101-NYA-05 Biology I
Objectives: Animals W16 (sections 05 & 06)

References

- Readings in Reece, J.B. *et al.* 2014 *Campbell Biology, First Canadian Ed.* Pearson;
- PPT lecture notes;
- Required Concept Check questions.

When you have studied the material covered in this module, you should be able to:

A. GENERAL CHARACTERISTICS OF ANIMALS:

1. List seven (7) general characteristics of animals;
2. Realize that both animals & plants are multicellular eukaryotes & that most have extensive cell specialization. Further, in many plants & animals, these cells are organized into tissues. Lastly, many plants reproduce sexually, as do animals;
3. Out of the seven (7) characteristics listed above, list five (5) characteristics that distinguish animals from plants;
4. In animal evolution, the main theme, as it was in plants, was on selection for adaptations that allow for survival & reproduction without the presence of *large* amounts of water. Fill in table 1 to briefly explain six (6) adaptations exhibited by many animals & how these adaptations decreased dependence on water.

TABLE 1: GENERAL ADAPTATIONS TO LAND BY ANIMALS

	Adaptation	Potential reason(s) behind adaptation
1		Terrestrial animals are not surrounded by water/moisture but O_2 & CO_2 can only diffuse when dissolved in an aqueous solution (i.e. water)
2		As animals became > terrestrial, needed to rely < on diffusion as a means of exchange with the environment
3		Without being surrounded by water, terrestrial animals needed to develop another means of support (& motility)
4		Water is required for all metabolic activities yet terrestrial animals ran the risk of desiccation
5		As animals became > terrestrial, needed to rely < less on water for the dispersal of gametes & the fertilization of the egg; further had to avoid desiccation of the embryos
6		Water moderates temperature & general environmental fluctuations yet terrestrial animals do not benefit as much from this role of water as aquatic organisms do

B. FOR CLASSIFICATION OF ANIMALS:

NOTE: when reviewing these objectives as well as when completing the associated tables, keep in mind the six (6) general adaptations to land found in Table 1.

1. Distinguish between radial & bilateral symmetry;
2. Distinguish between exoskeleton & endoskeleton, keeping in mind that both meet the requirement for body support (& motility) of animals within & outside of water;
3. Briefly explain diffusion; then indicate why diffusion limits animal complexity & adaptations to various (& variable) environments;
4. Explain the general functions of a circulatory system (both exchange & delivery of nutrients, gases & wastes); further, indicate why an absence of a circulatory system generally implies the absence of all other complex systems;
5. Compare & contrast open & closed circulatory systems, using the terms hemolymph, direct exchange, blood & blood vessels;
6. Explain the general function of a respiratory system;
7. Realizing that O_2 & CO_2 can only diffuse when dissolved in an aqueous solution (i.e. water), list the three (3) types of respiratory membranes found in animals. Further indicate two (2) factors that are common to all three (3) types & why these factors are essential for maximal gas exchange with the environment;
8. List & briefly explain three (3) types of asexual reproduction found in animals;
9. As part of sexual reproduction in animals, compare & contrast internal & external fertilization, keeping in mind that internal fertilization increases the likelihood of male & female gametes meeting & decreases the possible desiccation of both gametes & offspring;
10. Review the two (2) purposes of nutrient/food intake;
11. Knowing that all animals are heterotrophic, compare & contrast extracellular digestion & intracellular digestion;
12. List six (6) distinct characteristics of insects, the first invertebrate animals to have very successfully colonized land;
13. Fill in table 2.

C. FOR CHARACTERIZATION OF VERTEBRATES:

1. Knowing that vertebrates are chordates with a cranium (head) & a vertebral column (backbone), list the five (5) vertebrate groups in order from least to most adapted to land;
2. Realize that the amniotic egg:
   - I. retains moisture this preventing the desiccation of the embryo on land;
   - II. allows for gas exchange with the environment;
   - III. protects the embryo more from potential injury;
   - IV. provides the embryo with a store of nutrients;
   - V. allows for the sequestering/collecting of waste away from the developing embryo.
3. Compare & contrast the egg structure of reptiles & birds the list two (2) drawbacks of the amniotic egg;

4. Realizing that, in placental mammals, the embryo/fetus/baby is joined to the mother via the placenta, list & briefly explain three (3) advantages of development within the placenta;
5. Fill in tables 3A & 3B.

D. FOR A GENERAL CHARACTERIZATION OF PRIMATES, INCLUDING HUMANS:

1. List the four (4) mammals that are part of the Primate order & indicate to which of the four (4) humans belong;
2. List ten (10) common characteristics of all primates, appreciating that many of these characteristics are adaptations to living in trees;
3. Compare & contrast the structure & relative function of the feet & hands – particularly the large toes & thumbs – between primates, including humans, realizing that these differences are linked to a transition from full-fledged tree dwelling to non-tree dwelling (living on the ground permanently), an example of descent with modification;
4. Know that *Homo sapiens*, chimpanzees & bonobos – with whom we share approximately 99% of the same DNA – are descended from a distant common ancestor. Humans are not descended from chimpanzees or bonobos, gorillas or any other apes - we are an entirely separate branch on the "family tree" of primates & apes (see page 778 in the textbook);
5. List nine (9) phenotypic characteristics of *Homo sapiens*; to this list of specific characteristics add reduced hirsuteness (less body hair) & an increase in the number & type of sweat glands compared to other apes;
6. Knowing that the ancestors of modern humans were all hominin species (hominins), indicate when the oldest *discovered* hominin lived (according to the textbook);
7. Indicate how long it is believed *Homo sapiens* has existed (according to the textbook);
8. List & briefly explain at least one (1) characteristic of early hominins that allows researchers to hypothesize that even these early hominins were more bipedal than chimpanzees;
9. Realize that hominin evolution was not an orderly passage from the earliest "primitive" hominins to the "best adapted" *Homo sapiens*. Instead hominin evolution was a multi-branched & unsystematic jumble, with several hominin species co-existing on the planet at the same time - including Neanderthals, *Homo floresiensis* & *Homo sapiens*. All hominin species, save for *Homo sapiens*, are extinct for reasons that are not known. In other words, we are not the "ultimate hominin", we are the only one that survived.

Table 2: General Characterization of Invertebrates & Chordates - as you fill in this table, add some representative animals for each phylum

	Symmetry		Support - Skeleton		Exchange with Environment (& Distribution w/i Animal)								
	Radial	Bilat.	Exo	Endo	Diffusion	Circulatory System		Respiratory System			Digestive System		Extra Comments
						Open	Closed	Gills	Tracheal	Lungs	Extra	Intra	
Porifera **sponges**					√						√		**Asymmetric**
Cnideria													**Some reproduce by budding**
Platyhelmin-thes (note: *some* are parasitic)													**Some reproduce by regeneration**
Mollusca													
Annelida													
Nematoda (note: *some* are parasitic)													
Echinoder-mata													**Some reproduce by regeneration**
Arthropoda													**Internal fertilization**
Chordata													

Table 3A: General Characterization of Vertebrates

	Scales	Skin	Locomotion & Skeletal structure			Body t°		Respiratory System			Confined to water &/or moist areas	Reproduction	
			Fins	Limbs	Wings	Exo-thermic	Endo-thermic	Diffusion through skin	Gills	Lungs		External fertilization	Internal fertilization
Jawless Fishes													
Cartilaginous fishes													
Bony fishes													
Amphibians													
Reptiles													
Birds													
Mammals													
Mono-tremes													
Marsu-pials													
Placental Mammals													

Table 3B: General Characterization of Vertebrates – Emphasis on Reproductive Strategies

	Confined to water &/or moist areas	External fertilization	Internal fertilization			Extra comments
			Embryo w/i amniotic egg	Embryo w/i mother but premature birth	Embryo w/i placenta in mother	
Jawless Fishes						**No jaws**
Cartilaginous fishes						**Endoskeleton is made of cartilage not bone**
Bony fishes						
Amphibians						
Reptiles						
Birds						
Mammals						**Enlarged skull relative to size; mammary glands; hair/fur; teeth**
Monotremes						
Marsupials						
Placental Mammals						