
SECTION

I



Introduction to Small Animal Care

OBJECTIVES

After reading this chapter, one should be able to:

- briefly describe the history of animals on the earth.
- list the important time periods in the evolution of animals.
- describe how animals probably became domesticated.
- describe the importance of the small animal industry.
- describe how organisms are classified.

TERMS TO KNOW

Animalia	Monera	Reptilia
Aves	notochord	taxa
binomial nomenclature	Osteichthyes	taxonomy
Chordata	pharyngeal	trinomial nomenclature
Fungi	placental mammals	vertebrate
invertebrates	Plantae	
Mammalia	Protista	

A BRIEF HISTORY OF ANIMALS

The oldest direct traces of life on earth date back 3.4 to 3.5 billion years. In rocks that age in Australia and Southern Africa, geologists have found stromatolites, layered structures created through the activity of primitive algae and bacteria. Other Australian rocks of similar age provide even more direct evidence of ancient life. Sections of these rocks, known as cherts, show fossilized remains of blue-green algae themselves.

Rocks also reveal even more distant, indirect traces of life. Living things use particular isotopes (atomic forms) of the element carbon preferentially. The mix of carbon isotopes detected in rocks from Greenland more than 3.8 billion years old show evidence of life on earth.¹

Some 2.2 billion years ago, free oxygen was present in the atmosphere. Living things used this reactive substance in the biochemical functions of their cells. The free oxygen in the atmosphere also produced a layer of ozone, which filters out the ultraviolet light from the sun that is harmful to life. See Figure 1–1.

Era	Period	Epoch	Biologic events	Years before present (B.P.)	Geologic events Events refer especially to North America and do not reflect great worldwide variations	
CENOZOIC	Quaternary	Recent	Modern man	11 thousand	Ice ages; then warmer	
		Pleistocene	Early man	0.5 to 3 million		
	Tertiary		Pliocene	Large carnivores	7 million	Continental elevation; cool
			Miocene	Abundant grazing mammals	25 million	Plains and grasslands; moderate
			Oligocene	Apes, monkeys, whales	40 million	Mountain erosion; mild
			Eocene	Radiation of placentals	60 million	Mountain erosion; rain and mild
Paleocene	First placental mammals	70 million	Mountain building; subtropical			
MESOZOIC	Cretaceous		Climax of giant land and marine reptiles, followed by extinction; flowering plants; decline of gymnosperms	135 million	Spread of inland seas and swamps; building of Andes, Himalayas, Rockies; mild to cool	
	Jurassic		First birds; first mammals; dinosaurs abundant	180 million	Continents with shallow seas, building of Sierra Nevada mountains; cool then mild	
	Triassic		First dinosaurs; mammal-like reptiles; conifers dominate plants	230 million	Continents elevated; widespread deserts; cool and dry	
PALEOZOIC	Permian		Radiation of reptiles; displacement of amphibians; extinction of many marine invertebrates	280 million	Continents elevated; building of Appalachians; cold and dry	
	Carboniferous	Pennsylvanian	First reptiles; giant insects; great conifer forests	310 million	Shallow inland seas; extensive coal deposits; warm and moist	
		Mississippian	Radiation of amphibians; abundant sharks; scale trees and seed ferns	345 million	Inland seas; warm to hot; swamplands	
	Devonian		First amphibians; freshwater fishes abundant; bryozoans and corals	405 million	Inland seas; first forests; mild	
	Silurian		First jawed fishes	425 million	Continental seas and reefs; mild	
	Ordovician		Ostracoderms (first vertebrates); abundant marine invertebrates; first land plants	500 million	Submergence of land; warm	
	Cambrian		Origin of many invertebrate phyla and classes; trilobites dominant; marine algae	600 million	Three periods of land submergence; mild	
PRE-CAMBRIAN	Proterozoic Archeon Hadean		Fossil algae; other fossils extremely rare; evidence of sponges and worm burrows	2.5 billion 3.8 billion 4.5 billion	Volcanic activity; mountain building; glaciations; variable climate	

Figure 1-1 The history of the earth is divided into periods of time. This Geologic Time Chart shows the geologic events that occurred in North America and the living organisms that were present during the geologic events. By permission of McGraw-Hill Company.

The first land plants were believed to have become established about 420 million years ago during the Ordovician period. This is also the period of time when **invertebrates**, such as arthropods and worms, appeared on land. These first terrestrial invertebrates fed on decaying plant material.

Vertebrate animals, in the form of amphibians and reptiles, appeared during the Devonian period

about 370 million years ago. The bony fish appeared during the Ordovician period and became abundant during the Devonian period. See Figure 1-2.

During the Triassic period, 180 million years ago, dinosaurs appeared along with mammal-like reptiles. The first birds and mammals appeared 135 million years ago during the Jurassic period, when dinosaurs became abundant. See Figures 1-3 and 1-4.



Figure 1-2 *Coelacanth, a primitive, lobe-finned, bony fish that some believe may be the ancestor of land animals. Coelacanth was thought to be extinct until some living specimens were discovered off the East Coast of South Africa. Negative #325025 (Photo by Rota). Courtesy Department of Library Services, American Museum of Natural History.*

During the Cretaceous period 135 to 70 million years ago, dinosaurs and marine reptiles reached their period of greatest abundance and then disappeared. The reason for their demise is still debated by scientists.

With the extinction of the dinosaurs, an opportunity arose for smaller creatures to evolve and become

abundant. During the Paleocene and Eocene epoch 70 to 40 million years ago, **placental mammals** evolved, dispersed, and adapted to new environments. Placental mammals have a placenta through which the embryo and fetus are nourished while in the uterus. Many of the small animals discussed in this book are placental mammals and evolved during this period.



Figure 1-3 *Archaeopteryx is one of the ancestors of modern birds. It lived 150 million years ago during the Jurassic period. This fossil was discovered in a Bavarian stone quarry. Negative #34711. Courtesy Department of Library Services, American Museum of Natural History.*



Figure 1-4 *A reconstruction of Archaeopteryx from fossil remains. Illustrated by Ron Ervin.*

DOMESTICATION OF ANIMALS

Domestication of animals probably began when human hunters brought back the young of the adult animals they killed. Dogs are believed to be the first animals domesticated. Wolves may have hung around villages looking for meals, and wolf cubs were probably domesticated and became companion animals. In addition, they may also have warned the villages of approaching predators or enemies. The discovery of a dog's jawbone found in a cave in Iraq dates back 12,000 years. This is the earliest indication of a domesticated animal.

The cat's association with humans dates back about 3,500 years ago. Pictures of cats have been found in the Egyptian tombs. The domestic cat probably provided pleasure and companionship, as well as controlled rats and mice.

THE SMALL ANIMAL INDUSTRY

Pet ownership is at an all-time high—58.9 percent of all American families, about 58.2 million households, include at least one companion animal. See Figure 1–5. Cats outnumber dogs as the most common household pet, see Figure 1–6; there are more than 59.1 million cats in the United States compared with 52.9 million dogs. Dogs are found in 31.6 percent of the nation's households and cats in 27.3 percent, see Table 1–1. Most cat owners have an average of two cats.



Figure 1–5 Pets are an important part of the family. Courtesy of Carolyn Miller.

American households also contain 12.6 million birds, 4.9 million rabbits, 1.8 million hamsters, and 55 million fish.² See Table 1–2.

Altogether, an estimated 10,500 to 11,000 retail pet stores nationwide produce some \$21 billion in sales. See Figure 1–7.³ Veterinary expenditures in 1996 were nearly \$7.008 billion for dogs, \$3.971 billion for cats, and \$91.2 million for birds. These figures represent increases in veterinary expenses of 42.2 percent for dogs, 96.8 percent for cats, and 141.9 percent for birds since 1991.⁴ This could put total expenditures for pet care in the United States at well over \$32 billion, an increase of more than 50 percent since 1991.

Figures from the United States Department of Agriculture in the Animal Welfare Enforcement Report for fiscal year 1997 showed a total of 1,267,828 animals used in laboratory experiments. Of this total, there were 75,429 dogs, 26,091 cats, 56,381 primates, 272,797 guinea pigs, 217,079 hamsters, and 309,322 rabbits. Since the use of birds, laboratory rats, and laboratory mice are currently excluded from Animal Welfare Act (AWA) regulation, no accurate figure is available, although the Animal Welfare Enforcement



Figure 1–6 Animals can teach children many things such as responsibility, compassion, and trust. Courtesy of Tracey A. Carter.

Table 1-1 United States Pet Ownership—The Percentage and Number of Pet-Ownning Households and Pet Population Estimates, December 31, 1987, 1991, and 1996.

	Percentage of Households (%)			Number of Households (Millions)			Average (Mean) Number Owned Per Household			Total Population (Millions)		
	1987	1991	1996	1987	1991	1996	1987	1991	1996	1987	1991	1996
Dogs	38.2	36.5	31.6	34.7	34.6	31.2	1.51	1.52	1.69	52.4	52.5	52.9
Cats	30.5	30.9	27.3	27.7	29.2	27.0	2.04	1.95	2.19	54.6	57.0	59.1
Birds	5.7	5.7	4.6	5.2	5.4	4.6	2.48	2.16	2.74	12.9	11.0	12.6
Horses	2.8	2.0	1.5	2.6	1.9	1.5	2.63	2.54	2.67	6.6	4.9	4.0

Source: Reprinted with permission from "U.S. Pet Ownership & Demographics Sourcebook," Center for Information Management, American Veterinary Medical Association, 1997.

Table 1-2 United States Pet Ownership—The Number of Specialty and Exotic Pet-Ownning Households and Pet Population Estimates, December 31, 1991 and 1996.

Type of Pet	Number of Pets Per Household		Number of Households (1,000)		Population of Pets (1,000)	
	1991	1996	1991	1996	1991	1996
Fish*	9.05	8.92	2,652	6,228	23,997	55,554
Ferrets*	1.45	2.00	189	395	275	791
Rabbits*	3.22	2.63	1,420	1,878	4,574	4,940
Hamsters	1.39	1.86	947	1,008	1,316	1,876
Guinea pigs	1.77	1.87	473	583	838	1,091
Gerbils	2.18	2.76	284	277	619	764
Other rodents	2.31	2.42	379	435	875	1,053
Turtles	1.87	1.78	379	534	708	950
Snakes	3.88	4.14	189	217	735	900
Lizards	1.66	1.55	189	455	314	705
Other reptiles	2.97	2.75	95	336	281	924
Other birds (pigeons and poultry)	13.78	13.16	379	336	5,220	4,423
Livestock	7.12	11.61	473	524	3,371	6,083
All others	3.37	3.26	189	376	638	1,225

*Fish, ferrets, and rabbits were specifically listed on the 1996 survey, but they were not listed in 1991.

Source: Reprinted with permission from "U.S. Pet Ownership & Demographics Sourcebook," Center for Information Management, American Veterinary Medical Association, 1997.



Figure 1-7 A variety of pet foods are available on the market today. Courtesy of Brian Yacur and Guilderland Animal Hospital.

Report lists 150,987 other animals used in experiments. See Figure 1-8.

Registered with the AWA for fiscal year 1997 are 1,243 research facilities, 2,098 exhibitors, 4,043 dealers, 96 carriers, and 309 intermediate handlers. Research facilities include hospitals, colleges and universities, diagnostic laboratories, and many private firms in the pharmaceutical and biotechnology industries. Exhibitors operate animal acts, carnivals, circuses, public zoos, roadside zoos, and marine mammal displays. Carriers include airlines, motor freight lines, railroads, and other shipping lines. Intermediate handlers usually provide services for animals between



Figure 1-8 *Animals are also used in research.*
Courtesy of Agricultural Communications Department,
University of Georgia.

consignor and carrier; they also care for animals delayed in transit. Dealers are persons selling lab animals for research and teaching, wild animals for exhibition, or pet animals at the wholesale level.

Animal care is a very large and rapidly growing industry. Pet care workers, zoo administrators, laboratory animal care workers, small animal breeders, animal trainers, animal groomers, veterinarians, veterinary technicians, and biologists will continue to be needed for this important industry.

CLASSIFICATION OF ORGANISMS

Taxonomy is the science concerned with the naming and classification of organisms. The Greek philosopher and biologist Aristotle is credited with the first attempts at classifying organisms based on their structural similarities. An English naturalist, John Ray (1627–1705), developed a more comprehensive system of classification, but Carolus Linnaeus (1707–1778), a Swedish botanist, is credited with developing our modern method of classification.

Linnaeus's system has been expanded since then and today is made up of seven categories, or **taxa**. These categories are kingdom, phylum, class, order, family, genus, and species. These categories can be subdivided into finer categories, such as subphylum or subclass. Today about 30 different taxa are recognized.

All organisms are divided into one of five kingdoms:

1. **Monera** are the bacterial organisms that lack a true nucleus in the cell and reproduce by fission.
2. **Protista** are single-celled or microscopic animals, including algae.
3. **Plantae** include multicellular photosynthesizing organisms, higher plants, and multicellular algae.
4. **Fungi** are molds, yeasts, and fungi.
5. **Animalia** is composed of the invertebrates and vertebrates.

All animals discussed in this book belong to the phylum **Chordata**. All members of this phylum have the following four distinctive characteristics:

1. an embryonic **notochord**, which is usually replaced by the spinal cord
2. a dorsal tubular nerve cord running down the back side
3. **pharyngeal** or throat area gill slits
4. a rear area tail

Although they possess these structures at some embryonic stage, these characteristics may be altered or disappear in later stages of life.

All animals discussed in this book then belong to one of the following four classes:

1. **Mammalia** is the class of vertebrates that possess mammary glands, have a body that is more or less covered with hair, and possess a well-developed brain.
2. **Reptilia** is the class that includes snakes, lizards, and turtles. This class comprises cold-blooded vertebrates having lungs, an entirely bony skeleton, a body covered with scales or horny plates, and a heart with two atria and (usually) a single ventricle.
3. **Aves** is the class for birds. These are warm-blooded vertebrate animals with two legs, wings, and feathers and that lay eggs.
4. **Osteichthyes** are the bony fish. This is a large group of vertebrate animals that live in the water and have permanent gills for breathing, fins, and a body usually covered with scales.

Linnaeus's system of naming species is called **binomial nomenclature** and uses the Latin language. Each species has a name composed of two words. The first word is the genus and is written with the first letter capitalized. The second name is the species and is written with a small-cased first letter. The domesticated dog, for example, is named *Canis familiaris*. *Canis* is the genus and *familiaris* is the species. In some cases, an organism may have a subspecies name and would then use a **trinomial nomenclature**. An

SECTION ONE

example of a complete classification for the domestic dog would be as follows:

1. Kingdom — Animalia — Animal kingdom
2. Phylum — Chordata — Animals with vertebrae
3. Class — Mammalia — Animals that suckle young
4. Order — Carnivora — Flesh or meat eaters
5. Family — Canidae — The dog family (includes wolves, fox, and coyotes)
6. Genus — Canis — dogs
7. Species — familiaria — domestic dog

SUMMARY

Most of the small animals used as pets or in laboratories evolved during the Paleocene and Eocene epochs of the Tertiary period 70 to 40 million years ago. Modern birds evolved earlier during the Cretaceous and early Tertiary periods.

The Cretaceous period, 135 to 70 million years ago, was the period of the dinosaurs. After the demise of the dinosaurs, smaller reptiles evolved. These small reptiles included snakes, lizards, and turtles, and they could compete with the large number of mammals that were also evolving.

The bony fish are the oldest vertebrate group. Some of them remain virtually unchanged since their evolution during the Devonian period 400 million years ago.

Domestication of animals probably began with the wolf about 12,000 years ago. As humans moved from being hunters to farmers, other animals were domesticated. Cats were thought to have been domesticated some 3,500 years ago. These domesticated animals served as pets and companion animals.

Today, the pet industry is large and growing. Fully 58.9 percent of American households have a pet or companion animal. A large industry exists to supply food, equipment, and health care for all of these animals. Millions of other small animals, birds, reptiles, and fish are used in exhibitions and laboratories. Together these industries provide jobs, careers, and opportunities for a significant segment of our population.

DISCUSSION QUESTIONS

1. When did life on earth begin according to scientific data? Please support your response.
2. When did plants first appear on earth? How do we know this?
3. Why weren't plants the first life to appear on earth?
4. During which time period were dinosaurs most abundant?
5. During which time period did the placental mammals appear on earth?
6. Which animals were first to be domesticated? Why?
7. What agency has responsibility for regulating the care and management of small animals?

SUGGESTED ACTIVITIES

1. Visit the library and use reference materials to trace the evolution of various classes of animals through time.
2. From references in the library, research the various theories as to why the dinosaurs became extinct.
3. Obtain a copy of the Animal Welfare Act. What are the regulations covered under the act?

ADDITIONAL RESOURCES

1. Dinosaurs and Birds
www.enchantedlearning.com/subjects/dinosaurs/Dinobirds.html
2. Geologic Time Scale
www.geosociety.org/pubs/public/geotime1.htm
3. Geologic Time—Enchanted Learning Software
www.enchantedlearning.com
4. Geologic Time Chart
www.littleexplorers.com/subjects/Geologictime.html

END NOTES

1. Excerpt from *Atlas of the Living World* by David Attenborough. Copyright © 1989 by Marshall Editions Ltd. Reprinted by permission of Marshall Editions Ltd. All rights reserved.
2. Excerpt from “U.S. Pet Ownership & Demographics Sourcebook,” Center for Information Management, American Veterinary Medical Association, 1997.
3. Excerpt from “Pet Industry Fact Sheet,” Pet Industry Joint Advisory Council, 1998.
4. Excerpt from “U.S. Pet Ownership & Demographics Sourcebook,” Center for Information Management, American Veterinary Medical Association, 1997.