upwards, passing between the caudal *setæ* and terminating in acute points: the legs are very long and slender: the insect is of a dark brown colour, the wings being opaque, dark brown, and the exterior portion of the fore wings regularly spotted with dirty white; the hind wings are immaculate; the *pro-* and *mesofemora* having a bright testaceous ring; the *metafemora* are testaceous, with the apex only dark brown, the *tibiæ* are rather paler, and the *tarsi* nearly black.

Inhabits Van Dieman's Land. There is a single specimen in the cabinet of the Rev. F. W. Hope.

ART. VII.—*Observations on the* Rodentia, *with a view to point out the groups, as indicated by the structure of the* Crania, *in this order of Mammals.* By G. R. WATERHOUSE, Esq., Curator to the Zoological Society.

THE various published classifications of the *Rodentia* appear to be chiefly founded upon the external structure of the species composing this order, combined with their dentition. The habits of animals of the same group, however, are often very variable, and their external characters and certain portions of their skeletons, are of necessity equally so. "The skeletons of *Rodentia*," says Cuvier,[1] "are so variable, owing to the diversity of the movements of the species of different genera, and to the presence or absence of clavicles, that it is difficult to find any characters in common, unless it be in the bones of the skull." These considerations have led me to search in the skull for characters by which to define the larger groups and to determine the affinities of the genera, and the object of the present communication is to point out such as appear most important, and in fact to state the results arising from the examination of an extensive series of *crania*, with the view of so arranging the various species of rodents, that by the position of any particular individual the most important points in its structure shall be indicated, and the relative value of the characters expressed by the nature of the divisions and sub-divisions.

It may be asked upon what principles I estimate the value of characters? and as this is a very important point, a few words on this subject appear necessary. I may answer that I value a character by its constancy; and consider that character of most importance which extends through the greatest number of species, provided these species evince affinities one with another by the gradual modifications of other characters of less importance,—that is to say, more subject to variation.

[1] 'Ossements Fossiles.'

There are, however, certain points in which the greater portion of the species agree,—these, which may be called the typical characters of the group, in my opinion should not be selected, with the departures from such typical characters, for the establishment of *primary* divisions. The skulls of rodents, for instance, generally possess a large glenoid cavity, longitudinal in its direction; but in the genus *Lepus* this cavity is remarkably small and narrow:—thus rodents in general might be arranged in one family, and the genus *Lepus* in another.

Or if we take the perfect or imperfect state of the clavicles as our guide, the present order would also be divided into two families or sections. Rodents are typically claviculated animals, those with imperfect clavicles being exceptions in this respect to that structure which is most commonly found in the species. The claviculated or unclaviculated groups cannot, I think, be of equal value.

My principles will be more fully illustrated by the mode in which I have proceeded in the investigation of the affinities of the animals under consideration.

After a careful comparison of part with part throughout the whole series of rodent skulls which I have had an opportunity of examining, it appeared to me that the zygomatic arch and ant-orbital *foramen* afforded the most constant characters. In the *Sciuridæ*, *Muridæ*, and *Arvicolidæ* for instance, we find the zygomatic process of the maxillary bone to consist of a large thin plate of bone, which is oblique in its position, and has the lower edge emarginated so as to throw the anterior portion of the zygomatic arch above the plane of the palate: here the anterior outlet of the sub-orbital *foramen* is much contracted. On the other hand in the *Hystrices*, the genera *Echimys*, *Myopotamus*, *Dasyprocta*, and in the *Chinchillidæ* and *Caviidæ*, the ant-orbital *foramen* is very large, enclosed by two meeting branches from the maxillary bone, the lower branch being thrown out from the level of the palate.

In the hares and rabbits (*Lepus*), taking the same character, we find quite a new type of form, indeed these animals appear to be in many respects isolated. In the very imperfect state of the palate, however, and in some other characters which will be hereafter mentioned, there appears to be an approach in the *Chinchillidæ* and *Caviidæ*.

Thus we have nearly all the principal genera of rodents thrown into three great sections, which may be easily distinguished; and upon arranging the various species of the genera or families above mentioned *in* these sections, we find

many other points indicative of the mutual affinity of those placed in the same section.

Two genera, however, form exceptions, not possessing the combination of characters above noticed; I allude to *Dipus* and *Helamys*. The whole of the skulls were therefore re-examined, with a hope that the discovery of some other characters might enable me to determine the situation of these genera. I then perceived that the lower jaw afforded points of distinction of great importance, by means of which the affinities of one of the two genera just mentioned (*Dipus*), can, I think, be satisfactorily determined.

In order the more clearly to describe the lower jaw, I shall view each *ramus* as divided into four portions, which may be called the *alveolar portion*, the *condyloid*, the *coronoid*, and the descending *ramus*.—A ridge of bone on the inner side of the *ramus*, extending from the alveolar portion to the condyle, forms the upper or anterior boundary of what I term the descending *ramus*.

In the first section, which I shall call *Murina*, the descending *ramus* of the jaw consists of a broad plate, concave on the inner side, and flat or convex on the outer. It approaches more or less to a quadrate form, the upper posterior angle is directed outwards, and the lower posterior angle, which is often rounded, is directed inwards. The lower boundary of this plate consists of a thickened ridge or branch, which springs from the under side of the alveolar portion of the jaw, and is directed backwards and downwards. The posterior part of the descending ramus is usually in the same perpendicular line as that of the condyle, and very seldom extends beyond that line.

The coronoid process terminates usually high above the level of the molars. The condyloid portion is long and directed obliquely upwards and backwards. The *rami* of the jaws converge to a point at the *symphysis*, which is usually of but small extent, and forms an angle of about 45° with the horizontal *ramus*.

The lower jaw of a squirrel may be regarded as the type of the form just described. I shall have occasion to notice the departures from this type when I define the families.

The principal genera contained in this section are *Sciurus*, *Arctomys*, *Myoxus*, *Dipus*, *Mus*, *Arvicola*, *Geomys*, and *Castor*.

Section II.—*Hystricina*. In this section the descending ramus of the jaw is formed by a triangular flattened plate, the lower boundary of which consists of a thickened ridge or branch, (the under surface of which is almost always flat) which springs from the *outer* side of the alveolar portion, and

the apex of which is produced and forms an acute angle, which almost invariably terminates beyond the *condyle*. The *rami* of the jaw somewhat suddenly diverge behind their junction at the *symphysis menti*, which is of considerable extent. The horizontal *ramus* is separated from the alveolar portion beneath, by a groove, which is more or less distinct. The *coronoid* process is usually small or but slightly elevated above the level of the molars, and situated more forward than in section I., and the *condyloid* is *comparatively* short.

The principal genera, are *Bathyergus*, *Poephagomys*, *Octodon*, *Abrocoma*, *Myopotamus*, *Capromys*, *Echimys*, *Aulacodus*, *Hystrix*, *Dasyprocta*, *Chinchilla*, *Cavia and Hydrochærus*.

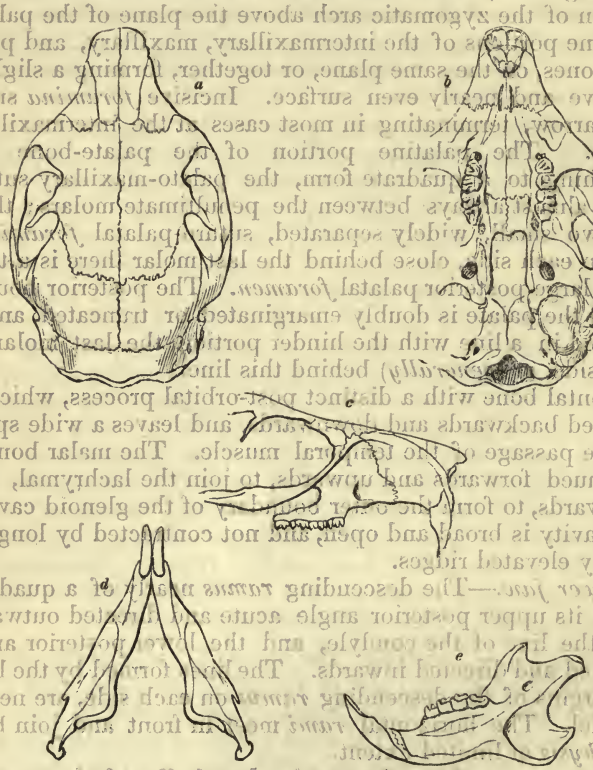
The greater portion of the genera here mentioned possess all the characters combined which have just been pointed out. Some, however, will not agree with the description in all respects, but it is a curious fact that in these instances the remainder of the distinguishing characters are more than usually evident. In *Bathyergus* for instance, the posterior portion of the descending *ramus* is rounded, and not *acute*; but here, this portion of the jaw is thrown out from the *alveoli* of the great inferior incisors in an extraordinary degree, and there is a *very distinct* broad channel on the under side of the jaw separating the two portions in question—a character never found in the species of the first section. The coronoid process is also very small. Again, in the cavies (*Cavia*) the lower boundary of the descending ramus is *not* thrown out from the outer side of the alveolar portion; the angle of the jaw however, is greatly produced, the *condyloid* process is short and the *coronoid* is very small. It is not, therefore, by any *one* particular character that I would pretend to define the sections, but by the *combination of characters*.

Section III.—*Leporina*. The hares (*Lepus*) are remarkable for the flatness of the *rami* of the lower jaw, and their great size compared with the teeth, the almost horizontal direction of the *symphysis menti*, the great height of the condyloid portion—along the outer side of which there is an elevated ridge which represents the coronoid. The condyloid process is also more upright than in other rodents. The descending *ramus* is very large and flat, and has the lower margin rounded or angular, as in the genus *Lagomys*, at least in some of the species.

Section I.—*Murina.*

Family I.—Sciuridæ.

Dentition.—Incisors laterally compressed. Molares $\frac{5}{4}\frac{5}{4}$, rarely $\frac{4}{4}\frac{4}{4}$, equal in size or nearly so, excepting the anterior molar of the upper jaw (where there are are $\frac{5}{5}\frac{5}{5}$), which is smaller than the rest. The series of molars on the opposite side of each jaw are widely separated, and parallel.



Skull of *Sciurus vulgaris*.

(*a*), upper side. (*b*), under side (*c*), side view, showing the position of the ant-orbital *foramen*, &c. (*d*), lower jaw, viewed from beneath. (*e*), one of the *rami* of the lower jaw, inner side.

Skull.—*Ant-orbital foramen* very small, situated near the plane of the palate, and about midway between the line of the front molar and the intermaxillary suture. This *foramen* has its anterior outlet bounded externally by a bony protuberance,

which is produced downwards into an angle more or less distinctly marked. *Zygomatic process* of the *maxillary bone* consisting of a broad thin plate, which is concave in front, oblique in its position, (the lower part being the farthest removed from the nasal portion of the skull), and occupies the whole space between the plane of the palate, and that of the upper surface of the skull. The lower boundary of this plate is emarginated, and forms an arch which throws the anterior portion of the zygomatic arch above the plane of the palate. Palatine portions of the intermaxillary, maxillary, and palatine bones, on the same plane, or together, forming a slightly concave and nearly even surface. Incisive *foramina* small and narrow, terminating in most cases at the intermaxillary suture. The palatine portion of the palate-bone approaching to a quadrate form, the palato-maxillary suture being almost always between the penultimate molars: there are two small, widely separated, suturo-palatal *foramina*; and on each side, close behind the last molar there is a tolerably large posterior palatal *foramen*. The posterior boundary of the palate is doubly emarginated or truncated, and is situated in a line with the hinder portion, the last molar on each side, or (*generally*) behind this line.

Frontal bone with a distinct post-orbital process, which is directed backwards and downwards, and leaves a wide space for the passage of the temporal muscle. The malar bone is continued forwards and upwards, to join the lachrymal, and backwards, to form the outer boundary of the glenoid cavity; this cavity is broad and open, and not contracted by longitudinally elevated ridges.

Lower jaw.—The descending *ramus* nearly of a quadrate form, its upper posterior angle acute and directed outwards from the line of the condyle, and the lower posterior angle rounded and directed inwards. The lines formed by the lower margins of the descending *ramus* on each side, are nearly parallel. The horizontal *rami* meet in front and join by a *symphysis* of limited extent.

The most striking feature in the skulls of the present family, and one which distinguishes them from all other rodents with which I am acquainted, is the distinct *post-orbital* process. This process however, although always distinct, varies considerably in size. It is most developed in the larger species of the genus *Pteromys*. In some of the marmots it is also very large. In the genus *Sciurus* it varies considerably, but neither in this genus nor in any other of the present family, have I ever found it wanting. It is least developed in the palm squirrel, (*Sciurus palmarum*). In some

of the *Spermophili* (if not all) it is very small, and it is also small in the genus *Geosciurus* of Dr. And. Smith, (which I have no doubt is the same as the genus *Xerus* of Hemp and Ehr.) The palate is proportionally larger in the *Sciuridæ* than any other Rodents. It almost always extends considerably beyond the last molars. In *Sc. Prevostii* however, the palate terminates *in* the line of the hinder portion of the last molar, and in *Sc. maximus* and *Sc. Leschenaultii* it terminates rather within this line. The position, combined with the small size of the ant-orbital *foramen*, will also serve to distinguish the *Sciuridæ*. The genus *Castor*, in the character of the ant-orbital *foramen*, makes the nearest approach to the present family; here however, this opening is not so low down.

The general form of the skull in the true *Sciuridæ* is short and rounded, the cranial portion is very large, and the nasal portion short. In the genus *Arctomys* the nasal portion is proportionately larger, and the cranial smaller. Here the interorbital portion of the skull is considerably contracted, as we also find the same part in the larger species of *Pteromys*, these however have the short nasal bones, as in the genus *Sciurus*. In *Sc. palmarum*, and in the genera *Spermophilus* and *Geosciurus* (*Sci. erythropus*[1]), the skull is considerably elongated and somewhat ovate, the nasal bones are longer than in the true squirrels. The animal last named offers many peculiarities in the form of the *cranium*, it is not however my intention to enter into detail at present; I will merely notice one, viz., the horizontally compressed form of that portion of the zygomatic arch which forms the lower boundary of the orbit: a character in which it differs from all the other *Sciuri* examined by me, but to which I find an approach in the skull of a species of *Spermophilus*, (*Sp. Franklinii*).

The genera and subgenera contained in this family the skulls of which I have examined, are—*Pteromys*, *Sciuropterus*, *Sciurus*, *Macroxus*, *Tamia*, *Geosciurus*, *Spermophilus*, and *Arctomys*.

(*To be continued.*)

[1] I am indebted to Dr. Richardson for the loan of the skull of this species, and also of the *crania* of several other rodents, which have been of great service to me.

AA. { *Vittæ* filiform, involucella absent or few-leaved.....*Pastinaca.*
{ *Vittæ* clavate, involucella many-leaved .....*Heracleum.*

BB. { Calyx 5-toothed, seeds with many *vittæ*.....*Archangelica.*
{ Calyx obsolete, channels with single *vittæ*.....*Angelica.*

CC. { Channels with single filiform *vittæ*.....*Tordylium.*
{ Channels each with 3 *vittæ* .....*Condylocarpus*

† †

A. { Fruit armed with prickles..... B.
{ Fruit smooth, or nearly so..... D.

B. { Fruit beaked.....*Anthriscus.*
{ Fruit not beaked ..... C.

C. { Fr. with about 4 rows of prickles; rays of umbel 3..*Caucalis.*
{ Fr. covered with prickles; rays of umb. exceeding 4.*Torilis.*

D. { Umbels without involucra.....*Smyrnium.*
{ Umbels with at least a partial involucre..... E.

E. { Fruit laterally compressed, linear ..... F.
{ Fruit laterally compressed, ovate..... I.

F. { Fruit beaked.....*Scandix.*
{ Fruit beakless..... H.

H. { Fruit with blunt ridges; pericarp solid.....*Chærophyllum*
{ Fruit with acute ridges; pericarp hollow.....*Myrrhis.*

I. { Partial involucre 3-lvd. halved; ridges of fr. crenate.*Conium.*
{ Partial involucre many-lvd. ridges fine or depressed. K.

K. { Flowers monœcious .....*Echinophora.*
{ Flowers hermaphrodite.....*Physospermum*

† † †

Fruit globose, partial involucre halved .....*Coriandrum.*

The last-named genus is here enumerated as indigenous to this country, although it is still a matter of doubt whether it ought to be ranked as such; but the numerous and wild localities in which it has been found, together with its frequent abundance, tend considerably to strengthen the opinion of its being so.

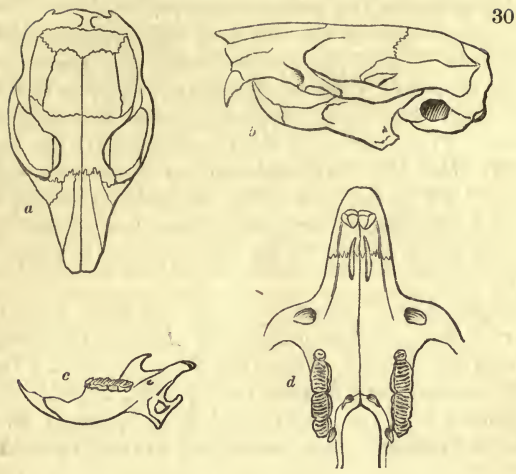
(To be continued.)

ART. IX.—*Observations on the* Rodentia, *with a view to point out the groups as indicated by the structure of the* Crania, *in this Order of Mammals.* By G. R. WATERHOUSE, Esq., Curator to the Zoological Society, Vice-Pres. of the Entomological Society.

(Continued from page 96).

Family II.—MYOXIDÆ.

Dentition.—Incisors laterally compressed. Molares $\frac{4}{4}\frac{4}{4}$, unequal in size, rooted; the series on each side of each jaw widely separated and parallel.



(*a*) Skull of *Graphiurus Capensis*, seen from above. (*b*) the same, seen laterally. (*c*) ramus of lower jaw of *Myoxus avellanarius*, (inner side. (*d*) skull of the same seen from beneath.

Skull.—Without any post-orbital process to the temporal bone; zygomatic process of maxillary bone consisting of a broad thin plate, the base of which occupies the whole space between the plane of the palate and that of the upper surface of the skull: this plate perforated by a tolerably large ant-orbital *foramen*. Palatine portions of intermaxillary, maxillary, and palate bones (in *Myoxus avellanarius*[1]) on the same plane. Incisive *foramina* long and narrow, situated partially in the intermaxillary and partially in the maxillary bones; palatine process of the maxillary terminating opposite the penultimate molar, and followed by a narrow palatine process of the palate bone. In the palato-maxillary suture are two large *foramina*, and there are two large posterior palatal *foramina*, one on each side, near the inner margin of the last molar. Glenoid cavity somewhat contracted.

Lower jaw with the descending *ramus* forming a quadrate process, which is sometimes perforated. The lower posterior angle of this process is incurved, and either angular or rounded and the upper posterior angle is acute and twisted outwards.

The drawings of the skulls of *Myoxus glis*, and *Graphiurus Capensis*, which illustrate M. F. Cuvier's paper in the 'Nouvelles Annales du Mus.' vol. i., together with some skulls

[1] I have not had an opportunity of examining the palate in the skulls of any other species of this family.

of *Myoxus avellanarius*, now before me, enable me to give the above characters of the present family.

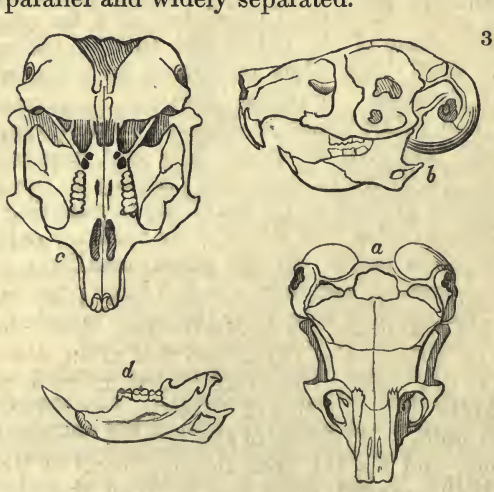
The general form of the skull of the *Myoxidæ* is intermediate between that of the *Sciuridæ* and the *Muridæ;* the inter-orbital portion is more contracted than in the *Sciuridæ*, and the nasal bones are proportionately narrower and more elongated. The species of the present family are readily distinguished from the *Sciuridæ* by the want of a post-orbital process and the larger size of the ant-orbital *foramen*, which, instead of being placed far forward and low down, is situated in the thin plate which forms the zygomatic process of the maxillary bone.

The larger size of the ant-orbital *foramen* and the imperfect state of the palatine process of the palate-bone, lead us to the Jerboas (*Dipus*), where the form of the jaw bears a remarkable resemblance to that of *Myoxus*, as will be seen.

The genera *Myoxus* and *Graphiurus* contain all the species I am acquainted with belonging to the *Myoxidæ*.

Family III.—Gerboidæ.

Dentition.—Incisors laterally compressed. Molars $\frac{4}{3}\frac{4}{3}$ or $\frac{3}{3}\frac{3}{3}$, rooted and unequal in size; the series on each side of each jaw parallel and widely separated.



(*a*) Skull of *Dipus hirtipes*, seen from above. (*b*) the same seen laterally. (*c*) skull of *Dipus Ægyptius*, seen from beneath (*d*) ramus of lower jaw of ditto, inner side.

Skull.—Palatine portions of the intermaxillary, maxillary, and palatine bones on the same plane, or nearly so. Inci-

sive *foramina* rather large, long and narrow, situated partly in the intermaxillaries and partly in the maxillary bones.—Orbits large, extending far back, and leaving but a narrow passage for the temporal muscle. *Ant-orbital foramen* very large. The arch which incloses the ant-orbital *foramen*, and separates this from the orbit, is formed by two bones, the superior maxillary bone and the malar, the latter running parallel with the former, and articulating with the lachrymal bone. The maxillary bone may be described as throwing out two processes, one superior and one inferior, which unite to form an arch. The superior process is thrown out from the plane of the upper surface of the skull, and the inferior is directed outwards from the plane of the palate, and is bifurcate, one portion being carried upwards to join the superior process and form the arch, and the other portion, directed backwards beneath the malar bone, assists in the formation of the *zygoma*. Zygomatic arches slender and curved downwards, so that their lower boundary is below the level of the palate, the hinder portion of the *zygoma* is horizontally compressed. The glenoid cavity somewhat contracted and oblique in its position, being directed forwards and inwards from the root of the zygomatic process of the temporal bone, and extending upon the sphenoid. Palatine process of palate bone continuing the plane of the palate beyond the line of the last molars. The inter-parietal bone is large and nearly of a semicircular form.

Lower jaw with the coronoid process rather small, the condyloid curved inwards: the descending *ramus* (or posterior coronoid process, according to Carus) is somewhat quadrate and perforated, angular in *Dipus*, and has the lower and posterior portion somewhat rounded in *Alactaga*. The *symphysis menti* is of but small extent.

My materials for drawing up the characters of the present group are very limited: skulls of *Dipus Ægyptius*, and two or three figures, are all I have at my command. M. F. Cuvier (in his 'Mémoire sur les Gerboises,' &c.[1]) has figured the skull of a species of *Dipus* and that of an *Alactaga*, and in both the descending *ramus* of the lower jaw is perforated.

The skulls of the species of *Dipus* are remarkable for the somewhat oblique direction of the glenoid cavity of the temporal bone, and for the great developement of the auditory *bullæ*, which encroach upon and contract the occipital portion of the *cranium*. A narrow band of the squamous portion of the temporal bone is extended backwards over the

[1] See 'Transactions of the Zoological Society,' Vol. ii. pl. 24.

auditory *bulla*, and joins a similar band which forms part of the supra-occipital bone. In the genus *Alactaga* the auditory *bullæ* are comparatively small, and the peculiar bands just described do not appear to exist.

In the form of the lower jaw the genus *Dipus* very closely resembles *Myoxus*, especially *My. avellanarius;* in both the descending *ramus* is perforated, and in *Myoxus* as in *Dipus* the glenoid cavity of the temporal bone is oblique, though in a less marked degree. On the other hand we find a considerable resemblance, in the palate and its *foramina*, between the animals of the present family and those of the genus *Gerbillus*.

The genera *Dipus*, *Alactaga*, and *Meriones* belong to the present family; I must observe however that the *Dipus Canadensis*, (which constitutes the genus *Meriones*, according to most of the *later writers*), presents a form of skull which, in many respects, is intermediate between the jerboas and the dormice (*Myoxidæ*). Comparing the lower jaw of *Dipus Ægyptius* with that of *Myoxus avellanarius*, we perceive that the coronoid process is proportionately larger in the latter; in this respect the *Meriones Canadensis* agrees with the dormouse; it also approaches more nearly to the last-mentioned animal in the comparatively small extent of the palatine portion of the palate bone. In the size of the ant-orbital *foramen*, the *Mer. Canadensis* is intermediate between the two animals with which we are comparing it. This *foramen* being larger than in *Myoxus*, and smaller than in *Dipus*. In *Mer. Canadensis*, as in the jerboas, the portion of the zygomatic process of the *maxilla* which forms the lower boundary of the ant-orbital passage is thrown out from the plane of the palate. The incisive *foramina* are larger in *Mer. Canadensis* than in *Myoxus avellanarius*, thus agreeing with *Dipus*.

(To be continued.)

ART. X.—*Observations on the application of Heliographic or Photogenic Drawing to Botanical Purposes; with an account of an economic mode of preparing the Paper: in a Letter to the Editor of the 'Magazine of Natural History.'* By GOLDING BIRD, M.D., F.L.S., &c.

SIR,

The mode of fixing the images of the camera obscura, and copying engravings, by means of the chemical action of light on paper prepared with a solution of chloride of

Family 2. *Dactylethridæ*. Adult body short, frog-like. Tail none. Legs four. Tongue distinct. *Tympanum* hid.

Genera.—*Dactylethra. Bombinator. Breviceps.*

Family 3. *Astrodactylidæ*. Adult body short, flat, frog-like, tailless. Legs four. Tongue wanting. *Tympanum* hid.

Genus.—*Astrodactylus. (Pipa).*

Family 4. *Salamandridæ*. Adult body long, lizard-like. Tail long.—Legs four.

Genera.—*Salamandra. Salamandrina. Molge. Triton.*

Sub-class II.—*DIPLOPNEUMENA*. Respiring doubly; *both* by lungs *and* gills.

Order III.—IMPERFECTIBRANCHIA. Gills *imperfect*.

Family 1. *Menopomatidæ*. Body long, lizard-like; or lengthened, snake-like; with a tail. Legs four. Gill-like organs internal.

Genera.—*Menopoma. Amphiuma.*

Order IV.—MANENTIBRANCHIA. Gills *permanent*.

Family 1. *Sirenidæ*. Body lengthened, snake-like, having a tail. Legs two in front. Gills tufted, external.

Genera.—*Siren. Parvibranchus.*

Family 2. *Proteidæ*. Body long, lizard-like, or fish-like, with a tail. Legs four. Gills ramified, external.

Genera.—*Proteus. Menobranchus. Siredon.*

(To be continued.)

ART. III.—*Observations on the* Rodentia, *with a view to point out the groups as indicated by the structure of the* Crania, *in this Order of Mammals.* By G. R. WATERHOUSE, Esq., Curator to the Zoological Society, Vice-Pres. of the Entomological Society.

(Continued from page 188.*)*

Family IV.—MURIDÆ.

DENTITION.—Incisors compressed laterally: molars $\frac{3}{3}\frac{3}{3}$ (in one genus $\frac{2}{2}\frac{2}{2}$), rooted; the anterior molar of each series the largest, and the posterior one the smallest. The series on each side of each jaw widely separated and parallel.

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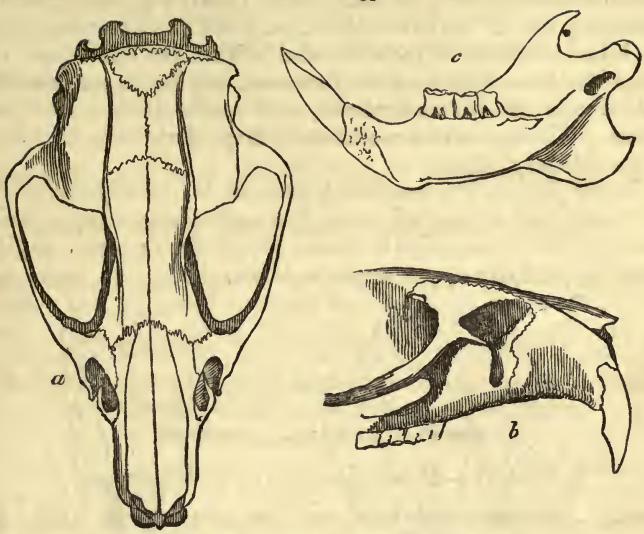

(*a*) upper view of the skull of *Mus giganteus*. (*b*) side view of the anterior portion of the skull. (*c*) one of the *rami* of the lower jaw, inner side.

Skull.—Zygomatic process of the *maxilla* broad, continued obliquely upwards and outwards from the plane of the palate, and divided into three parts, one of which is extended backwards to articulate with the malar bone, and complete the *zygoma;* the second is continued forwards in the form of a compressed and almost vertical plate, which serves to defend a vacuity connected with the nasal cavity. This vacuity is situated anterior to the orbit, and seems to hold the place of the lachrymal canal. The production forwards of the vertical plate converts the anterior outlet of the ant-orbital *foramen* into a narrow slit. Connected with this narrow slit, (through which the infra-orbital nerve passes), there is another opening of a larger size, and the outlet of which is directed upwards. Through this upper opening passes a portion of the maseter muscle. The third division of the zygomatic process of the *maxilla* is continued upwards and inwards, articulates with the ant-orbital process, and completes the anterior boundary of the orbit. The superior maxillary bone sends backwards a vertically compressed process almost immediately behind the intermaxillary suture. The zygomatic arch runs obliquely downwards and outwards from the ant-orbital process, and is recurved at the temporal portion. The glenoid cavity is of considerable extent in a longitudinal direction, and has a moderate transverse diameter. The pala-

tine portions of the intermaxillary, maxillary, and palatine bones are all on the same plane, and the posterior margin of the latter is almost always situated behind the line of the posterior molars. The incisive *foramina* are large, and situated partially in the intermaxillary, and partly in the maxillary bones. There are two moderately large *foramina* in the palato-maxillary suture.

Lower jaw.—The coronoid process is usually large, and the condyloid elongated: the descending *ramus* approaches more or less to a quadrate form; the posterior lower angle is rounded, and the upper angle is acute.

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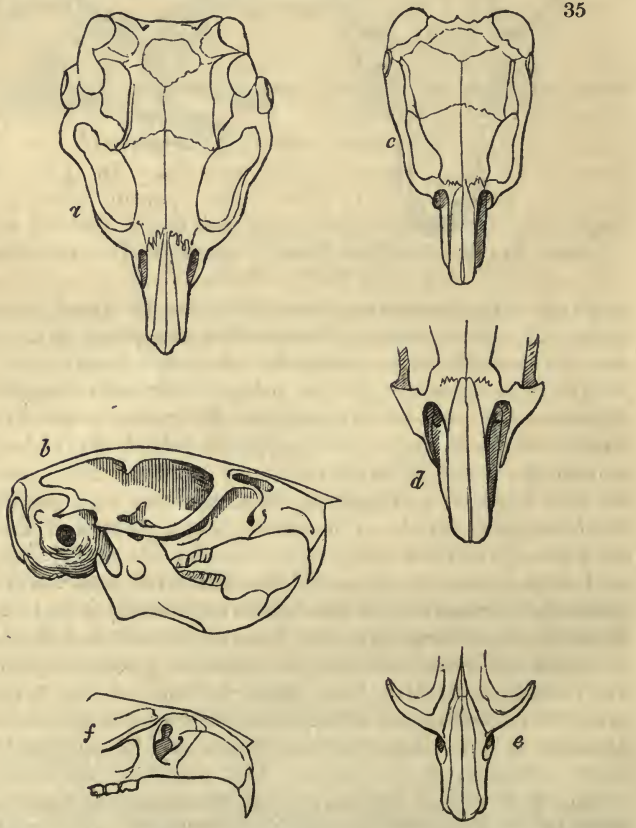


(*a* and *b*) *Psammomys obesus.* (*c*) *Gerbillus brevicaudatus.* (*d*) *Gerbillus Indicus* (*e*) anterior part of the skull of *Cricetus auratus.* (*f*) side view of the same.

In the form of the lower jaw the *Muridæ* do not differ essentially from the preceding families, the skull however is of

a more elongated form, and the facial portion is proportionately larger as compared with that devoted to the protection of the brain. One of the most striking characters observable in the *crania* of the *Muridæ*, consists in the peculiar thin plate which is produced anteriorly from the zygomatic process of the *maxilla*. This thin plate (see *a*, fig. 34, and *d*, fig. 35) is usually of considerable extent, and is sometimes nearly vertical (as in *Gerbillus Indicus*, fig. 35, *d*), but is generally carried upwards and outwards from the palate, as in the common rat (*Mus decumanus*). This plate is proportionately most extended in the species of *Gerbillus* just mentioned, but in other species of the same genus it is very short; this is the case in *Gerb. brevicaudatus* (fig. 35, *c*). *Gerb. otarius*, *Gerb. pygargus*, &c.[1] In the hamster (*Cricetus vulgaris*) its outer surface is concave, and in *Neotoma Floridana* it is also concave, though in a less degree. *Cricetus auratus*[2] (fig. 35, *e* and *f*) is remarkable for the narrowness of this process of the *maxilla*. In this animal it does not project so as to protect the opening beneath, which leads into the nasal cavity, as in nearly all the other species of the *Muridæ* which I have examined. In *Hydromys chrysogaster* there is a still narrower loop of bone inclosing the ant-orbital *foramen*, which is larger than usual, and there is a remarkable angular process projecting from the lower and anterior portion of this loop.

The two animals just mentioned (*Cricetus auratus* and *Hydromys chrysogaster*), and the *Rhizomys Sinensis* of Mr. Gray (which is the *Nyctocleptes Dekan* of M. Temminck), constitute the only species of the present family, the skulls of which I have examined, in which the thin plate arising from the *maxilla* above described is not produced anteriorly, as we find it in the rat.

Judging from the figure of the skull of *Nyctocleptes Dekan* given by Temminck in his 'Monographies,' I feel but little doubt that this animal belongs to the present family; it offers however some marked exceptions to the general characters of the *crania* of the *Muridæ:* the most remarkable of these is the want of the thin plate of the *maxilla* just mentioned, and the absence of the vertical slit through which (in the genus *Mus*)

[1] See M. F. Cuvier's 'Mémoire sur les Gerboises et les Gerbilles,' published in the 'Transactions of the Zool. Society,' vol. ii. pt. 2, pl. 25 & 26.

[2] A beautiful new species of hamster, from Aleppo, recently described by me, and to which I have applied the above specific name, on account of its rich yellow colouring; the under parts of the body, however, are nearly white. The length, measured in a straight line, is 6½ inches, the ears are about ½ an inch long, and the tail is about the same length.

the ant-orbital nerve passes. Here the ant-orbital *foramen* constitutes a tolerably large rounded opening, situated near the upper surface of the skull, and also near the anterior angle of the orbit. The broad spherical condyle also removes this genus from the typical rats. In *Mus Braziliensis*, however, we may perceive an approach to this spherical form of the condyle. The great size and strength of the incisors in *Nyctocleptes*, require a corresponding development of the temporal and maseter muscles; hence the great width of the temporal *fossæ*, and strength of the zygomatic arches, characters which exist in a minor degree in the common hamster.

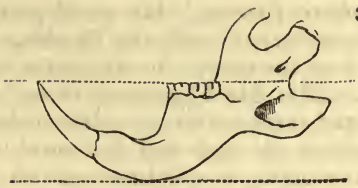
The skulls of upwards of forty species of the family *Muridæ* have been examined by me, and among these were *crania* of the following genera. *Mus*, *Gerbillus*, *Psammomys*, *Reithrodon*, *Hydromys*, *Cricetus*, *Sigmodon*, *Neotoma*, *Hapalotis* and *Rhizomys*.

The skull of the *Mus giganteus* has been selected to exhibit the most common form observable in the present group, and the skulls of *Psammomys obesus* and *Gerbillus brevicaudatus* have been drawn to show the approach made by these species to those of the preceding family (the *Gerboidæ*). It is not only in the general form of the skull, with its narrow and elongated nasal bones, that this affinity is evinced, but what I consider more important, in the form of the descending *ramus* of the lower jaw. In several of the specimens from which M. F. Cuvier's figures of the *Gerbilli* (in the memoir before referred to) were taken, it appears that this portion of the lower jaw was imperfect, but where this was not the case, they are all represented as having the upper posterior angle of the descending *ramus* acute and elongated, as in the *Gerboidæ*.

The principal difference between the *Gerboidæ* and the *Gerbilli* consists in the size of the ant-orbital *foramen*, but in either group this varies considerably, hence in all probability the discovery of other species will render it necessary to merge the gerboas into the *Muridæ*. I have thought it desirable however, for the purpose of drawing attention to the various modifications observable in the *crania* of these animals, to separate these sections, and also to separate the *Myoxidæ* from the *Muridæ*, although in so doing I may give a name to groups which really are not distinct.

The genus *Psammomys* of M. Ruppell is evidently an offshoot (if I may so term it) of the *Gerbilli*. A skull figured by M. F. Cuvier,[1] as *Gerbillus*———? very closely resembles that of *Psammomys obesus*.

[1] See Transactions of the Zoological Society, vol. ii. pt. 2, pl. 26, fig. 1 & 2



Lower jaw of the common Hamster.

I have also drawn one of the *rami* of the lower jaw of the common hamster, since it exhibits a modification of form which is important, especially to the investigator of fossil remains.[1] The peculiarity in this jaw consists in the *ramus* being so curved that the angle is considerably raised above the line of the symphysis, this line being drawn backwards from the *symphysis menti*, and parallel with the crowns of the molar teeth, as represented by the dotted lines in the woodcut. If similar dotted lines be introduced in the figure of the lower jaw of the *Mus giganteus*, it will be seen that in that animal the lower boundary of the descending *ramus* is in the same line as the lowest anterior portion of the jaw. In the *Arvicoli* (which appear to constitute a sub-family of the great group *Muridæ*) the angle of the jaw, as in *Cricetus*, is considerably raised, but excepting in these animals I am not acquainted with any rodents in which this is the case.

(To be continued).

ART. IV.—*Description of the Frontal Spine of a second species of* Hybodus; *from the Wealden Clay, Isle of Wight.* By WILLIAM OGILBY, Esq., M.A., F.R.A.S., &c. &c.

THE beautiful fragment of the jaws of *Hybodus Delabechei*, discovered by Mr. Higgins, and described in the last number of the 'Magazine of Natural History,' whilst it throws a new and valuable light upon the structure and characters of that remarkable genus of extinct fishes, has enabled me to ascertain the nature of a small fossil which had been for some time in my possession, but of which neither myself, nor the scientific friends to whom I showed it, could imagine the origin or relations. It consists of the tri-furcated base of a cranial spine, (fig. 37), or rather of the middle and one of the lateral processes, the corresponding process of the opposite side

[1] Fossil remains of a species of this group are figured n the 'Nouveaux Mémoires de la Société Impériale des Naturalistes de Moscou; see tome iii. tab. 20, fig. 6.