Technical and Bibliographic Notes / Notes techniques et bibliographiques

The Institute has attempted to obtain the best original copy available for filming. Features of this copy which may be bibliographically unique, which may alter any of the images in the reproduction, or which may significantly change the usual method of filming, are checked below.

L'Institut a microfilmé le meilleur exemplaire qu'il lui a été possible de se procurer. Les détails de cet exemplaire qui sont peut-être uniques du point de vue bibliographique, qui peuvent modifier une image reproduite, ou qui peuvent exiger une modification dans la méthode normale de filmage sont indiqués ci-dessous.

- ☐ Coloured covers/ Couverture de couleur
- ☐ Covers damaged/ Couverture endommagée
- ☐ Covers restored and/or laminated/ Couverture restaurée et/ou pelliculée
- ☐ Cover title missing/ Le titre de couverture manque
- ☐ Coloured maps/ Cartes géographiques en couleur
- ☐ Coloured ink (i.e. other than blue or black)/ Encre de couleur (i.e. autre que bleue ou noire)
- ☐ Coloured plates and/or illustrations/ Planches et/ou illustrations en couleur
- ☑ Bound with other material/ Relié avec d'autres documents
- ☑ Tight binding may cause shadows or distortion along interior margin/ La reliure serrée peut causer de l'ombre ou de la distorsion le long de la marge intérieure
- ☐ Blank leaves added during restoration may appear within the text. Whenever possible, these have been omitted from filming/ Il se peut que certaines pages blanches ajoutées lors d'une restauration apparaissent dans le texte, mais, lorsque cela était possible, ces pages n'ont pas été filmées.

- ☐ Coloured pages/ Pages de couleur
- ☐ Pages damaged/ Pages endommagées
- ☐ Pages restored and/or laminated/ Pages restaurées et/ou pelliculées
- ☑ Pages discoloured, stained or foxed/ Pages décolorées, tachetées ou piquées
- ☐ Pages detached/ Pages détachées
- ☑ Showthrough/ Transparence
- ☑ Quality of print varies/ Qualité inégale de l'impression
- ☑ Continuous pagination/ Pagination continue
- ☐ Includes index(es)/ Comprend un (des) index

  Title on header taken from:/ Le titre de l'en-tête provient:

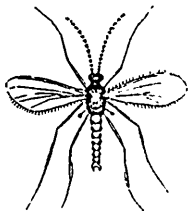
- ☐ Title page of issue/ Page de titre de la livraison
- ☐ Caption of issue/ Titre de départ de la livraison
- ☐ Masthead/ Générique (périodiques) de la livraison

☐ Additional comments:/ Commentaires supplémentaires:

This item is filmed at the reduction ratio checked below/
Ce document est filmé au taux de réduction indiqué ci-dessous.

10X	12X	14X	16X	18X	20X	22X	24X	26X	28X	30X	32X
										✓	

HESSIAN FLY.

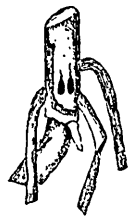


Male, magnified.

Magnified

Pupa Case.

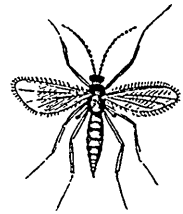
Natural Size.



Stalk with insect in flaxseed state.

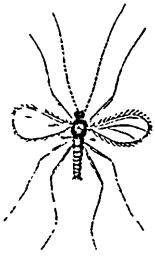
Mag. Larva

Natural Size.



Female magnified,

WHEAT MIDGE.

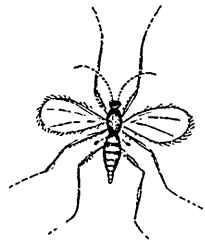


Male magnified.

Magnified Larva.

Nat Size.

Wheat as injured.

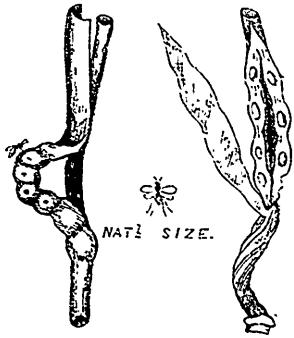


Female, magnified.

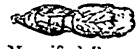
JOINT WORM.

Magnified Larva.

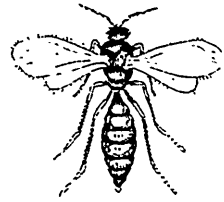
Male.



Injured Stalk and Cells.



Magnified Pupa.



Female.

THE

CANADIAN

NATURALIST AND GEOLOGIST.

BY E. BILLINGS.

VOLUME I. SEPTEMBER, 1856. NUMBER IV.

ARTICLE XXXIX.—*Natural History of the Wolverene or Carcajou, (Gulo Luscus.)*

GENUS GULO.—STORR.

DENTAL FORMULA.

Incisive $\frac{6}{6}$; *Canine*, $\frac{1}{1}—\frac{1}{1}$; *Molar*, $\frac{5}{6}—\frac{5}{6}$.

GENERIC CHARACTERS.—"The three first molars in the upper and the four first in the lower jaw, small; succeeded by a larger carnivorous or trenchant tooth, and a small tuberculous tooth at the back. In the upper jaw the three first molars are uni-cuspidateous, and may be called false-carnivorous teeth, increasing successively in size; the following or carnivorous tooth is large and strong, furnished with two points on the inner side, and a trenchant edge in front; the last tooth is small, and tuberculous or flattish. In the lower jaw the first four molars are false, each presenting only one point or edge; the fifth is long and large, with two trenchant points; the last molar is nearly flat. All the teeth touch each

other successively." (Cuvier.) Head of moderate length; body long; legs short; tail bushy; feet with five deeply divided toes, terminated by long curved nails; no glandular pouch in some of the species, but a simple fold beneath the tail; habits carnivorous and nocturnal. The generic name is derived from the Latin *gulo*, a glutton. Four species of this genus have been described: one existing in the Arctic regions of both continents; two in South America, and one in Africa." (Audubon and Bachman, vol. I, page 202.) The North American species is commonly known by the name of the *Wolverene* or *Carcajou.*

GULO LUSCUS, (Linn.)

SPECIFIC CHARACTERS.—" *Dark brown passing into black above, a pale band upon each side, running from the shoulders round the flanks, and uniting on the hips; tail with long bushy hairs.*"

The earlier writers upon the Natural History of Northern Europe and America published many gross misrepresentations upon the Wolverene, affecting materially not only his personal appearance but his habits and general character. According to several authors the length of his tail is so extraordinary that it can be wound several times round his body, while his voracity exceeds that of any other denizen of the forest. The account given in Goldsmith's Natural History, although intended for the truth, is in fact a very good summary of all the errors concerning the habits of this animal extant at the date of the publication of that work: "It is chiefly in North America (he says) that this voracious creature is seen, lurking among the thick branches of trees, in order to surprise the deer, with which the extensive forests of that part of the world abound. Endued with a degree of patience equal to its rapacity the glutton singles out such trees as it observes marked by the teeth or the antlers of the deer, and it is known to remain there watching for several days together. If it has fixed upon a wrong tree, and finds that the deer have either left that part of the country, or cautiously shun the place, it reluctantly descends, pursues the beaver to its retreat, or even ventures into the water in pursuit of fishes. But if it happen that, by long attention and keeping close, at last the elk or the reindeer happen to pass that way, it at once darts upon them, sticks its claws between their shoulders and remains there unalterably firm. It is in vain that the large frighted animal increases its speed, or threatens with its branching horns, the glutton

having taken possession of its post, nothing can drive it off; its enormous prey drives rapidly along amongst the thickest woods, rubs itself against the largest trees, and tears down the branches with its expanded horns; but still its insatiable foe sticks behind, eating its neck, and digging its passage to the great blood vessels that lie in that part. Travellers who wander through these deserts often see pieces of the glutton's skin sticking to the trees against which it was rubbed by the deer. But the animal's voracity is greater than its feelings, and it never seizes without bringing down its prey; when therefore the deer, wounded and feeble with the loss of blood, falls, the glutton is seen to make up for its former abstinence by its present voracity. As it is not possessed of a feast of this kind every day, it resolves to lay in a store to serve it for a good while to come. It is indeed amazing how much one of these animals can eat at a time. That which was seen by Mr. Velein, although without exercise or air, although taken from its native climate, and enjoying but an indifferent state of health, was yet seen to eat thirteen pounds of flesh every day, and yet remain unsatisfied. We may therefore easily conceive how much more it must devour at once, after a long fast, of food of its own procuring, and in the climate most natural to its constitution. We are told accordingly that from being a lank, thin animal, which it naturally is, it then gorges in such quantities that its belly is distended and its whole figure seems to alter. Thus voraciously it continues eating till, incapable of any other animal function, it lies totally torpid by the animal it has killed; and in this situation it continues for two or three days. In this loathsome and helpless state it finds its chief protection from its horrid smell, which few animals care to come near; so that it continues eating and sleeping till its prey be devoured, bones and all, and then it mounts a tree in quest of another adventure."

He then proceeds to state that the glutton prefers putrid flesh to that of the animals newly killed, that it pursues the beaver, plunders the traps and snares set by the hunters, digs open graves and devours the bodies interred therein, and is so universally predacious that the natives of the countries where the animal inhabits hold it in detestation, and usually term it the Vulture of quadrupeds. Another author, Olaus Magnus, from whom perhaps Goldsmith compiled much of his history, says that the Arctic fox provides for the glutton in the same manner that the jackal was reputed to hunt for the lion. And Gmelin informs us that

our animal watches large beasts like a robber, or surprises them when asleep, and that after having darted down from a tree like an arrow upon the reindeer or elk he sinks his teeth into its body and gnaws its flesh till it expires, after which he devours it at his ease and swallows both hair and skin.

It is frequently the task of the modern Naturalist to strip the accounts of those more ancient of much that is marvellous, and those who have recently and without prejudice studied the Wolverene or glutton find him a very ordinary animal much resembling in appearance a small brown bear, its length being scarcely three feet and its height not much exceeding one foot. Its head is of moderate size, broad on the hinder part much arched, rounded on all sides; nose obtuse, naked; eyes small; ears short, broad, rounded, and partially hidden by the surrounding fur. The body is long in proportion to the height of the animal, and its tail instead of being long enough to wind round the body is only seven or eight inches in length. The legs are short and stout, and each one of the five toes is armed with a rounded and pretty sharp claw. The feet are broad, and clothed on the under surface with woolly hairs, so that the tracks made on the snow by the animal are large and are said to be not very unlike those of the bear. The fur is also like that of the bear. It is in general dark brown approaching to black. A pale reddish band commences behind the shoulder, and running along the flanks, turns up on the hip, and unites on the rump with similar markings on the opposite side. The nose, eyes and whiskers are black, legs and tail brownish black, and claws dark brown.

As to the habits of the Wolverene, Sir John Richardson says that it feeds chiefly on the carcases of animals that have been killed by accident. It also devours meadow-mice, marmots and other rodentia, and occasionally destroys disabled quadrupeds of a larger size; it possesses neither the agility nor the strength to destroy deer or other large game, as is stated by the early writers. Richardson saw one chasing an American hare, which was at the same time harassed by the large white owl. The speed of the hare is, however, greater than that of the Wolverene. All writers agree that it follows the footsteps of the trapper in order to prey upon the hare, marten, beaver or other animal that may be caught in them, or to feed upon the bait. It is probable, however, that in such excursions the animal is directed by scenting the bait at a distance, and thus finds its way to the traps. We cannot

believe that it, as any other North American animal, is possessed of sufficient intelligence to understand the mission of the trapper, whose foot-prints it may happen to find in the snow; and we know by having practiced the same art in our youth in the valley of the Ottawa, that trappers are in the habit of trailing a roasted bird, squirrel or piece of flesh from one trap to another, knowing that the marten will follow the scent and thus be guided to the trap. It is not therefore the footsteps of the trapper, but the scent of the bait or trail that the Wolverene in all probability follows. Audubon and Bachman say that this animal has always existed sparingly in the United States, and only in the northern portion of the Union. It is still found, although rarely, in Canada. The metropolis of the species is in the cold north. Occasionally a pack of furs brought from the back settlements of Canada contains a skin of the Wolverene. Audubon killed one in the Ransselaer County in the State of New York; it had its den in a narrow cave in the rocks, where it had made a large nest for itself of dried leaves.

The same species is found on both continents. It inhabits the most northern points of Europe and Asia, occurring in Sweden, Norway, Lapland and Siberia, as well as in some of the Alpine regions, and in the forests of Courland and Poland. In North America it is found throughout the whole Arctic Circle. They were caught to the number of ten or twelve every winter by Capt. Cartwright in Labrador. It exists at Davis Straits, and has been traced across the continent to the shores of the Pacific. It is found on the Russian Islands of Alaska. Richardson remarks: "It even visits the islands of the Polar Sea, its bones having been found in Melville Island, nearly in latitude 75°." It occurs in Canada, although diminishing in numbers the further we proceed southerly. Specimens have been procured in Newfoundland and in Maine.

In the expedition of Sir John Ross, as described by Captain I. C. Ross, R. N. and R. S., the following anecdote of this species is related: "In the middle of winter time, or three months before we abandoned the ship, we were one day surprised by a visit from a Wolverene, which, hard pressed by hunger, had climbed the snow wall that surrounded our vessel, and came boldly on deck, where the crew were walking for exercise; undismayed at the presence of twelve or fourteen men, he seized upon a canister that had some meat in it, and was in so ravenous a state that whilst busily engaged at his feast he suffered me to pass a noose over

his head, by which he was immediately secured and strangled." The animal had evidently become desperate by extreme hunger.

Audubon says: "We have seen this species in confinement in Europe; the specimens came, we are informed, from the north of that continent. In Denmark, a keeper of a small caravan of animals, allowed us the privilege of examining a Wolverene which he had exhibited for two years; we took him out of his cage; he was very gentle, opened his mouth to enable us to examine his teeth, and buried his head in our lap whilst we admired his long claws, and felt his woolly feet; he seemed pleased to escape from the confinement of the cage, ran round us in short circles, and made awkward attempts to play with and caress us, which reminded us very much of the habit of the American black bear. He had been taught to sit upon his haunches and hold in his mouth a German pipe. We observed he was somewhat averse to the light of the sun, keeping his eyes wholly closed when exposed to its rays. The keeper informed us that he suffered a good deal from the heat in warm weather, that he drank water freely, and ate meat voraciously, but consumed more in winter than in summer. There was in the same cage a marmot from the Alps, to which the Wolverene seemed much attached. When returned to the cage he rolled himself up like a ball, his long shaggy hairs so completely covering his limbs that he presented the appearance of a bear skin rolled up into a bundle."

"The Wolverene produces young once a year in number from two to four, and the cubs are covered with a downy fur of a pale cream colour." (Richardson.) The fur bears a great similarity to that of the black bear, but is not so long nor of so much value.

The Glutton (*Gulo luscus*) is the Carcajou of La Hontan and the French Canadians; Quickhatch (*Ursulo affinis Americana*) of Catesby (*Carolina*); Quickhatch of the English residents at Hudson's Bay; Quickhatch, or Wolverene, of Ellis; Wolverene of Pennant; Wolverin, Quiquihatch, or Carcajou, of Graham (manuscripts); Kablee-arioo of the Esquimaux of Melville Peninsula; Ka e week of the Esquimaux of Boothia Felix; Naghai-eh of the Chippeways; Ommeethatsees, Okeecoohagew, and Okeecoohawgees (whence, as Sir John Richardson observes, the term Quickhatch of the European labourers in the service of the Hudson's Bay Company is evidently derived), of the Crees, or Algonquins; Rosomak of the Russians; Jarf, Filfress, of the 'Fauna Suecica'; Timmi of the Kamtschatkans; Haeppi of the Koratzki; Glouton of the French; *Gulo* of Olaus Magnus; *Gulo*, Vielfrass, of Gener; *Hyæna* and *Ursus Freti Hudsonis* of Brisson; *Mustela Gulo* and *Ursus luscus* of Linnæus; *Ursus Gulo* of Pallas and Gmelin; *Taxus Gulo* of Tiedemann; *Gulo arcticus* of Desmarest; *Gulo vulgaris* of Griffith's Cuvier; *Gulo luscus* of Sabine.

ARTICLE XL.—*On the Loup Cervier, or Canadian Lynx, (Lynx Canadensis), and the Bay Lynx or Wild Cat of the United States, (Lynx Rufus.)*

GENUS LYNX.

Dental Formula.

Incisive $\frac{6}{6}$; *Canine* $\frac{1}{1}$—$\frac{1}{1}$; *Cheek-Teeth* $\frac{3}{3}$—$\frac{3}{3}$=28.

Generic Characters.—The teeth of the genus Lynx do not differ from those of the tame cats, except that there is one less on each side in the upper jaw. The canines are large and strong; and the small false molars, next to the canines, which exist in the large long tailed cats, such as the lion, tiger, panther, cougar, etc., as well as in the common domestic cat, are here wanting. There is one false molar, or conical tooth, on each side, one carnivorous, with three lobes and a tubercle, or blunted heel, on the inner. The third cheek-tooth is rather small, and is placed transversely. In the lower jaw there are on each side two false compressed simple molars and one canine, which is bicuspid. The head is short, round and arched; jaws short; tongue aculeated; ears short, erect, more or less tufted; fore feet with five toes, hind feet with only four; nails retractile; tail shorter than the head, although nearly as long in a few instances.

This genus has been separated from the old genus Felis on account of the tufted ears, shorter bodies and tails, and also the slight differences in the teeth. The generic name is from the Greek *lunyx*, a lynx. There are eight species, one in Africa, two in Persia, one in Arabia, two in Europe, and two in North America. (Aud. and Bach.)

Both of the American species are found in Canada. They are described as follows:

1. Lynx Rufus.—Guldenstaed. Common American Wild Cat, Bay Lynx.

Specific Characters.—*Tail nearly as long as head; extremity on the upper surface black, tipt with more or less white; a whitish spot on the hinder part of the ear, bordered with black; general colour reddish, brown in autumn, and winter ashy brown; in spring and summer, soles of feet naked.*

2. Lynx Canadensis.—Geoffrey. The Loup Cervier, or Canada Lynx.

Specific Characters.—*Longer than L.Rufus; ears triangular, tipt with an upright slender tuft of coarse black hairs; tail shorter than the head; soles hairy; general colours, grey above, a little clouded with irregular darker spots, lighter beneath.*

The skins of the Loup Cervier may be seen in the collections of almost every extensive fur dealer in Canada, although the animal itself is not often to be met with, unless by those sportsmen or hunters who penetrate into the more retired recesses of the forest. The settlements are seldom visited by this beast of prey, its habits being such that it finds in general a sufficiency of food in the woods, and is therefore not often compelled by famine to forage in the farm yard. There can be little doubt, however, that sometimes the wolf is blamed for carrying off a lamb which has feasted the lynx. Its prey consists of such small animals as the northern hare, the grey rabbit, squirrels, mice, grouse, and birds of various kinds. It is said that in the northern regions it preys upon the Arctic fox (*Vulpes lagopus,*) and that it also there makes great havoc among the lemmings. When it enters a place frequented by rabbits it seldom leaves the locality until it has killed them all. One was found with its mouth full of the sharp quills of the porcupine, its head greatly inflamed, and its sight nearly destroyed in consequence. There are some accounts of its attacking deer, but although its strength is doubtless sufficient to warrant an encounter with such large prey, yet the habit of the lynx is more like that of the common cat to seek its food among animals smaller and weaker than itself.

From the great size of its claws and teeth, and its formidable appearance, the Canada Lynx has acquired a reputation for ferocity, cunning and daring, to which it is not entitled. All that has been said of the Wolverene with respect to its leaping from trees upon the backs of the deer and elk has also been applied to this animal. In fact one of its common names, *Loup Cervier*, or "*Deer Wolf*," was bestowed upon it from its supposed habit of pouncing upon and destroying deer. Although, however, strongly built, and capable of climbing trees with ease, the lynx is timid, and at the sight of man cowardly, and a very small dog will put it to flight instantly. It swims well, breeds once a year, having two young at a time, is easily taken in traps; and the Indians eat its flesh. When attacked by dogs, and cornered up, it fights like a cat, spitting and striking with its sharp claws, with which it can inflict severe wounds.

This animal has a short round head, large eyes, long, thick and strong legs, a short tail, and erect ears, which are tufted with black hairs. Its feet are completely covered by long woolly fur, so that its tracks upon the snow are very large, and do not show any impressions of the toes; its steps are short. The general colour is grey, with indistinct brownish spots.

It is found more or less abundantly all over the British Provinces of North America, being a species of the Arctic and North Temperate Zones. It is not found in the Southern States, and is less common in the Northern States than it is in Canada, New Brunswick, and thence northerly.

The Wild Cat, Lynx Rufus.

The common American Wild Cat differs from the Canadian Lynx principally in being smaller and of a yellowish or reddish brown color instead of gray. Although in appearance a ferocious looking animal, yet it is cowardly, and has never been known to attack any but animals smaller than itself. In those portions of the States where it is not well known, there are always many traditions afloat, attributing to this species the character of a fierce and dangerous animal. The urchin, seldom partial to strange cats of even the domestic species, generally regards that portion of his road to school, which happens to traverse some lonely swamp reputed to be the haunt of a wild cat, with especial aversion; he treads softly, breathes deeply, and looks around him most suspiciously, expecting every moment to be pounced upon by a savage with claws and teeth of unknown length and sharpness; as he draws near the opening upon the far side, his heels involuntarily become much lighter, and not unfrequently the dreaded passage terminates in a nimble run, until some safer spot is gained. In after years he learns that this dread of an enemy may be classed among the "lost fears," and like, many of the brighter fancies of childhood, without foundation. There appears to be no well authenticated instance of an attack by the wild cat upon any animal larger than a lamb or a young pig.

Audubon states that this animal "is fond of swampy retired situations, as well as the wooded sides of hills, and is still seen occasionally in that portion of the Alleghany Mountains which traverses the States of Pennsylvania and New York. It is abundant in the cane brakes bordering the lakes, rivers, and lagoons of Carolina, Louisiana, and other southern and south-western

States. This species also inhabits the mountains and undulating or rolling country of the Southern States, and frequents the thickets that generally spring up on deserted cotton plantations, some of which are two or three miles long, and perhaps a mile wide, and afford, from the quantity of briars, shrubs and young trees of various kinds which have overgrown them, excellent cover for many quadrupeds and birds. In these bramble covered old fields the "Cats" feed chiefly on the rabbits and rats that make their homes in their almost impenetrable and tangled recesses; and seldom does the Wild Cat voluntarily leave so comfortable and secure a lurking place, except in the breeding season, or to follow in very sultry weather the dry beds of streams or brooks, to pick up the catfish, &c., or crawfish and frogs that remain in the deep holes of the creeks during the drought of summer.

"The Wild Cat not only makes great havoc among the chickens, turkeys and ducks of the planters, but destroys many of the smaller quadrupeds, as well as partridges and such other birds as he can surprise roosting on the ground. The hunters often run down the Wild Cat with packs of fox-hounds. When hard pressed by fast dogs, and in an open country, he ascends a tree with the agility of a squirrel, but the baying of the dogs calling his pursuers to the spot, the unerring rifle brings him to the ground, when, if not mortally wounded, he fights fiercely with the pack until killed. He will, however, when pursued by hunters with hounds, frequently elude both dogs and huntsmen, by an exercise of instinct so closely bordering on reason that we are bewildered in the attempt to separate it from the latter. No sooner does he become aware that the enemy is on his track than instead of taking a straight course for the deepest forest he speeds to one of the largest old fields overgrown with briary thickets in the neighbourhood, and having reached this tangled maze, he runs in a variety of circles, crossing and recrossing his path many times; and when he thinks the scent has been sufficiently diffused in different directions by this manœuvre to puzzle both men and dogs, he creeps slyly forth, and makes for the woods, or for some well known swamp; and if he should be lucky enough to find a half dried up pond, or a part of the swamp on which the clayey bottom is moist and sticky, he seems to know that the adhesive soil, covering his feet and legs, so far destroys the scent that although the hounds may be in full cry on reaching such a place, and while crossing it, they will lose the

track on the opposite side, and perhaps not regain it without some difficulty and delay.

"At other times the "Cat," when chased by the dogs, gains some tract of "burnt woods," common especially in the fine lands of Carolina, where fallen and upright trees are alike blackened by the fire that has run among them, burning before it every blade of grass, every leaf and shrub, and destroying many of the largest trees, in its furious course; and here the charcoal and ashes on the ground, after he has traversed the burnt district a short distance, and made a few leaps along the trunk of a fallen tree, that has been charred in the conflagration, will generally put any hounds at fault. Should no such chance of safety be within his reach, he does not despair, but exerting his powers of flight to the utmost, increases his distance from the pursuing pack, and following as intricate and devious a path as possible, after many a weary mile has been run over, he reaches a long fallen trunk of a tree, on which he may perchance at some previous time have baffled the hunters as he is now about to do. He leaps on to it, and hastily running to the further end he doubles and returns to the point from which he gained the tree, and after running backward and forward repeatedly on the fallen trunk, he makes a sudden and vigorous spring, leaping as high up into a tree some feet distant as he can; he then climbs to its highest forks, crouches, and, closely squatted, watches the movements of his pursuers. The dogs are soon at fault, for he has already led them through many a crooked path; the hunters are dispirited and uneasy, and perhaps the density of the woods, or the approach of night favours him; the huntsmen call off their dogs from the fruitless search, and give up the chase, and shortly after the escaped marauder descends leisurely to the earth, and wanders off in search of food, and to begin a new series of adventures."

The Wild Cat is a great destroyer of the eggs of birds, and never finds the nest of a grouse, partridge, wild turkey, or other bird, without sucking every egg in it. The following is a method of capturing the animal, practiced in the Southern States, where it is abundant: "A large and strong box trap is constructed, and a chicken, placed at the farthest end of it from the door, is tied by one leg so that he cannot move; there is a stout wire partition about half way between the fowl and the door, which prevents the Cat, when entering the trap, from seizing the bird; the trap is then set so that when the animal enters the door closes behind

him with a spring, commonly the branch of some tree bent down for that purpose, and released by a trigger set at the entrance or just within the trap. These traps are placed in different points of the plantations, or in the woods, and the Wild Cat is generally attracted by the crowing of the cock at the dawn of day."

The Cats are often caught in this way, and they do not therefore seem to possess the cunning of the fox, enabling the latter to avoid the traps set for racoons. Audubon and Bachman, from whose work the above particulars are extracted, state that they have seen this animal taken from the common log traps set for racoons, and that they are often found in the steel traps baited and set for otters.

When this animal discovers a flock of wild turkeys he follows them for a little distance, to ascertain their direction, and then makes a rapid detour so as to get in front of them; he then conceals himself, and when they have arrived within a convenient distance springs into their midst, and seldom fails to secure one of the number.

When kept in confinement they shew their close relationship to the common cat by purring and mewing loud enough to be heard at some distance. They hunt both by night and by day. The female makes a comfortable nest of dry moss and leaves in a hollow log or tree, and there brings forth her young, from two to four at a time.

Audubon and Bachman state that "the geographical range of this species is very extensive, it being found to inhabit portions of the continent from the tropics as far north as 60 degrees. It abounds in Texas, Louisiana, Florida, Georgia, and in both the Carolinas, and is found in all the States east of these, and likewise in New Brunswick and Nova Scotia; we have seen it on the shores of the Upper Missouri, more than a thousand miles above St. Louis. We examined one that had been taken a few hours before by some hunters in Erie County in the State of New York, and have heard of its existing, although rather sparingly, in Upper Canada, where it has been occasionally captured."

ARTICLE XLI.—*Natural History of the Raccoon,(Procyon Lotor.)*

GENUS PROCYON.—Storr.

Dental Formula.

Incisive $\frac{6}{6}$; *Canine* $\frac{1}{1}$—$\frac{1}{1}$; *Molar* $\frac{6}{6}$—$\frac{6}{6}$=40.

Generic Characters.—"Muzzle pointed and projecting beyond the lower jaw; ears short and oval; tail bushy and long; feet five toed, with strong nails not retractile; soles of feet (posterior) naked; the species rest on the heel, but walk on the toes. Mammæ, six ventral; there is a gland on each side of the anus which secretes a slightly offensive fluid.

"The generic name is derived from the Greek *pro*, before, and *kron*, a dog.

"Two species only have been noticed, one in the northern and the other in the southern parts of North America." The northern species is that which occurs in Canada.

Procyon Lotor.—Linn.

Specific Characters.—"*Body above grayish, mixed with black; ears, and beneath, whitish; a black patch across the eye; tail, with four or five annulations of black and gray.*"

The body of the Raccoon is rather stout, the legs of moderate length, and the appearance of the animal would indicate that although he is not intended for great speed, he is still by his compact and well organized structure, his strong musculous limbs and short and stout claws, capable of a tolerably rapid race, and is able to climb, although not with the agility of the squirrel still with greater alacrity than his near relative the bear.

"His head is rather round; nose tapering, sharp, and snout moveable; point of nose naked; eyes round, and of moderate size; moustaches few, very rigid, resembling bristles, extending to the chin; ears low, erect, elliptical, with their tips much rounded, clothed with hair on both sides; on the inner surface the hairs are longer and less dense; tail of moderate length and bushy. In its feet the Raccoon is partially plantigrade; hence it was classed by Linnæus among the bears, under the genus *Ursus;* soles of feet naked. When it sits, it often brings the whole hind sole to the ground, resting in the manner of the bears. The canine teeth are

large and extend beyond the lips; the nails are strong, hooked and sharp, not covered with hairs. The body is densely clothed with two kinds of hairs; the outer and longer, long and coarse; the inner, softer and more like wool.

"*Colour.*—Point of nose, and soles of feet black; nails of dark brown; moustaches nearly all white; ears, lips, above the snout and chin, dingy white; above the eyes, and around the forehead, light gray. A dark brown patch extends from each side of the neck and passes the eyes over the nose nearly reaching the snout, and gradually fading on the forehead into the colours of the back; eyes black; the longer hairs on the back are dark brown at the roots, then yellowish white for half their length, and are broadly tipped with black; the softer fur beneath, pale brown throughout the whole body; on the sides and belly, the longer hairs are dingy white from the roots; the tail has about six distinct black rings, and is tipped with black; these rings alternate with five light yellowish brown annulations."

This animal is well known all over Canada and the United States as far as south as the Gulf of Mexico. It is said to extend its geographical range further towards the north on the Pacific west of North America, than on that of the Atlantic. The Hudson's Bay Company procure skins in the Red River Settlement, and it appears that that locality is about its extreme northern range. Although somewhat common in this Province especially in the newer settlements, its history is not very generally known, and yet few animals are more interesting in their habits. We think the following account given by Audubon and Bachman can scarcely be read without amusement:

HABITS.

The Raccoon is a cunning animal, is easily tamed, and makes a pleasant monkey-like pet. It is quite dexterous in the use of its fore-feet, and will amble after its master in the manner of a bear, and even follow him into the streets. It is fond of eggs, and devours them raw or cooked with avidity, but prefers them raw of course, and if it finds a nest will feast on them morning, noon and night without being satiated. It will adroitly pick its keeper's pockets of anything it likes to eat, and is always on the watch for dainties. The habits of the muscles (*unios*) that inhabit our fresh water rivers are better known to the Raccoon than to most conchologists, and their flavour is as highly relished by this animal as

is that of the best bowl of clam soup by the epicure in that condiment.

Being an expert climber, the Raccoon ascends trees with facility, and frequently invades the nest of the woodpecker, although it may be secure against ordinary thieves, by means of his fore-feet getting hold of the eggs or the young birds. He watches too the soft-shelled turtle when she is about to deposit her eggs, for which purpose she leaves the water, and crawling on to the white sand-bar, digs a hole and places them underneath the heated surface. Quickly does the rogue dig up the elastic ova, although ever so carefully covered, and appropriate them to his own use, notwithstanding the efforts of the luckless turtle to conceal them.

Sometimes by the margin of a pond, shrouded, or crouched, among tall reeds and grasses, Grimalkin-like, the Raccoon lies still as death, waiting with patience for some ill-fated duck that may come within his reach. No negro on a plantation knows with more accuracy when the corn (maize) is juicy and ready for the connoisseur in roasting ears, and he does not require the aid of fire to improve its flavour, but attacks it more voraciously than the squirrel or the blackbird, and is the last to quit the cornfield.

The favourite resorts of the Raccoon are retired swampy lands well covered with lofty trees, and through which are small water-courses. In such places its tracks may be seen following the margins of the bayous and creeks, which it occasionally crosses in search of frogs and muscles which are found on their banks. It also follows the margins of rivers for the same purpose, and is dexterous in getting at the shell-fish, notwithstanding the hardness of the siliceous covering with which nature has provided them. In dry seasons, the receding waters sometimes leave the muscles exposed to the heat of the sun, which destroys their life and causes their shells to open, leaving them accessible to the first animal or bird that approaches.

In the dreary months of winter, should you be encamped in any of the great western forests, obliged by the pitiless storm to remain for some days, as we have been, you will not be unthankful if you have a fat Raccoon suspended on a tree above your camp, for when kept awhile, the flesh of this species is both tender and well-flavoured.

The Raccoon when full grown and in good condition we consider quite a handsome animal. We have often watched him with interest, cautiously moving from one trunk to another to escape

his view. His bright eye, however, almost invariably detected us ere we could take aim at him, and he adroitly fled into a hollow tree and escaped from us.

We once met with one of these animals whilst we were traveling on horseback from Henderson to Vincennes, on the edge of a large prairie in a copse, and on approaching it ran up a small sapling from which we shook it off with ease; but as soon as it reached the ground it opened its mouth and made directly towards us, and looked so fierce, that drawing a pistol from our holsters, we shot it dead when it was only a few feet from us.

The young are at their birth quite small, (about the size of a half-grown rat;) some that we saw in Texas were not more than two days old and were kept in a barrel. They uttered a plaintive cry not unlike the wail of an infant.

The Raccoon usually produces from four to six young at a time, which are generally brought forth early in May, although the period of their littering varies in different latitudes.

When the Indian corn is ripening, the Raccoons invade the fields to feast on the rich milky grain, as we have just stated, and as the stalks are too weak to bear the weight of these marauders, they generally break them down with their fore-paws, tear off the husks from the ears, and then munch them at their leisure. During this inviting season, the Raccoon is not the only trespasser on the corn fields, but various animals are attracted thither to receive their portion, and even the merry school-boy shares the feast with them, at the risk of paying for his indulgence by incurring the necessity of a physician's prescription the next day. The havoc committed in the Western States by squirrels and other animals is almost incalculable, and no vigilance of the farmer can guard against the depredations of these hungry intruders, which extend from farm to farm, and even penetrate to those embosomed in the forests, where settlements are few and far between.

The Raccoon is not strictly a nocturnal animal; and although it generally visits the corn fields at night, sometimes feeds on the green corn during the day; we have seen it thus employed during the heat of summer, and it will occasionally enter a poultry house at mid-day, and destroy many of the feathered inhabitants, contenting itself with the head and blood of the fowls it kills.

The nest or lair of the Raccoon is usually made in the hollow of some broken branch of a tree. When tamed, these animals are seldom induced to lie or sleep on a layer of straw.

There exists a species of oyster in the Southern States, of inferior quality, which bears the name of Raccoon Oyster: it lies imbedded in masses in the shallow waters of the rivers. These oysters are covered by high tides, but are exposed at low water. On these the Raccoons are fond of feeding, and we have on several occasions seen them on the oyster banks. We have, however, never had an opportunity of ascertaining by personal observation the accuracy of a statement which we have frequently heard made with great confidence, viz., that the Raccoon, at low tide, in endeavouring to extricate these oysters from the shell, is occasionally caught by the foot in consequence of the closing of the valve of the shell fish, when numbers of these being clustered and imbedded together, the Raccoon cannot drag them from their bed, and the returning tide drowns him.

The Naturalist has many difficulties to encounter when inquiring into facts connected with his pursuit: every one acquainted with the habits of even our common species must know that the information gained from most of those who reside near their localities, from their want of particular observation, is generally very limited, and probably the most interesting knowledge gained by such queries would be the result of a comparison of the accounts given at different places. From the Alleghany Mountains, the swamps of Louisiana, and the marshes of Carolina, we have received nearly the same history of the cunning manœuvres and sly tricks of the Raccoon in procuring food.

We add the following notes on a Raccoon kept for a considerable time in a tame state, or partially domesticated:

When it first came into our possession it was about one-third grown. By kind treatment it soon became very docile, but from its well known mischievous propensities we always kept it chained.

It was truly omnivorous, never refusing any thing eatable; vegetable or animal, cooked or uncooked, all was devoured with equal avidity. Of some articles, however, it seemed particularly fond, as sugar, honey, chestnuts, fish and poultry. The animal would become almost frantic when either of the two first was placed near it, but beyond its reach. No means would be left untried to obtain the dainty morsel. It would rush forward as far as the chain permitted, and stretch out a fore-paw toward the object of its wishes to its utmost extent, which failing to reach it, the other was extended; again disappointed, the hind limbs were tried in succession, by which there was a nearer approach to the food, on account of the animal being chained by the neck.

On being offered food when hungry, or roused up suddenly from any cause, or when in active play, the eye was of a lustrous green, changing apparently the whole countenance.

It had a strong propensity to roll food and other things under its paws; segars in particular, especially when lighted. We have observed a similar propensity in young bears.

On placing a pail of water within its reach, it ran to it, and after drinking would examine the contents to the bottom with the fore-paws, seemingly expecting to find some fish or frog. If any thing was found it was speedily brought to the surface and scrutinized. We have seen it throw chips, bits of china and pebbles, &c., into the pail, and then fish them out for amusement, but never saw it put a particle of its food in to soak, except in a few instances when it threw in hard corn, but we do not think it was for this purpose. After playing for a short time in the water it would commonly urinate in it and then upset the pail.

We gave it a fish weighing two pounds. The Raccoon turned it in all directions in search of a convenient point of attack. The mouth, nose, fins, vent, &c., were tried. At length an opening was made at the vent, into which a paw was deeply inserted; the intestines were withdrawn and eaten with avidity. At the same time an attempt was made to insert the other paw into the mouth of the fish to meet its fellow. This disposition to use the paws in concert was shown in almost every action, sometimes in a very ludicrous manner. On giving the animal a jug, one paw would be inserted in the aperture, and a hundred twists and turns would be made to join its fellow on the outside.

After devouring as much of the fish as it wished, it placed the paws on the remainder, and lay down to doze until hunger returned; watching the favourite food, and growling at any animal which happened to pass near it. By degrees this propensity to defend its food passed off, and it would allow the dog or fox to partake of it freely. We placed a half-grown fox within its reach: the Raccoon instantly grasped it with its legs and paws, and commenced a close examination. It thrust its pointed nose in the ear of the fox to the very bottom, smelling and snuffing as if determined to find out the nature of the animal. During this time it showed no disposition to injure the fox.

The Raccoon can scent an object for some distance with accuracy. We suffered ours to go loose on one occasion, when it made directly for some small marmots confined in a cage in another room.

Our pet Raccoon, whose habits we are relating, evinced a singular propensity to listen to things at a distance, however many persons were around him, even though he might be at the moment eating a frog, of which food he was very fond. He would apparently hear some distant noise, then raise his head and continue listening, seeming every moment more absorbed; at last he would suddenly run and hide himself in his burrow. This seems to be connected with some instinct of the animal in his wild state, probably whilst sitting on a tree sunning himself, when he is in the habit of listening to hear the approach of an enemy, and then hurrying to his hole in the tree.

Enjoying the hospitality of a friend one night at his plantation, the conversation turned on the habits of animals: and in speaking of the Raccoon he mentioned that it fed on birds and rabbits generally, but in winter robbed the poultry houses. The negroes on his plantation he said kept good dogs, and relied on them for hunting the Raccoon.

Whenever a Raccoon was about to attack the poultry house, the dogs scenting him give a shrill cry, which is the signal for his owner to commence the hunt. He comes out armed with an axe, with a companion or two, resolved on a Raccoon hunt. The dog soon gives chase, with such rapidity that the Raccoon, hard pressed, takes to a tree. The dog, close at his heels, changes his whining cry while running to a shrill short sharp bark. If the tree is small or has limbs near the ground so that it can be easily ascended, the eager hunters climb up after the "coon." He perceives his danger, endeavours to avoid his pursuers by ascending to the farthest topmost branch, or the extremity of a limb; but all his efforts are in vain, his relentless pursuers shake the limb, until he is compelled to let go his hold, and he comes toppling heavily to the ground, and is instantly seized by the dogs. It frequently happens, however, that the trees are tall and destitute of lower branches, so that they cannot be climbed without the risk of of life or limb. The negroes survey for a few moments in the bright moonlight the tall and formidable tree that shelters the coon, grumble a little at the beast for not having saved them trouble by mounting an easier tree, and then the ringing of their axes resounds through the still woods, awakening echoes of the solitude previously disturbed only by the hooting of the owl, or the impatient barking of the dogs. In half an hour the tree is brought to the ground and with it the Raccoon, stunned by the fall; his foes give

him no time to define his position, and after a short and bloody contest with the dogs, he is despatched, and the sable hunters remunerated,—for his skin they will sell to the hatters in the nearest town, and his flesh they will hang up in a tree to freeze and furnish them with many a savoury meal.

The greatest number of Raccoons, however, are killed by log-traps set with a figure of 4 trigger, and baited with a bird or squirrel, an ear of corn, or a fish: either the appetite or curiosity of these animals will entice them into a trap or entangle them in a snare.

Another mode of destroying this species is by fire-hunting, which requires good shooting, as the animal only shows one eye from behind the branch of a tree, which reflecting the light of the fire-hunter's torch, shines like a ball of phosphorus, and is generally knocked out at twenty-five or thirty yards by a good marksman.

The Raccoon, like the bear, hibernates for several months during winter in the latitude of New York, and only occasionally and in a warm day leaves its retreat, which is found in the hollow of some large tree. We once, however, tracked in deep snow the footsteps of a pair of this species in the northern parts of New York, and obtained them by having the tree in which they lay concealed cut down. They had made a circle in company of about a mile, and then returned to their winter domicile.

ARTICLE XLII.—*On the Metamorphoses of Insects.*

(From Kirby and Spence's Introduction to Entomology.)

METAMORPHOSES OF INSECTS.

Were a Naturalist to announce to the world the discovery of an animal which for the first five years of its life existed in the form of a serpent, which then penetrating into the earth, and weaving a shroud of pure silk of the finest texture, contracted itself within this covering into a body without external mouth or limbs, and resembling, more than anything else, an Egyptian mummy, and which, lastly, after remaining in this state without food and without motion for three years longer, should at the end of that period burst its silken cerements, struggle through its earthy covering, and start into day a winged bird,—what think you would be the sensation excited by this strange piece of intelli-

gence? After the first doubt of its truth were dispelled, what astonishment would succeed! Amongst the learned, what surmises!—what investigations! Amongst the vulgar, what eager curiosity and amazement! All would be interested in the history of such an unheard-of phenomenon; even the most torpid would flock to the sight of such a prodigy.

But, you ask, "To what do all these improbable suppositions tend?" Simply to rouse your attention to the *metamorphoses* of the insect world, almost as strange and surprising, to which I am now about to direct your view,—miracles which, though scarcely surpassed in singularity by all that poets have feigned, and though actually wrought every day beneath our eyes, are, because of their commonness, and the minuteness of the objects, unheeded alike by the ignorant and the learned.

The butterfly which amuses you with his aërial excursions, one while extracting nectar from the tube of the honeysuckle, and then the very image of fickleness, flying to a rose as if to contrast the hue of its wings with that of the flower on which it reposes, did not come into the world as you now behold it. At its first exclusion from the egg, and for some months of its existence afterwards, it was a worm-like caterpillar, crawling upon sixteen short legs, greedily devouring leaves with two jaws, and seeing by means of twelve eyes so minute as to be nearly imperceptible without the aid of a microscope. You now view it furnished with wings capable of rapid and extensive flights; of its sixteen feet ten have disappeared, and the remaining six are in most respects wholly unlike those to which they have succeeded; its jaws have vanished, and are replaced by a curled-up proboscis suited only for sipping liquid sweets; the form of its head is entirely changed,—two long horns project from its upper surface; and instead of twelve invisible eyes, you behold two very large, and composed of at least seventeen thousand convex lenses, each supposed to be a distinct and effective eye!

Were you to push your examination further, and by dissection to compare the internal conformation of the caterpillar with that of the butterfly, you would witness changes even more extraordinary. In the former you would find some thousands of muscles, which in the latter are replaced by others of a form and structure entirely different. Nearly the whole body of the caterpillar is occupied by a capacious stomach. In the butterfly it has become converted into an almost imperceptible thread-like

viscus; and the abdomen is now filled by two large packets of eggs, or other organs not visible in the first state. In the former, two spirally-convoluted tubes were filled with a silky gum; in the latter, both tubes and silk have almost totally vanished; and changes equally great have taken place in the economy and structure of the nerves and other organs.

What a surprising transformation! Nor was this all. The change from one form to the other was not direct. An intermediate state not less singular intervened. After casting its skin, even to its very jaws, several times, and attaining its full growth, the caterpillar attached itself to a leaf by a silken girth. Its body greatly contracted: its skin once more split asunder, and disclosed an oviform mass, without exterior mouth, eyes, or limbs, and exhibiting no other symptom of life than a slight motion when touched. In this state of death-like torpor, and without tasting food, the insect existed for several months, until at length the tomb burst, and out of a case not more than an inch long, and a quarter of an inch in diameter, proceeded the butterfly before you, which covers a surface of nearly four inches square.

Almost every insect which you see has undergone a transformation as singular and surprising, though varied in many of its circumstances. That active little fly, now an unbidden guest at your table, * whose delicate palate selects your choicest viands one while extending his proboscis to the margin of a drop of wine, and then gaily flying to take a more solid repast from a pear or a peach; now gamboling with his comrades in the air, now gracefully carrying his furled wings with his taper feet, was but the other day a disgusting grub, without wings, without legs, without eyes, wallowing, well pleased, in the midst of a mass of excrement.

The "grey-coated gnat," whose humming salutation, while she makes her airy circles about your bed, gives terrific warning of the sanguinary operation in which she is ready to engage, was a few hours ago the inhabitant of a stagnant pool, more in shape like a fish than an insect. Then to have been taken out of the water would have been speedily fatal; now it could as little exist in any other element than air. Then it breathed through its tail; now through openings in its sides. Its shapeless head, in that period

* "Cœnis etiam non vocatus ut Musca advolo." Aristophon in *Pythagorista* apud Athenæum. (Mouffet, 56.)

of its existence, is now changed for one adorned with elegantly tufted antennæ, and furnished, instead of jaws, with an apparatus more artfully constructed than the cupping-glasses of the phlebotomist,—an apparatus which, at the same time that it strikes in the lancets, composes a tube for pumping up the flowing blood.

The "shard-born beetle," whose "sullen horn," as he directs his "droning flight" close past your ears in your evening walk, calling up in poetic association the lines in which he has been alluded to by Shakspeare, Collins, and Gray, was not in his infancy an inhabitant of air, the first period of his life being spent in gloomy solitude, as a grub, under the surface of the earth. The shapeless maggot which you scarcely fail to meet with in some one of every handful of nuts you crack, would not always have grovelled in that humble state. If your unlucky intrusion upon its vaulted dwelling had not left it to perish in the wide world, it would have continued to reside there until its full growth had been attained. Then it would have gnawed itself an opening, and, having entered the earth, and passed a few months in a state of inaction, would at length have emerged an elegant beetle, furnished with a slender and very long ebony beak, two wings, and two wing-cases, ornamented with yellow bands, six feet, and in every respect unlike the worm from which it proceeded.

That bee———but it is needless to multiply instances, a sufficient number has been adduced to show that the apparently extravagant supposition with which I set out may be paralleled in the insect world; and that the metamorphoses of its inhabitants are scarcely less astonishing than would be the transformation of a serpent into an eagle.

These changes I do not purpose explaining minutely in this place: they will be adverted to more fully in subsequent letters. Here I mean merely to give you such a general view of the subject as shall impress you with its claims to attention, and such an explanation of the states through which insects pass, and of the different terms made use of to designate them in each, as shall enable you to comprehend the frequent allusions which must be made to them in our future correspondence.

The states through which insects pass are four: the *egg*, the *larva*, the *pupa*, and the *imago*.

The first of these need not be here adverted to. In the *second*, or immediately after the exclusion from the egg, they are soft,

without wings, and in shape usually somewhat like worms. This Linné called the *larva* state, and an insect when in it a *larva*, adopting a Latin word signifying a *mask*, because he considered the real insect while under this form to be as it were masked. In the English language we have no common term that applies to the second state of all insects, though we have several for that of different tribes. Thus we call the coloured and often hairy larvæ of butterflies and moths *caterpillars;* the white and more compact larvæ of flies, many beetles, &c., *grubs* or *maggots;** and the depressed larvæ of many other insects *worms*. The two former terms I shall sometimes use in a similar sense, rejecting the last, which ought to be confined to true *vermes;* but I shall more commonly adopt Linné's term, and call insects in their second state *larvæ*.

In this period of their life, during which they eat voraciously and cast their skin several times, insects live a shorter or longer period, some only a few days or weeks, others several months or years. They then cease eating; fix themselves in a secure place; their skin separates once more, and discloses an oblong body, and they have now attained the *third* state of their existence.

From the swathed appearance of most insects in this state, in which they do not badly resemble in miniature a child trussed up like a mummy in swaddling clothes, according to the barbarous fashion once prevalent here, and still retained in many parts of the Continent, Linné has called it the *pupa* state, and an insect when under this form a *pupa*,—terms which will be here adopted in the same sense. In this state most insects eat no food; are incapable of locomotion; and, if opened, seem filled with a watery fluid, in which no distinct organs can be traced. Externally, however, the shape of the pupæ of different tribes varies considerably, and different names have been applied to them.

Those of the beetle and bee tribes are covered with a membraneous skin, enclosing in separate and distinct sheaths the external organs, as the antennæ, legs, and wings, which are conse-

---

* *Gentils*, or *gentles*, is a synonymous word employed by our old authors, but is now obsolete, except with anglers. Thus Tusser, in a passage pointed out to me by Sir Joseph Banks:—

"Reward not thy sheep when ye take of his cote
With twitches and patches as brode as a grote;
Let not such ungentlenesse happen to thine,
Least fly with her *gentils* do make it to pine."

quently not closely applied to the body, but have their form for the most part clearly distinguishable. To these Aristotle originally gave the name of *nymphæ*,* which was continued by Swammerdam and other authors prior to Linné (who calls them *incomplete* pupæ,) and has been adopted by many English writers on insects.

Butterflies, moths, and some of the two-winged tribe, are in their pupa state also enclosed in a similar membraneous envelope; but their legs, antennæ, and wings, are closely folded over the breast and sides; and the whole body enclosed in a common case or covering of a more horny consistence, which admits a much less distinct view of the organs beneath it. As these pupæ are often tinged of a golden colour, they were called from this circumstance *chrysalides* by the Greeks, and *aureliæ* by the Romans, both which terms are in some measure become anglicized; and though not applicable to ungilded pupæ, are now often given to those of all lepidopterous insects.† These by Linné are denominated *obtected* pupæ.

I have said that *most* insects eat no food in the pupa state. This qualification is necessary, because in the metamorphoses of insects, as in all her other operations, nature proceeds by measured steps,

---

* *Hist. Anim.* l. 5. c. 10.

† In explanation of the terms *Lepidopterous*, *Coleoptera*, &c., which will frequently occur in the following pages before coming regularly to definitions, it is necessary here to state that they have reference to the names given by entomologists to the different *orders* or tribes of insects, as under:—

1. *Coleoptera*, consisting of *Beetles*.
2. *Strepsiptera*, ——— of the genera *Xenos* and *Stylops*.
3. *Dermaptera*, ——— of the *Earwigs*.
4. *Orthoptera*, ——— of *Cockroaches*, *Locusts*, *Grasshoppers*, *Crickets*, *Spectres*, *Mantes*, &c.
5. *Hemiptera*, consisting of *Bugs*, *Cicadæ*, *Water-scorpions*, *Water-boatmen*, *Plant-lice*, *Cochineal Insects*, &c.
6. *Trichoptera*, consisting of the *flies* produced by the various species of *Case-worms*, *Phryganea*, L.
7. *Lepidoptera*, consisting of *Butterflies*, *Hawkmoths*, and *Moths*.
8. *Neuroptera*, consisting of *Dragon-flies*, *Ant-lions*, *Ephemeræ*, &c.
9. *Hymenoptera*, consisting of *Bees*, *Wasps*, and other insects armed with a *sting* or *ovipositor*, and its *valves*.
10. *Diptera*, consisting of *Flies*, *Gnats*, and other *two-winged* insects.
11. *Aphaniptera*, consisting of the *Flea* tribe.
12. *Aptera*, ——— of *Mites*, *Lice*, &c.

and a very considerable number (the tribe of locusts, cockroaches, bugs, spiders, &c.,) not only greatly resemble the perfect insect in form, but are equally capable with it of eating and moving. As these insects, however, cast their skins at stated periods, and undergo changes, though slight, in their external and internal conformation, they are regarded also as being subject to metamorphoses. These pupæ may be subdivided into two classes: first, those comprised, with some exceptions, under the Linnean *Aptera*, which in almost every respect resemble the perfect insect, and were called by Linné *complete* pupæ; and, secondly, those of the Linnean order *Hemiptera*, which resemble the perfect insect, except in having only the rudiments of wings, and to which the name of *semi-complete* pupæ was applied by Linné, and that of *semi-nymphs* by some other authors. There is still a fifth kind of pupæ, which are not, as in other instances, excluded from the skin of the larva, but remain concealed under it, and were hence called by Linné *coarctate* pupæ. These, which are peculiar to flies and some other dipterous genera, may be termed *cased-nymphs*.

When, therefore, we employ the term *pupa*, we refer indifferently to the third state of any insect, the particular order being indicated by the context, or an explanatory epithet. The terms *chrysalis* (dropping *aurelia*, which is superfluous,) *nymph*, *semi-nymph*, and *cased-nymph*, on the other hand definitely pointing out the particular sort of pupa meant: just as in Botany, the common term *pericarp* applies to all seed-vessels, the several kinds being designated by the names of capsule, silicle, &c.

The envelope of *cased-nymphs*, which is formed of the skin of the larva, considerably altered in form and texture, may be conveniently called the *puparium*; but to the artificial coverings of different kinds, whether of silk, wool, or earth, &c., which many insects of the other orders fabricate for themselves previously to assuming the pupa state, and which have been called by different writers, *pods*, *cods*, *husks*, and *beans*, I shall continue the more definite French term *cocon*, anglicized into *cocoon*.

After remaining a shorter or longer period, some species only a few hours, others months, others one or more years, in the pupa state, the enclosed insect, now become mature in all its parts, bursts the case which enclosed it, quits the pupa, and enters upon the fourth and last state.

We now see it (unless it be an apterious species) furnished with wings, capable of propagation, and often under a form

altogether different from those which it has previously borne—a perfect beetle, butterfly, or other insect. This Linné termed the *imago* state, and the animal that had attained to it the *imago;* because, having laid aside its *mask*, and cast off its *swaddling bands*, being no longer disguised or confined, or in any respect imperfect, it is now become a true representative or *image* of its species. This state is in general referred to when an insect is spoken of without the restricting terms larva or pupa.

Such being the singularity of the transformation of insects, you will not think the ancients were so wholly unprovided with a show of argument as we are accustomed to consider them, for their belief in the possibility of many of the marvellous metamorphoses which their poets recount. Utterly ignorant as they were of modern physiological discoveries, the conversion of a caterpillar into a butterfly must have been a fact sufficient to put to a nonplus all the sceptical oppugners of such transformations. And however we may smile, in this enlightened age, at the inference drawn not two centuries ago by Sir Theodore Mayerne, the editor of Mouffet's Work on Insects, "that if animals are transmuted so may metals," * it was not, in fact, with his limited knowledge on these subjects, so very preposterous. It is even possible that some of the wonderful tales of the ancients were grafted on the changes which they observed to take place in insects. The death and revivification of the phœnix, from the ashes of which, before attaining his perfect state, arose first a *worm* (*Scolex*,) in many of its particulars resembles what occurs in the metamorphoses of insects. Nor is it very unlikely that the doctrine of the metempsychosis took its rise from the same source. What argument would be thought by those who maintained this doctrine more plausible, in favor of the transmigration of souls, than the seeming revivification of the dead *chrysalis?* What more probable than that its apparent re-assumption of life should be owing to its receiving for tenant the soul of some criminal doomed to animate an insect of similar habits with those which had defiled his human element? †

---

* Epist. Dedicat.

† "A priest who has drunk wine shall migrate into a moth or fly, feeding on ordure. He who steals the gold of a priest shall pass a thousand times into the bodies of spiders. If a man shall steal honey, he shall be born a great stinging gnat; if oil, an oil-drinking beetle; if salt, a cicada; if a household utensil, an ichneumon fly." *Institute of Menu*, 353.

At the present day, however, the transformations of insects have lost that excess of the marvellous, which might once have furnished arguments for the fictions of the ancients, and the dreams of Paracelsus. We call them metamorphoses and transformations, because these terms are in common use, and are more expressive of the sudden changes that ensue than any new ones. But, strictly, they ought rather to be termed a series of developments. A caterpillar is not, in fact, a simple but a compound animal, containing within it the germ of the future butterfly, enclosed in what will be the case of the pupa, which is itself included in the three or more skins, one over the other, that will successively cover the larva. As this increases in size these parts expand, present themselves, and are in turn thrown off, until at length the perfect insect, which had been concealed in this succession of masks, is displayed in its genuine form. That this is the proper explanation of the phenomenon has been satisfactorily proved by Swammerdam, Malpighi, and other anatomists. The first-mentioned illustrious naturalist discovered, by accurate dissections, not only the skins of the larva and of the pupa encased in each other, but within them the very butterfly itself, with its organs indeed in an almost fluid state, but still perfect in all its parts. * Of this fact you may convince yourself without Swammerdam's skill, by plunging into vinegar or spirit of wine a caterpillar about to assume the pupa state, and letting it remain there a few days for the purpose of giving consistency to its parts; or by boiling it in water for a few minutes. A very rough dissection will then enable you to detect the future butterfly; and you will find that the wings, rolled up into a sort of cord, are lodged between the first and second segment of the caterpillar; that the antennæ and trunk are coiled up in front of the head; and that the legs, however different their form, are actually sheathed in its legs. Malpighi discovered the eggs of the future moth in the chrysalis of a silk-worm only a few days old, † and Reaumur those of another moth (*Hypogymna dispar*) even in the caterpillar, and that seven or eight days before its change into the pupa. ‡ A caterpillar, then, may be regarded as a locomotive egg, having for its embryo the included butterfly, which after a

* Hill's *Swamm.* ii. 24, t. 37. f. 2. 4.

† *De Bombyce* 29.

‡ Reaum. i. 359.

certain period assimilates to itself the animal substances by which it is surrounded; has its organs gradually developed; and at length breaks through the shell which encloses it.

This explanation strips the subject of every thing miraculous, yet by no means reduces it to a simple or uninteresting operation. Our reason is confounded at the reflection that a larva, at first not thicker than a thread, includes the germs of its own triple, or sometimes octuple, teguments; the case of a chrysalis, and of a butterfly, all curiously folded in each other; with an apparatus of vessels for breathing and digesting, of nerves for sensation, and of muscles for moving; and that these various forms of existence will undergo their successive evolutions, by aid of a few leaves received into its stomach. And still less able are we to comprehend how this organ should at one time be capable of digesting leaves, at another only honey; how one while a silky fluid should be secreted, at another none; or how organs at one period essential to the existence of the insect should at another be cast off, and the whole system which supported them vanish. *

Nor does this explanation, though it precludes the idea of that resemblance, in every particular, which, at one time, was thought to obtain between the metamorphosis of insects, especially of the *Lepidoptera* order, and the resurrection of the body, do away that general analogy which cannot fail to strike every one who at all considers the subject. Even Swammerdam, whose observations have proved that the analogy is not so complete as had been imagined, speaking of the metamorphosis of insects, uses these strong words: "This process is formed in so remarkable a manner in butterflies, that we see therein the resurrection painted before our eyes, and exemplified so as to be examined by our hands." † To see, indeed, a caterpillar crawling upon the earth sustained by the most ordinary kinds of food, which, when it has existed a few weeks or months under this humble form, its appointed work being finished, passes into an intermediate state of seeming death, when it is wound up in a kind of shroud and encased in a coffin,

* Dr. Herold (*Entwickelungs geschichte der Schmetterlinge.*) and other modern physiologists, deny that the germs of the skins of the caterpillar and chrysalis and of the future butterfly exist in the young caterpillar; but, for reasons assigned in detail in another place (vol. iii. edit. 5. pp. 52—62.) the theory of Swammerdam and Bonnet, as above explained, is here preferred.

† Hill's *Swamm.* i. 127. a.

and is most commonly buried under the earth (though sometimes its sepulchre is in the water, and at others in various substances in the air,) and after this creature and others of its tribe have remained their destined time in this death-like state, to behold earth, air, and water give up their several prisoners: to survey them, when, called by the warmth of the solar beam, they burst from their sepulchres, cast off their cerements, from this state of torpid inactivity, come forth, as a bride out of her chamber,—to survey them, I say, arrayed in their nuptial glory, prepared to enjoy a new and more exalted condition of life, in which all their powers are developed, and they are arrived at the perfection of their nature; when no longer confined to the earth they can traverse the fields of air, their food is the nectar of flowers, and love begins his blissful reign;—who that witnesses this interesting scene can help seeing in it a lively representation of man in his threefold state of existence, and more especially of that happy day, when, at the call of the great Son of Righteousness, "all that are in the graves shall come forth; the sea shall give up her dead, and death being swallowed up of life, the nations of the blessed shall live and love to the ages of eternity?"

But although the analogy between the different states of insects and those of the body of man is only general, yet it is much more complete with respect to his soul. He first appears in his frail body—a child of the earth, a crawling worm, his soul being in a course of training and preparation for a more perfect and glorious existence. Its course being finished, it casts of the earthly body, and goes into a hidden state of being in Hades, where it rests from its works, and is prepared for its final consummation. The time for this being arrived, it comes forth clothed with a glorious body, not like its former, though germinating from it, for, though "*it is sown an animal body, it shall be raised a spiritual body*," endowed with augmented powers, faculties, and privileges commensurate to its new and happy state. And here the parallel holds perfectly between the insect and the man. The butterfly, the representative of the soul, is prepared in the *larva* for its future state of glory; and if it be not destroyed by the ichneumons and other enemies to which it is exposed, symbolical of the vices that destroy the spiritual life of the soul, it will come to its state of repose in the *pupa*, which is its Hades; and at length, when it assumes the *imago*, break forth with new powers and beauty to its final glory and the reign of love. So that in this view of the subject well might the Italian poet exclaim:—

Non v' accorgete voi, che noi siam' vermi,
Nati a formar l' angelica farfalla? *

The Egyptian fable, as it is supposed to be, of Cupid and Psyche, seems built upon this foundation. "Psyche," says an ingenious and learned writer, "means in Greek the human soul; and it means also a butterfly, † of which apparently strange double sense the undoubted reason is that a butterfly was a very ancient symbol of the soul: from the prevalence of this symbol, and the consequent coincidence of the names, it happened that the Greek sculptors frequently represented Psyche as subject to Cupid in the shape of a butterfly; and that even when she appears in their works under the human form, we find her decorated with the light and filmy wings of that gay insect." ‡

The following beautiful little poem falls in so exactly with the subject I have been discussing, that I cannot resist the temptation I feel to copy it for you, especially as I am not aware that it has appeared anywhere but in a newspaper:—

THE BUTTERFLY'S BIRTH-DAY.

BY THE AUTHOR OF "THE BUTTERFLY'S BALL."

The shades of night were scarcely fled;
The air was mild, the winds were still;
And slow the slanting sun-beams spread
O'er wood and lawn, o'er heath and hill:

From fleecy clouds of pearly hue
Had dropt a short but balmy shower,
That hung like gems of morning dew
On every tree and every flower:

And from the blackbird's mellow throat
Was pour'd so loud and long a swell,
As echoed with responsive note
From mountain side and shadow dell.

---

* Do you not perceive that we are caterpillars, born to form the angelic butterfly?

† It is worthy of remark that in the north and west of England the moths that fly into candles are called *saules* (souls,) perhaps from the old notion that the souls of the dead fly about at night in search of light. For the same reason, probably, the common people in Germany call them *ghosts* (geistchen.)

‡ Nare's *Essays*, i. 101, 102.

When bursting forth to life and light,
The offspring of enraptured May,
The BUTTERFLY, on pinions bright,
Launch'd in full splendour on the day.

Unconscious of a mother's care,
No infant wretchedness she knew;
But as she felt the vernal air,
At once to full perfection grew.

Her slender form, ethereal light,
Her velvet-textured wings unfold;
With all the rainbow's colours bright,
And dropt with spots of burnish'd gold.

Trembling with joy awhile she stood,
And felt the sun's enlivening ray;
Drank from the skies the vital flood,
And wondered at her plumage gay!

And balanced oft her broidered wings,
Through fields of air prepared to sail:
Then on her vent'rous journey springs,
And floats along the rising gale.

Go, child of pleasure, range the fields,
Taste all the joys that spring can give,
Partake what bounteous summer yields,
And live whilst yet, tis time to live.

Go sip the rose's fragrant dew,
The lily's honeyed cup explore,
From flower to flower the search renew,
And rifle all the woodbine's store:

And let me trace thy vagrant flight,
Thy moments too of short repose,
And mark thee then with fresh delight
Thy golden pinions ope and close.

But hark! whilst thus I musing stand
Pours on the gale an airy note,
And breathing from a viewless band,
Soft silvery tones around me float!

— They cease—but still a voice I hear,
A wisper'd voice of hope and joy,
"Thy hour of rest approaches near,
"Prepare thee, mortal!—thou must die!

"Yet start not!—on thy closing eyes
"Another day shall still unfold,
"A sun of milder radiance rise,
"A happier age of joys untold.

"Shall the poor worm that shocks thy sight,
"The humblest form in nature's train,
"Thus rise in new-born lustre bright,
"And yet the emblem teach in vain?

"Ah! where were once her golden eyes,
"Her glittering wings of purple pride?
"Concealed beneath a rude disguise,
"A shapeless mass to earth allied.

"Like thee the hapless reptile lived,
"Like thee he toil'd like thee he spun,
"Like thine his closing hour arrived,
"His labour ceased, his web was done.

"And shalt thou, number'd with the dead,
"No happier state of being know?
"And shall no future morrow shed
"On thee a beam of brighter glow?

"Is this the bound of power divine,
"To animate an insect frame?
"Or shall not He who moulded thine
"Wake at his will the vital flame.

"Go, mortal! in thy reptile state,
"Enough to know to thee is given;
"Go, and the joyful truth relate;
"Frail child of earth! high heir of heaven!"

A question here naturally presents itself—Why are insects subject to these changes? For what end is it that, instead of preserving, like other animals,* the same general form from

* A few verterbrate animals, viz., frogs, toads, and newts, undergo metamorphoses in some respects analogous to those of insects; their first form as tadpoles being very different from that which they afterwards assume. These reptiles, too, as well as snakes, cast their skin by an operation somewhat similar to that in *larvæ*. There is nothing, however, in their metamorphoses at all resembling the *pupa* state in insects. (See, however, Von Baer's article on the Analogies of the Transformations of Insects and the Higher Animals in the *Annales des Sciences Nat.*) According to Mr. J. V. Thompson, both the common barnacles and many *crustacea* undergo metamorphoses, but to what extent these changes take place in the latter does not seem clearly ascertained.

infancy to old age, they appear at one period under a shape so different from that which they finally assume; and why should they pass through an intermediate state of torpidity so extraordinary? I can only answer that such is the will of the Creator, who doubtless had the wisest ends in view, although we are incompetent satisfactorily to discover them. Yet one reason for this conformation may be hazarded. A very important part assigned to insects in the economy of nature, as I shall hereafter show, is that of speedily removing superabundant and decaying animal and vegetable matter. For such agents an insatiable voracity is an indispensible qualification, and not less so unusual powers of multiplication. But these faculties are in a great degree incompatible. An insect occupied in the work of reproduction could not continue its voracious feeding. Its life, therefore, after leaving the egg, is divided into three stages. In the first, as *larva*, it is in a state of sterility; its sole object is the satisfying its insatiable hunger; and, for digesting the masses of food which it consumes, its intestines are almost all stomach. This is usually by much the longest period of its existence. Having now laid up a store of materials for the development of the future perfect insect, it becomes a *pupa;* and during this inactive period the important process slowly proceeds, uninterrupted by the calls of appetite. At length the perfect insect is disclosed. It now often requires no food at all; and scarcely ever more than a very small quantity; for the reception of which its stomach has been contracted, in some instances, to a tenth of its former bulk. Its almost sole object is now the multiplication of its kind, from which it is diverted by no other propensity; and this important duty being performed, the end of its existence has been answered, and it expires.

It must be confessed that some objections might be thrown out against this hypothesis, yet I think none that would not admit of a plausible answer. To these it is foreign to my purpose now to attend, and I shall conclude this letter by pointing out to you the variety of new relations which this arrangement introduces into nature. One individual unites in itself, in fact, three species, whose modes of existence are often as different as those of the most distantly related animals of other tribes. The same insect often lives successively in three or four worlds. It is an inhabitant of the water during one period, of the earth during another and of the air during a third; and fitted for its various abodes by

new organs and instruments, and a new form in each. Think (to use an illustration of Bonnet) but of the cocoon of the silk-worm! How many hands, how many machines does not this little ball put in motion! Of what riches should we not have been deprived, if the moth of the silk-worm had been born a moth, without having been previously a caterpillar! The domestic economy of a large portion of mankind would have been formed on a plan altogether different from that which now prevails.

I am, &c.

ARTICLE XLIII.—*On the Classification of Fishes. With particular reference to the Fishes of Canada.*—By FRANK FORELLE.

Fishes belong to the first department of the animal kingdom, the Vertebrata, having an internal skeleton, with a back-bone for its axis, yet occupying the lowest position in that department, as will be seen by referring to the first number of this Magazine. They have red blood, not warm like that of the animals comprised in the first and second classes of this department, the mammals and birds, but cold like that of the reptiles. They are destitute of lungs, and on this account they cannot live in the air, for their blood is oxygenized through the medium of water passing between their branchiæ or gills. These are for the most part composed of thin plates or laminæ, fixed on arches, called the branchial arches, and are covered with countless minute blood vessels, which are so arranged as to present a large surface to the water, which in most fishes is taken in at the mouth and expelled at the aperture under the gill covers, so as to keep a constant current passing through the gills to renew the supply of oxygen.

Their heart is unilocular, that is, it is not divided into two auricles and two ventricles, as in mammals and birds, nor yet into two auricles and one ventricle as in reptiles, but has only one auricle and one ventricle. The blood in its circulation passes from the auricle into the ventricle and from thence into the gills, where it is brought into close proximity to the air diffused through the water, and having been thus aërated is distributed by arteries through the system, and returned by the veins to the auricle.

Fishes are variously covered: some have imbricate scales, as the Perch; some have bony shields or plates, as the Sturgeon; some are covered with a rough shagreen like skin, as the Shark; and

others only by a smooth mucous skin, as some of the Catfishes. The scales are of two kinds: one kind is composed of a substance resembling horn; the other is harder and quite enamel-like in its appearance, and may be seen on the Garfishes. For the most part fishes are oviparous, reproducing by eggs, and these usually are fecundated after they are laid; but the distinction between oviparous and viviparous animals has lost its importance since modern science has shewn that there is a period in the existence of every animal when it was enclosed in an egg. The limbs of fishes are adapted in form to suit the element in which they move, so that instead of arms and legs they have fins. Those on the back are called dorsal fins; the one that forms the tail is the caudal fin; the fins on the under side, which are placed vertically, are called anal fins; the remainder are arranged in pairs, one fin on each side: the pair nearest the head are called pectoral fins; the other pair, usually placed behind the pectorals, though sometimes found just beneath them, are the ventral fins. The number of dorsal and of anal fins varies in different species, but there is never more than one caudal, nor more than one pair of pectorals or of ventrals; but in some species the ventrals are absent, and in others the ventrals and pectorals are both wanting. The fins are a membrane, usually thin, supported and extended by rays. Some of these rays are composed of a single continuous bony spine, hard and often sharply pointed, and these are called spinous rays; others are formed of numerous small bones articulated upon each other, often branching out towards their extremities into several filaments, which, from their structure, are soft and flexible, and are called indifferently soft rays, flexible rays or articulated rays. Some fins are composed part of spinous rays and part soft rays, like the dorsal fin of the Rock Bass, *Centrarchus æneus;* some are wholly spine-rayed, like the first dorsal of the American Sandre, *Lucioperca Americana;* and some are wholly soft-rayed, like the fins of the common Pickerel, *Esox reticulatus*

The teeth are usually a simple spine, very acute, and curving inward at the tip, and are arranged sometimes in single rows, sometimes in double and sometimes in cards. They are to be met with on the tongue, the vomer, the palatal bones, the maxillaries, intermaxillaries, and on the pharangeal bones, and their presence or absence is of much importance often in determining the species. The vomer is the bone in the centre of the roof of the mouth; the palatal bones are those lying on each side of the vomer, and

forming the greater portion of the roof of the mouth; the intermaxillaries usually form the greater part of the upper jaw, the maxillaries lying behind them, and articulating with the vomer, though in some fishes, as the Salmones, the intermaxillaries and maxillaries form one continuous arch; the pharyngeal bones are located in the pharynx, the cavity leading to the œsophagus or gullet.

It is thought that the senses of taste and of touch are but imperfectly developed, and that those of sight and smell are much more acute, while their power of hearing has been wholly doubted, though it is now generally believed that they can hear. They certainly possess some sense which enables them to find the bait in the darkness of night, many feet down, in waters that break and boil like a caldron, when the eye of man could barely discern the white crests on the rapids.

There is a line more or less distinct along each side of the body, extending from the gill-covers to the tail, known as the lateral line. It is formed by a series of tubes, whose office is to pour out a slimy secretion, which covers and lubricates the body of the fish. The gill-covers are usually composed of four bones: the anterior one is called the pre-opercle; the next and usually the largest bone is the opercle; at the posterior edge of the opercle is a bone called the sub-opercle, and at the inferior edge of the pre-opercle is usually a small bone called the inter-opercle.

Most fishes are carnivorous, preying upon worms, insects and smaller fishes, even those of their own species; a few subsist mainly upon vegetable substances.

Of the several systems of classification that have been propounded, that of Cuvier has been the most extensively employed, and though more extensive acquaintance with this branch of Natural History proves the system to be somewhat too artificial, yet it is indispensable that the student understand it thoroughly. Observing that some fishes had a bony skeleton of fibrous texture, and that others had a cartilaginous skeleton without fibres, Cuvier divided all fishes into two great series, and called one of them the Osseous Series and the other the Cartilaginous Series. The osseous or bony series comprises by far the greater number, and this series he subdivided into three sections, which are based chiefly upon the differences observable in the construction of the gills and jaws. The first section is called PECTINIBRANCHII, from *pecten*, a comb, and *branchiæ*, gills, the gills being arranged in comb-

like ridges; the second, PLECTOGNATHI, from *pleko*, to connect, and *gnathos*, a jaw, the maxillary and intermaxillary bones being connected or soldered together on the sides, to form the upper jaw; the third, LOPHOBRANCHII, from *lophos*, a tuft, and *branchiæ*, gills, the gills being arranged in small round tufts. The first section he again divided into three orders, founded upon differences in their fins. Those which have spinous rays in the dorsal fins he placed in the first order, which he called ACANTHOPTERYGII, from *acanthos*, a spine, and *pteryx*, a wing or fin. Of this order are the Yellow Perch, *Perca flavescens*, the common Pondfish, *Pomotis vulgaris*, the Black Bass, *Grystes nigricans*, &c. In the second order he arranged those which have only soft rays, excepting sometimes the first ray of the dorsal and pectoral fins, and called this order MALACOPTERYGII, from *malacos*, soft, and *pteryx*, a fin. Of this order he made two divisions, according to the position of the ventral fins: those having their ventrals attached to the walls of the abdomen, he called ABDOMINAL MALACOPTERYGII; those having them placed very near to the pectorals, with the bones supporting them, attached to the bones of the shoulder, he called SUBBRACHIAL MALACOPTERYGII. The abdominal soft-rayed fishes can be studied in the common Pickerel, *Esox reticulatus*, the Brook Trout, *Salmo fontinalis*, the common Catfish, *Pimelodus catus*, &c. In the subbrachial division will be found the American Codfish, *Morrhua Americana*, the Halibut, *Hippoglossus vulgaris*, &c. Those which had no ventral fins he formed into a third order, which he denominated APODAL, from *a*, negative, and *pous*, a foot. This order the student will notice in the common Eel, *Anguilla tenuirostris*.

The second section, PLECTOGNATHI, embraces the Balloonfishes, Puffers, Filefishes, &c. The third section, LOPHOBRANCHII, contains the Pipefishes, &c; neither of them, however, so far as I am informed, have any representatives in our waters.

Cuvier divided the cartilaginous fishes also into three orders: the first order he called, ELEUTHEROPOMI, from *eleutheros*, free, and *poma*, a cover, in which he placed those fishes of this series which have free pectinated gills, with an aperture on each side, covered by an opercle; this order may be studied in the Sturgeons, ACIPENSERIDÆ. The second order embraces those which have the gills fixed by their external edges, with five small external openings on each side, but without any gill-cover, and is called PLAGIOSTOMI, from *plagios*, curved, and *stoma*, a mouth; in this order is found the Sharks, SQUALIDÆ, and Rays, RAIIDÆ.

In the third order is placed those having purse-shaped gills, fixed and opening outwards, with a circular mouth, and is called CYCLOSTOMI, from *kuklos*, a circle, and *stoma*, a mouth; this order may be studied in the Lampreys, PETROMYZONTIDÆ.

The different orders are divided into families; the families are again divided into genera, and each genus comprises one or more species. The order ACANTHOPTERYGII, or spine-rayed fishes, is divided now into perhaps twenty different families; of these the first is the PERCIDÆ, the Perch family, so named because the Perch may be considered as the type of all the fishes included in this family. This family includes a large number of genera, several of which may be met with in our waters. Of these perhaps the genus Perca is the most widely disseminated in our lakes and streams, though it has but one species in America, the Yellow Perch, *Perca flavescens*. Dekay, in the Natural History of New York, has described five different species, relying on the authority of Cuvier; but Agassiz says that the differences upon which they are based are not constant characters, and that after comparing specimens from Sault St. Mary, Lake Huron, the waters of Massachusetts, New York and Pennsylvania, he has seen the same variations occuring in each of the supposed species, and is satisfied of their specific identity. The Yellow Perch has two dorsal fins, barely separate from each other, about three-tenths of an inch; the first has thirteen spinous rays, the second has the first two spinous, and fifteen soft rays. There are fifteen soft rays in the pectoral, and one spinous and five soft rays in the ventrals; the anal fin has two spinous and eight soft rays, and the caudal seventeen soft rays. The number of the fin rays is often stated in scientific works in a brief formula, and those of the Perch would be given thus, D. 13, II, 16; P.15; V. I, 5; A. II, 8; C. 17. The rays which support the membrane lying beneath the gill-covers are called the Branchiostegous rays, and in the Yellow Perch are seven in number. On the side the color is yellow, though varying much in brilliancy in different waters, with several dark vertical bands across the back, extending quite on to the sides; the pectoral, ventral and anal fins are a bright orange, the dorsals and caudal greenish; the iris is golden yellow, and the pupil of the eye is black.

This handsome fish is also very hardy, and can be easily transported from one pond to another, while the sharp spines of his dorsal fin serve as a good defence against the attacks of those fresh

water sharks, the Pickerels. He bites boldly at the worm or the minnow, and with light tackle affords considerable sport for a few minutes, for he pulls strong and struggles vigorously while his strength lasts. Nor is he by any means to be despised by the inland angler, for though not often exceeding a pound in weight, nicely broiled or fried he is very acceptable.

Also the genus Labrax has a representative, in Lakes Erie and Ontario, in the White Lake Bass, *Labrax albidus*. This genus is distinguished by having a disk or bands of teeth on the tongue, the dorsal fins distant and separate, and teeth on both jaws, and on the vomer and the palatine bones. The White Lake Bass seldom exceeds fifteen inches in length, is of a bluish white on the back, white on the sides, with a few narrow dusky stripes running parallel with the lateral line, and white on the belly. The fins have a bluish tinge; iris white, mixed with a little brown; pupil black; the fin rays are D. IX, I, 13; P. 17; V. I, 5; A. III, 12; C. 17.

It is probable that another species of this genus, the Striped Sea Bass, *Labrax lineatus*, ascends the Saint Lawrence to spawn.

The genus Lucioperca is also found in nearly all our waters. Agassiz is of the opinion that there is but one American species of this genus, and that the *Lucioperca Canadensis* of H. Smith and the *L. grisea* of Dekay are nothing more than the *L. Americana*. This fish, the Lucioperca Americana, has been very generally called Pike, Yellow Pike, or Pickerel, although it is not a Pickerel at all, not even belonging to the same order as the Pickerels. Dekay has translated the Latin name, and calls it Pikeperch, but the analogous European fish is called *Sandre*, and this might with great propriety be called the *American Sandre*.

The Canadian student will also find the genus Grystes: it is nobly reprensented by the Black Bass, *Grystes nigricans;* also the genus Centrarchus, of which we have but one species, the Rock Bass, *Centrarchus æneus;* and the genus Pomotis, which he can study in the common Pondfish, *Pomotis vulgaris*.

The fourth family of this order, the SCIENIDÆ, so called from the Maigres, *Scienæ*, being the type, is represented in Canadian waters by the genus CORVINA, of which there are two species, the Malasheganay, *Corvina Richardsonii*, found only in the lakes above Niagara Falls, and the Lake Sheepshead, *Corvina oscula*, which is as abundant below the Falls as it is above. The first is an excellent fish, and always considered a prize; the second is tough

and tasteless, a pest to the angler for Black Bass, for running in company with the latter, he often takes the bait designed for his betters.

The family SCOMBRIDÆ, of which the Mackerel is the type, contains the Spring Mackerel, *Scomber vernalis*, the Fall Mackerel, *Scomber grex*, the Tunny, *Thynnus vulgaris*, the Swordfish, *Xiphias gladius*, the Bluefish, *Temnodon saltator*, &c., inhabitants of the ocean.

The family GOBIDÆ is probably represented in the waters off our costs by the genus Zoarces, which contains the Thick lipped Eelpout, *Zoarces anguillaris*, and by the genus Anarrhicas, to which belongs the Sea Wolf, *Anarrhicas lupus*.

So also the family LOPHIDÆ, to which belongs the American Angler, *Lophius Americanus*, and the Toadfishes, BATRACHII, and likewise the family LABRIDÆ, in which is the Cunner, *Ctenolabrus cereuleus*, are no doubt met with on our shores.

In the abdominal division of the Malacopterygii are six families, which are widely diffused through the lakes and streams of Canada, namely, SILURIDÆ, CYPRINDÆ, ESOCIDÆ, SALMONIDÆ, CLUPIDÆ, and SAURIDÆ.

The only representative of SILURIDÆ that we have is the genus Pimelodus, of which there are several species. The most widely known is the common Catfish *Pimelodus catus*, which frequents nearly every muddy bottom to be found in our ponds, lakes and streams. This fish has the first ray of the dorsal and pectoral fins spinous, thus forming an exception to the rule in soft-rayed fishes, as every angler well knows who has had occasion to take them from his hook, and in unsuspecting haste rushed upon the sharp points and yet sharper seratures of these formidable spines. There is also the Channel Catfish, *Pimelodus nigricans*, at once distinguished from the former by his forked tail and the irregular round black spots on the body. Agassiz describes a species found in Lake Superior, to which he has given the name *Pimelodus felis*. This genus will reward the student's careful examination of every individual that falls under his notice, for the scientific world is yet in doubt as to the number of species that should compose Pimelodus proper.

In CYPRINIDÆ, the Carp family, we have several species of the genus Catastomus and of the genus Leuciscus. The common Sucker, *Catastomus communis*, and the Mullet Sucker, *Catastomus aureolus*, are perhaps the most common species of this genus.

Here also there is opportunity for careful examination by the Canadian student, as accurate descriptions of the different species are very much needed. Agassiz has recently given a description of two species from Lake Superior, with which comparison may be instituted in the study of specimens, and order be brought out of the present confusion. There is a great multiplicity of species of the genus Leuciscus ; how many of them will be found in our waters I am not prepared to say: doubtless there is the Black-nosed Dace, *Leuciscus atronasus*, in many places called the Brook Minnow, the Redfin or Rough-head, *Leuciscus cornutus*, and the Shining Dace, *Leuciscus nitidus*. Indeed I am quite sure I have seen the two latter in the streams in the neighborhood of Lake Memphremagog. Agassiz describes two new species from Lake Superior, closely resembling *Leuciscus cornutus*, which he calls *Leuciscus frontalis* and *Leuciscus gracilis*, and probably other species will be found in our streams and lakes by the careful Naturalist.

The Pickerel family, *Esocidæ*, seems to be at home in Canadian waters, and the careful student will be very likely to meet with new and undescribed species of the genus Esox, to which belongs the great Mascalonge, *Esox estor*, the common Pickerel, *Esox reticulatus*, the Northern Pickerel, *Esox Boreus*. I have been informed by an enthusiastic student of nature, who has the means of knowing, that the Ojibway Indians call our *Esox estor* the Maskinongé, whence it has been corrupted into Mascalonge.

The Salmon family, SALMONIDÆ, are peculiar to the northern temperate regions; and between the great lakes and Arctic seas will be found several genera, each of which includes a number of species. The noble Salmon is the type of this family, to which an article has been devoted in a previous number, and to the same genus belong that speckled beauty, the Brook Trout, *Salmo fontinalis*, and the great Lake Trout, *Salmo namaycush*, the Siskawitz, *Salmo siskawitz*, recently discovered by Agassiz in Lake Superior, the Salmon Trout, *Salmo trutta*, which is found only in the Gulf of St. Lawrence and in the estuaries of New Brunswick and Nova Scotia, and the Masamacush, *Salmo Hoodii*. To this family belongs the genus Coregonus, the species of which fall so naturally into two groups that Agassiz proposes to divide them into two genera, calling the group which have the lower jaw longer than the upper ARGYROSOMUS, and for that which has the upper jaw longer than the lower retain the

name of COREGONUS. This genus may be studied in the *Attihawmeg* or Whitefish, and what in the neighborhood of the Lakes are called Herring, though they are not herring at all, but a species of *Coregonus.*

The Herring family, CLUPIDÆ, may be studied on the coast in the American Herring, *Clupea elongata*, and in the American Alewive, *Alosa tyrannus;* in our inland waters it is represented by the genera Hyodon and Amia, of which will be found the Lake Mooneye, *Hyodon clodulis*, and the Dog-fish, *Amia ocellicauda.*

The family SAURIDÆ is peculiarly interesting, from the close resemblance to the Saurian fishes of past geological ages. It may be studied in the genus Lepidosteus, the Garfishes, which are found in the great chain of lakes from Lake St. Clair to the Gulf of the St. Lawrence. A careful study of its embryology, in the opinion of Agassiz, would throw great light upon the history of the succession of fishes of all geological periods, and indicate the manner in which the separation of true iethyological characters from reptilian was introduced. I know not whether we have more than one species in Canada, the *Lepidosteus Huronensis.*

In the subbrachial division of the soft-rayed fishes are two families largely represented on our coast, the GADIDÆ and PLEURONIDÆ. The former can be studied in the American Codfish, *Morrhua Americana*, the Haddock, *Morrhua æglefinis*, the American Hake, *Merlucius albidus*, &c.; the latter in the Halibut, *Hyppoglossus vulgaris*, the Flatfishes, *Platessa plana*, &c.

The fishes of Canada present to the student of nature a large field of observation as yet but partially traversed, and one which will well repay minute investigation, one where he may hope to find species hitherto unobserved and undescribed, and where, by a more careful description and comparison of those already noted, he may contribute much to the progress of science. Let him not think minute examination unnecessary, for it is from the most minute examination of individuals that we derive our grandest generalizations; it is by making sure each step in our progress that we gain those heights which enable us to take in at one view the grand scheme of creation, and trace its beautiful unity from the days when fishes were the sole representatives of the vertebrates down to the last act of creative power, man.

ARTICLE XLIV.—*On some of the Game Birds of Canada.*

The Partridge or Quail, (*Ortyx Virginiana.*)

This bird, so well known in Western Canada, does not, so far as we have been able to learn, occur in any part of the Province east of Kingston, at the lower end of Lake Ontario. Even there, we are informed, it is but rarely seen. It is probable that the pine clad forests of the Laurentian series of rocks have been an effectual bar against its progress in that direction. The bird is a denizen of the treeless plains, or open forests; and as these seldom occur on the rugged ridges of hills, which characterize the formations we have mentioned, the Partridge cannot there support existence. So true it is that the Geology of a country exerts an influence over its Zoology. No doubt that if the plains of the west extended further to the east the Partridge would also be found ranging into Lower Canada. It is a species, however, of the warmer and more temperate regions, and it could not therefore proceed much further north of its present dominion. The following accounts of the natural history of this bird, we have gleaned from several authors:

"In their natural, undisturbed state, Partridges delight in the open country, frequenting without fear the stubble fields appertaining to the well-cultivated farms of our agriculturists, where they can obtain a plentiful supply of loose grain. The morning and evening is the time when Partridges feed. When the weather is favorable, they leave their roost at an early hour of the day, and, being very industrious feeders, they are soon able to retire from the open fields to some favorite and secluded spot, to bask themselves in the mid-day sun, or roll themselves in the dust to rid their plumage of the vermin with which all birds more or less are infested.

"Partridges are not strictly migratory birds, as the greater portion of them remain distributed throughout the northern portions of our country during the whole winter, and not unfrequently suffer immensely from the intense cold and deep snows; still, at that period of the autumn known as the "running season," large numbers abandon their former haunts, and, continuing along the borders of our rivers, take up their abode for a time in the low-land [illegible] hundreds of miles, perhaps, from their breeding places. In

the northern sections of our country, the ground is frequently covered for weeks with snow; and, all access to food being thus cut off, these poor birds, driven by stern necessity, often become quite tame, visiting the barnyards, and even mixing with the poultry, to gain a scanty subsistence, which not unfrequently preserves them from actual starvation.

"Partridges commence pairing in the month of March, early or late, according to the state of the weather and, even after separating for the purposes of procreation, it is not unusual for them to reassemble in coveys as before, provided the weather should again become stormy and cold, as is often the case in our changeable climate.

"They generally complete their nests in five or six weeks after pairing. A small tuft of grass, sheltered by a bush or a tree, the corner of a worm fence, or the foot of an old stump, are the spots usually selected for the building of their nests, which are composed of leaves, dry grass, and a few feathers plucked from her own person. The little habitation is rudely but often ingeniously constructed; and, being so well concealed from observation, it not unfrequently bids defiance to the searching glances of the most inquisitive eye, as well as affording ample protection on every side from the inclemency of the weather. The eggs are white, and average from fifteen to twenty in number, and, in some rare instances, greatly exceed that quantity. If the birds be in their prime, and the season very favorable, it is not improbable that the female may deposit twenty-five or even thirty eggs, but such cases are anomalies; and we should be more disposed to attribute the unusual increase of eggs to an occasional propensity that some birds have of laying in each other's nests. Mr. Daniel, speaking of the amazing fecundity of the English Partridge, which is closely allied to our species, states that a nest was discovered with thirty-three eggs in it, another with twenty-eight, and another with thirty-three. The greatest number we have ever seen in the nest of the American bird is twenty-four; but we have often been told by farm hands that twenty-five is no unusual number. For the truth of these vague assertions we cannot, however, vouch. The period of incubation is about twenty-one days; some contend for a longer period, but we believe the former statement the more correct, although, in proof of the latter assertion, it has been argued that it requires four weeks to hatch the eggs when placed under a common hen. This, however, proves nothing, as the

disparity in the time may be accounted for by the circumstance of the Partridge sitting much closer than the domestic fowl, and, consequently, generating a larger amount, if not a higher degree, of animal heat.

"The female bird during the period of incubation becomes quite poor, and undergoes the process of a partial moult, which provides a few downy feathers to assist in keeping the eggs warm during her absence from the nest in quest of food. The young birds are quite strong when they first burst from their narrow confines; and it is no very uncommon thing for them to be seen running about with a portion of the shell adhering to their backs. While the hen is sitting, and even after the birds are hatched, her mate may often be seen early in the mornings, or late in the afternoons, perched on a fence rail or low limb of a tree, whistling with all diligence for a half hour at a time, as if to cheer the female in her arduous and solitary duties. Partridges are strictly monogamous; and it is supposed by some that the cock assists the hen in covering the nest; and we incline to the opinion that these birds, in common with many others, do share the cares of hatching the little brood.

"If the weather remains dry and mild after hatching, the young birds will be able to fly in the course of three or four weeks; if, on the other hand, the season should be backward and inclement, the tender little brood gains strength but slowly, and great numbers consequently will fall victims to the damp and cold, while being led about in search of food.

"As soon as the anxious mother abandons her nest, attended by her nimble little progeny, she is joined by the cock Partridge, who gives all his attention to the searching for food and protecting the active little brood from any danger that may beset them. At the first alarm, the young birds instinctively skulk in the deep grass and remain perfectly motionless, while the old ones resort to every artifice within their power to ward off the impending danger. It is interesting to observe the earnest solicitude with which both the parents watch over their young, and the wonderful instinct they exhibit in guarding them when surprised by the huntsman, before they are sufficiently fledged to fly off. The old birds take to the wing, and the young ones run with all speed into the nearest thicket, or conceal themselves in the brushwood, or long grass that abounds at this season on their feeding-grounds. The hen, after flying a few hundred yards, alights, and returns

by a circuitous route to the place she just abandoned; and, calling in subdued tones, she soon collects around her the scattered progeny, and quickly leads them off from the scene of danger. The cock Partridge at the same time is using every effort to distract the attention of the intruder by flying or rather tumbling confusedly before him, running along the ground, hanging his wings, fluttering as if badly wounded and unable to escape his every grasp. By such like artifices, the male bird strives to delude the eager observer, and deceive, perchance, his no less anxious dog; for, leading them both away, step by step, from the young covey, sufficient time is gained for the female to perform her important task. When the danger is passed, the hen bird, by her joyful call, directs the mate to her retreat.

"It is not only in devices of this kind that Partridges display a strong and lively affection for their young, but where there appears a probability of success, they will not hesitate to attack any enemy that assails them; and it is no uncommon thing for the old ones to be seen flying up at hawks, or other birds of prey, screaming and fighting with all vigor to defend their helpless offspring. Several years ago we witnessed a desperate battle between a cock Partridge and a black snake, which rather singular combat would, however, have soon proved fatal to the former, if we had not so opportunely come to his rescue, as the serpent had already caught the exhausted bird by the wing, and so deadly was the grasp that he even held on to his affrighted, but nevertheless courageous victim, after we had broken his back with a blow from a large stick. On searching around in the grass, we discovered two very young Partridges, somewhat mutilated, and nearly dead, both of which no doubt had been seized by his snakeship as a dainty meal, which he was not, however, permitted to enjoy, owing to the bold attack of the parent bird.

"The wild nature of the Partridge renders its domestication almost impossible, though in some instances, where the eggs have been placed under the common hen, they have been hatched and reared with as much success as if the progeny were of her own species. The young brood, however, though perfectly familiar with all the other occupants of the farm-yard, and apparently reconciled to their unnatural mode of life, still exhibited the wandering and restless disposition of their race, and in most instances have flown away to their native haunts at the pairing season of the following year. The American Partridge, in com-

mon with those of other countries, cannot bear close confinement; they may appear for a time to thrive, still, if too much restricted in their movements, invariably die. We unfortunately, during the last winter, lost several fine birds that were presented to us by our friend G. D. Wetherill, Esq., owing, we suppose, to the smallness of the cage in which we had temporarily placed them."—*From Lewis' American Sportsman.*

This bird feeds upon seeds, berries and various grains, in the open fields, and is particularly fond of Indian corn. Its note is a clear loud whistle, composed of three notes, the first and last nearly equal in length, and louder than the intermediate one. In the breeding season the call of the male consists of three notes, having a fancied simularity to the words *Ah Bob White*, which he repeats from a fence, stake, or low branch of a tree for hours together. At night they rest upon the ground, either in the grass or under a log or other cover. When there is a flock of them, they dispose of themselves in their resting place in a circle, their bodies touching each other, and their heads outward. This arrangement enables them when alarmed to fly away in different directions at once. They are easily caught in snares, and when kept in cages on coops, soon become very fat, but all attemps to domesticate them have been unsuccessful. In the autumn they perform occasional migrations in the manner of the wild turkey, their flight is rapid, and performed at a short distance from the ground. They are said to live from seven to ten years.

In Eastern Canada the Grouse is commonly called a Partridge. The true American Partridge, the subject of this notice is, however, a very different bird. The following is a discription of this species, taken from Wilson's Ornithology. We shall give a synopsis of the genera of the family to which it belongs in another place:

"The Partridge is nine inches long, and fourteen inches in extent; the bill is black; line over the eye, down the neck, and whole chin, pure white, bounded by a band of black, which descends and spreads broadly over the throat; the eye is dark hazel; down neck and upper part of the breast, red brown; sides of the neck spotted with white and black, on a reddish brown ground; back scapulars and lesser coverts, red brown intermixed with ash, and sprinkled with black; tertials edged with yellowish-white, beautifully marked with numerous curving spots or arrowheads

of black; tail, ash, sprinkled with reddish brown; legs, very pale ash."

This bird breeds all over the United States, from Massachusetts to Texas, and thence northerly to the upper tributaries of the Missouri River. The generic name is Greek, *ortyx* a quail.

THE RUFFED GROUSE.—(*Tetrao Umbellus.*)

This bird is commonly called "the Partridge" in Canada and the Eastern United States, while in the West it is called the *Pheasant.* Next to the wild turkey it is considered to surpass as an article of food all other land birds of America, while to the sportsman and the student of nature its habits are full of interest. It is found in all the United States as far south as Maryland, and in all the British Provinces as far north as the Soscatchawan River. Its geographical distribution is therefore much more extensive than that of the American Partridge, (*Ortyx Virginiana.*)

These birds love to frequent the craggy sides of hills, and mountains, and also during the breeding and summer season prefer the borders of open spaces, such as beaver meadows or tracts where the trees have been destroyed by fire. Its food consists of seeds and berries of all kinds; and in the winter when the ground is deeply covered with snow in all the northern portion of their territory, the Grouse feed principally upon the buds of trees such as those of the birch and soft maple. They spend the greater portion of their time upon the ground in search of food. "The female makes her nest in May, beside a prostrate tree, or at the foot of a low bush, on the ground, in a spot where a heap of dried leaves has been formed by the wind. The nest is composed of leaves or dried twigs. The female lays from five to twelve eggs which are of a uniform dull yellowish colour, and are proportionate in size to the bird. She never covers them on leaving the nest, and in consequence, the raven and the crow, always on the look out for such dainties, frequently discover and eat them. When the female is present, however, she generally defends them with great obstinacy, striking the intruder with her wings and feet, in the manner of the common hen.

"The young run about and follow the mother the moment after they leave the egg. They are able to fly for a few yards at a time, when only six or seven days old, and still very small. The mother

leads them in search of food, covers them at night with her wings, and evinces the greatest care and affection towards them on the least appearance of danger, trying by every art in her power to draw the attention of her enemies to herself, feigning lameness, tumbling and rolling about as if severely wounded, and by this means generally succeeding in saving them. The little ones squat at the least chuck of alarm from the mother, and lie so close as to suffer one to catch them in the hand, should he chance to discover them, which, however, it is very difficult to do. The males are then beginning to form small parties, and continue separated from the females until the approach of winter, when males, females and young mingle together. During summer these birds are fond of dusting themselves, and resort to the roads for that purpose, as well as to pick up gravel." (Audubon, vol. 5, p. 79.)

In the spring the woods where these birds are common resound with the drumming of the male, which is thus performed: the male bird, standing erect on a prostrate decayed tree, raises the feathers of its body in the manner of a turkey-cock, draws its head towards its tail, erecting the feathers of the latter at the same time, and raising its ruff around the neck, suffers its wings to droop, and struts about on the log. A few moments elapse, when the bird draws the whole of its feathers close to its body, and stretching itself out, beats its sides with its wings in the manner of the domestic cock, but more loudly, and with such rapidity of motion, after a few of the first strokes, as to cause a tremor in the air not unlike the rumbling of distant thunder; in perfectly calm weather this sound may be heard two hundred yards. The female never drums. The male occupies the same tree for drumming during the season, and it may be easily recognized by the quantity of excrements and feathers.

The bird when started by a man or dog rises suddenly from the ground with a loud whirring noise which, according to Audubon, is only made when the bird is alarmed. He says that he has often seen the Grouse rise from the ground of its own accord as gently and softly as any other bird, and without producing any whirring sound whatever. Its flight is straight forward and is seldom protracted beyond a few hundred yards at a time. Sometimes when started on the sides of a steep hill the Grouse will dive towards the foot of the declivity, and take a sudden turn to the right or left in a direction so unexpected that unless the sportsman is aware of the trick he may not put up the bird again that day.

Audubon says that the prevailing notion which exists in almost every district where these birds are numerous, that on firing at the lowest bird perched on a tree, the next above will not fly, and that by continuing to shoot at the lowest in succession, the whole may be killed, is contradicted by his experience; for on every attempt which he has made to shoot several in this manner on the same tree, his efforts have proved unsuccessful, unless during a fall of snow when he has killed three and sometimes four. The same cause produces the same effect on different birds. It may happen, he says, that in districts covered with deep snow for several weeks, during severe winters, these birds, becoming emaciated and weak, may stand a repetition of shots from a person determined to shoot Grouse even when they are good for nothing, but not when they are in good order. When this bird alights on a tree after being raised, it stands perfectly still in an erect attitude, and may then be closely approached. When the ground is covered with snow sufficiently soft to allow this bird to conceal itself under it, it drives headlong into it, with such force as to form a hole several yards in length, re-appears at that distance, and continues to elude the sportsman by flight. They are sometimes caught while beneath the snow.

The Ruffed Grouse is eighteen inches long, and twenty-three in extent; bill a horn color; eye reddish hazel, immediately above which is a small spot of bare skin of a scarlet color; crested head, and neck variegated with black, red, brown, white and pale brown; sides of the neck furnished with a tuft of large black feathers, twenty-nine or thirty in number, which it occasionally raises; body above of a bright rust color, marked with oval spots of yellowish-white, spotted with olive; the tail is rounded, extends five inches beyond the tips of the wings, is of a reddish-brown, barred and minutely mottled with black, and terminated by a broad band of the latter color between two narrow bands of bluish white, of which one is terminal; a yellowish white band from the upper mandible to the eye, beyond which it is prolonged; throat and lower part of the neck, light brownish yellow; lower ruff feathers of the same color, barred with reddish brown, the upper black, with blue reflections; a tuft of light chesnut feathers under the wings; the rest of the under parts yellowish white, with broad transverse spots of brownish red; the abdomen yellowish red, and the under tail coverts mottled with brown.

The plumage of the female is less developed and of inferior beauty. The feathers of the head and ruff are less elongated, the latter of a duller black. The tints of the plumage generally are lighter than the male.

The generic name *tetrao* is Latin, probably derived from the Greek *tetrax*, a *moor fowl*. The specific name is from the Latin *umbella*, which may be translated a "ruff."

THE SPRUCE PARTRIDGE OR CANADA GROUSE, (*Tetrao Canadensis.*)

The Canada Grouse, or Spruce Partridge as it is commonly called, is not so abundant in the settled portions of Canada as the species just described in the more retired recesses of the forest; it is, however, often met with, and it appears at no great distance from the large towns. G. W. Allan, Esq., of Toronto, says he has had specimens brought "which were said to have been procured not many miles distant" from that city.

Audubon thus describes the habits of this beautiful bird:

The Spruce Partridge or Canada Grouse breeds in the States of Maine and Massachusetts about the middle of May, nearly a month earlier than at Labrador. The males pay their addresses to the females by strutting before them on the ground or moss, in the manner of the turkey cock, frequently rising several yards in the air in a spiral manner, when they beat their wings violently against their body, thereby producing a drumming noise, clearer than that of the Ruffed Grouse, and which can be heard at a considerable distance. The female places her nest beneath the low horizontal branches of fir trees, taking care to conceal it well. It consists of a bed of twigs, dry leaves and mosses, on which she deposits from eight to fourteen eggs, of a deep fawn colour, irregularly splashed with different tints of brown. They raise only one brood in the season, and the young follow the mother as soon as hatched. The males leave the females whenever incubation has commenced, and do not join them again until late in autumn; indeed, they remove to different woods, where they are more shy and wary than during the love season or in winter.

This species walks much in the manner of our Partridge. I never saw one jerk its tail as the Ruffed Grouse does, nor do they burrow in the snow like that bird, but usually resort to trees to save themselves from their pursuers. They seldom move from thence at the barking of a dog, and when roused fly only to a

short distance, uttering a few *clucks*, which they repeat on alighting. In general, when a flock is discovered, each individual forming it may be easily caught, for so seldom do they see men in the secluded places which they inhabit, that they do not seem to be aware of the hostile propensities of the race.

Along the shores of the Bay of Fundy, the Spruce Partridge is much more abundant than the Ruffed Grouse, which indeed gradually becomes scarcer the farther north we proceed, and is unknown in Labrador, where it is replaced by the Willow Ptarmigan, and two other species. The females of the Canada Grouse differ materially in their colouring in different latitudes: in Maine, for instance, they are more richly coloured than in Labrador, where I observed that all the individuals procured by me were of a much greyer hue than those shot near Dennisville. The like difference is perhaps still more remarkable in the Ruffed Grouse, which are so very grey and uniformly coloured in the Northern and Eastern States, as to induce almost every person to consider them as of a species distinct from those found in Kentucky, or any of the southern mountainous districts of the Union. I have in my possession skins of both species procured a thousand miles apart, that present these remarkable differences in the general hue of their plumage.

All the species of this genus indicate the approach of rainy weather or as now storm, with far more precision than the best barometer; for on the afternoon previous to such weather, they all resort to their roosting places earlier by several hours than they do during a continuation of fine weather. I have seen groups of Grouse flying up to their roosts at mid-day, or as soon as the weather felt heavy, and have observed that it generally rained in the course of that afternoon. When, on the contrary, the same flock would remain busily engaged in search of food until sunset, I found the night and the following morning fresh and clear. Indeed, I believe that this kind of foresight exists in the whole tribe of gallinaceous birds.

One day, while on the coast of Labrador, I accidentally almost walked upon a female Canada Grouse surrounded by her young brood. It was on the 18th of July. The affrighted mother, on seeing us, ruffled up all her feathers like a common hen, and advanced close to us as if determined to defend her offspring. Her distressed condition claimed our forbearance, and we allowed her to remain in safety. The moment we retired, she smoothed down

her plumage, and uttered a tender maternal chuck, when the little ones took to their wings, although they were, I can venture to assert, not more than *one week old*, with so much ease and delight, that I felt highly pleased at having allowed them to escape.

Two days afterwards, my youthful and industrious party returned to the Ripley with a pair of these Grouse in moult. This species undergoes that severe trial at a much earlier season than the Willow Ptarmigan. My son reported that some young ones which he saw with their mother were able to fly fully a hundred yards, and alighted on the low trees, among which he caught several of them, which, however, died before he reached the vessel.

This species is found not only in the State of Maine, but also in the mountainous districts of New Hampshire, and the northern parts of New York, as well as around our northern great lakes, and the head waters of the Missouri. It is abundant in the British Provinces of New Brunswick, Nova Scotia, Newfoundland and Labrador.

Among the great number, procured at all seasons of the year, which I have examined, I never found one without the rufous band at the extremity of the tail, represented in the plate; nor did I see any having the terminal white spot on the upper tail-coverts exhibited in figures of this species.

Their food consists of berries of different sorts, and the young twigs and blossoms of several species of plants. In the summer and autumn I have found them gorged with the berries of the plant represented in the plate, and which is commonly called "Solomon's Seal." In the winter I have seen the crop filled with the short leaves of the larch or hackmetack.

I have frequently heard it said that these birds could be knocked down with sticks, or that a whole covey could be shot while perched on trees, by beginning at the lowest one; but I have never witnessed any thing of the kind, and therefore cannot vouch for the truth of the assertion. During the autumn of 1833, these birds were uncommonly abundant in the State of Maine. My friend EDWARD HARRIS, of New York, THOMAS LINCOLN, and others, killed a great number; and the last mentioned gentleman procured a pair alive, which were fed on oats and did well.

The flesh of this Grouse is dark, and fit for being eaten only when it has fed on berries. In winter, when it feeds on the leaves of trees and other plants, the flesh is quite bitter and disagreeable.

According to Dr. RICHARDSON, all the thick and swampy black-spruce forests between Canada and the Arctic Sea abound with this bird, and considerable numbers exist in the severest seasons as high as the 67th parallel. I am informed by Mr. TOWNSEND that it is also plentiful on the Rocky Mountains and the plains of the Columbia, from which parts I have obtained specimens differing in nothing from others procured in Maine and Labrador. I have also compared those in the Edinburgh Museum, which Mr. DOUGLASS was pleased to name *Tetrao Franklinii*, with several of my own, and feel perfectly confident that they are all of one and the same species.

Description.—Tail of sixteen feathers, rounded; male with the upper parts transversely banded with brownish black and light gray; wings variegated with dusky and greyish yellow; quills brown the outer webs of the primaries mottled with yellowish; tail blackish brown, tipped with reddish yellow; lower parts black; the feathers near the throat with a white spot near the end; a band of white spots behind the eye; on the breast the feathers with a broad subterminal spot, and the lower tail coverts largely tipped with white; female with the upper parts as in the male, but more broadly barred; head; sides of neck, fore-neck and anterior part of breast, yellowish red, barred with brownish black; lower parts greyish black, barred with reddish white; tail minutely mottled, and tipped with reddish brown.

Male 15¾—*Female* 15½ = 21.

Breeds from the northern part of New York to Labrador as well as from Canada to the Arctic Sea, Columbia River; partially migratory in winter. (Audubon's Synopsis, page 203.)

THE SNIPE, (*Scolopax Wilsonii.*)

The Snipe, so highly prized by sportsmen, is common throughout the United States and the British Provinces, its breeding grounds, however, being in the northern portions of these extensive regions. In the Southern States it is not seen in summer, but in winter is exceedingly abundant; we are informed that occasionally a stray Snipe is to be met with in Canada, so late in the season as the beginning of January, but such must be regarded as stragglers who have loitered behind long after the great body of the species has returned to the southern climes.

Audubon says that in the northern districts, meaning Maine, Nova Scotia, the Northern States, and Canada, "the Snipe begins to lay its eggs in the early part of June. The swampy parts of the extensive moss-covered marshes in elevated situations afford it places of security and comfort, in which it is not likely to be disturbed by man, and finds immediately around it an abundance of food. The nest itself is a mere hollow in the moss, scantily inlaid with a few grasses. The eggs are four, placed with the small ends together, and measure one inch and five-eighths by one and one-eighth, being pyriform, with the tip somewhat inflated. The ground colour is a yellowish, olive, pretty thickly spotted, and blotched with light and dark umbers, the markings increasing in size as they approach the large end, where they form a circle. The young, like those of the woodcock, leave the nest as soon as they are hatched, and so resemble those of the common Snipe of Europe, *Scolopax gallinago*, that the same description answers for both, they being covered with down of different tints of brown and greyish yellow. The bill, at this age, is short, very soft and easily bent by the least pressure, nor does it acquire its full growth before winter; and its length differs in different apparently full grown individuals, by half an inch or even three-fourths. They seem to feed at first upon minute insects collected on the surface of the mires, or amid the grass and moss, but as they grow older and the bill becomes firmer and larger, they probe the ground like their parents, and soon become expert in this operation, introducing the bill at every half inch or so of the oozy mire, from which they principally obtain their food. In the middle States this Snipe, however, has been found breeding in meadows, as well as in the State of Maine; and it also nestles in the mountainous districts of these parts of the Union."

After spending the summer in the north these birds remove southward in October, and then become so numerous in some of the states that hundreds may be shot in the same field. When started they there rise in the air in flocks, each one emitting its cry, *wau-aik*, after which they fly around a few times and then suddenly alight not many yards from the spot where they were. They occasionally are attached so much to one spot that they will repeatedly return no matter how often they may be shot at, until the greater part of the flock is killed. Audubon says "they are abundant in the wet savannahs in the Floridas, from which they retire a few weeks earlier than from Louisiana and the Carolinas,

where some remain until the beginning of April. During the whole of the winter months, these birds are observed to ramble from one place to another, and a field which yesterday contained a good number, has only a few to day, and to-morrow may be quite deserted; but before the end of the week there you will find them again, as abundant as at first. They rarely visit salt waters, and never resort to the interior of the woods."

The food of the Snipe consists principally of ground worms, insects, and the juicy slender roots of different vegetables, all of which tend to give its flesh that richness of flavour and juicy tenderness for which it is so deservedly renowned, it being equal to that of the Woodcock. Many epicures eat up the Snipe and Woodcock with all their viscera, worms and insects to boot, the intestines in fact, being considered the most savory part. On opening some newely killed Snipes, I have more than once found fine large and well fed ground worms, and at times a leech, which I must acknowledge I never conceived suitable articles of food for man, and for this reason I have always taken good care to have both Snipes and Woodcock well cleaned, as all game ought to be.

The following is from Lewis' American Sportsman:

There are several game varieties of Snipe known in the Old World, and all equally sought after by sportsmen; there are also many species in our own country, but only one that attracts much attention from our shooters. In Russia, there is a large Snipe that occasionally wanders as far as England, and is known there, we believe, as the Horseman's Snipe, from its superior size and fine appearance. This bird affords much sport to the Russian Noblesse, as well as a savory dish for their tables. The Double, or Solitary Snipe, Scolopax Major, although quite rare in England, is very common in Sweden; it is nearly twice as large as the common Snipe, and offers attractive amusement to the inhabitants of that country, who pursue field sports with as great zest as the sportsmen of our own country. The Scolopax Gallinago, or English Snipe of America, is closely allied to the common snipe of the Old World—it resembles it in plumage, size, and habits; a little difference, perhaps, may be conceded to the latter variety in point of weight. The observant Wilson, in his usual style of close investigation, discovered a very marked distinction between the English and American bird, and in consideration of this discovery, Temminck and other European Naturalists have very justly dedicated the American Snipe to this distinguished Ornithologist,

by bestowing upon it the title of Scolopax Wilsonii, or Wilson's Snipe, a compliment not less deserved than generously awarded. Wilson states that the American Snipe has the same soaring, irregular flight in the air during gloomy weather, as the Snipe of Europe; the same bleating note and occasional rapid descent; springs from the marshes with the like feeble "squeak," and in every respects resembles the common Snipe of Britain, except in being about one inch less, and in having sixteen feathers in the tail instead of fourteen. Audubon, however, informs us that the notes of the two varieties are quite dissimilar, in fact, as different from each other as those of the American Crow and the Carrion Crow of Europe, and expresses some surprise that Wilson should not have mentioned this difference.

Frank Forrester, on the other hand, observes that the cry of the two varieties is *perfectly identical*, and in this statement, he further remarks that he is corroborated by the judgment of several English sportsmen with whom he has frequently shot.

This Snipe is known in Britain as the Common Snipe, Snipe, or Heather-bleater, and with us is called English Snipe or Wilson's Snipe. In Louisiana, the Creoles term it *cache-cache*, the derivation of which, we imagine, arose from the well-known retired or lurking habits of the bird.

"The Snipe is eleven inches long, seventeen inches in extent; the bill over two inches and a-half long, fluted lengthwise; brown color; black towards the tip, crown black, divided by an irregular line of pale brown; another broader hue of the same tint passes over each eye; from the bill to the eye there is a narrow dusky line; neck and upper part of the breast pale brown, variegated with touches of white and dusky; chin pale; back and scapulars deep velvety black, the latter elegantly marbled with waving lines of ferruginous, and broadly edged, exteriorly, with white; wings plain dusky; all the feathers, as well as those of the coverts, tipped with white; shoulder of the wing deep dusky brown, exterior quill edged with white; tail coverts long, reaching within three-quarters of an inch of the tip, and of a pale rust-color, spotted with black; tail rounded, deep black, ending in a bar of bright ferruginous, crossed with a narrow waving line of black, and tipped with whitish; belly pure white; sides barred with dusky; legs and feet a very pale, ashy green; sometimes the whole thighs and sides of the vent are barred with dusky and white. The female

differs in being more obscure in her colors; the white on the back being less pure, and the black not so deep."

In the spring season, the Snipe performs some very singular manœuvres, not very unlike those that are noticed in the Woodcock, during the period of incubation. If the sportsman should, at early dawn, or even at mid-day, visit the low meadows frequented by those birds, he will probably see one or both of a pair mounting high in the air in a spiral manner, beating their wings or sailing around in rapid circles, until they have gained a hundred yards or more in height; then clasping each other, they whirl around flapping their wings with great velocity, and then dropping in mid-air, give utterance at the same time to a low twittering, or rather rolling sound, supposed to be produced by the action of the wings upon the air in their rapid descent. We have seen them perform this manœuvre more than once, but at no other period of the year than the spring.

The flight of the Snipe, together with its shyness during its sojourn at the north, and the disagreeable nature of the ground that it alone frequents, renders it the most difficult as well as fatiguing and vexatious of birds to hunt. When sprung, they take wing very suddenly, and fly off in rapid zigzag lines for a few paces, in such a confused, irregular, and tortuous course that it is almost impossible even for a snap shot, during this time, to cover the bird for an instant while performing these elliptical gyrations.

Snipe-shooting, not only in England, but also in our own country, may very justly be pronounced the "Crux Jaculatorum" of sportsmen, as there is no game that requires more skill and judgment in shooting, or demands a greater share of labor and perseverance to follow. A sporting writer—no great admirer of this sport, however, we imagine—remarks that "Snipe-shooting is a sport the best calculated (Grousing excepted) to try the keenness of the sportsman, to ascertain his bottom, and if he can stand labor, water, mire, swamps, and bogs. He should be possessed of a strong constitution, not liable to catch cold, and have all the fortitude, as well as exertion, of a water spaniel; he should be habitually inured to wet, dirt, and difficulties, and not be deterred by cold or severe weather."

This statement, although a little overdrawn, is not far wide of the real truth, as every Snipe-shooter knows full well; and when entering on the sport, each one should be willing to repeat within himself *audax omnia perpeti*. Notwithstanding the numerous ills

attendant on this sport, it has many ardent admirers, who, in spite of wind and weather, cold and rain, mud and mire, are, at each succeeding spring and autumn, found ready at their posts, all eagerness to commence the fray; and, at the close of every season each one has a long list of adventures to relate, not perhaps—

> " Of moving accidents by flood and field,
> Of hair-breadth' scapes i' the imminent deadly breach;"

but of many mishaps and hardships encountered during the campaign on the filthy marshes, the most of which, though grievous at the time, in reality added zest to the sport, and will ever remain imbedded on the memory of the true sportsman as playful souvenirs by which to recall the scenes of much past enjoyment.

THE WOODCOCK.

MICROPTERA AMERICANA, (Audubon.)
SCOLOPAX MINOR, (Wilson.)

The Woodcock arrives in Canada in the latter part of March, and immediately commences to make preparations for breeding. It is a bird so nocturnal in its habits that it may be quite abundant in a neighbourhood and still its presence not be suspected, unless by the sportsman who knows all the lurking places of the game in his vicinity. During the greater portion of the day they remain concealed in secluded thickets or marshes, and only come out to feed in the wide open places during the night, at sunset, or early dawn. They breed in the spring and summer in Canada and the Northern States, and spend the winter in the south. Wilson

says "the Woodcock usually begins to lay in April. The nest is placed on the ground, in a retired part of the woods, frequently at the root of an old stump. It is formed of a few withered leaves and stalks of grass laid with very little art. The female lays four, sometimes five eggs, about an inch and a-half long, and an inch or rather more in diameter, tapering suddenly to the small end. These are of a dun clay color, thickly marked with spots of brown particularly at the great end, and interspersed with others of a very pale purple. The nest of the Woodcock has, in several instances that have come to my knowledge, been found with eggs in February; but its usual time of beginning to lay is early in April. In July, August, and September, they are considered in good order for shooting."

The Woodcock is properly a nocturnal bird, feeding chiefly at night, and seldom stirring about till after sunset. At such times, as well as in the early part of the morning, particularly in spring, he rises, by a kind of spiral course, to a considerable height in the air, uttering at times a sudden *quack*, till, having gained his utmost height, he hovers around in a wild, irregular manner, making a sort of murmuring sound; then descends with rapidity as he rose. When uttering his common note on the ground, he seems to do it with difficulty, throwing his head towards the earth, and frequently jetting up his tail. These notes and manœuvres are most usual in spring, and are the call of the male to his favorite female. Their food consists of various larvæ, and other aquatic worms, for which during the evening, they are almost continually turning over the leaves with their bill, or searching in the bogs. Their flesh is reckoned delicious, and prized highly. They remain with us till late in autumn, and, on the falling of the first snows, descend from the ranges of the Alleghany to the lower parts of the country in great numbers; soon after which, viz., in November, they move off to the south.

This bird, in its general figure and manners, greatly resembles the Woodcock of Europe, but is considerably less, and very differently marked below, being an entirely distinct species. A few traits will clearly point out their differences. The lower parts of the European Woodcock are thickly barred with dusky waved lines, on a yellowish white ground. The present species has those parts of a bright ferruginous. The male of the American species weighs from five to six ounces, the female eight; the European, twelve. The European Woodcock makes its first appearance in

Britain in October and November, that country being in fact only its winter quarters; for, early in March, they move off to the northern parts of the continent to breed. The American species, on the contrary, winters in countries south of the United States, arrives here early in March, extends its migrations as far, at least, as the River St. Lawrence, breeds in all the intermediate places, and retires again to the south on the approach of winter. The one migrates from the torrid to the temperate regions, the other, from the temperate to the Arctic. The two birds, therefore, notwithstanding their names are the same, differ not only in size and markings, but also in native climate. Hence the absurdity of those who would persuade us that the Woodcock of America crosses the Atlantic to Europe, and *vice versa*. These observations have been thought necessary, from the respectability of some of our own writers, who seem to have adopted this opinion.

How far to the north our Woodcock is found, I am unable to say. It is not mentioned as a bird of Hudson's Bay, and, being altogether unknown in the northern parts of Europe, it is very probable that its migrations do not extend to a very high latitude, for it may be laid down as a general rule that those birds which migrate to the Arctic regions, in either continent, are very often common to both. The head of the Woodcock is of singular conformation, large, somewhat triangular, and the eye fixed at a remarkable distance from the bill, and high in the head. This construction was necessary to give a greater range of vision, and to secure the eye from injury, while the owner is searching in the mire. The flight of the Woodcock is slow. When flushed at any time in the woods, he rises to the height of the bushes or underwood, and almost instantly drops behind them again at a short distance, generally running off for several yards as soon as he touches the ground. The notion that there are two species of Woodcock in this country probably originated from the great difference of size between the male and female, the latter being considerably the larger.

The male Woodcock is ten inches and a-half long, and sixteen inches in extent; bill, a brownish flesh color, black towards the tip, the upper mandible ending in a slight knob, that projects about one tenth of an inch beyond the lower, each grooved, and, in length, somewhat more than two inches and a-half; forehead, line over the eye, and whole lower parts, reddish tawny; sides of the neck, inclining to ash; between the eye and bill, a light streak of

dark brown; crown, from the forepart of the eye backwards, black, crossed by three narrow bands of brownish white; cheeks, marked with a bar of black, variegated with light brown; edges of the back, and of the scapulars, pale bluish white; back and scapulars, deep black, each feather tipped or marbled with light brown and bright ferruginous, with numerous fine zigzag lines of black crossing the lighter parts; quills, plain dusky brown; tail, black, each feather marked along the outer edge with small spots of pale brown and ending in narrow tips, of a pale drab color above, and silvery white below; lining of the wing, bright rust; legs and feet, a pale reddish flesh color; eye, very full and black, seated high and very far back in the head; weight, five ounces and a-half, sometimes six.

The female is twelve inches long, and eighteen in extent, weighs eight ounces, and differs also in having the bill very near three inches in length; the black on the back is not quite so intense; and the sides under the wings are slightly barred with dusky.

The young Woodcocks of a week or ten days old are covered with down of a brownish white color, and are marked from the bill along the crown to the hind head, with a broad stripe of deep brown; another line of the same passes through the eyes to the hind head, curving under the eye; from the back to the rudiments of the tail, runs another of the same tint, and also on the sides under the wings; the throat and breast are considerably tinged with rufous; and the quills at this age are just bursting from their light blue sheaths, and appear marbled, as in the old birds; the legs and bill are of a pale purplish ash colour, the latter about an inch long. When taken, they utter a long, clear, but feeble *peep*, not louder than that of a mouse. They are far inferior to young Partridges in running and skulking; and, should the female unfortunately be killed, may easily be taken on the spot."

Audubon says that when the Woodcocks are travelling from the south towards all parts of the United States, on their way to their breeding places, they migrate singly, and follow each other with such rapidity that they might be said to arrive in flocks, the one coming directly in the wake of the other. This is particularly observable by a person standing on the eastern banks of the Mississippi or the Ohio, in the evening at dusk, from the middle of March to that of April, when almost every instant there whizzes past him a Woodcock with a velocity equalling that of our swiftest birds. He states also that he has seen them in New Brunswick returning southward in equal numbers late in the evening, and in

the same continuous manner within a few feet of the ground on the roads or through the woods. When the young birds are six weeks old, it requires nearly as much skill to shoot them as if they were much older.

The Woodcock is a particular favorite of the sportsman, and although the pursuit is laborious on account of the difficult nature of the ground in which the bird is found, yet no other shooting appears to be more fascinating. In Lewis' American Sportsman, from which work we have taken the figure of the bird, it is stated, with reference to finding Woodcocks, that "these birds, as before observed, delight in a wet loamy soil, and are seldom or never found in the upland districts, but most frequently locate themselves along the marshy willow and elder borders and extensive flats of our rivers. They also secrete themselves in the dense thickets of underbrush along the margins of smaller streams, or hide themselves in the rank grass and luxuriant fern of our wet meadow lands. In fact, wherever there is a good boring-ground, and a certain degree of seclusion, there will be found Woodcocks in the month of July, many or few, according to the nature of the ground and the favorable or unfavorable state of the breeding season.

When there has been a succession of dry weather, it is quite useless to examine light and open coverts, or sparse woods, in quest of Cocks, as at such times they will be found either on the open wet bottoms, if such spots can then be come across, or more likely in the deep, impermeable thickets and entangled brakes, where the ground seldom or never entirely loses its moisture. On the other hand, when the weather has been extremely wet for some days, Woodcocks will partake themselves to the hill-sides or elevated grounds, as they are not by any means partial to too much water, although a certain degree of moisture is absolutely necessary for their very existence. When the weather begins to get cool, they may also be found in the open woody glens or clearings, enjoying, as it were, the mild warmth of the autumn's sun, as the feeble rays from time to time pierce the sparse foliage of the overhanging trees, or actively engaged boring in the mossy banks of the warm rills, which so often spring up from such sheltered situations. In sections of the country where these birds resort, we can scarcely visit a spot of this kind early in October without finding a couple or so of Cocks, provided the ground is not too often overrun with shooters.

Still later in the season they may be met with in the more deep and sheltered wood swamps, where the insects, larvæ, and earth-worms, protected, in a measure, from the biting frosts of the more exposed situations, are enabled to remain near the surface during the severest weather; here it is that the sportsman will discover the perforations or borings of this lonely bird.

The warm and almost impenetrable cedar swamps are also favorite resorts for such Woodcocks as remain in the north during the cold weather, as the springs in such situations seldom freeze, and there is always to be found a scanty supply of suitable food even in the depth of winter. These birds, however, like the snipe, are very uncertain in their movements, being governed a good deal by the state of the weather, and other similar causes.

Woodcocks are very abundant in Jersey and Delaware, particularly after a dry spell of weather, as they congregate there from the interior of the country, and spread themselves over the wide extent of meadow lands and marshy cripples so congenial to their habits, and which are so general in the lower portions of these States. Cock-shooting in these districts is equally if not more laborious than Snipe-shooting, more particularly if pursued, as is, we may say, universally the custom, during the oppressively hot weather of July and August. In wandering over these extensive marshes, or, as they are vulgarly called, mashes, it is necessary for the sportsman to exercise considerable dexterity in stepping from tussock to tussock; otherwise he will often be doomed to a sudden plunge into the filthy oozes that surround him on every side. The excessive heat of the weather is another strong objection to the shooting of Woodcocks in the month of July, as the heat is often so oppressive that the birds will spoil in the course of a few hours after being shot, and, in some instances, even before leaving the field for the day. As for hoping to keep the birds over a day or two, to carry home, such a thing is quite impossible, and the sportsman, consequently, is forced to throw them away sometimes when only a day old, if he cannot procure ice to pack them in, which article, by the by, is not always to be had in the country.

The Woodcocks and Snipes are very closely related, and are classified under the genus *Scolopax* by some authors, while others think a separation necessary. The generic name is from the Greek "*micropteryx*," "that has small wings."

ARTICLE XLV.—*On the Insects injurious to the Wheat crop.*

The recent appearance of the Fly, in Upper Canada, having occasioned a good deal of anxiety, we have thought proper to publish the following article, in order to give as wide a circulation as possible to the Natural History of this destroyer of the staff of life. The Wheat Midge, *Cecidomya tritici*, appears to be the species which threatens our crops with the greatest amount of damage. Its history has been known to Naturalists during the last fifty years, but no effectual method has been discovered of guarding against its ravages. There is but one way of arriving at this much desired knowledge. It is by increasing the number of qualified observers throughout the country. Were any argument necessary to establish the expediency of introducing the study of Natural History into all the common schools throughout the civilized world, the best would be that a creature barely visible to the naked eye may, under circumstances favourable to its multiplication, scourge the nations with famine. We do not know how to protect ourselves, and we never shall know until we arrive at a more perfect insight into those laws of life which regulate the introduction, increase and extermination of species. Geology teaches us that there is a power in nature which destroys not only individuals but even whole races. No doubt there is a power which, could man discover it, would enable him to slay the Wheat Midge, as it has in by-gone ages silenced for ever the Ichthyosaurus, the Mastodon, or any other of the buried thousands of the old lost worlds. It is not enough that a few men know at what season the Wheat Midge lays her egg, the time when that egg produces the worm-like larva, or when the pupa bursts to liberate the perfected insect, the parent of new swarms: all this has been for the last half century but a small item in the journal of the Entomologist; our only hope is to have thousands of observers of nature where there are now scarcely half a dozen; and surely when the vast interests depending upon the wheat crop are at stake, there is a sufficient reason to encourage the only science through which the means of saving it can be approached.

We regret that not having duly apportioned our space, much that we had prepared on this subject, together with some engravings already executed, must be excluded from the present number.

The following is from the Report of the Commissioner of Patents at Washington for the year 1854; Department of Agriculture.

THE HESSIAN FLY.

"The following account of the Hessian Fly, (*Cecidomyia destructor*,) see plate, is condensed from Dr. Harris' Treatise on the Insects of New England, injurious to Vegetation. This insect was first observed in the year 1776, in the neighbourhood of Sir William Howe's debarkation on Staten Island, and at Flatbush on the west end of Long Island, New York. It is properly a small, two-winged gnat, which lays its eggs in winter or fall in wheat, when the grain has sprouted and begins to show leaves.

"According to the account of Mr. Edward Tilghman, of Queen Ann County, Maryland, the eggs are deposited in October, in the longitudinal cavities between the little ridges of the blade, from which, in about fifteen days, very small worms or maggots appear. They make way down the blades with considerable activity until hidden between them and the stems of the plants. Mr. Herrick, in the "Connecticut Farmer," says: "I have repeatedly, both in autumn and spring, seen the Hessian Fly in the act of depositing eggs on wheat. The number on a single leaf is often twenty or thirty, and sometimes much greater." The eggs are extremely minute, and of a pale red color; and if the weather prove favorable they will hatch in four days. The maggots, when they first come out of their shells, are also of a pale red color. Forthwith they crawl down the leaves and work their way between them and the main stalk, passing downwards till they come to a joint, just above which they remain, a little below the surface of the ground, with the head towards the root of the plant. Having thus fixed themselves upon the stalk, they become stationary, and never move from the place before their transformations are completed. They do not eat the stalk, neither do they penetrate within it, as some persons have supposed, but lie lengthwise on its surface, covered by the lower part of the leaves, and are wholly nourished by the sap, which they appear to take by suction. They soon lose their reddish color, turn pale, and will be found to be clouded with whitish spots, and through their transparent skins a greenish stripe may be seen in the middle of their bodies. As they increase in size and grow plump and firm, they become imbedded in the side of the stem by the pressure of their bodies upon the growing plant. One maggot thus placed seldom destroys the plant; but when two or three are fixed in this manner around the stem, they weaken and impoverish it, and cause it to fall down, or wither and die. They usually come to their full size in five or six weeks, and then measure about three-twentieths of an inch in length. Their skins now gradually harden, become brownish, and soon change to a bright chestnut color, which change usually happens about the first of December. The insect, in this form, has been commonly likened to flax-seed; hence many observers speak of this as the "flax-seed state." In two or three weeks after this change of color, the insect within becomes entirely detached from the old larva skin, and lies within it a motionless grub. The

process of growth goes on, and some time after, on opening the leathery maggot skin, now a puparium, you find the pupa so far advanced that some of the members of the future fly are discernible through the scarf, which envelopes and fetters it on all sides. Within this shell, (the flax-seed case,) the pupa gradually advances to the winged state, until the end of April or beginning of May, when the flies make their escape by breaking through one end of the shell. The body of the Hessian Fly measures about the tenth of an inch in length, the head, antennæ, and thorax are black, the hind body tawny, more or less widely marked with black on each wing, and clothed with fine greyish hairs. The wings expand about a quarter of an inch or more, and are blackish, except at the base, where they are tawny and very narrow. They are fringed with short hairs, and rounded at the tip. The legs are pale red or brownish, and the feet black. The antennæ are jointed, and surrounded with whorls of short hairs. The flies, which come out in spring, lay their eggs on the leaves both of fall and spring-sown wheat. The maggots hatched from these, in New England, become stationary, and take the flax-seed state in June or July. They are generally transformed to flies in the autumn. According to Mr. James Worth, of Sharon, Pennsylvania, the second brood of flies, which appears early in June, has been entirely overlooked or confounded with the spring brood. He remarks that there are three complete broods, and partially a fourth in one season.

"The Hessian Fly is subject to the attacks of several parasitic insects, which serve more or less to lessen their numbers, the chief of which is the Ceraphron destructor, of Say, a shining black four-winged fly, about one-tenth of an inch in length. This fact is merely mentioned here, as it has often been mistaken for the true Hessian Fly, from being seen in wheat-fields in vast numbers, and known to come out of the dried larva skin of that fly, which, however, it had previously destroyed.

Mr. Herrick recommends that the stouter varieties of wheat should be chosen, and the ground kept in good condition. If fall wheat is sown late, some of the eggs will be avoided, but the risk of winter-killing will be incurred. Cattle or sheep, permitted to graze the wheat-fields during the fall will devour many of these eggs. Burning the stubble immediately after harvest, and then ploughing and harrowing the land, is also highly recommended. Steeping the grain, and rolling it in air-slacked lime or plaster, as promoting a rapid and vigorous growth, would also be beneficial.

THE WHEAT MIDGE.

"The Wheat Midge, (*Cecidomyia tritici*,) see plate, according to Dr. Harris, is a small yellow two-winged fly, very much resembling a mosquito in form, but much smaller in size. It is stated to have been first seen in America about the year 1828, in the northern part of Vermont and on the borders of Lower Canada. The parent fly deposits her eggs in the beginning of July, in the opening

flowers of the grain, or when the wheat is still in the milky state. The eggs hatch in about eight days, when the little yellow maggots or worms may be found within the chaffy scales of the grain. The seed scales of grass also sometimes serve as a shelter for these depredators. The worms, which are of a bright yellow or orange color, do not exceed an eight of an inch in length, and are often much smaller. I have seen as many as twelve within the chaff of one single grain, sent to the Patent Office from Ohio. These maggots prey upon the wheat when only in a milky state. When they begin their depredations, soon after the blossoming of the plant, they do the greatest injury, as the grains never fill out. Towards the last of July or beginning of August, the full-grown maggots cease eating, and become sluggish and torpid, preparatory to shedding their skins, which takes place in the following manner: the body of the maggot gradually shrinks in length within its skin, and becomes more flattened and less pointed, as readily may be seen through its delicate transparency. This torpid state lasts only a few days, after which the insect casts its skin, leaving the latter entire, except a little rent at one end of it. These empty cases, or skins, may be found in great abundance in the wheat ears, after the moulting process is completed. Mr. J. W. Dawson,* of Pictou, Nova Scotia, says that sometimes the maggot descends from the plants and moults on the surface of the ground. After shedding this skin, it recovers its activity, and writhes about as at first, but takes no food. It is shorter, somewhat flattened, and more obtuse than before, and is of a deeper yellow color, with an oblong greenish spot in the middle of the body. Within two or three days after moulting, the maggots either descend of their own accord or are shaken out of the ears by the wind, and fall to the ground. They do not let themselves down by threads, as has been supposed by some, for they are not able to spin. Nearly all of them disappear before the middle of August, and they are rarely found in the grain at the time of harvest. Hon. William D. Lindsley, of Sandusky City, Ohio, however, sent me several specimens of wheat with this insect in it as late as the beginning of August. From observations and remarks made by intelligent farmers, it appears that the descent of these insects is facilitated by falling rain and heavy dews. Having reached the ground, the maggots soon burrow under the surface, sometimes to the depth of an inch, those which have not moulted casting their skins before entering the earth. Here they remain without further change through the following winter. It is not usually before June that they are transformed to pupæ, this change being effected without another moulting of the skin. This pupa state lasts but a short time, a week or two at most, and in many cases only a few days. Under the most favorable circumstances, the pupa works its way to the surface before liberating the included fly, and when the insect has taken wing, the empty pupa

* Now Principal of the University of McGill College, Montreal.

shell, or skin, will be seen protruding from the ground. In other cases, the fly issues from its pupa skin in the earth, and comes to the surface with flabby wings, which soon expand and dry on exposure to the air. This last change occurs mostly in the months of June and July, when great numbers of the flies have been seen apparently coming from the ground in fields where grain was raised the year before.

"The Wheat Midge, or Fly, " is a small orange-colored gnat, with long slender pale yellow legs, and two transparent wings reflecting the tints of the rainbow, and fringed with delicate hairs. Its eyes are black and prominent; its face and feelers yellow; its antennæ long and blackish. Those of the male are twice as long as the body, and consist of twenty-four joints, which, except the two basal ones, are globular, surrounded by hairs, and connected by slender portions like beads on a string. The antennæ of the female are about as long as the body, and consist of only twelve joints, which, except at the base, are oblong-oval, somewhat narrowed in the middle, and surrounded by two whorls of hairs. These insects vary much in size. The largest females do not exceed one tenth of an inch in length, and many are found towards the end of the season less than half this length. The males are usually rather smaller than the female, and somewhat paler in color." Mr. Lindsley sent several of these insects to the Patent Office in August last, and stated that they have been extremely destructive in several parts of his district last year, (1854,) and that in some places the cattle where turned into the field in order to eat the straw and what little was left of the grain, the main crop not being worth the trouble and expense of harvesting. These flies are likewise said to be much more numerous and destructive on the edges of fields than in the centre, and in some cases when the edges were completely worthless, the centre bore comparatively a good crop.

"Fumigation with sulphur and burning weeds on the windward side of the field, when the grain is in blossom, has been recommended. Air-slacked lime or wood ashes, strewn over the grain when in blossom, in the proportion of one bushel of lime or ashes to be scattered over the field when the plants are wet with dew or rain. Two or three applications have sometimes been found necessary. Ploughing up the ground also to destroy the maggots, and the dust-chaff, or refuse straw, if found to contain any of these insects, should be immediately burned. In those parts of New England where these insects have done the greatest injury, according to Dr. Harris, the cultivation of fall-sown or winter-grain has been given up, and this for some years to come will be the safest course."

THE JOINT WORM.

"The Joint Worm, (*Eurytoma hordei,*) see plate, now committing such ravages in the wheat fields of Virginia, is a small, black, four-winged fly, about an eighth of an inch in length. The female

lays several eggs in the outer sheath of the stalk, above the joints. After they hatch, the worms commence feeding within the sheath, and the constant irritation produced by them forms a woody gall, or rather succession of galls, in the cavity of each of which lies a small footless maggot, about the seventh or eighth of an inch in length, having a body with thirteen segments, and of a pale, glossy, yellowish color. The number of worms in each cluster of galls varies from four to ten, or even more. The substance of the stalk attacked becomes brittle, and either partially or entirely fills its central cavity, and frequently distorts it into various irregular shapes. I have often observed young rootlets putting out immediately below a joint thus affected. The worms on the stalks of wheat, when examined in February last, were yet in the larva, but early in March several had assumed the pupa state. They were about an eighth of an inch in length, of a pale yellow color, which, as the pupæ were near coming out, became afterwards nearly black. These pupæ had the rudiments of wings, legs, and antennæ, as in the perfect fly, but were motionless. Late in April and the beginning of May, the flies made their appearance through holes gnawed through the tough woody covering of the gall-like excrescence in which they had passed the winter. This transformation, however, took place in a warm room. These flies are about an eighth of an inch in length, of a black color, the knees, joints, and feet, being tinged with yellow. The males, according to Dr. Harris, vary from the females by being smaller, and in having no piercers. The joints of the antennæ are likewise longer, and surrounded with whorls of little hairs. The hind body is shorter, less pointed at the extremity, and is connected with the thorax by a longer stem. He also says that among fifteen females only one male was found. This corresponds with what I have observed, as out of sixty to eighty Joint Worm Flies, produced from diseased stalks of wheat, I only procured one male, answering to his description, and eight parasites not quite a tenth of an inch in length, of a dark metallic shade, with yellow legs, and the antennæ much thicker at the end. These flies were furnished with four transparent dotted wings. If the small insect figured in the plate is the male, it is somewhat incomprehensible how it happens that so many females appear at the same time without more males.

"Another four-winged fly also made its appearance from the same stalks, of about an eighth of an inch in length, with an abdomen and legs of a bright yellow. The head and thorax were of a dark color, and somewhat metallic lustre. The wings were transparent, dotted, and fringed with short hairs, and the piercer reached to the middle of the under part of the abdomen.

"Dr. Harris states that it has been found in Massachusetts, that ploughing in the stubble has no effect upon the insects, which remain alive and uninjured under the slight covering of earth, and easily make their way to the surface, when they have completed their transformation. A free use of manure and thorough tillage,

by promoting a rapid and vigorous growth of the plant, may render it less liable to suffer from the attacks of the insect. It has been stated that this fly, like the wheat midge, does more injury on the edges of the fields than in the middle.

"At the Joint Worm Convention, held at Warrenton, Virginia, in 1854, the following was recommended: prepare well the land intended for wheat, and sow it in the beginning of autumn, with the earliest and most thrifty and hardy varieties, and do nothing to retard the ripening of the crop, by grazing or otherwise. Use guano or some other fertilizer liberally, particularly when seeding corn-land or stubble. Burn other harbors of vegetable growth, contiguous to the crop. Sow the wheat in as large bodies, and in compact forms as practicable; and, if possible, neighbors should arrange amongst themselves to sow adjoining fields the same year. Feed all the wheat, or other straw, which may be infected, in racks or pens, or on confined spots; and in April set fire to all refuse fragments about the racks; and on or before the first of May carefully burn all the straw which has not been fed. The refuse of wheat, such as screenings, &c., should also be destroyed, as the pupa case is hard, and not easily softened by dampness or wet."

ARTICLE XLVI.—*Description of Fossils occurring in the Silurian Rocks of Canada.*

A gentleman walking upon the sea shore saw crawling on the hard sandy beach, a creature of extraordinary form, which had been left dry by the receding tide, and which was groping about as if seeking to find the waters again, its natural element. Its form was somewhat like that of a huge spider, with a number of flexible legs that bent beneath its globular body as if unable to sustain the weight. As our friend became greatly interested in its figure and movements, he seized it, fancying he had captured a prize, but soon found that he had "caught a Tartar." The strange beast suddenly wound its legs around his arms and held him fast with prodigious force, as if bound with so many strong cords. So powerful was the grasp of these organs, and so tenaciously did they retain their hold, that before they could be removed it was necessary to cut them away with a knife.

This sea monster was a Cuttlefish, belonging to the class CEPHALOPODA, "animals, says a modern Naturalist, distinguished by most strange and paradoxical characters, and exhibiting forms so uncouth that the young Zoologist, who for the first time encounters one of these creatures, may well be startled at the anomolous appearance presented by beings so remote in their external construction from everything with which he has been familiar.

"Let him conceive an animal whose body is *a closed bag* containing the viscera, connected with digestion, circulation and reproduction, furnished with a head and staring eyes; that upon the head are supported numerous and complex organs of locomotion used as feet or organs of prehension; moreover, that in the centre of the locomotive apparatus, thus singularly situated is a strong and sharp horny beak, resembling that of a parrot; and he will rudely picture to himself a Cephalopod."

The Cuttlefishes are organized for a purely predacious life, and their structure is such that no animal of their own size can be entangled in their arms without almost a certainty of destruction. The body in some of the species is nearly as round as a ball; in others it is flattened and elliptical, while in many species it is elongated or cylindrical, having the mouth surrounded with its circle of arms at one end. The arms are strong, perfectly flexible, and with the whole of their inner surface covered with suckers which adhere to whatever object the animal attaches them, with such force that they will tear away the piece of flesh to which they are fastened rather than relinquish their hold. "If, says the distinguished Naturalist whom we have above quoted, the Poulpe but touch its prey it is enough: once a few of those tenacious suckers get firm hold, the swiftness of the fish is unavailing, as it is soon trammelled on all sides and dragged to the mouth of its destroyer; the shell of the lobster or of the crab is a vain protection, for the hard and crooked beak of the Cephalopod easily breaks to pieces the frail armour; and even man himself, while bathing, has been entwined by the strong arms of gigantic species and struggled in vain against a grasp so pertinacious." *

The Cephalopoda are divided by Professor Owen into two orders, the DIBRANCHIATA, having two gills, and the TETRABRANCHIATA, with four gills. Of the last mentioned order there is only one species, the celebrated Nautilus (*Nautilus Pompilius*,) known to be living in the whole world. Yet in the fossil state there are more than 1400 species whose remains have been found in the various formations. Here we have an instance of the almost total extermination of not merely a species or a genus but of nearly a whole order of animals. No doubt the Nautilus itself will in course of time cease to exist, and then the order TETRABRANCHIATA will no longer have a living representative upon earth.

* Thomas Rymer Jones: General Outline of the Animal Kingdom; 1st Ed., page 432.

The remains of the most ancient tribes of the Cephalopoda are exceedingly abundant in certain formations in Canada. The seas of the Silurian period, judging from the numbers of Orthoceratites found in the rocks of that age, swarmed with these creatures; they all belonged to the order *Tetrabranchiata.* The Dibranchiata, so powerful in the present oceans, did not come into existence until many ages had elapsed after the Trenton limestone was formed. The most common fossil Cephalopoda in Canada are the Orthoceratites, an ideal figure of one of which is here given.

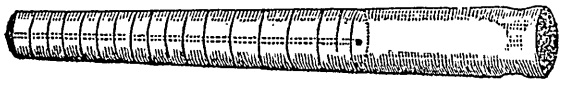


Fig. 1. *An Orthoceratite.**

In order to understand the above figure, the reader will please recollect what we have stated concerning the organization of the modern Cuttlefish. Its body consists simply of a fleshy bag, in some species of a globular shape in others cylindrical and having the head and arms at one end. The object above figured is a long straight shell, open at one end at the letter *a*, and closed at *b*. The space from *b* to *c* is divided into a number of compartments by a equal number of transverse plates of shell, or *septa* as they are called. These all communicate with each other by a tube represented by the dotted lines along the centre. This tube is called the siphuncle. From *c* to *a* is a space undivided and constituting a single large chamber, which contained the body of the animal. We have only to imagine the body of a modern Cuttlefish placed in the large chamber from *c* to *a*; and with its head and legs or arms protruding from the mouth of the shell at *a*, and we shall have formed a tolerably correct idea of a living Orthoceratite.

Certain species of those creatures in the ancient seas were of a great size. In the collection of the Geological Survey at Montreal, there are numerous specimens of the shells, which when perfect must have been ten feet in length. Their arms may have been of a corresponding length, and as the ocean swarmed with them, bathing (had there been anybody in those remote ages to bathe) would have been a dangerous recreation.

* Copied from the "Bulletin de la Société Géologique de France, Tome 12, Planche V.

These remains are quite common in the Silurian rocks of Canada, and wherever a river has worn away the loose soil, and in low water leaves a few yards of flat rock bare, the remains of Orthoceratites may be seen. In some of the species the siphuncle was composed of a number of more or less globular divisions, and in such instances, where it is seen imbedded in the stone, it bears a certain resemblance to the back-bone of a fish. The rings of the siphuncle represent the joints, and the septa the ribs, and they are often mistaken for the remains of vertebrated fishes, although none of that department of animated beings existed in the Silurian seas. Many of the species were of diminutive size, in fact mere pigmies when compared with some of their gigantic brethren. Two of these we shall figure in the present article, leaving the discussion of the others for the next number of this periodical.

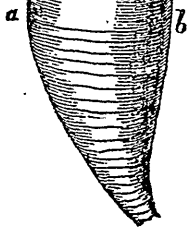


Fig. 2.

Fig. 3.

Fig. 2. *Oncoceras constrictum.*—Hall.

Fig. 3. *A section across Oncoceras constrictum, at the upper chamber from a to b.*

The word Orthoceratite is derived from two Greek words: *orthos*, straight, and *keras*, a horn, meaning literally a straight horn. The Orthoceratites are all straight. The word *Oncoceras* is from the Greek *onkos*, a bending or protuberance, and *keras*, a horn. The fossil of which the word is the generic name is not quite straight but curved, as above represented in Fig. 2. The largest are scarcely four inches in length. They are usually found in the condition of casts or moulds of the interior, the tubular shell having been destroyed. These casts shew all the septa, and the form of the large chamber in which the body of the animal was contained. This species is slightly curved, ventricose in the

middle, the greatest diameter being at the base of the upper chamber. Near the mouth there is a constriction in the casts caused by the thickening of the shell at this place. The septa are very thin and nearly flat. The siphuncle is very small, and situated close to the dorsal or convex side at the point *a*. The dorsal side is not so much rounded as the ventral, consequently a section across the fossil from *a* to *b* is elliptical, as seen in Fig. 3. In Fig. 3, the position of the siphuncle is indicated at the point *a*. The fossil tapers very rapidly to a point from the outer chamber. The ventral side is the straightest. Specimens with the outer shell preserved are covered with fine striæ which are slightly flexuous on the dorsal side.

This interesting little species was first described by Professor Hall, and as it differs from all other known generic forms of the great family of Orthoceratites, he constituted a new genus for its reception with the following characters: Genus Oncoceras, "tube curved; aperture constricted; lower part of the outer chamber and upper part of the septate portion, ventricose; abruptly contracting towards the apex; siphuncle small, dorsal; septa plane, nearly flat, slightly elevated on the dorsal margin."

Orthoceras Bilineatum.—Hall.

Fig. 4. *Portion of Orthoceras bilineatum.*

We may add that specimens in the collection of the Geological Survey of Canada shew that the aperture of *Oncoceras constrictum* was elliptical, and that the constriction seen in the casts as before stated is caused by the thickening of the shell near the aperture, forming an internal ring at this part of the tube.

The specific name is Latin, *constrictus*, narrow or constrained. We have collected specimens of this species at the "Little Chaudiere Rapids, Pauquettes Rapids, and at the City of Ottawa. It appears to be most abundant in the lower part of the Trenton limestone, in the beds reposing directly upon the Black River limestone.

Fig, 4 is also an Orthoceratite which is never seen of a great size. The largest specimen we have observed is about eight inches

in length, and scarcely an inch in diameter at the aperture. The form of the species is straight, cylindrical, slender and gradually tapering. The shell is characterized by slightly arched or undulating rounded annulations, distant from each other about two fifths of the diameter of the tube. The surface is marked from one end to the other by sharp longitudinal elevated lines, a finer line between every two of the coarser ones; we have never seen the septa of this species, and cannot say how near they are together. The siphuncle is near the centre.

This species is found at the localities given for *Oncoceras constrictum*. The specific name is from the Latin *bis*, twice or double, and *lineatus*, the participle of the verb *lineo*, to draw lines.

Fig. 5.—*Ptilodictya acuta.*

Stictopora acuta.—Hall.

The genus Ptilodictya consists of thin leaf-like fossils, branched, and with both surfaces set with numerous small ovate cells. These and other fossils of several allied genera have until recently been considered to be corals. They are now, however, thought to be the remains of animals which belonged to the department of the Mollusca. There are many species in the existing seas, and they are characterized principally by their mode of growth. The ordinary Mollusca consist of individuals free and separated from each other, each one leading an independent existence; but in the *Bryozoa*, (Greek, *bruon*, sea moss, and *zoon*, an animal,) as they are called from their moss like growth, great numbers grow together, forming twigs, leaves or plant-like objects, or encrusting in thin

layers, shells and stones on the bottom of the sea. Concerning their structure, little can be said in this place. Each one of the minute cells to be seen in the fossils is the cavity once occupied by the viscera of a single Bryozoon. Minute as these animals are, yet each individual of the recent species is found to possess a mouth surrounded by about twelve tentacula covered with vibratile cilia, or exceedingly fine hair like filaments, which by their constant motion cause currents in the water, and assist in capturing food. The food passes from the mouth into a gizzard, whence after having been comminuted, it is conveyed into an elongated stomach, and there digested. From the stomach an intestine proceeds to the surface, and opens near the mouth of the animal, serving to discharge the undigested portion of the food.

Ptilodictya acuta, the most abundant Bryozoon of the Trenton limestone, is represented by Fig. 5, copied from the first vol. of the Palæontology of New York. The branches are about one eighth of an inch in width, and from one to four inches in length. They are flat and rather sharp at the edges. There are from six to ten rows of cells. A narrow pace on the edge of each branch is without cells.

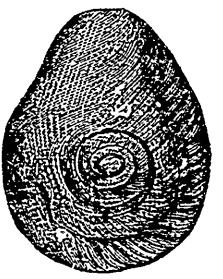


Fig. 6.

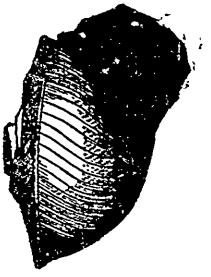


Fig. 7.

Fig. 8.

Fig. 6. *Raphistoma staminea.*—Hall. *View of the top of the shell.*
Fig. 7. *Raphistoma staminea. View of one side.*
Fig. 8. *Lingula quadrata.*

Ptilodictya is from the Greek *ptilon*, a wing, "more especially a membranous wing as that of an insect," and *dictuon*, a net, *acuta*, Latin, sharp, in allusion to the sharp edges of this species. It was called *Stictopora* by Professor Hall, from *stictos*, spotted, and *pora*, a pore, but it is now thought to belong to the first named genus. It is common in the Trenton limestone, and also in rocks of the same age in Wales.

Figs. 6 and 7 represent a fossil found in the Chazy limestone. In general shape it somewhat resembles a Pleurotamaria, but it is nearly flat above, and covered with striæ across the whorls, which are interrupted along the centre of the upper part of the whorl by a concentric elevated line, as seen in Fig. 6. Good specimens of this fossil are rare.

The generic name is from the Greek *raphe*, a seam or suture, and *stoma*, a month, from the suture or seam like appearance in the upper side of the aperture.

The specific name appears to be from the Latin *stamineus*, made of threads, or full of threads, thready, probably having reference to the thread-like striæ on the surface of this fossil.

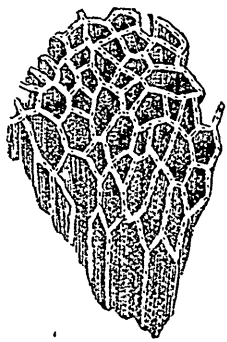


Fig. 9.

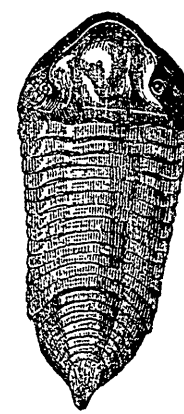


Fig. 10.

Fig. 9. *Halysites catenulates*, or *Catenipora escharoides.*
Fig. 10. *Homolonotus delphinocepalus.*

Lingula quadrata, Fig. 8, is one of the largest fossils of this genus known. Its length is about an inch, its sides nearly parrallel, extremities rounded, and the surface covered with strong concentric striæ, with longitudinal striæ extending from the top to the bottom. It occurs in the Trenton limestone and Hudson River group, and is found in the lower Silurian rocks of Europe. The specific name, *quadrata*, has allusion to the somewhat four sided shape.

The chain coral, *Halysites catenulatus*, is one of the most common of the Silurian fossils both in Europe and in America. It consists of numerous irregular vertical plates joining together so

as to form an easily recognized net-work upon the surface of the rock. The edges of the plates contain the numerous cell cavities of the polyps. These are small, oval, and varying in size from one half a line to one line in length.

Halysites is from the Greek *halysion*, a small chain or necklace, and *lithos*, a stone; *catenulatus*, Latin, from *catena*, a chain, or *catella*, a small chain; *catenopora*, from the Latin *catena*, a chain, and the Greek *pora*, a pore; *escharoides*, from the Greek, *eschara*, a gridiron.

Homolonotus delphinocephalus.

This trilobite has thirteen segments in the thorax and in the caudal shield or tail, eleven to thirteen in the central lobe, and from seven to nine in each of the lateral lobes. The head is ovate or sub-triangular; the tail is also sub-triangular and pointed at the extremity; each one of the articulations of the body has a groove running nearly its whole length near the front margin. The surface is rough and granulated. This is one of those species trilobites the central lobe of whose body is scarcely definable, the articulations being without the sharp bend on each side the centre, which constitutes the middle lobe in many other species. The glabella, or that portion in the centre of the head which is usually elevated in the trilobite, has in this species very little if any prominence. The eyes are small. The facial suture, as described by Professor Hall, is parallel and coincident with, or slighty within, the flexure of the margin (in front,) passing thence obliquely through the eye, and turning comes to the margin a little above the posterior angle. It abounds in the Niagara formation and also in the Wenlock limestone in England.