

# **TwoOldGuys™ Study Guides**

## **BI114 Biological Concepts for Teachers**

### **Chapter 2. Diversity of Life**

#### **2.1. Mammals**

#### **2.2. Birds**

Based on Indiana's Academic Standards, Science, as adopted by the Indiana State Board of Education, Nov 2000.

*Numbers refer to the age-appropriate grade-level for the content.*

### **Review**

We developed a tentative definition of life, and applied it to all known life-forms consistent with the cognitive development of the 8<sup>th</sup> grade mind. To outline the known living things, we expanded the 20-Questions classification scheme to include several ranks of taxa which are recognized as artificial: Kingdom, Phylum, Class, Order, Family, and Genus; plus one real taxon: the species.

The artificial taxa are defined by enumeration. This section, and several subsequent ones, will develop definitions by enumeration for the major taxa with which your students should be familiar.

### **2.1. Mammals (class Mammalia)**

There seems to be a tendency for the 'man on the street' to consider 'mammal' and 'animal' to be synonyms. One example of this is an overheard reference to "animals, birds, and bugs" (anon.) at a county fair somewhere in the Great Lakes region. The mammals are considered to be the most advanced class of animals. Included in this class is the Primate order which includes the Family of Man. If you accept only the assumptions of systematics, these are the creatures which most closely resemble us.

*grade K: to 8:*

### Animals typically covered with fur

Humans are an example of a mammal which is not strictly 'covered' with fur. The Human has considerable hair on the head (except for certain males in the Gezeer population), but is otherwise nearly hairless. A few other rather hairless mammals are pig, elephant, hippopotamus, rhinoceros, dolphins and whales. Most other mammals have fur, which may be short or long.

*grade 5: to 8:*

### Produce milk to feed helpless new-born young (normally live-birth)

Milk production for feeding the very young offspring is the defining character of this class. [Defining character](#) refers to the single character which is considered to be the one characteristic which best describes the difference between any taxon and other equal rank taxa within the same higher taxon. In this case the characteristic which distinguishes the Class Mammal from the other Classes in the Phylum Vertebrates.

### Warm-blooded; 4-chambered heart; complex brain

Animals are either 'warm-blooded' or 'cold-blooded.' Some older texts state that warm-blooded animals maintain their internal body temperature, implying that cold-blooded animals do not. We now know that all animals (and even plants) maintain an internal body temperature. The difference is that the warm-blooded animals allow their body temperature to change by only a couple of degrees before they

respond to correct the "error;" while the cold-blooded animals wait until their temperature has changed by several degrees before they respond.

A recent hypothesis (late 20<sup>th</sup> Century) suggests that the four-chambered heart is necessary for warm-blooded animals. The logic of this hypothesis is that regulating temperature costs energy, so precise regulation must cost more energy than less precise regulation does. Higher energy production requires more oxygen, and therefore the more efficient four-chambered heart.

The simple brain can handle instinctive behavior. A slightly more complex brain adds the ability to learn behavior [in the psychology sense that Pavlov's dog 'learns' to salivate on hearing a bell; not in the educational sense that students learn subject matter]. The complex brain supports higher level functions such as cognitive development, reasoning, memory, and emotion. The most complex brains known to exist are found in Humans [Class Mammals, Order Primates] and in Dolphins [Class Mammals, Order Whales or *Cetaceans*]. The other Mammals have very complex brains compared to the rest of the Animal Kingdom.

*grade 6: to 8:*

Even the 'naked' (hairless) mammals (such as humans, pigs, hippopotamuses) are covered with sparse fine hair.

The Class Mammal is divided into three sub-classes: the Placental Mammals, the Marsupial Mammals, and the Monotreme Mammals.

**Placental mammals:**

- long fetal development in womb
- extended period of childhood & pre-adult stages
- some exhibit distinct post-reproductive stage

The fetal development is the defining character. All these creatures also have an extended childhood (as a percent of **life** expectancy [defined as the average age at death for the species]), and most have a distinct pre-adult stage [typically appears mature, but is not socially accepted as adult]. Humans have a distinct post-reproductive stage ["geezers," or old people].

### Marsupial mammals:

- short development in womb; continued development in pouch
- extended period of childhood & pre-adult stages
- mostly in Australia (such as Kangaroo); opossum of S<sup>N</sup> North America

The pouch where development occurs is the defining character. The most familiar of these mammals are the kangaroo and the smaller wallabee.

### Monotreme mammals:

- development in hard-shell egg
- childhood stage
- duckbill platypus

You may prefer to ignore this sub-class, and hope that it goes away. It is included here in case one of your students has heard of the Monotremes.

## 2.2. Birds (class Aves)

*grade K: to 8:*

- animals typically covered with feathers;
- horny beak, lacking teeth
  - usually capable of flight

For the purposes of grades K through 6, the presence of feathers can be called the defining character for the Birds.

If you have ever looked a goose in the mouth, you will have seen what seem to be teeth. Technically these 'teeth' are merely ridges and grooves along the beak, and are not true teeth. Teeth are anchored in the jaw bone, but are not bone.

The best known of the flight-less birds is the Ostrich, although there are several others. Some birds, such as domestic chickens, are technically capable of flight, but do not fly well at all. At the opposite extreme, many kinds of birds migrate very long distances between their summer nesting territories in northern North America to their winter territories in southern South America. Most birds migrate, but over much shorter distances, for example from the U.S.-Canada border to Tennessee and the Carolinas. The "snow bird," or *Junco*, migrates as little as 100 or so miles, wintering in areas with substantial amounts of snow.

Seed eating birds regularly visit bird feeders, so are easy to attract for observation. Maintaining a winter bird feeder just outside a classroom window may attract a surprisingly larger variety of birds. Younger student will be able to observe 'arguments' among the birds over who gets to eat at the feeder first.

*grade 3: to 8:*

Strong nesting & territorial behaviour  
Perhaps related to bi-pedal dinosaurs (raptors)

Nesting is strongly related to the care of the young; birds typically are among the best parents in the entire animal kingdom, often better than many mammals [although we like to believe that no animals can compare with Humans for parenting]. Territorial behavior is usually described as functioning to assure adequate food supply, especially for the young. It appears to me that it is also involved in establishing and maintaining the social structure among birds species. Territorial behavior can be observed easily, but not near most grade schools where I have tried to observe it. Even at bird feeders outside grade school windows, territorial behavior is not sufficiently obvious to allow students to realize that they have seen it.

Late in the 20<sup>th</sup> Century, the hypothesis that the birds are related to the bipedal dinosaurs became widely known. Another hypothesis that has been suggested is that the bipedal dinosaurs [specifically the *raptors*] were birds not lizards.

*grade 5: to 8:*

Development in hard-shelled egg  
Warm-blooded; 4-chambered heart; complex brain

The counter argument to the hypothesis that the raptors were birds is that birds are warm-blooded, and therefore have four-chambered hearts. So, if raptors were birds, they should have four-chambered hearts. The point is that we do not have any current fossil evidence of heart anatomy in any dinosaurs. However, beginning in about 2004 there have been sporadic reports in the scientific literature of bipedal dinosaurs with **putative** (defined as “some researchers have claimed...”) feathers.

*grade 6: to 8:*

Period of childhood (hatchling & fledgling)  
- often followed by pre-reproductive period (1<sup>st</sup> year adult)

From the time the chicks hatch until they first leave the nest to learn to fly, the chicks are called **hatchlings**. These young are almost helpless, and require full-time care by both parents (in most species). When either the chicks are ready to learn to fly, or the parents are ready to force them to learn, they enter the **fledgling** stage. As fledglings, the chicks learn to fly and to feed themselves. They still require large amounts of parental care, and are highly susceptible to predators. There have been numerous reports of parent birds literally kicking their fledging offspring out of the nest. By the start of the autumn migration, the chicks have matured to sub-adult (or pre-reproductive). For many species, they remain as pre-reproductives for their 1<sup>st</sup> year during which they appear to be adults but are not accepted into the reproducing population by the adults. A few do not get their adult plumage (feathers) until their 2<sup>nd</sup> year, but still are not accepted as reproducing adults for yet another year.