ON THE GENERA OF FELIDÆ AND CANIDÆ.

BY E. D. COPE.

FELIDÆ.

The discovery of extinct species from time to time, renders it necessary to re-examine the definitions of the families and genera into which living forms naturally fall. We thus learn the characters of their primitive types, and the successive steps through which they passed in attaining their present characteristics. The *Felidæ* are known as that family of *Carnivora* in which the feet and teeth are most specialized for the functions of seizing and lacerating living prey. The number of living species enumerated by Dr. Gray is sixty-four, which he throws into a number of genera. The extinct species yet known are less numerous, but they present a greater variety of structure than the former. Two types or series may be recognized among the genera, namely those represented by the genera *Felis* and *Machærodus* respectively. All of the latter are extinct.

The greater number of the genera allied to *Macahrodus* are distingnished by the great development of the superior canine teeth, whose crowns are generally compressed and trenchant. The corresponding part of the mandible is expanded downwards so as to furnish a protection to the slender crown from fracture by lateral blows when not in use, but in some of the genera, *e. g. Nimravus*, this flange is not developed The only definition which can be used to distinguish these sections of the family, is found in the angular separation of the anterior and lateral planes of the ramus of the mandible, and this character cannot be expected to remain unaffected by future discovery. Forms will doubtless be found in which the angle is obsolete, and in which the lateral and anterior faces pass gradually into each other. Other characters which distinguish the extinct genera are found in the numbers of molar teeth, and, what has been heretofore neglected, the number of lobes of the molars themselves.

As regards the existing genera, Dr. Gray[1] has brought out their

[1] Catalogue of Carnivorous, Pachydermatous, and Edentate Mammalia in the British Museum. By John Edward Gray, F.R.S., V.P.Z.S., F.L.S., etc. London, 1869.

characters more fully than any other author. He points out the fact that in some of the species the orbits are closed behind, and in others open. He first examined into the manner of the contraction and closing of the pupil in the presence of light, and pointed out the fact that in the large cats it is always round and approximates a point in closing, while in the smaller forms the pupil closes as a vertical slit. He shows that the cats of the former group have the smaller orbits of the cranium, and the latter the larger. Dr. Gray, however, uses other characteristics in the discrimination of the genera, which are, in my estimation, quite inadmissible; as the relative length of the muzzle and of the premaxillary bones; also of the hair on different parts of the body and tail. Such features of proportion are essential as characters of species, but not of genera. In accordance with these views, I have united several of Dr. Gray's divisions into groups, which I call genera, and which repose on some definite structural characters. Thus I combine his *Uncia*, *Tigris*, *Leo* and *Leopardus* into a genus for which I employ his name *Uncia*, as the least objectionable,[1] after having confirmed by autopsy the circular character of the pupil. This I was enabled to do through the courtesy of my friend Arthur E. Brown, Superintendent of the Philadelphia Zoological Garden, who aided me in examining the eyes of these animals both by sunlight and the light of a bull's-eye lantern.[2] The detailed characters of the genera will now be given:—

I. The anterior and lateral faces of the mandible separated by an angle.

a. Inferior sectorial with a heel; no anterior lobe of superior sectorial; no posterior lobes of the premolars.

* An inferior tubercular molar.

Premolars $\frac{2}{3}$.	*Dinictis.*
Premolars $\frac{2}{2}$.	*Nimravus.*

[1] I assume that this name is derived from *uncus*, a hook, which is appropriate to the weapons of these animals.

[2] I add the following notes on some other *Carnivora*, which do not come within the scope of this paper:—

Hyæna crocuta. Pupils a vertical slit.

Viverridæ. Three species of *Ichneumon* and *viverricula*, a horizontal oval.

Nasua. A horizontal oval.

** No inferior tubercular molar.

Premolars $\frac{2}{2}$; incisors $\frac{3}{3}$. *Hoplophoneus.*

Premolars $\frac{1}{1}$; incisors $\frac{1}{2}$. *Eusmilus.*

aa. Inferior sectorial without heel; an anterior lobe of the superior sectorial, and posterior lobes of the premolars.

Premolars $\frac{2}{2}$, first inferior two rooted. *Machærodus.*

Premolars $\frac{2}{2 \text{ or } 1}$; first inferior one rooted. *Smilodon.*

II. The anterior and lateral faces of the mandible continuous, convex. (No inferior tubercular molar.)

a. Inferior sectorial tooth with a heel.

Premolars $\frac{2}{4}$, no posterior lobes; second superior with internal heel (plantigrade). *Cryptoprocta.*

Premolars $\frac{2}{4}$ with posterior lobes; no heel of second superior. *Pseudælurus.*

aa. Inferior sectorial without heel; premolars with posterior lobes; superior sectorial with anterior lobe.

β. Superior sectorial with internal heel.

γ. Pupil round.

Premolars $\frac{2}{2}$. *Uncia.*

Premolars $\frac{1}{2}$. *Neofelis.*

γγ. Pupil vertical.

Orbit closed behind; premolars $\frac{2}{2}$. *Catolynx.*

Orbit open; premolars $\frac{2}{2}$. *Felis.*

Orbit open; premolars $\frac{1}{2}$. *Lyncus.*

ββ. Superior sectorial without internal heel.

Pupil round, premolars $\frac{2}{2}$; orbit open posteriorly. *Cynælurus.*

The following catalogue includes the species of the *Felidæ*, the names of the recent ones being derived from Gray's Catalogue, and printed in Roman letters. These are probably too numerous in the genera *Felis* and *Lyncus*, but I do not possess the means of properly disposing of them.

Dinictis, Leidy. *Aelurogale,* Filhol. *?Daptophilus,* Cope.

D. intermedia, Filhol. Phosphorites, France.

D. squalidens, Cope. White River, Colorado.

D. felina, Leidy. White River, Nebraska.

D. cyclops, Cope. White River, Oregon.

Nimravus, Cope.

N. brachyops, Cope. White River, Oregon.

Hoplophoneus, Cope.

H. primævus, Leidy. White River, Nebraska.
H. occidentalis, Leidy. White River, Nebraska.

Eusmilus, Gervais.

E. bidentatus, Filhol. Phosphorites, France.

Machærodus, Kaup. *Agnotherium*, Kaup. *Drepanodon*, Nesti.

M. palmidens, Blv. Falunian Sansan.
M. ogygius, Kaup. Oeningian, Epplesheim.
M. antiquus, Nesti. Pliocene, Italy, France.
M. falconeri, Pomel. Upper Miocene, India.
M. cultridens, Cuv. Pliocene, Europe.
M. latidens, Owen. Pliocene, England.
M. aphanista, Kaup. Oeningian, Epplesheim.
M. maritimus, Gerv. Pliocene, Montpellier.

Smilodon, Lund.

S. neogæus, Lund. Pliocene, Brazil.
S. necator, Gervais, Buenos Ayres.

Cryptoprocta, Bennett.

C. ferox, Bennett. Madagascar.

Pseudælurus, Gervais.

P. hyænoides, Lartet. Falunian Sansan.
P. intrepidus, Leidy. Loup River, Nebraska.
P. edwardsi, Filhol. Phosphorites, France.
P. ? intermedius, Filhol. Phosphorites, France.
P. sivalensis, Lydekker.

Catolynx, Gray. *Viverriceps*, Gray.

C. marmoratus, Martin. India, Borneo.
C. charltoni, Gray. Nepal, Darjeeling (Charlton).
C. viverrina, Bennett. East Indies.
C. planiceps, Vig. and Horsf. Malacca, Sumatra, Borneo.
C. ellioti, Gray. Madras.
C. rubiginosa, I. Geoff. India, Madras.

Felis, Linn. *Pardalina*, *Felis*, and *Chaus*, Gray.

F. pardalis, L. America, tropical or subtropical.
F. grisea, Gray. Gautemala.
F. melanura, Ball. America.
F. picta, Gray. Central America.
F. pardoides, Gray. Tropical America.

F. macroura, Pr. Max. de Wied. Brazil.
F. mitis, F. Cuv. Mexico.? Paraguay.?
F. tigrina, Schreb. South America.
F. geoffroyi, D'Orb. South America.
F. colocolla, Molina, South America, Chili (Molina), Surinam (H. Smith).
F. jaguarondi, Lacép. South America.
F. eyra, Desm. Tropical America.
F. serval, Schreb. South and West Africa.
F. rutila, Waterhouse, Sierra Leone.
F. neglecta, Gray. Gambia.
F. servalina, Ogilby. Sierra Leone.
F. celidogaster, Temm. Guinea.
F. senegalensis, Lesson. Senegal.
F minuta (pars.), Temm. Sumatra.
F. javanensis, Horsf. Java.
F. nepalensis, Vig. and Horsf. India (perhaps a hybrid or domesticated).
F. chinensis, Gray. China.
F. pardinoides, Gray. India (Capt. Junes.)
F. pardochroa, Hodgson. Nepal (Hodgson). Tenasserim (Packman).
F. tenasserimensis, Gray. India, Tenasserim (Packman).
F. jerdoni, Blyth. Indian Peninsula, Madras.
F. herscheli, Gray. India, "Zanzibar."?
F. wagati, Elliot. India.
F. caligata, Temm. Africa, North, South, Central, and East.
F. inconspicua, Gray. India (domesticated or perhaps a variety).
F. domestica, Brisson. Syria.? Domesticated in most countries.
F. manul, Pallas. Thibet.
F. catus, L. Europe.
F. megalotis, Müller. Timar.
F. himalayanus, Gray. Himalaya (Cross, Warwick).
F. jacquemonti, J. Geoffr. Africa and Asia.
F. ornata, Gray. India (Capt. Boys).
F. catolynx, Pallas. Nepal (Hodgson).

Lyncus, Raf. *Pajeros*, *Lynx* et *Caracal*, Gray.

L. pajeros, Desm. South America. The Pampas.
L. borealis, Gray. Northern Europe, Sweden.
L. canadensis, Geoffr. North America.
L. pardinus, Temm. Southern Europe, Turkey.
L. isabellinus, Blyth. Thibet.
L. rufus, Güldenst. North America.
L. maculatus, Vig. and Horsf. North America, Mexico, and California.
L. caracal, Schreb. Southern Asia and Africa, Persia and Arabia.

Neofelis, Gray.

N. macrocelis, Temm. Himalaya (Hodgson), Malacca.
N. brachyurus (Temm), Siam. Swinhoe, Formosa (Swinhoe).

Uncia, Gray, Cope emend. *Leo*, *Tigris* et *Leopardus*, Gray.

U. concolor, L. North and South America.
U. auratus, Temm. Himalaya, Sumatra, Borneo.
U. onca, L. South America, Mexico, Texas.
U. chinensis, Gray. Pekin, mountain forests of the west.
U. japonensis, Gray. Japan.
U. pardus, L. Southern Asia, North, South, and West Africa.
U. tigris, L. Asia.
U. leo, L. Africa, India.
U. irbis. Thibet.

Cynælurus, Wagler. *Gueparda*, Gray.

C. jubatus, L. Africa, Asia, Persia, Cape of Good Hope.
? *C. ferox*, Leidy (*Aelurodon*). Loup River, Nebraska.

The successive order of the modifications of structure which define the above genera is not difficult to perceive, and it is interesting to discover that, as in other cases, it coincides with the succession in geologic time. The typical genera *Uncia*, *Felis*, etc., are characterized by great specialization, and it is they which now exist. The oldest found *Dinictis*, *Nimravus*, etc., are the least specialized in most respects, and they disappeared before the close of Miocene time.

Since one of the special characters of the *Felidæ* is the reduction in the number of the molar teeth by subtraction from both ends of the series, an increased number of these constitutes re-

semblance to other families. The genus *Dinictis*, above defined, has been shown by Leidy to possess two more inferior molars than *Felis*, or three more than *Neofelis* and *Lynx*, as in the *Mustelidæ*. The extinct *Pseudælurus* and the living *Cryptoprocta* have but one less molar than *Dinictis*, lacking the posterior tubercular. *Nimravus* has the same number of molars as *Pseudælurus*, but lacks the first premolar instead of the last true molar. In *Hoplophoneus* we first find the number of molars as in the existing genera, viz., Pm. $\frac{3}{2}$ m. $\frac{1}{1}$. Other characters of this genus are, however, of a generalized kind.

I here recall the statement that the genera of *Felidæ* fall into two series, which are distinguished by the forms of the anterior part of the mandibular rami, and generally by the large size of the canine teeth to which the former are adapted. This distinction appeared early in Miocene, or Oligocene time, in fact in the oldest of the cats of which we have any knowledge. The genera with large canines or Machærodontine line were then represented by *Dinictis*, and the Feline line by *Pseudælurus*. It is interesting to observe that these genera differed from their latest prototypes in the same way, viz.: (1) in the presence of more numerous inferior molars; (2) in the presence of a heel of the inferior sectorial; (3) in the absence of an anterior cusp of the superior sectorial. In the case of *Dinictis* one other character of primitive carnivora may be noticed, viz.: the absence of the cutting lobes on the posterior edges of the superior and inferior premolars, so distinct in the existing cats. The same feature characterizes the superior premolars of *Pseudælurus*, but the inferior premolars have the lobes. In the existing *Cryptoprocta*, which Gervais has shown to be nearly allied in dentition to *Pseudælurus*, the lobes are wanting from both jaws, but this genus adds to this primitive character another of modern significance, viz., the presence of the anterior cusp of the superior sectorial. Moreover *Cryptoprocta* has another peculiarity which recalls the genera of the Eocene *Creodonta*, in the well-developed interior tubercle of the third premolar, a character unknown in Miocene or existing *Carnivora*. That genus is evidently, like the *Lemuridæ*, also of Madagascar, a remnant of the Eocene Fauna, which once covered most of the earth, and may be regarded as, on the whole, the most primitive of the *Felidæ*, recent and extinct.

Following the two lines of *Felidæ* already indicated, we attain

the same conclusion in both, by the same stages. The primitive form of the Machærodont line represented by *Hoplophoneus* has its extreme in *Eusmilus*, where the second inferior premolar and an incisor tooth are wanting, giving a formula of I. 2, C. 1; Pm. 1; M. 1. In *Machærodus* we have the modern characters of the molars seen in *Felis*, viz., no heel of the inferior sectorial; the superior sectorial with an anterior lobe, and posterior lobes of the premolars. The extreme of this line is reached in *Smilodon*, where the second inferior premolar is one rooted or wanting. This genus then stands related to *Machærodus*, as *Eusmilus* to *Hoplophoneus*. In the Feline line proper, on reaching the existing genera, we have lost the heel of the inferior sectorial and gained the posterior lobes of the premolars and anterior lobe of the superior sectorial at once. A further modification of the dentition of the superior series of the recent forms, is seen in the loss of the first superior premolar in *Lynx* and *Neofelis*. Still another, which is one step beyond what is known in the Machærodont line, is the loss of the interior tubercle of the superior sectorial, which characterizes the genus *Cynælurus*. A superior sectorial tooth having the character of that of this genus was discovered by Dr. Hayden in the Loup River formation of Nebraska, and was referred to a species by Dr. Leidy under the name of *Aelurodon ferox*. It was much larger than the *C. jubatus*.

As already remarked, the genera of the Machærodont line are extinct, and this in spite of the fact that they presented the most perfect weapons of destruction in their canine teeth, from the earliest times. Their other modifications of structure advanced *pari passu* with those of the Feline series, and, among others, the feet presented in the latter forms at least (*e. g.*, *Smilodon necator*, Gew.), the most perfect prehensile power of the lions and tigers of to-day. As nothing but the characters of the canine teeth distinguished these from the typical felines, it is to these that we must look for the cause of their failure to continue. Prof. Flower's suggestion appears to be a good one, viz.: that the length of these teeth became an inconvenience and a hindrance to their possessors. I think there can be no doubt that the huge canines in the Smilodons must have prevented the biting off of flesh from large pieces, so as to greatly interfere with feeding, and to keep the animals in poor condition. The size of the canines is such as to prevent their use as cutting instruments, excepting

with the mouth closed, for the latter could not have been opened sufficiently to allow any object to enter it from the front. Even were it opened so far as to allow the mandible to pass behind the apices of the canines, there would appear to be some risk of the latter's becoming caught on the point of one or the other canine, and forced to remain open, causing early starvation. Such may have been the fate of the fine individual of the *S. neogaeus*, Lund, whose skull was found in Brazil by Lund, and which is familiar to us through the figures of Dr. Blainville, etc.

Description of New Species.

Dinictis cyclops.

The species of *Dinictis* differ in the proportions of their anterior molar and canine teeth as follows:—

First inferior molar one rooted; first superior molar two rooted; superior canine short, robust; large. *D. intermedia.*[1]

First inferior molar one rooted; superior canine compressed; two inferior incisors. *D. squalidens.*

First inferior molar two rooted; first superior molar one rooted; canine long, compressed. *D. cyclops.*

First molar of both jaws two rooted; canine long, compressed. *D. felina.*

In the *D. cyclops* the first superior molar is rudimental, and will probably be found to be wanting in some specimens. The second premolar has a distinct anterior tubercle on the inner side, a character not seen in *D. felina;* the anterior angle of the superior sectorial is more produced than in that species. The crown of the superior tubercular looks partly inwards, is rather long, and has three roots. The superior canine is quite long, and has a regularly lenticular section, without facets. Its anterior and posterior edges are denticulate. The external incisors are much larger than the internal, and have subconic crowns. The crowns of the others are subcuneiform. The inferior canines are considerably larger than the incisors. The latter are regular, and do not overlap each other. The second and third inferior premolars have well-developed basal lobes anteriorly and posteriorly. The

[1] *Aelurogale intermedia*, Filhol.

heel of the sectorial is well developed. The tubercular is very small.

The form of the skull is short and wide; the zygomata are much expanded, and the profile is very convex. The muzzle is short, and the orbits are rather large. The interorbital region is wide and convex, and the postorbital processes are robust, acuminate, and directed downwards. The infra-orbital foramen is very large. The apices of the premaxillary bones are elongate, but do not reach the frontals. The nasals are rounded posteriorly. The sagittal crest is prominent, and the inion elevated. The posttympanic process is short, and the paroccipital is short and is directed backwards. The cranium is constricted behind the orbits. The mandibular ramus is low posteriorly, and the anterior inferior flange is well-developed, but not large.

Measurements.	M.
Length of skull on base	.140
Width of skull, measured below	.111
Length of palate	.060
Width of palate between posterior angles of sectorials	.062
Width of palate between canines	.026
Length of skull to front of orbits (axial)	.050
Vertical diameter of orbit	.031
Interorbital width (least)	.045
Elevation of inion from foramen	.032
Length of inferior molar series	.050
Length of inferior sectorial	.018
Length of base of inferior first premolar	.055
Depth of ramus at sectorial	.016
Depth of ramus at first premolar	.021
Depth of ramus at flange	.026

From the Truckee beds of John Day River, Oregon.

CANIDÆ.

The range of variation presented by the species of *Canidæ* includes several generic divisions, recent and extinct. These genera are, however, as closely intergraded as are those of the cats, and their definite characters are subject to occasional failure from ab-

normal variations. These are, however, not so frequent as to invalidate the classification to which they form the exceptions.

The *Canidæ* appeared in the Upper Eocene period, and the genus *Canis* was well represented by species in the lowest Miocene in Europe and the United States. The other genera are represented by fewer species, and many of them are extinct. The foxes (*Vulpes*) are the most numerous of them, and but few extinct species of them are known. America presents us with the greatest variety of genera, as *Enhydrocyon*, *Temnocyon*, and *Palæocyon* extinct, and *Icticyon*, extinct and recent. *Speothus*, extinct in America, still exists in Asia.

The most complete catalogue of the species *Canidæ* is that of Dr. Gray. In his work the author brings together observations of various naturalists, and adds a number of his own. He admits a large number of generic divisions, but many of these, like those of his *Felidæ*, are simply founded on specific characters. A few good genera, however, exist, and a synopsis of their characters is given below. The genus *Megalotis* is here excluded from the *Canidæ* on account of the unspecialized character of the superior sectorial tooth, as is done by Dr. Gray:—

I. True molars $\frac{3}{3}$.
Premolars $\frac{4}{4}$; inferior sectorial with internal tubercle.
Amphicyon.

II. True molars $\frac{2}{4}$.
Premolars $\frac{4}{4}$; inferior sectorial with internal tubercle.
Thous.

III. True molars $\frac{2}{3}$.
α. Premolars $\frac{4}{4}$.
β. Inferior sectorial without internal tubercle.
Heel of sectorial cutting. *Palæocyon.*
ββ. Inferior sectorial with internal tubercle.
γ. Four toes in the manus;
A sagittal crest. *Lycaon.*
γγ. Five toes in the manus.
δ. Heel of sectorial simply cutting.
A median sagittal crest (? toes). *Temnocyon.*
δδ. Heel of sectorial concave, with raised borders.
Pupil round; temporal fossa with simple superior border.
Canis.

Pupil erect; temporal fossa with simple superior border. *Vulpes.*

Pupil erect; temporal fossa bounded above by a rib-like crest. *Urocyon.*

aa. Premolars $\frac{3}{3}$.

Inferior sectorial with internal tubercle and cutting heel. *Enhydrocyon.*

Inferior sectorial with internal tubercle, and wide tuberculär heel. *Tomarctus.*

IV. True molars $\frac{2}{2}$.

a. Premolars $\frac{4}{4}$.

Inferior sectorial with internal tubercle. *Speothus.*

Inferior sectorial without internal tubercle (superior molar sometimes one). *Synagodus.*

aa. Premolars $\frac{2}{2}$.

Inferior sectorial without internal tubercle (incisors caducous). *Dysodus.*

V. True molars $\frac{1}{2}$.

Premolars $\frac{4}{4}$; inferior sectorial with internal tubercle. *Icticyon.*

It is discoverable that the series represented by the above genera is a part of the greater line of the digitigrade *Carnivora*, embracing the greater part of it which is less specialized than, or inferior to, the part covered by the *Hyænidæ* and *Felidæ*. Without entering into the relations of the *Canidæ* with the civets and *Mustelidæ*, it may be remarked that the genera display a successive reduction in the number of premolars and molars from the more ancient to modern geologic times. It is interesting to note that the genera presenting the greatest reduction in all respects, *Synagodus* and *Dysodus*, are now only known in a domesticated condition. Another reduction is seen in the number of tubercles of the inferior sectorial.

Amphicyon, Lartet.

This genus is better represented in Europe than in North America, but two species being certainly known from the latter. No recent species.

Thous, Gray, *Dusicyon*, Smith (nomen nudum).

Existing species of South America only.

Palæocyon, Lund.

Extinct species of South America only.

Lycaon, Brooks.

Existing species of Africa, only known as yet.

Temnocyon, Cope, Proceedings Amer. Philosophical Society, 1878, p. 68.

In this genus the heel of the inferior sectorial tooth rises into a single more or less median crest; in *Canis* the corresponding front is basin-shaped, with tubercles on each side. The superior molars of the typical species, *T. altigenis*, are unknown, but those of a new species, described below, do not differ from those of the genus *Canis*. The *Cynodictis crassirostris* of Filhol, from the French Phosphorites, approaches this genus.

Temnocyon coryphæus, sp. nov.

This is the most abundant dog of the Truckee beds of the John Day country. I have identified it heretofore as my *Canis hartshornianus*, but I find on examination of the inferior sectorial tooth that it is a species of *Temnocyon*. This genus was characterized by me on evidence furnished by a mandible of a species which I named *T. altigenis*,[1] which is of considerably larger size than the present one, but which agrees with it in the presence of a cutting edge instead of a basin on the heel of the inferior sectorial. The *C. hartshornianus*, known as yet from few fragments, is intermediate in dimensions between these two.

Several crania, and more or less of the skeleton of the *T. coryphæus*, are present in my collection. A nearly perfect skull displays the following characters: The orbits are entirely anterior to the vertical line dividing the skull into halves, and the muzzle is proportionately shortened. It is also narrowed anteriorly, and its median line above is shallowly grooved. The interorbital region is greatly convex to the supra-orbital region, and is grooved medially. The postorbital processes are mere angles, and are flattened from below. The cranium is much constricted behind the orbits, where its diameter is not greater than the width of the premaxillary incisive border. The sagittal crest is much elevated, and forms a perfectly straight and gradually rising outline to its junction with the incisor. The borders of the latter are very prominent, extending backwards considerably beyond

[1] Proceedings Amer. Philosoph. Soc., 1878, viii. p. 68.

the brain case. The zygoma is rather slender, is elongate, and but little expanded. The otic bullæ are very large; the paroccipital processes are directed backwards, at an angle of 45°, and are rather elongate and acute; they cap the bullæ posteriorly. The lateral occipital crests bound a fossa of the occipital region near the condyles. The occipital surface is directed horizontally backwards above the foramen magnum. This part of it, and its superior portion, are divided by a median keel.

The basioccipital is keeled on the middle line below. The sphenoid is not keeled, and is concave, its borders descending on the inner side of the bullæ. The pterygoid fossa is rather narrow, and the hamular process is short. The posterior border of the palate does not extend anterior to the posterior edges of the last tubercular molar, and its middle portion projects backwards in a triangular process. The palatine fossa for the inferior sectorial is shallow. The superior surface of the postorbital region is roughened.

The *foramen infraorbitale exterius* is rather large, and issues above the anterior border of the sectorial tooth. The *f. incisiva* are short, not extending posterior to the middle of the canines. The *f. palatina* are opposite the posterior border of the sectorial. The *f. lachrymale* is altogether within the orbital border. The *f. opticum* is rather large. This species is peculiar in having the *f. f. spheno-orbitale*, *rotundum*, and *alisphenoidale anterius* united into one large external orifice. The alisphenoid canal is larger in *Canis latrans*, and its posterior foramen small. The *f. ovale* is further removed from the *f. alisphenoidale* than in the coyote, and is exterior to and a little behind the *f. carotideum*.

The nasal bones extend to above the middles of the orbits, and contract gradually to their apex. Their combined anterior border is a regular concave, and the lateral angles at this point are produced outwards and forwards. The posterior apex of the premaxillary bone is separated from the anterior apex of the frontal by a short space. The maxillo-malar suture is deeply notched in front below, and it extends upwards to above the infra-orbital foramen. A very narrow surface of the lachrymal is exposed on the external surface. The pterygoid bone is distinct, and is nearly equally bounded by the sphenoid and palatine on the outer side. The inferior suture of the orbito-sphenoid runs in a groove, which is deepest anteriorly.

The crowns of all the incisor teeth are narrow or compressed, and, though slightly worn, present no indication of notch. As usual, the external ones are much the largest in antero-posterior diameter. The canines have robust fangs and rapidly tapering crowns, which are but little compressed. The first superior premolar is one-rooted, and the crown is simple. The crown of the second is without posterior heel and tubercle, while the third possesses both. The sectorial is relatively short, less so than in *C. latrans*. The blades are low and obtuse as compared with recent species, and the notch separating them is quite open. The anterior external heel is small, and there is no anterior external tubercle. The first tubercular molar is large, and the crown is narrower than that of *C. latrans*. It has an obtuse external cingulum, two external conical cusps, a V-shaped median ridge, and a wide internal cingulum. This crown differs from the corresponding one of *C. latrans* in having conical instead of compressed external cusps, and a simple V-shaped crest within instead of two adjacent cusps. The second tubercular is smaller than in *C. latrans*, and its tubercles are less distinct. There are two outer tubercles, a V-shaped ridge, and an inner cingulum, all very obscure. The enamel of all these teeth is smooth.

Measurements of Cranium.	M.
Length along base of skull, including incisive border and occipital condyle	.160
Length of skull to palatal notch	.075
Length of skull to posterior border of pterygoid bone	.102
Length to front of orbit axially	.046
Width between zygomas (greatest)	.094
Width between orbits (least)	.036
Width at postorbital constriction	.021
Width between bases of canines	.017
Width between bases of second tuberculars	.027
Width between otic bullæ	.009
Width between apices of paroccipitals	.042
Width of foramen magnum	.017
Width of occiput above	.032

Six well-preserved crania of this species are embraced in the collection, and the mandible remains attached to some of them.

One of these exhibits the following characters: there is a well-developed marginal lobe of the posterior cutting edge of the third and fourth premolars as well as a low posterior heel, and a rudiment of an anterior one. The heel of the sectorial is shorter than the remaining part of the tooth, and rises to a cutting edge a little external to the middle line; there is a small tubercle at its interior base. The anterior blade-cusp of the sectorial is much lower than the median, which is conical; the two diverge, diminishing the shear-like character and action of the tooth. The internal cusp is well developed. The first tubercular is of moderate size, and is a longitudinal oval in outline. The crown supports two low tubercles anterior to the middle, of which the external is the larger. The last molar has a single compressed root, and the crown is a longitudinal oval in outline. Its position is on the ascending base of the coronoid ramus, so that the crown is slightly oblique. The masseteric fossa is profound and well defined; its anterior termination is below the middle of the second tubercular tooth. The horizontal ramus is not robust, but is compressed, and rather deep.

Measurements of Mandible.	M.
Length along bases of posterior five molars	.049
Length of base of fourth premolar	.011
Elevation of crown	.008
Length of base of sectorial	.018
Elevation of crown of "	.012
Length of base of first tubercular	.0075
Width " " "	.0050
Length of base of second tubercular	.0050

While the characters of this dog do not separate it widely from the genus *Canis*, many of them are quite different from those presented by the recent species of the genus with which I am acquainted. Thus the union of the foramina spheno-orbitale and rotunda, the anterior position of the orbits, and the postorbital constriction are not seen in the wolf, domestic dog, coyote, jackal, or the North American and European foxes. The size of the brain was evidently less than in those species, and the sectorial teeth quite inferior in the efficiency of their blades. These characters may be considered in connection with the low geological position of the beds in which the species occurs.

From the Truckee beds of the White River formation in Oregon.

Canis, Linn.

The names proposed by Smith, Gray, and others, and which must be regarded as synonyms of *Canis*, are *Lupus*, *Dieba*, *Simenia*, *Chrysocyon*, and *Lycalopex*. Many of the species, referred to by European paleontologists under the name of *Cynodictis*, Pomel, appear to me to be undistinguishable from *Canis*. Through the great kindness of M. Filhol, I possess specimens of the jaws of several of these species. A mandible with nearly complete dentition of the *Cynodon velaunum* of Aymard, agrees very nearly with the jaws of some of the smaller species from the American White River beds, which I have referred to *Canis*. *Helocyon*, Aym. may be distinct, but may not belong to the *Canidæ*.

The dentition of many of the recent species of *Canis* differs in very slight characters. The following may be detected in an examination of the superior molars of the three larger species most accessible in the United States.

Last superior tubercular short, wide; inner cingulum and crest nearly confounded.

Inner crest of tub. m. I. composed of two low tubercles.
C. familiaris.

Vars. *molossus*, *terrarius*, *graius*.

Last superior tubercular narrower, transverse; inner cingulum very distinct.

Inner crest of tub. M. I., a ridge higher anteriorly. *C. lupus.*

Inner crest of tub. M. I. with two sharp cusps. *C. latrans.*

It is worthy of note that the wide oval form of the second superior molar of the *Canis familiaris*, exists equally in the extreme races or species, the grayhound and bulldog, as I observe by examination of several crania of each. This has also been shown by De Blainville. It is also seen in the terrier, and in various other races. But in some Saint Bernard crania in the Museum of the Academy of Natural Sciences, this tooth is more elongate; and in some of the specimens of *Canis lupus* from Europe its form is quite the same. So this character, as might have been anticipated, is not of universal application. Another character is seen in the crania of three specimens, which are supposed to belong to *Canis terrarius*. The superior border of the foramen magnum is interrupted by a deep vertical excavation. This is not seen in the St.