

a most prejudicial effect upon the district of the Rhine; and the peace of Westphalia gave France a footing on the left bank of the athero exclusively German river by the acquisition of Alsace. The violent seizure of Strasburg by France in 1681 was ratified by the peace of Ryswick in 1697, which recognized the Rhine as the boundary between Germany and France from Basel to above Germersheim. It was an easy inference for the French mind that the Rhine should be the boundary throughout and the Gaul of Caesar restored. This ideal was realized in 1801, when the whole of the left bank of the Rhine was formally ceded to France. The congress of Vienna (1815) restored the lower part of the Rhineish valley to Germany, but it was not till the year of 1870-71 that the recovery of Alsace and Lorraine made the Rhine once more "Germany's river, not Germany's frontier." In the military history of all these centuries constant allusion is made to the Rhine, its passages, and its fortresses. Every general who has fought in its neighbourhood has at one time or another had to provide for a crossing of the Rhine, from Julius Caesar, who crossed it twice, down to our own time. The wars carried on here by his Most Christian Majesty Louis XIV. are still remembered in the Rhine district, where the devastations of his generals were of the most appalling description; and scarcely a village or town but has a tale to tell of the murder and rapine of this period.

The Rhine has always exercised a peculiar sort of fascination over the German mind, in a measure and in a manner not easily paralleled by the case of any other river. "Father Rhine" is the centre of the German's patriotism and the symbol of his country. In his literature it has played a prominent part from the *Nibelungenlied* to the present day; and its weird and romantic legends have been alternately the awe and the delight of his childhood. The Rhine was the classic river of the Middle Ages; and probably the Tiber alone is of equal historical interest among European rivers. Victor Hugo has perhaps best described the mingled feelings which the Rhine awakens. "Le Rhin," he says, "rien est tel. Le Rhin est rapide comme le Rhône, large comme la Seine, encaissé comme la Meuse, tortueux comme la Saône, limpide et vert comme la Somme, historique comme le Tibre, royal comme le Danube, mystérieux comme le Nil, pailleté d'or comme un fleuve d'Andalousie, couvert de falotes et de fantômes comme un fleuve d'Asie." (J. F. M.).

RHINOCEROS, a name applied by the ancients to an animal the most striking external peculiarity of which is certainly the horn growing above its nose (*sericeus*, nose-horn).

The various existing and extinct species are grouped into a family, *Rhinocerotidae*, which is a division of the Perissodactyle (odd-toed) section of the great order of *Ungulata* or hoofed mammals, of which section the tapirs and horses are the only other surviving members (see *MAMMALIA*, vol. iv, p. 428).

The following are the general characters applicable to all the members of the family.

First, as regards dentition. Incisors variable, generally reduced in number and often quite rudimentary, and early deciduous. Canines, in existing species, absent. Molar series, consisting of the full number of four premolars and three molars above and below, all in contact and closely resembling each other, except the first, which is

obliquely inwards and backwards from it, terminating internally in conical eminences or columns, and enclosing a deep (middle) sinus between. The posterior sinus is formed behind the posterior transverse ridge, and is bounded externally by a backward continuation of the outer wall and behind by the cingulum. The anterior sinus is formed in the same manner, but is much smaller. The middle sinus is often intersected by vertical laminae ("combing plates") projecting into it from the anterior surface of the posterior transverse ridge or from the wall, the development of which is a useful guide in discriminating the species, especially those no longer existing and known only by the teeth and bones. The depressions between the ridges are not filled up with cementum as in the horse. The lower molars have the crown formed by a pair of crescents; the last has no third lobe or talon.

Head large, skull elongated, elevated posteriorly into a transverse occipital crest. No post-orbital processes or any separation between orbits and temporal fossae. Nasal bones large and stout, co-ossified, and standing out freely above the premaxilla, from which they are separated by a deep and wide fissure; the latter small, generally not meeting in the middle line in front, often quite rudimentary. Tympanics small, not forming a bulla. Brain cavity very small for the size of the skull. Vertebrae—cervical, 7; dorsal, 19-20; lumbar, 3; sacral, 4; caudal, about 22. Limbs stout, and of moderate length. Three completely developed toes, with distinct broad rounded hoofs on each foot. Mammary two, inguinal. Eyes small. Ears of moderate size, oval, erect, prominent, placed near the occiput. Skin very thick, in many species thrown into massive folds. Hairy covering scanty. All existing species have one or two median horns on the face. When one is present it is situated over the conjoined nasal bones; when two, the hinder one is over the frontals. These horns, which are of a more or less conical form and usually recurved, and often grow to a great length (three or even four feet), are composed of a solid mass of hardened epidermic cells growing from a cluster of long dermal papillae. The cells formed on each papilla constitute a distinct horny fibre, like a thick hair, and the whole are cemented together by an intermediate mass of cells which grow up from the interspaces between the papillae. It results from this that the horn has the appearance of a mass of agglutinated hairs, which, in the newly growing part at the base, readily fray out on destruction of the softer intermediate substance; but the fibres differ from true hairs in growing from a free papilla of the derm, and not within a follicular involution of the same.

The *Rhinocerotidae* are all animals of large size, but of little intelligence, generally timid in disposition, though ferocious when attacked and brought to bay, using the nasal horns as weapons, by which they strike and toss their assailant. Their sight is dull, but their hearing and scent are remarkably acute. They feed on herbage, shrubs, and leaves of trees, and, like so many other large animals which inhabit hot countries, sleep the greater part of the day, being most active in the cool of the evening or even during the night. They are fond of bathing and wallowing in water or mud. None of the species have been domesticated. Animals of the group have existed in both the Old and New Worlds since the beginning of the Miocene period. In America they all became extinct before the end of the Pliocene period. In the Old World their distribution has become greatly restricted, being no longer found in Europe and North Asia, but only in Africa and in portions of the Indian and Indo-Malayan regions.

¹ In some extinct species a small outer toe is present on the forefoot.



FIG. 1.—Grinding surface of a moderately worn right upper second molar of *Rhinoceros*. A, *Rhinoceros uelleri*; B, *Rhinoceros bonapartei*. 1, anterior surface; 2, posterior surface; 3, external median wall or cusp; 4, antero-internal pillar or cusp; 5, postero-internal pillar or cusp; 6, posterior sinus; 7, median sinus; 8, posterior sinus; 9, posterior sinus or valley; 10, anterior sinus; 11, crest (anterior combing plate); 12, crest (posterior combing plate).

much smaller than the rest and often deciduous. The others gradually increasing in size up to the penultimate. The upper molars have a very characteristic pattern of crown, having a much-developed flat or more or less sinuous outer wall, and two transverse ridges running

The existing species of rhinoceros are naturally grouped into three sections, which some zoologists consider of generic value.

I. *Rhinoceros* proper. The adults with a single large compressed incisor above on each side, and occasionally a small lateral one; below, a very small median, and a very large, procumbent, pointed lateral incisor. Nasal bones pointed in front. A single nasal horn. Skin very thick, and raised into strong, definitely arranged ridges or folds.

There are two well-marked species of one-horned rhinoceroses. (1) The Indian Rhinoceros, *R. unicornis* of Linnaeus,¹ the largest and best known, from being the most frequently exhibited alive in England, is at present only



FIG. 2.—Indian Rhinoceros (*Rhinoceros unicornis*). This and the following woodcuts are reduced from drawings by J. Wolf, from animals living in the London Zoological Society's Gardens.

met with in a wild state in the terai region of Nepal and Bhutan, and in the upper valley of the Brahmaputra or province of Assam, though it formerly had a wider range.



FIG. 3.—Javan Rhinoceros (*Rhinoceros sondaicus*).

The first rhinoceros seen alive in Europe since the time when they, in common with nearly all the large remarkable beasts of both Africa and Asia, were exhibited in the

¹ Many authors use Cuvier's name, *R. indicus*, in preference to this, on the ground that there are more than one species with one horn, forgetting that the name substituted is equally inconvenient, as more than one species live in India. The fact of a specific name being applicable to several members of a genus is no objection to its restriction to the first to which it was applied; otherwise changes in old and well-received names would constantly have to be made in consequence of new discoveries.

Roman shows, was of this species. It was sent from India to Emmanuel, king of Portugal, in 1513; and from a sketch of it, taken in Lisbon, Albert Dürer composed his celebrated but rather fanciful engraving, which was reproduced in so many old books on natural history. (2) The Javan Rhinoceros, *R. sondaicus*, Cuvier, is distinguished by smaller size, special characters of the teeth and skull, and different arrangement of the plications of the skin (as seen in the figures); the horn in the female appears to be very little developed, if not altogether absent. This has a more extensive geographical range, being found in the Bengal Sunderbans near Calcutta, Burmah, the Malay Peninsula, Java, Sumatra, and probably Borneo.

II. *Ceratotherium*. The adults with a moderate-sized compressed incisor above, and a laterally placed, pointed, procumbent incisor below, which is sometimes lost in old animals. Nasal bones narrow and pointed anteriorly. A well-developed nasal, and a small frontal horn separated by an interval. The skin thrown into folds, but these not so strongly marked as in the former section. The smallest living member of the family, the Sumatran Rhinoceros, *R. sumatrensis*, Cuv., belongs to this group. Its geographical range is nearly the same as that of the Javan species, though not extending into Bengal; but it has been found in Assam, Chittagong, Burmah, the Malay Peninsula, Sumatra, and Borneo. It is possible that more than one species have been confounded under this designation, as two animals now living in the London Zoological Gardens present considerable differences of form and colour. One of them, from Chittagong, has been named by Schaller *R. lasiotis*, the Hairy-Eared Rhinoceros, but until an opportunity is afforded for anatomical examination, it is difficult to pronounce upon the value of the distinction.

III. *Aelodonta*. In the adults, the incisors are quite rudimentary or entirely wanting. Nasal bones thick, rounded and truncated in front. Well-developed anterior and posterior horns in close contact. Skin without any definite permanent folds.

The two well-marked existing species are peculiar to the African continent.

1. The common Two-Horned Rhinoceros, *R. bicornis*, Linn., is the smaller of the two, with a pointed prehensile upper lip, and a narrow compressed deep symphysis of the



FIG. 4.—Common African Rhinoceros (*Rhinoceros bicornis*).

lower jaw. It ranges through the wooded and watered districts of Africa, from Abyssinia in the north to the Cape Colony, but its numbers are yearly diminishing, owing to

the inroads of European civilization, and especially of English sportsmen. It feeds exclusively upon leaves and branches of bushes and small trees, and chiefly frequents the sides of wood-clad rugged hills. Specimens in which the posterior horn has attained a length as great as or greater than the anterior have been separated under the name of *R. tricornis*, but the characters of these appendages are too variable to found specific distinctions upon. The two-horned African rhinoceros is far more rarely seen in menageries in Europe than either of the three Indian species, but one has lived in the gardens of the London Zoological Society since 1868. Excellent figures from life of this and the other species are published in the ninth volume of the *Transactions* of the society, from which the accompanying woodcuts are reduced.

2. Burchell's or the Square-Mouthed Rhinoceros (*R. sinensis*), sometimes called the White Rhinoceros, though the colour (dark-slate) is not materially different from that of the last species, is the largest of the whole group, and differs from all the others in having a square truncated upper lip and a wide, shallow, spatulate symphysis to the lower jaw. In conformity with the structure of the mouth, this species lives entirely by browsing on grass, and is therefore more partial to open countries or districts where there are broad grassy valleys between the tracts of bush. It is only found in Africa south of the Zambezi, and of late years has become extremely scarce, owing to the persecutions of sportsmen; indeed, the time of its complete extinction cannot be far off. No specimen of this species has ever been brought alive to Europe. Mr F. C. Selous gives the following description of its habits from extensive personal observation:—

"The square-mouthed rhinoceros is a huge ungainly-looking beast, with a disproportionately large head, a large male standing 6 feet 6 inches at the shoulder. Like elephants and buffaloes they lie asleep during the heat of the day, and feed during the night and in the cool hours of early morning and evening. Their sight is very bad; but they are quick of hearing, and their scent is very keen; but they are accompanied by rhinoceros birds, which, by running about their heads, flapping their wings, and screeching at the same time, frequently give them notice of the approach of danger. When disturbed they go off at a swift trot, which soon leaves all pursuit from a man on foot far behind; but if chased by a horseman they break into a gallop, which they can keep up for some distance. However, although they run very swiftly, when their sin and heavy build is considered, they are no match for an average good horse. They are, as a rule, very easy to shoot on horseback, as, if one gallops a little in front of and on one side of them, they will hold their course, and come sailing past, offering a magnificent broadside shot, while under similar circumstances a prebendable rhinoceros will usually swerve away in such a manner as only to present his hind-quarters for a shot. When either walking or running accompanied by rhinoceros birds, his head very low, its nose nearly touching the ground. When a small calf accompanies its mother, it always runs in front and she appears to guide it by holding the point of her horn upon the little animal's rump; and it is perfectly wonderful to note how in all sudden changes of pace, from a trot to a gallop or vice versa, the same position is always exactly maintained. During the hot sun and winter months (i.e. from March to August) the square-mouthed rhinoceros is usually very fat; and its meat is then most excellent, being something like beef, but yet having a peculiar flavor of its own. The part in greatest favor among hunters is the hump, which, if cut off whole and roasted just as it is in the skin, in a hole dug in the ground, would, I think, be difficult to match either for palateness or flavor."—*Proc. Zool. Soc.*, 1881, p. 726.

Extinct Species of Rhinoceros.—The family once contained many more species, which were far more widely distributed than at present. As in similar cases, our knowledge of them is as yet but fragmentary, though constantly augmenting, especially by discoveries made in the Tertiary deposits of North America, a region in which they all died out long ago, though, judging from the evidence at present available, this was the locality in which they first made their appearance. In the Eocene formations of the Rocky Mountains are found the remains of numerous modifications of the primitive Protoceratops type, from which the rhinoceros may have originated. In the Lower Miocene a form called *Hypoceros* by Lillj already presented many of the

characteristics of the family, though, especially as regards the dentition, in a very generalized condition. The next stage of specialization is represented by *Aceratherium*, found in the Miocene of both Europe and America, which still, like the last, shows no sign of having possessed a nasal horn. It differed from the existing species also in having four toes on the anterior limb, instead of only three. At the same period *Foras* occurred (*Diceratherium*, Munk) which show a pair of lateral tubercles on the nasal bones, apparently supporting horns side by side. These, however, soon disappeared and gave way in the Old World to species with one or two horns in the median line, a stage of development which apparently was never reached in America. In the Pliocene and Pleistocene of Europe and Asia numerous modifications of the existing types have been found. The present African two-horned type was represented in the Early Pliocene of Greece by *R. pectygnathus*, the skeleton of which is described by Gaudry as intermediate between the existing *R. bicornis* and *R. sinensis*. As many as three species were inhabitants of the British Isles, of which the best known is the Tiberline or Woolly Rhinoceros, *R. antiquitatis* of Blumenbach, nearly barren carcasses of which, with the thick woolly external covering, have been discovered associated with those of the mammoth, preserved in the frozen soil of the north of Siberia, and which, in common with some other extinct species, had a solid median wall of bone supporting the nasal, from which it is inferred that the horns were of a size and weight surpassing that of the modern species. The one-horned Indian type was well represented under several modifications (*R. sivalensis*, *palaeindicus*, &c.), in the Pliocene deposits of the sub-Himalayan region, and forms are more allied to the African *bicornis* species have also been found in India. *R. schreineri* of the late European Miocene was in some respects allied to the existing Sumatran rhinoceros, possessing incisor teeth and two horns. (W. H. F.)

RHODE ISLAND, one of the six New England States, Plate IV.

and the smallest in extent of all the States, is one of the original thirteen which formed the American Union. It has an actual land area of only 1054.6 square miles, the waters of Narragansett Bay, its chief physical feature, comprising an additional area of not far from 360 square miles. It lies between 41° 18' and 42° 3' N. lat., and 71° 6' and 71° 55' W. long., its greatest length from north to south being about 48 miles, and its greatest width from east to west about 35 miles. It is shut in on the east and north by Massachusetts, and on the west by Connecticut, while its southern shores are washed by the Atlantic Ocean.

Physical Characteristics.—The geological formation of the western portion of the State is chiefly that of the Montalban gneiss, which characterizes a great part of southern New England (see geological sketch map of New England, in article NEW HAMPSHIRE, vol. xvii, p. 391), but under the bay and to the east of it is an extensive coal-bearing formation, from which at different times upwards of 750,000 tons of coal have been taken. The only other important deposit is one of magnetic oxide of iron. The climate of Rhode Island, though variable, differs from that of the exposed coast of Massachusetts Bay in the absence of harassing east winds; while the proximity of the southern parts of the State (Newport and vicinity) to the Gulf Stream results in an atmosphere of unusual warmth and moisture, and at the same time comparatively equable. No great extremes, either of heat or of cold, are experienced in the State.

Population.—The earliest authentic estimate of population is that of 1718 in 1708. The War of Independence (1775-83) had the effect of reducing it from 59,707 in 1774 to 52,347 in 1782. The subsequent United States census shows steady gain, as follows:—1790, 68,225; 1800, 69,122; 1810, 77,031; 1820, 83,629; 1830, 92,210; 1840, 108,550; 1850, 147,545; 1860, 174,620; 1870, 217,323; 1880, 276,331 (145,501 males; 131,830 females); while a State census in 1885 (advance returns) gives 304,412. The census of 1880 shows Rhode Island to be second in aggregate population by all except Colorado, Oregon, Delaware, and Nevada, but in density it was surpassed by none (254.9 per square mile, the average for the whole United States being 13.92). By the same census the number of persons of foreign birth was 73,993, or 26.8 per cent., no State east of Lake Michigan showing

¹ The town of New Shoreham, which lies on an island 10 miles from shore, is beyond this limit.