

# A Brief History of the Taxonomy of Mammals

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The mammals are an ancient division of the animal kingdom. They probably developed from reptile-like creatures in the early Triassic period, about 200 million years ago. Ever since then they have been changing to meet different and varying conditions of climate, enemies, and many other factors. Of the more than one million animals known in the entire animal kingdom, the 4,000 or so species of mammals represent a small minority.

Mammals are characterized by being warm-blooded, having two pairs of appendages, and having hair at some stage of their development. They all bring forth their young alive except two egg-laying mammals (the Australian platypus and the echidna), and their brain is large in proportion to body size. Mammals also have a vertebral column; they have seven cervical vertebrae with the exception of the two-toed sloth which has six, the three-toed sloth which has nine, and the manatee which has eight. The word "mammal" is derived from the Latin *mamma*, for breast, since mammals nourish their young by breast-feeding them milk. Inasmuch as mammals are efficient in their way of life and adaptable to different environmental conditions, they have risen to the highest stratum of Nature's social order; and, as a class, they are more intelligent than the other vertebrates.

The science of mammalogy originated from the archaic study of medicine. Man wanted to know more about his body and soul relation, but because of ancient cus-

toms that arose from superstition and mysticism and forbade dissection of the human body, man turned to the study of animals.

These studies began in the form of comparisons of the exterior and interior parts of the animal body. Early taxonomy made use of this type of classification. Centuries later, the study of fossil remains shed some light on previously existing mammals. The study of taxonomy thus embraces many fields of endeavor, each demanding a different approach but all inseparably related. Essentially, taxonomy gathers together, utilizes, summarizes, and implements everything that is known about animals involving comparative, gross, and microscopic anatomy; biochemistry; physiology; geology; and paleontology. From a humanitarian standpoint, man experiments on animals using humane conditions and controls. Certain knowledge cannot be gained unless experiments are made on living animals, and, in order to evaluate results, the experimentalist needs to know, taxonomically, the animal on which he is performing experiments.

The oldest and most obvious system of classifying animals was according to their mode of life, adaptations to their environment, and their associations. To this end Aristotle (384–322 B.C.) attempted the first classification of animals. Even earlier, however, there was a listing and arrangement of names of animals in a systematic manner in Leviticus 11: 1–47 and in the old Assyrian inscriptions taken from the library of Ashurbanipal

(ca. 688 B.C.). Aristotle recognized some natural groups of animals, and in his work *On Animals*, he designated groups of animals as the *genos*, and individual animals or species as the *eidos*. His work also included an incipient theory of evolution; that is, there was a general graduation from polyp to man.

From the time of Aristotle until the rise of scholasticism in the 11th Century, Europe was too preoccupied with barbaric invasions to devote much time to natural science. With St. Thomas Aquinas (1225–1274) and St. Albertus Magnus (1206–1280), scholasticism reached its peak in the 13th Century. These two churchmen aroused and perpetuated interest in Aristotle's analyses. Not only the concept of genus and species was kept alive, but also the method of division, which was a forerunner of modern classification. Through their insistence on the use of Latin in the church teachings as well as in the pulpit, Latin became the scientific language after the Renaissance.

With the coming of the Renaissance to Europe in the 16th Century, reasoning started to be empirical, science started to separate from the church and mythical speculation, and the idea of natural classification of animals gained acceptance. Science, however, was slower in developing than literature, politics, and astronomy (Nordenskiöld, 1928; Singer, 1950).

Influential in the rebirth of learning was Konrad von Gesner (1516–1565). His main contribution was the work entitled *Historia Animalium*, in which he attempted to separate truth from error by assembling from many sources known materials on animals. He used illustrated descriptions of animals which initiated the systematic work of the coming generations.

Along with the development of mammalogy in regard to taxonomy, botany classification received its share of taxonomic researchers.

One of these was Andrea Cesalpino (1519–1603). His main work, *De Plantis*, published in Florence in 1583, was botanical; but he endeavored to associate parts of animals with parts of plants. His system of classification was his most important contribution.

John Ray (1627–1705), an Englishman called the "Father of Systematic Zoology," in 1693 published *Synopsis Methodica Animalium Quadrupedum et Serpentinae Generis*. In this work he organized previous systems of descriptions of animals into a reasonable, systematic arrangement that became the basis for the taxonomic work in the following century by Carolus Linnaeus (Carl von Linné). Linnaeus (1707–1778) was a Swedish botanist who devoted his life to taxonomic research. He listed the whole animal kingdom in an orderly, systematic manner in the tenth edition of his great work *Systema Naturae*. There were 12 editions of this work, the word "mammalia" appearing for the first time in the tenth edition of 1758. The 1758 edition is taken as the zero point for zoological nomenclature. The names and contents remain much the same today. Linnaeus is responsible for the binomial nomenclature employed in taxonomic work, which used a Latin noun for the genus and a descriptive adjective for the species in the animal description.

Claude Perrault (1613–1688), a Parisian, is remembered more for the designs of beautiful buildings than for his *Mémoires pour Servir à l'Histoire Naturelle des Animaux*, published in 1731, but his work was important in that it was a prelude to the more extensive work of Louis Jean Marie Daubenton. Perrault's classification was based on the external appearance and anatomy of animals. Daubenton (1716–1799), in collaboration with George Louis Leclerc, Comte de Buffon, published the series of volumes of the *Histoire Naturelle* issued between

1753 and 1767. Each animal was described more or less as an independent unit; the authors did not give any groupings.

In 1762 Mathurin Brisson (1723–1806) published the second edition of *Regnum Animale*. In this book he divided the animal kingdom into nine classes, basing his taxonomic study on Ray.

In 1777 Giovanni Scopoli (1723–1788) published a classification which was an adaptation of the work of Ray and Linnaeus. Entitled *Introductio ad Historium Naturalem Sistens Genera Lapidum, Plantarum et Animalium*, it was conservatively and intelligently arranged. Two years after Scopoli's classification was published, Johann Friedrich Blumenbach (1752–1840), often called the "Father of Anthropology," sent to press his *Handbuch der Naturgeschichte*, a taxonomic study that embodied many features of Linnaeus' work and foreshadowed the Cuvierian system. In the "Handbuch," which had excellent illustrations, there was a natural transition between certain adjacent orders. In 1792 Felix Vicq-d'Azyr (1748–1794) published his *Système Anatomique des Quadrupèdes*. His taxonomic study was based on strict anatomical observation and critical comparison. Much of his work was based on that of Linnaeus and Blumenbach.

In 1795 Étienne Geoffroy Saint-Hilaire (1772–1844) and Baron Georges Léopold Chrétien Frédéric Dagobert Cuvier (1769–1832) published their classification of mammals in volume 6 of the *Magasin Encyclopédique*. It contained their account of the Australian marsupials and the monotremes. Saint-Hilaire confined himself to monographic work thereafter. Therefore, later changes in the classification were made by Cuvier according to his Principle of Correlation. In 1798 he published his original classification *Tableau Élémentaire de l'Histoire Naturelle des Animaux*, in which the term "family" first

appeared as a division of an order.

One year later, in 1799, Bernard Germain Étienne de la Ville, Comte de Lacépède (1756–1825), published *Tableau des Divisions*, in which he grouped all the marine mammals. He followed Brisson's classification in having a large number of orders based on the number and kinds of teeth.

The following year Cuvier published *Leçons d'Anatomie Comparée*, which improved the classification set forth in his volume of 1798; a great number of new genera which had been described by various authors were included therein.

Another system of mammalian classification was proposed by Johann Karl Wilhelm Illiger (1775–1813) in 1811 in a treatise entitled *Prodromus Mammalium et Avium*. Based on foot structure, it contained little that was new in principle.

Henri Marie Ducrotay de Blainville (1777–1850) drew his criteria for taxonomy from the reproductive system and the skull and was the first to use the term "subclass" in its modern sense. Like most other taxonomists prior to Huxley, de Blainville began his classification with the primates. He attempted to progress from a lower to a more advanced archetype. This new taxonomic study was published in 1816 in *Prodrome d'une Nouvelle Distribution Systématique du Règne Animal*.

In 1817 Cuvier published the first edition of *Le Règne Animal*, which became as popular as Linnaeus' *Systema Naturae*. It contained a new arrangement of the carnivores and became the standard work on natural history.

In 1821 John Edward Gray (1824–1875), during a long term of service at the British Museum, described in the *London Medical Repository* the first application of the term-ending idea for families of mammals. The ending had been suggested for the families of insects by William Kirby in 1815. Gray's

classification contained several new generic names and divided the Cetacea into two new suborders, Denticete and Mysticeti.

In 1834 de Blainville presented a classification superior to any then extant. He separated the monotremes from the marsupials and improved the arrangement of the carnivores. He divided the Mammalia into three subclasses, which he called the Ornithodelphia, the Didelphia, and the Monodelphia. Though his terms have been largely superseded, the underlying idea is still retained in modern form.

In 1838 Prince Charles Lucien Bonaparte (1775–1840), the next younger brother of Emperor Napoleon I, published his *New Systematic Arrangement of Vertebrated Animals* in which the classification was based on brain evolution.

In 1855 Christoph Gottfried Andreas (1820–1881), curator for the museum at the University of Halle, published *Odontographie*, in which he devised a classification based on teeth.

In 1864 de Blainville's work *Osteographie* was published containing a classification based upon the study of bone structure. This work was supported by Charles Darwin (1809–1882) whose *Origin of Species* (1859) stressed skeletal similarity and progressions.

In 1868 Sir Richard Owen (1804–1892) published a non-formal classification based upon Bonaparte's taxonomic study of 1837. The work was entitled *On the Anatomy of Vertebrates, Volume III—Mammals*, and selection was based on animal reproduction.

Thomas Henry Huxley (1825–1895) in 1869 proposed the name "Hypotheria" for the class of Mammalia, a name suggested because of speculations about the origin of the class. Huxley's work in taxonomy, *A Manual of the Anatomy of Vertebrate Animals*, followed de Blainville's threefold division of the Mammalia. It was published in 1872.

In the same year, Theodore Nicolas Gill (1837–1914) published his work, *The Relations of the Orders of Mammals*. It was a simplified classification containing the best features of earlier systems. For example, it improved de Blainville's plan by reducing the primary division from three subclasses to two: 1) Prototheria (Ornithodelphia), and 2) Eutheria (Didelphia and Monodelphia).

Huxley, in 1880, published a classification, *On the Application of the Laws of Evolution to the Arrangement of the Vertebrata, and More Particularly, of the Mammalia*. He inserted another subclass, Metatheria, between the Prototheria and Eutheria in Gill's classification. The most important feature of Huxley's classification was that the main divisions were not founded upon traditional criteria, such as the number of digits or teeth, but upon deep-seated anatomical characters having little relationship to particular life habits.

In 1883 Sir William Henry Flower (1831–1899) published a classification which dealt only with existing orders and combined the best of Cuvier, de Blainville, Owen, Gill, and Huxley.

In 1891, Edward Drinker Cope (1840–1897) published part 3 of his *Syllabus of Lectures on Geology and Paleontology*. In 1898 part 4 was published. This syllabus was Cope's final attempt to express the taxonomic relationships of all the recent and fossil orders (Gregory, 1910).

In 1904 Max Weber (1864–1920), published *Die Säugetiere*. In this taxonomic study he tried to recognize and discount the misleading interpretations of parallel and convergent evolution, which in earlier classification had caused animals of widely different derivations to be grouped in the same order.

Most of the more complete classifications have originated in the United States. An excellent example is *The Age of Mammals* by

Henry Fairfield Osborn (1857–1935). This work contained a complete review of mammalian study, incorporating the latest knowledge of classification up to 1910. William Berryman Scott (1858–1947) published a *History of Land Mammals of the Western Hemisphere* (1937) which, like Osborn's *The Age of Mammals*, was very thorough. Parker, Haswell, and Cooper (1940) wrote a zoology textbook which gave an excellent, illustrated description of each mammalian order.

George Gaylord Simpson (1945) published *The Principles of Classification and a Classification of Mammals*. This treatise contained a complete classification of living and fossil mammals arranged so that one could tell at a glance who first proposed the name for a particular taxonomic group and when it was proposed. For the fossil mammals there was also a description of where the animal was found in geological time. The cohort Ferungulata replaced the older cohort Ungulata; in the former the order Carnivora is listed along with the rest of the orders formerly assigned to the latter.

With the publication of the *List of North American Recent Mammals* (Miller and Kellogg, 1955), the results of taxonomic studies of North American mammals were summarized.

Interrelated with the study of mammalian taxonomy is the preparation of keys for identifying a specimen. Among the published taxonomic keys for mammals which have had extensive usage are: *A*

*Field Guide to the Mammals* (Burt and Grossenheider, 1952) and W. F. Blair's "Mammals" in *Vertebrates of the United States* (Blair, et al., 1957).

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