is the growth rate?
2. What is an ecological footprint?

**Chapter 54 (Community Ecology)**
- difference between a biological community and an ecosystem
- concept of a niche (fundamental & realized)
  - how natural selection due to competition determines niches and results in resource partitioning
- intraspecific vs interspecific competition
- the concept of competitive exclusion
- predation vs herbivory
- various tactics used by prey species to avoid being eaten by predators
  - Batesian vs Mullerian mimicry
  - mimicry can also be a strategy for predators
  - mechanical vs chemical defenses
  - cryptic coloration (camouflage) vs warning coloration
- the concept of a keystone species
- characteristics of the 3 types of symbiosis:
  - obligate vs facultative mutualism
  - commensalism
  - parasitism – endoparasites vs ectoparasites
- concepts of facilitation and ecosystem engineers
- the concept of ecological succession
  - primary succession vs secondary succession
- the 3 outcomes for introduced species
  - problems associated with invasive species

**Sample questions:**
1. Distinguish primary succession from secondary succession.
2. Provide a brief description of each of the 3 types of symbiosis and provide an example of each.

**Chapter 55 (Ecosystems)**
- how the one-way flow of energy differs from the cycling of matter
- characteristics of each mode of feeding:
  - producers (autotrophs)
  - consumers (heterotrophs) – herbivores, carnivores, omnivores, detritivores
- food sources consumed at each trophic level
- the important ecological roles of detritus feeders (detritivores), decomposers
- important features of the water (hydrologic), carbon, nitrogen and phosphorus cycles:
  - different forms of carbon, nitrogen, etc, and their locations throughout the cycle
• human impact on each cycle and how this may effect ecosystems
  • concept of a food chain vs a food web
  • reasons for the inefficiency of energy transfer through trophic levels and why this limits the number of trophic levels
    o energy transfer through trophic levels correlates with the amount of biomass at each trophic level

sample questions:
1. Indicate the types of organisms (in terms of feeding) that occupy the first 3 trophic levels of a food chain.
2. Describe how the element nitrogen goes from the atmosphere to the tissues of omnivores such as humans.

Extra credit article