= Le Règne Animal =

Le Règne Animal ( The Animal Kingdom ) is the most famous work of the French naturalist Georges Cuvier . It sets out to describe the natural structure of the whole of the animal kingdom based on comparative anatomy , and its natural history .

The work appeared in four octavo volumes in 1817 ; a second edition in five volumes was brought out in 1829 ? 1830 and a third , written by twelve " disciples " of Cuvier , in 1836 ? 1849 . In this classic work , Cuvier presented the results of his life 's research into the structure of living and fossil animals . With the exception of the section on insects , in which he was assisted by his friend Pierre André Latreille , the whole of the work was his own . It was translated into English many times , often with substantial notes and supplementary material updating the book in accordance with the expansion of knowledge . It was also translated into German , Italian and other languages , and abridged in versions for children .

Le Règne Animal was influential in being widely read , and in presenting accurate descriptions of groups of related animals , such as the living elephants and the extinct mammoths , providing convincing evidence for evolutionary change to readers including Charles Darwin , although Cuvier himself rejected the possibility of evolution .

= = Context = =

As a boy , Georges Cuvier ( 1769 @-@ 1832 ) read the Comte de Buffon 's Histoire Naturelle from the previous century , as well as Linnaeus and Fabricius . He was brought to Paris by Étienne Geoffroy Saint @-@ Hilaire in 1795 , not long after the French Revolution . He soon became a professor of animal anatomy at the Musée National d 'Histoire Naturelle , surviving changes of government from revolutionary to Napoleonic to monarchy . Essentially on his own he created the discipline of vertebrate palaeontology and the accompanying comparative method . He demonstrated that animals had become extinct .

In an earlier attempt to improve the classification of animals , Cuvier transferred the concepts of Antoine @-@ Laurent de Jussieu 's ( 1748 @-@ 1836 ) method of natural classification , which had been presented in 1789 in Genera plantarum , from botany to zoology . In 1795 , from a " fixist " perspective ( denying the possibility of evolution ) , Cuvier divided Linnaeus 's two unsatisfactory classes ( " insects " and " worms " ) into six classes of " white @-@ blooded animals " or invertebrates : molluscs , crustaceans , insects and worms ( differently understood ) , echinoderms and zoophytes . Cuvier divided the molluscs into three orders : cephalopods , gastropods and acephala . Still not satisfied , he continued to work on animal classification , culminating over twenty years later in the Règne Animal .

For the Règne Animal , using evidence from comparative anatomy and palaeontology ? including his own observations ? Cuvier divided the animal kingdom into four principal body plans . Taking the central nervous system as an animal 's principal organ system which controlled all the other organ systems such as the circulatory and digestive systems , Cuvier distinguished four types of organisation of an animal 's body :

I. with a brain and a spinal cord ( surrounded by parts of the skeleton )

II. with organs linked by nerve fibres

III. with two longitudinal , ventral nerve cords linked by a band with two ganglia positioned below the oesophagus

IV. with a diffuse nervous system which is not clearly discernible

Grouping animals with these body plans resulted in four " embranchements " or branches ( vertebrates , molluscs , the articulata that he claimed were natural ( arguing that insects and annelid worms were related ) and zoophytes ( radiata ) ) . This effectively broke with the mediaeval notion of the continuity of the living world in the form of the great chain of being . It also set him in opposition to both Saint @-@ Hilaire and Jean @-@ Baptiste Lamarck . Lamarck claimed that species could transform through the influence of the environment , while Saint @-@ Hilaire argued in 1820 that two of Cuvier 's branches , the molluscs and radiata , could be united via various features , while the

other two , articulata and vertebrates , similarly had parallels with each other . Then in 1830 , Saint @-@ Hilaire argued that these two groups could themselves be related , implying a single form of life from which all others could have evolved , and that Cuvier 's four body plans were not fundamental .

= = Book = =

= = = Editions = = =

Le Règne Animal distribué d 'après son organisation , pour servir de base à l 'histoire naturelle des animaux et d 'introduction à l 'anatomie comparée ( 1st edition , 4 volumes , 1817 ) ( Volumes I , II and IV by Cuvier ; Volume III by Pierre André Latreille )
--- ( 2nd edition , 5 volumes , 1829 ? 1830 )
--- ( 3rd edition , 22 volumes , 1836 ? 1849 ) known as the " Disciples edition "
The twelve " disciples " who contributed to the 3rd edition were Jean Victor Audouin ( insects ) , Gerard Paul Deshayes ( molluscs ) , Alcide d 'Orbigny ( birds ) , Antoine Louis Dugès ( arachnids ) , Georges Louis Duvernoy ( reptiles ) , Charles Léopold Laurillard ( mammals in part ) , Henri Milne Edwards ( crustaceans , annelids , zoophytes , and mammals in part ) , Francois Desire Roulin ( mammals in part ) , Achille Valenciennes ( fishes ) , Louis Michel Français Doyère ( insects ) , Charles Émile Blanchard ( insects , zoophytes ) and Jean Louis Armand de Quatrefages de Bréau ( annelids , arachnids etc . ) .
The work was illustrated with tables and plates ( at the end of Volume IV ) covering only some of the species mentioned . A much larger set of illustrations , said by Cuvier to be " as accurate as they were elegant " was published by the entomologist Félix Édouard Guérin @-@ Méneville in his Iconographie du Règne Animal de G. Cuvier , the nine volumes appearing between 1829 and 1844 . The 448 quarto plates by Christophe Annedouche , Canu , Eugène Giraud , Lagesse , Lebrun , Vittore Pedretti , Plée and Smith illustrated some 6200 animals .

= = = Translations = = =

Le Règne Animal was translated into languages including English , German and Italian .
Many English translations and abridged versions were published and reprinted in the nineteenth century ; records may be for the entire work or individual volumes , which were not necessarily dated , while old translations were often brought out in " new " editions by other publishers , making for a complex publication history . A translation was made by John Edward Gray and published by Whittaker , Treacher and Co. in 1824 ; another by Edward Griffith and others was published by G. B. Whittaker in 1827 ? 1832 and many times reprinted ( up to 2012 and eBook format ) ; another by Henry MacMurtrie was published by G. Henderson in 1834 ? 1837 . A translation was made and published by the ornithologist William MacGillivray in Edinburgh in 1839 ? 1840 . Another version by Edward Blyth and others was published by William S. Orr and Co. in 1840 . An abridged version by an " experienced teacher " was published by Longman , Brown , Green and Longman in London , and by Stephen Knapp in Coventry , in 1844 . Kraus published an edition in New York in 1969 . Other editions were brought out by H.G. Bohn in 1851 and W. Orr in 1854 . An " easy introduction to the study of the animal kingdom : according to the natural method of Cuvier " , together with examination questions on each chapter , was made by Annie Roberts and published in the 1850s by Thomas Varty .
A German translation by H.R. Schinz was published by J.S. Cotta in 1821 ? 1825 ; another was made by Friedrich Siegmund Voigt and published by Brockhaus .
An Italian translation by G. de Cristofori was published by Stamperia Carmignani in 1832 .
A Hungarian translation by Peter Vajda was brought out in 1841 .

= = = Approach = = =

Each section , such as on reptiles at the start of Volume II ( and the entire work ) is introduced with an essay on distinguishing aspects of their zoology . In the case of the reptiles , the essay begins with the observation that their circulation is so arranged that only part of the blood pumped by the heart goes through the lungs ; Cuvier discusses the implications of this arrangement , next observing that they have a relatively small brain compared to the mammals and birds , and that none of them incubate their eggs .

Next , Cuvier identifies the taxonomic divisions of the group , in this case four orders of reptiles , the chelonians ( tortoises and turtles ) , saurians ( lizards ) , ophidians ( snakes ) and batracians ( amphibians , now considered a separate class of vertebrates ) , describing each group in a single sentence . Thus the batracians are said to have a heart with a single atrium , a naked body ( with no scales ) , and to pass with age from being fish @-@ like to being like a quadruped or biped .

There is then a section heading , in this case " The first order of Reptiles , or The Chelonians " , followed by a three @-@ page essay on their zoology , starting with the fact that their hearts have two atria . The structure then repeats at a lower taxonomic level , with what Cuvier notes is one of Linnaeus 's genera , Testudo , the tortoises , with five sub @-@ genera . The first sub @-@ genus comprises the land tortoises ; their zoology is summed up in a paragraph , which observes that they have a domed carapace , with a solid bony support ( the term being " charpente " , commonly used of the structure of wooden beams that support a roof ) . He records that the legs are thick , with short digits joined for most of their length , five toenails on the forelegs , four on the hind legs .

Then ( on the ninth page ) he arrives at the first species in the volume , the Greek tortoise , Testudo graeca . It is summed up in a paragraph , Cuvier noting that it is the commonest tortoise in Europe , living in Greece , Italy , Sardinia and ( he writes ) apparently all round the Mediterranean . He then gives its distinguishing marks , with a highly domed carapace , raised scales boldly marked with black and yellow marbling , and at the posterior edge a bulge over the tail . He gives its size ? rarely reaching a foot in length ; notes that it lives on leaves , fruit , insects and worms ; digs a hole in which to pass the winter ; mates in spring , and lays 4 or 5 eggs like those of a pigeon . The species is illustrated with two plates .

= = = Contents = = =

The classification adopted by Cuvier to define the natural structure of the animal kingdom , including both living and fossil forms , was as follows , the list forming the structure of the Règne Animal . Where Cuvier 's group names correspond ( more or less ) to modern taxa , these are named , in English if possible , in parentheses . The table from the 1828 Penny Cyclopaedia indicates species that were thought to belong to each group in Cuvier 's taxonomy .

I. Vertébrés . ( Vertebrates )

Mammifères ( Mammals ) : 1 . Bimanes , 2 . Quadrumanes , 3 . Carnassiers ( Carnivores ) , 4 . Rongeurs ( Rodents ) , 5 . Édentés ( Edentates ) , 6 . Pachydermes ( Pachyderms ) , 7 . Ruminants ( Ruminants ) , 8 . Cétacés ( Cetaceans ) .

Oiseaux ( Birds ) : 1 . Oiseaux de proie ( Birds of prey ) , 2 . Passereaux ( Passerines ) , 3 . Grimpeurs ( Piciformes ) , 4 . Gallinacés ( Gallinaceous birds ) , 5 . Échassiers ( Waders ) , 6 . Palmipèdes ( Anseriformes ) .

Reptiles ( Reptiles , inc . Amphibians ) : 1 . Chéloniens ( Chelonii ) , 2 . Sauriens ( Lizards ) , 3 . Ophidiens ( Snakes ) , 4 . Batraciens ( Amphibians ) .

Poissons ( Fishes ) : 1 . Chrondroptérygiens à branchies fixes ( Chondrichthyes ) , 2 . Sturioniens ou Chrondroptérygiens à branchies libres ( Sturgeons ) , 3 . Plectognates ( Tetraodontiformes ) , 4 . Lophobranches ( Syngnathidae ) , 5 . Malacoptérygiens abdominaux , 6 . Malacoptérygiens subbrachiens , 7 . Malacoptérygiens apodes , 8 . Acanthoptérygiens ( Acanthopterygians ) .

II . Mollusques . ( Molluscs )

Céphalopodes . ( Cephalopods )

Ptéropodes . ( Pteropods )

Gastéropodes ( Gastropods ) : 1 . Nudibranches ( Nudibranchs ) , 2 . Inférobranches , 3 .

Tectibranches , 4 . Pulmonés ( Pulmonata ) , 5 . Pectinibranches , 6 . Scutibranches , 7 . Cyclobranches .
Acéphales ( Bivalves etc . ) : 1 . Testacés , 2 . Sans coquilles .
Brachiopodes . ( Brachiopods , now a separate phylum )
Cirrhopodes . ( Barnacles , now in Crustacea )
III . Articulés . ( Articulated animals : now Arthropods and Annelids )
Annélides ( Annelids ) : 1 . Tubicoles , 2 . Dorsibranches , 3 . Abranches .
Crustacés ( Crustaceans ) : 1 . Décapodes ( Decapods ) , 2 . Stomapodes ( Stomatopods ) , 3 . Amphipodes ( Amphipods ) , 4 . Isopodes ( Isopods ) , 5 . Branchiopodes ( Branchiopods ) .
Arachnides ( Arachnids ) : 1 . Pulmonaires , 2 . Trachéennes .
Insectes ( Insects , inc . Myriapods ) : 1 . Myriapodes , 2 . Thysanoures ( Thysanura ) , 3 . Parasites , 4 . Suceurs , 5 . Coléoptères ( Coleoptera ) , 6 . Orthoptères ( Orthoptera ) , 7 . Hémiptères ( Hemiptera ) , 8 . Névroptères ( Neuroptera ) , 9 . Hyménoptères ( Hymenoptera ) , 10 . Lépidoptères ( Lepidoptera ) , 11 . Ripiptères ( Strepsiptera ) , 12 . Diptères ( Diptera ) .
IV . Zoophytes . ( Zoophytes , now Cnidaria ] and other phyla )
Échinodermes ( Echinoderms ) : 1 . Pédicellés , 2 . Sans pieds .
Intestinaux ( Intestinal worms ) : 1 . Cavitaires , 2 . Parenchymateux .
Acalèphes ( Jellyfish and other free @-@ floating polyps ) : 1 . Fixes , 2 . Libres .
Polypes ( Cnidaria ) : 1 . Nus , 2 . À polypiers .
Infusoires ( Infusoria , various protistan phyla ) : 1 . Rotifères ( Rotifers ) , 2 . Homogènes .

= = Reception = =

= = = Contemporary = = =

The entomologist William Sharp Macleay , in his 1821 book Horae Entomologicae which put forward the short @-@ lived " Quinarian " system of classification into 5 groups , each of 5 subgroups , etc . , asserted that in the Règne Animal " Cuvier was notoriously deficient in the power of legitimate and intuitive generalization in arranging the animal series " . The zoologist William John Swainson , also a Quinarian , added that " no person of such transcendent talents and ingenuity , ever made so little use of his observations towards a natural arrangement as M. Cuvier . "

The Magazine of Natural History of 1829 expressed surprise at the long interval between the first and second editions , surmising that there were too few scientific readers in France , apart from those in Paris itself ; it notes that while the first volume was little changed , the treatment of fish was considerably altered in volume II , while the section on the Articulata was greatly enlarged ( to two volumes , IV and V ) and written by M. Latreille . It also expressed the hope that there would be an English equivalent of Cuvier 's work , given the popularity of natural history resulting from the works of Thomas Bewick ( A History of British Birds 1797 ? 1804 ) and George Montagu ( Ornithological Dictionary , 1802 ) . The same review covers Félix Édouard Guérin @-@ Méneville 's Iconographie du Règne Animal de M. le Baron Cuvier , which offered illustrations of all Cuvier 's genera ( except for the birds ) .

The Foreign Review of 1830 broadly admired Cuvier 's work , but disagreed with his classification . It commented that " From the comprehensive nature of the Règne Animal , embracing equally the structure and history of all the existing and extinct races of animals , this work may be viewed as an epitome of M. Cuvier 's zoological labours ; and it presents the best outline , which exists in any language , of the present state of zoology and comparative anatomy . " The review continued less favourably , however , that " We cannot help thinking that the science of comparative anatomy is now so far advanced , as to afford the means of distributing the animal kingdom on some more uniform and philosophical principles , ? as on the modifications of those systems or functions which are most general in the animal economy " . The review argued that the vertebrate division relied on the presence of a vertebral column , " a part of the organization of comparatively little importance in the economy " ; it found the basis of the mollusca on " the general softness of the body " no better ;

the choice of the presence of articulations no better either , in the third division ; while in the fourth it points out that while the echinoderms may fit well into the chosen scheme , it did not apply " to the entozoa , zoophyta , and infusoria , which constitute by much the greatest portion of this division . " But the review notes that " the general distribution of the animal kingdom established by M. Cuvier in this work , are founded on a more extensive and minute survey of the organization than had ever before been taken , and many of the most important distinctions among the orders and families are the result of his own researches . "

Writing in the Monthly Review of 1834 , the pre @-@ Darwinian evolutionist surgeon Sir William Lawrence commented that " the Regne Animal of Cuvier is , in short , an abridged expression of the entire science . He carried the lights derived from his zoological researches into kindred but obscure parts of nature . " Lawrence calls the work " an arrangement of the animal kingdom nearly approaching to perfection ; grounded on principles so accurate , that the place which any animal occupies in this scheme , already indicates the leading circumstances in its structure , economy , and habits . "

The book was in the library of HMS Beagle for Charles Darwin 's voyage . In The Origin of Species ( 1859 ) , in a chapter on the difficulties facing the theory , Darwin comments that " The expression of conditions of existence , so often insisted on by the illustrious Cuvier , is fully embraced by the principle of natural selection . " Darwin continues , reflecting both on Cuvier 's emphasis on the conditions of existence , and Jean @-@ Baptiste Lamarck 's theory of acquiring heritable characteristics from those Cuvieran conditions : " For natural selection acts by either now adapting the varying parts of each being to its organic and inorganic conditions of life ; or by having adapted them during long @-@ past periods of time : the adaptations being aided in some cases by use and disuse , being slightly affected by the direct action of the external conditions of life , and being in all cases subjected to the several laws of growth . Hence , in fact , the law of the Conditions of Existence is the higher law ; as it includes , through the inheritance of former adaptations , that of Unity of Type . "

= = = Modern = = =

The palaeontologist Philippe Taquet wrote that " the Règne Animal was an attempt to create a complete inventory of the animal kingdom and to formulate a natural classification underpinned by the principles of the ' correlation of parts ' .. " He adds that with the book " Cuvier introduced clarity into natural history , accurately reproducing the actual ordering of animals . " Taquet further notes that while Cuvier rejected evolution , it was paradoxically " the precision of his anatomical descriptions and the importance of his research on fossil bones " , showing for instance that mammoths were extinct elephants , that enabled later naturalists including Darwin to argue convincingly that animals had evolved .