

L. P. Meigs, Nov 1871, 1872

Knowledge of Natural History

REVISED FROM

Reason Why: Natural History

Giving Reasons for Hundreds of Interesting Facts in connection with Zoology; and throwing Light upon the Peculiar Habits and Instincts of the Various Orders of the Animal Kingdom.

BY THE AUTHOR OF

"Knowledge of the Bible," "Knowledge of General Science," etc.

Illustrated with Numerous Engravings

We proceed here by the Induction Process, taking nothing on trust, nothing for granted, but reasoning upwards from the meanest fact established, and making every step sure before going one beyond it—like the engineer in his approaches to a fortress. We thus gain, ultimately, a roadway, a ladder, by which even a Child may, almost without knowing it, ascend to the summit of Truth, and obtain that immensely wide and extensive view which is spread beneath the feet of the astonished beholder.

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WHY WE HAVE REVISED AND PUBLISHED THIS BOOK.

First, realizing that the time has come that people in general want to know things and they want to learn it as easy as possible. Hence this volume is put in print.

If there is any other book of the same size that treats on the same subject that has as much real knowledge in it, we never have seen it nor we have never seen anyone else that would say that they had seen its equal. When you have this book as your own, you have something that has taken years of hard work and lots of gray matter to obtain and will be a great treasure for any library or home. It will be as good as long as time lasts as its information is absolutely reliable. There is no one that has the least asperation to know things that can deprive himself of this book. It will be a store-house of real information as long as time rolls on and will be used by your children's children. It is sent out in the name of the Giver of all Wisdom that it will gladden hearts everywhere on account of its simple way of revealing knowledge.

Respectfully,

J. B. Sanders & Co., *Publishers,*

CINCINNATI, OHIO.



PUBLISHER'S PREFACE

THE present volume of THE KNOWLEDGE OF NATURAL HISTORY is calculated to give not merely an increased interest, but a new application, to the science of Natural History. The old system of study comprehended merely a description of the external form, geographical habitation, and distinguishing habits, of individual species. The interest of the subject mainly rested upon anecdotes of animal sagacity or ferocity, and the perils of adventure into the wilds of nature. Few writers had ventured to inquire into *reasons* for the peculiarities of animal forms, or to seek Creative Design in their wonderful diversity, and mutual relations.

THE KNOWLEDGE OF NATURAL HISTORY is not a mere compilation. The Author has from boyhood been a close observer of the habits of animals, and both upon sea and land he has delighted to endeavor to interpret Nature's works. Hence the conception of the plan of this volume, and the diversity—perhaps boldness—of the questions asked.

THE KNOWLEDGE OF NATURAL HISTORY will particularly commend itself to most readers by the conversational freedom of its style—by the bold pertinence of some of its questions, and the frank, straightforwardness of its answers. It will thus be seen that it is not a mere compilation of the arid facts of naturalists, or a drowsy catechism of the wonders of this branch of creation; it is, on the contrary, a lively table-talk, as it were, between an eager, ob-

servant, curious inquirer, and a gossiping friend thoroughly informed upon every point on which his friend is probing for enlightenment and entertainment. Besides the grand basis, therefore, of acknowledged scientific truths relative to the higher order of animal life, **THE KNOWLEDGE OF NATURAL HISTORY** gives us a vast accumulation of interesting facts from the private storehouse of current experience. The interrogatories are just those which an inquisitive student would be likely to put to his instructor in obedience to the suggestions of the text; but, they are consequently those to which, in numberless instances, no work extant could furnish him with a satisfactory reply. He could obtain that reply from nothing but the practical knowledge of one familiar with the every day details, as well as the less common-place class of information on the subject. In this volume, all he seeks is grouped before him. The mental food he craves is prepared to his hand, seasoned to his taste, and exquisitely fitted to his moral digestion.

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"Nothing is foreign, parts relate to whole;
One all-extending, all-preserving soul
Connects each being, greatest with the least;
Made beast in aid of man, and man of beast."—POPE.

Knowledge of Natural History

CHAPTER I.

THE NATURAL HISTORY OF MAN.*

1. *What are the principal types of the varieties of the human race?*

The types generally recognized are those pointed out by Blumenbach, consisting of:—1. The *Caucasian*; 2. The *Mongolian*; 3. The *Ethiopian*; 4. The *American*; 5. The *Malay*.

2. *Why is the first of these types called the Caucasian?*

Because the tribes from which this great division of the human family descended have for many ages been the occupants of the mountain chain of the *Caucasus*.

The characters of this variety are, a white skin, either with a rosy tint, or inclining to brown; red cheeks; hair black, or of the various lighter colors, abundant, and more or less curled or waving; eyes dark in those of brown skin; light blue, gray, or greenish, in the fair or rosy complex-

* The chapter upon the Natural History of Man has been founded upon Johnson's Physical Atlas; Prichard's Physical History of Mankind; Lawrence's Lectures; Latham's Varieties of Man; The Encyclopædia Americana, art. Man; and the concluding pages of Humboldt's Cosmos. For the subsequent chapters, a great number of authorities have been consulted, which are specified in the list of "Authorities."

"He prayeth best who loveth best
 All things both great and small;
 For the great God who loveth us,
 He made and loveth all."—COLERIDGE.



CAUCASION.

ioned; large cranium with small face, the upper and anterior regions of the former particularly developed, and the latter falling perpendicularly under them; face oval and straight, with features distinct from each other; expanded forehead, narrow and rather aquiline nose, and small mouth; front teeth of both jaws perpendicular; lips, particularly the

lower, gently turned out; chin full, rounded, and bearded.

In this type the moral feelings and intellectual powers are most energetic, being susceptible of the highest development and culture. It includes all the ancient and modern Europeans, except the Laplanders and the rest of the Finnish race.

The sub-divisions, or varieties of this type are—the Circassian, or true Caucasian; the Syro-Arabian: Hindoo, Celtic, Grecian, Italian, German, Slavonic, etc., and Gypsies, originally from the banks of the Indus, from whence they have wandered over Europe.

"Know then thyself, presume not God to scan,
The proper study of mankind is man."—POPE.

3. Why is the second of these types called the *Mongolian*?

From the vast region of *Mongolia*, over which they are generally spread.



MONGOLIAN.

They are characterized by an olive color, which in many cases is very light; black eyes; black, straight, strong, and thin hair; little or no beard; head of a square form, with small and low forehead; broad and flattened face, with the features running together; nose small and flat; cheeks projecting; eyes

placed very obliquely; slight projection of the chin; with the ears large and lips thick. The stature, particularly in the countries within the Arctic circle, is inferior to that of Europeans.

The sub-divisions of this type are the true Mongols, the Tibetans, Chinese, Burmese, Siamese, Samooids, Yeniseians, Finns, Lapps, Esquimaux, Turks, etc. These tribes occupy Central and Northern Asia, the Asiatic Islands, and the Arctic coasts of Asia and America.

4. Why is the third type denominated the *Ethiopian*?

Because the primitive tribes were the occupants of *Ethiopia*, or the country of the *dark skinned*, the ancient name

“Be not of us afraid,
 Poor kindred man! thy fellow-creatures, we
 From the same Parent power our being drew,
 The same our Lord, our laws, our great pursuit.”—THOMPSON.



NEGRO.

of Africa. The Ethiopian embraces the African central tribes and their varieties, the *Negroes* of Western Africa, and the *Kaffirs* of the south. The *Central Africans* are marked by an elongated, narrow cranium, crisp and curly hair, projecting jaws, thick lips, and black or dusky skin. In

the *Negro* the skull is narrow, or compressed at the sides, and elongated from front to back, the dome arched and dense, the forehead convex, retreating, and narrow; the contour of the head is smooth compared with the angular form of the *Mongol*; the cheek bones project forward; the bridge of the nose is small and flat, the nostrils round and wide; mouth wide with thick lips; hair crisp and woolly, except the eyebrows and eyelashes; beard scanty on the upper lip, and chiefly confined to the point of the chin; body strong, muscular, and symmetrical; feet broad and heavy, and the soles flat. In the *Kaffir* the cranium rises higher, and is more rounded than in the *Negro*; the cheek bones project, the eyes are small and dark, the eyelids occasionally oblique, the face tapers towards the chin, and the jaws are much less prominent than those of the *Negro*.

5. *Why is the American type so called?*

"Man superior walks
Amid the glad creation, musing praise,
And looking lively gratitude."—THOMPSON.

Because it includes the aboriginals of the American continent which,

though distributed over wide latitudes, and exhibiting considerable diversity of form, have a general physical aspect which is common to the whole. The cheek bones are high, the forehead rather low and retreating; the nose prominent, not unfrequently aquiline; jaws powerful, mouth large, lips full, eyes small,



AMERICAN-WOMAN.

deep-set, and black; hair coarse, black, and rather scanty, beard scanty. Skin of a red copper color, and glossy in some North American tribes, and of a yellowish-red, light brown, and sallow hue in the various tribes of South America. This type includes all American aborigines except the Esquimaux, which are Mongolian.

6. *Why is the fifth type called the Malay?*

Because most of the tribes speak the Malay language, which, in the various ramifications of this race, may be traced from Madagascar to Easter Island in the South Pacific, half-way between Asia and America. The characteristics of this type are a brown color, varying from a light tawny tint, not deeper than that of the Spaniards and Portu-

"Truth bids me look on men as autumn leaves,
And all they bleed for as the summer's dust
Driven by the whirlwind."—YOUNG.

guese, to a deep brown, approaching to black; black hair, more or less curled, and abundant; head rather narrow; bones of the face large and prominent; nose full and broad towards the point, and mouth large. To this division belong the inhabitants of the peninsula of Malacca, of Sumatra, Java, Borneo, Celebes, and the adjacent islands of Australia, Van Dieman's Land, New Guinea, New Zealand, and the numberless islands scattered throughout the South Sea.



MALAY.

tra, Java, Borneo, Celebes, and the adjacent islands of Australia, Van Dieman's Land, New Guinea, New Zealand, and the numberless islands scattered throughout the South Sea.

7. *Why have the primitive types retained their characteristic features chiefly in mountainous countries?*

Because the stream of immigration naturally takes place in the direction of rivers, by which the tribes of the plains become mixed and changed; but mountains are less accessible, and frequently form almost impenetrable boundaries. We therefore find among mountaineers the remnants of the oldest races.

8. *Why are there so many different complexions in the tribes composing the various types?*

The problem has occupied the attention of philosophers and divines in all ages. The result of their investigations shows that no single cause, but a variety of causes, must

"'Tis vain to seek in man far more than man,
Though proud in promise big in previous thought,
Experience damps our triumphs."—YOUNG.

be considered. The most important of them are: 1, climate; 2, organization; 3, intermarriage; 4, exceptional circumstances. The influence of *climate* is shown by the fact that every zone is more or less marked by a distinctive color. Black prevails under the equator, copper color under the tropics, olive and fair towards the poles.

The influence of *organization* is shown in many instances, the Moors, who have lived for ages under a burning sun, still have white children, and the offspring of Europeans in the Indies have the original tint of their progenitors. Different complexions are in some cases intermixed by immigrant races, and white and black people dwell together; and complexions are modified by the offspring of marriages between members of the different races. But it is further and most conclusively demonstrated by an examination of the skins of the darkly-colored races, in which a secreted coloring matter is found. The skin is thicker and harder in black people than in white. The external skin of each is transparent and colorless. The coloring matter of the colored races lies in the *rete mucosum*, or inner skin, and this color is seen through the transparent *true skin*, just as white people see the traces of their dark veins through the same cuticle. The influences of *intermarriage* are abundantly demonstrated by the fact that the union of black and white parents generally produces children of an intermediate character, which are called *mulattoes*; and of *exceptional circumstances* in the less frequent occurrence of the birth of pie-bald negroes, having their skin diversified with black and white spots, and part of their woolly hair white; of short parents producing very tall children, etc.

9. The change of color in the human skin, from exposure to sun and air, is well known to be temporary. The discoloration which we term "tanning," or being "sun-burnt," as well as the spots called "freckles," are most incidental to fair skins, and disappear when the parts covered or no longer exposed to the sun. The children of the husbandman or of the sailor whose countenance bears the marks of other climes, are just as fair as those of the most delicate and pale inhabitants of a city.

"So from the first eternal order ran,
And creature link'd to creature man to man."—POPE.

10. *What imparted to various tribes the different habits and modes of life for which they are remarkable?*

Chiefly the physical features of the countries in which they were born, or into which they wandered. The people who established themselves in the frozen regions of the north not finding enough of vegetable nourishment, became *hunters and fishers*. Necessarily separated from each for the pursuit of sustenance, they multiplied slowly, and civilization remained unknown. Among such people the arts are confined to the construction of huts, the preparation of skins for covering, and to the manufacture of spears and other weapons. The inhabitants of the northern and eastern parts of Siberia, and the savages of North America, are almost the only people who are now to be found in this primitive state. Those people who feed numerous herds of cattle, in localities where it was necessary to seek new pastures for their maintenance, necessarily adopted a *wandering life*. Traveling in numbers, they acquired ideas of property and of mutual rights; and inequality of condition soon gave one man power over another. But the wandering life in search of new pastures and more agreeable climates, kept them still within very narrow limits of civilization. The Laplanders in the north of Europe, the Tartars, who inhabit the vast region in the interior of Asia, the Bedouin Arabs, who occupy the sands of Arabia and the north of Africa, and the Kaffirs and Hottentots in Southern Africa, are the principal wandering tribes that still remain. In countries where the nature of the soil and the value of the productions rendered an abiding residence essential, people took to *agriculture*, acquired property in land, developed themselves into classes, instituted laws, became less predatory and warlike; and when, in the division of labor and duty, the functions of the civilian became separated from those of the soldier, the civil portion of society cultivated various improvements and assumed the habits of civilized men.

"To man she gave, in that proud hour,
The boon of intellectual power."—MOORE.

11. *What is the chief physical distinction between man and the inferior animals?*

The *brain* of man is proportionally much larger, and the jaws are much shorter than in any other being. The brain, by its great extent, forms the protuberance of the occipital bone, the forehead, and all that part of the head which is above the ears.

In the inferior animals the brain is so small that most of them have no occiput, and the front is either wanting or but little raised. Man combines by far the largest cranium with the smallest face, and animals deviate from these relations in proportion as they increase in stupidity and ferocity.

12. *Why may we feel assured that all the varieties of man sprung from one original?*

Because we have, first, the Scriptural history of man's creation; and, secondly, scientific investigations entirely support the unity of man's origin.

Whilst attention was exclusively directed to the extremes of color and of form, the result of the first vivid impressions derived from the senses was a tendency to view these differences as characteristics, not of mere varieties, but of originally distinct species. The permanence of certain types in the midst of the most opposite influences, especially of climate, appeared to favor this view, notwithstanding the shortness of the time to which the historical evidence applied. But the many intermediate gradations of the tint of the skin and the form of the skull, which have been made known by the rapid progress of geographical science in modern times; the analogies derived from the history of varieties in animals, both domesticated and wild; and to the positive observations collected respecting the limits of fecundity in hybrids.

So long as the western nations were acquainted with only a part of the earth's surface, partial views almost necessarily prevailed; tropical heat and a black color of the skin appeared to be inseparable. When the first Portuguese navigators sailed for purposes of discovery to the shores of

"Happy the man who sees a God employed
In all the good and ill that chequer life!"—COWPER.

Africa, it was confidently predicted by learned men of the time that if ever they returned they would be as black as the negro race.

When we take a general view of the dark colored African nations, and compare them with the native of the Australasian Islands, and with the Papuas and Alfourous, we see that a black skin, woolly hair, and negro features, are by no means invariably associated.

13. Linnæus was the first who ventured to class man in a scientific system with other animals; and he did not escape the censure of some, as degrading the dignity of the human race by such an approximation; but classification is a mere statement of fact in anatomy, and the philosopher who observes and interprets nature, is not surely to blame.

Man, then, whether considered as the head of the animal creation, and a part of it; or as a sole genus and sole species, distinct from others, and lord of all; whether defined to be a biped without feathers, or a quadruped without hoofs, a monkey with a voice, or a monkey without a tail,—if viewed solely in a physical light, and setting aside his divine reason, and his immortal nature,—is a being provided with two hands, designed for prehension, and having fingers protected by flat nails, and two feet, with single soles, destined for walking; with a single stomach, and with three kinds of teeth,—incisive, canine, and molar.

His position is upright, his food both vegetable and animal, his body naked. It has been made a subject of dispute, whether there is more than one species in the human race; but it is merely a dispute of words; and if the term species is used in its common scientific sense, it cannot be denied that there is but one species. There are, however, certain and constant differences of stature, physiognomy, color, nature of the hair or form of the skull, which have given rise to subdivisions of this species.

CHAPTER II.

THE STRUCTURE OF THE HUMAN FRAME—THE BONES, MUSCLES, TENDONS, LIGAMENTS, NERVES, ETC.

14. *Why is the position of the human face exactly adapted to the erect attitude?*

Because in that posture the plane of the orbits is nearly horizontal; the cavities of the nose are in the direction for inhaling odors proceeding from before or from below; the jaws do not project in front of the forehead and chin. If the posture were changed, as painful an effort would be required to examine an object in front of the body as is now necessary to keep the eyes fixed on the zenith, and the

"Ye chief, for whom the whole creation smiles;
At once the head, the heart, the tongue of all,
Crown the great hymn!"—THOMSON.

heavens would be almost hidden from our view; the nose would be unable to perceive any other odors than those which proceeded from the earth or from the body itself; and the teeth and lips would be almost useless, for they would scarcely touch an object on the ground before the forehead and chin were in contact with it; while the view of that which they attempted to seize would be obstructed by the nose and cheeks.

15. *Why is a horizontal posture unfitted for the human body?*

Because if man were to attempt such a posture he would be compelled to rest on his knee, with his thighs bent towards the trunk; an attempt to advance them would be painful, and with his legs and feet would be immoveable and useless. Or, he must elevate his trunk on the extremities of his toes, throwing his head downwards, and exerting himself very forcibly at every attempt to bring forward the thighs by a rotary motion at the hip-joint. In either case, the only useful joint would be that at the hip, and the legs would be scarcely superior to wooden or rigid supports.

16. *Why is the variation of animal bodies most common in the center, whilst towards the extremities there is comparative uniformity?*

Because the central parts, as the skull, spine, and ribs, are in their offices permanent; whilst the extremities, as the hands and feet, are adapted to every exterior circumstance. In all animals the office of the cranial part of the skull is to protect the brain, that of the spine to contain the spinal marrow, and that of the ribs to perform the part of respiration. It is unnecessary, therefore, for these parts to vary in shape, while their offices remain the same. But the shoulder, on the contrary, must vary in form, as it does in motion, in different animals; so must the shape of the bones and of the joints more distant from the center be adapted to their various actions, and the wrist, the ankle, and the bones of

"What if the foot, ordained the dust to tread,
Or hand, to toil, aspired to be the head?"—POPE.

the fingers and toes must change more than all the rest, to accommodate the extremities to their diversified offices.

17. *Why cannot a statue stand upright on its feet without support, although it may be a model of symmetry in all its parts, and is placed in that attitude which is the most adapted to man?*

Because a statue has but one center of gravity, and when that is so shifted as that the perpendicular through it to the center of the earth falls in any way without the base of the statue—that is, without a figure formed by lines joining all the external points of the feet upon which the statue rests—the statue must necessarily fall to the earth with all the passiveness of a mass of matter of any other shape. The human body, on the other hand, has a *muscular feeling of the center of gravity*, in consequence of which, if that center inclines so much on one side that the position is beginning to become unstable, the motions and flexions of the limbs instantly shift the center of gravity, or rather shift the attitude of the body, so as to accommodate it to that center.

18. The center of gravity in the body is somewhere in the height of it, varying a little with the form; and if this center is kept in the perpendicular, the body will always maintain the position of the greatest stability, whatever may be the flexures of motions of the other parts; or the center of gravity may move so as to be over any one point in the base and yet be stable, only the stability will always be less the nearer that the body is to one side of the base, and the farther it is from the opposite side. The number of positions which the body can assume while on the same base of the two feet is almost beyond the power of arithmetic; and as the positions of the feet themselves may be also greatly varied, the command which we have of the body by means of our power of working it upon its center of gravity is truly wonderful.

19. *Why is the sole of the foot arched?*

Because by this arrangement the weight of the body is made to fall on the summit of the arch, which is supported by a strong ligament, and this method of support, as is demonstrated by bridges and other buildings, is the strongest and most secure that can be devised.

20. *Why is the human hand the most important member of the whole body?*

Because it is the hand which gives the power of execu-

"All are but parts of one stupendous whole,
Whose body nature is, and God the soul."—POPE.

tion to the mind; and it is the relative position of one of the fingers to the other four which principally stamps the character of the hand; for the thumb, by its capability of being brought into opposition with each of the other fingers, enables the hand to adapt itself to every shape, and gives it that complete dominion which it possesses over the various forms of matter.

21. *Why is the hand divided into several parts?*

Being thus constructed the hand is capable of applying a portion or the whole of its functions, according to the size, form, and weight of the object it designs to handle.

22. Thus the smallest things we take up with the tips of our fingers; those which are a little larger we take up with the same fingers, but not with the tips of them; substances still larger we take up with three fingers, and so on with four or all the five fingers, or even with the whole hand; all which we could not do were not the hand divided, and divided precisely as it is.

23. *Why are the hands made equal to and inclined towards each other?*

Because when bodies of a great weight and large size are to be grasped on opposite sides, it is necessary that the instruments which lift them should be capable of this combined action.

24. *Why are extremities of the fingers soft and round?*

If they had been otherwise formed, or made of bone instead of flesh, we could not then lay hold of such minute bodies as thorns or hairs. For, in order that a body may be firmly held, it is necessary that it be in some degree enfolded in the substance holding it; which condition could not have been fulfilled by a hard or bony material.

25. *Why are the fingers of an unequal length?*

This difference in the length of the fingers serves innumerable purposes in connection with the arts and ordinary operations of life; thus a pen, a pencil, a brush, an engraving tool, a sword, a hammer, etc., may be more securely grasped, and used with greater facility; for if the fingers were of an equal length, one would get in the way of the

“Man! know thyself. All wisdom centers there:
To none man seems ignoble, but to man.”—YOUNG.

other, and prevent the whole from performing their office properly.

26. *Why are the palms of the hands and the insides and tips of the fingers guarded by cushions of skin?*

If it were not for this protection, the strain upon the blood vessels and nerves would be too great, and the texture even of bones and muscles would not be able to sustain the demand made upon them.

27. *Why are the fingers furnished with nails?*

If the fingers were not thus furnished, the flesh would be forced out of its position and incapable of supporting hard substances; the assistance of the nails is also necessary in retaining minute objects which would otherwise elude the grasp.

28. The nails are applicable to many other purposes, and in polishing and scraping, in tearing and peeling off the skins of vegetables and animals, and in almost every act where nicety of execution is required.

29. *How are the nails of the hands and feet formed?*

The nails are a part of the scarf skin, and present the same phenomena of adaptation to the surface of the sensitive skin, but in a more striking manner. The portion of sensitive skin which gives support to the nail is formed into very delicate longitudinal folds, which stand up perpendicularly to the surface. The nail upon its under surface is fashioned into thin vertical plates, which are received between the folds of sensitive skin; and in this manner the two kinds of laminæ reciprocally embracing each other, the firmness of connection of the nail is maintained.

30. If we look on the surface of the nail we see an indication of its structure in the alternate red and white lines which are there observed; the former of these correspond with the sensitive laminæ, the latter with the horny plates, and the ribbed appearance of the nail is due to the same circumstance. These sensitive laminæ are provided with an unusual number of blood-vessels for the formation of the nail, and hence they give a red tint to that portion under which they lie; but nearer the root of the nail, there is a part which is not laminated, but merely ridged longitudinally, and is less abundantly supplied with capillary vessels. This latter part consequently looks pale if compared with the preceding. The root of the nail is embedded in a fold of sensitive skin to the depth of about a twelfth part of an inch for the fingers and toes, about

"Vast chain of being! which from God began,
Natures ethereal, human, angel, man."—POPE.

the eighth part of an inch for the thumb, and the sixth of an inch for the great toe.

31. *What are the papillae?*

Papillæ are the termination of the nerves on the surface of the skin, soft and pulpy, and forming minute protuberances, resembling the nap of frieze cloth, though greatly inferior in magnitude. These nerves are a species of animal feelers, and are the immediate instruments of sensation.

32. When examining or enjoying any object, it is natural to enquire, What are the changes produced in the nervous papillæ or organs of sensation? If an object possessed of agreeable feeling is perceived, the nervous papillæ instantly extend themselves, and from a state of flaccidity become comparatively rigid. When a person in the dark inclines to examine any object, in order to discover its figure or other qualities, he perceives a kind of rigidity at the tips of his fingers. If the fingers are kept long in this state the rigidity of the nervous papillæ will give him a kind of pain or anxiety, which is caused by the over distention of the papillæ. If a small insect creep upon a person's hand, when the papillæ are flaccid, its movements are not perceived; but if he happen to direct his eye to the animal, he immediately extends the papillæ, and feels distinctly all the motions of the insect.

33. *Why is the cuticle slightly rough, instead of being perfectly smooth; as might be hastily considered its most appropriate characteristic?*

Because the slightly rough surface endows it with a quality more adapted to convey sensation. An illustration of this truth is furnished by the imperfect sense of touch which contact with polished surfaces affords, as compared with the handling of rough bodies.

34. A provision for increasing friction is especially necessary in some parts of the skin. Thus the roughness of the cuticle in the palm of the hand, and in the sole of the foot, gives us a firmer grasp and a steadier footing. Nothing is so little apt to slip as the thickened scarf-skin, either of the hand or the foot.

35. *Why has the skin a purple hue when exposed to cold?*

Because the vigor of the nervous power is reduced by cold; and in addition to the repulsion inward of most of the blood contained within the vessels of the skin producing pallor, that which remains behind moves so languidly through the capillaries that the change from bright red to deep black

“Know, Nature’s children, all divide her care,
The fur that warms a monarch, warmed a bear.”—POPE.

red has time to be established before it completes its circuit and reaches the veins.

36. *Why is fat necessary to the system?*

Its principal uses are mechanical. It surrounds the organs like an elastic cushion, so as to protect the more delicate parts from sudden and injurious shocks. The soles of the feet, for example, upon which the whole weight of the body rests, and which in locomotion are subject to frequent concussion and pressure, are protected by a cushion of fat, which breaks the shocks which would otherwise take place between the foot and the ground, in the same manner as do the buffer-cushions which are placed between the carriages of a railway train.

37. There is another physical quality in fat which renders it of considerable utility in the animal economy. It is nearly a non-conductor of heat, and as it is generally collected in a superficial stratum investing the organs, it prevents the undue escape of heat, and keeps the body warm; it thus performs the part of a blanket or clothing, and it is found accordingly that fat persons are less chilly than thin persons.

3. *Why does hair form so appropriate a covering for the head?*

The hairs by their number and the manner in which they are disposed, are well adapted to deaden any strokes which may fall on the head, and to prevent strong pressure from wounding the skin. Being bad conductors of heat, they form a sort of felt, whose meshes intercept the air, and by that means preserve a uniform temperature in the head, to a certain degree, independent of that of the air and of surrounding bodies; besides, being impregnated with an oily matter, the hair imbibes but a small quantity of water, and very soon dries.

39. *Why is the human body soft and round in youth, and hard, unequal, and angular in advanced life?*

Because the softness and roundness of form of the human body is owing to the greater proportion of fluids to that of solids; the younger the age the greater the preponder-

“There closely braced,
And neatly fitted, it compresses hard
The prominent and most unsightly bones,
And binds the shoulders flat.”—COWPER.

ance of fluids. The human embryo when first perceptible is almost semi-fluid; solid substances are gradually but slowly superadded, and even after birth the preponderance is strictly according to age: for in the infant the fluids abound more than in the child; in the child more than in the youth; in the youth more than in the adolescent; in the adolescent more than in the adult; and in the adult more than in the aged.

40. The fluids are not only more abundant than the solids, but they are also more important, as they afford the immediate material of the organization of the body; the medium by which its composition and decomposition are affected. They bear nourishment to every part, and by them are carried out of the system its noxious and useless matter.

41. *Why is the spinal column flexible?*

This flexibility renders the movement of the body free, easy, and varied, and accommodating to the complex combination of motion which may be brought into play at any moment, with the rapidity of the changes of thought, and at the command of the impulses of feeling. If the spinal column were composed of a rigid and immovable pile of bones, all the other-parts of the body, to which they are directly or indirectly attached, would have been rendered stiff and mechanical in their movements, and would not have been able to move, save in a given direction.

42. The degree of flexibility which the spinal column possesses, and the extent to which, by the cultivation of it, it is sometimes actually brought, is exemplified in the positions and contortions of the posture-master and the tumbler. It is acquired by means of the compressible and elastic matter interposed between the several vertebræ. So compressible is this substance that the human body is half-an-inch shorter in the evening than in the morning, having lost by the exertions of the day so much of its stature; yet so elastic is this matter that the stature lost during the day is regained by the repose of the night.

43. *Why are all the bones of the body covered with a delicate coating, termed periosteum, except the teeth?*

The teeth are not true bones, but are related to the skin outgrowths. Like the hairs, the teeth are nourished through the base and not like the bones over the whole surface.

"In human works, though labored on with pain,
A thousand movements scarce our purpose gain;
In God's one single can its ends produce;
Yet serves to second too some other use."—POPE.

Had so exquisitely sensitive a membrane as the periosteum invested the teeth, as it invests every other bone of the body, action, necessary exposure, and irritation would have subjected the animal to continual pain. General as it is, it was not the sort of integument which suited the teeth; what they stood in need of was a strong, hard, insensible defensive coat, and exactly such a covering is given to them, in the ivory enamel which adheres to their surface.

44. *Why are the front teeth of the mouth sharp and the back teeth broad and blunted?*

Because the office of the former is to cut and separate the food; while the purpose of the latter is to grind it to a pulp, by which it becomes fitted for the process of digestion.

45. *What are the uses, distinct and mutual, of the bones and muscles?*

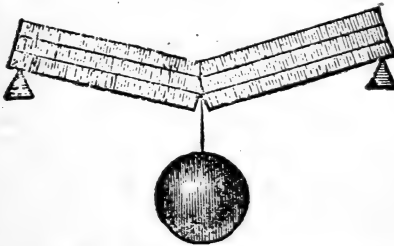
The bones are to the body what the masts and spars are to a ship—they give support and the power of resistance. The muscles, again, are to the bones what the ropes are to the masts and spars; it is to them that the bones are indebted for the preservation or the change of their position. If the bones or masts are too feeble in proportion to the weight which they are required to sustain, then a deviation from their shape or position takes place; and, on the other hand, if the muscles or ropes are not sufficiently strong and well braced, then insufficiency of support must necessarily result.

46. Early infancy affords an instance of both of the above-mentioned imperfections, the bones being infirm, and the muscles small and destitute of true fleshy fibers. The disease called "Softness of the bones," is an illustration of what may be called a weak mast of the body, which must yield if its muscles be strongly drawn. The state of muscular debility consequent on fever and many acute diseases, or even on sudden fright, is, on the other hand, an instance of the inability of the bones alone to preserve an attitude or execute motion, when the muscular system is weakened by disease.

47. *Why is the cylindrical form of the long bones of the body advantages to structure of the human frame?*

"The man who consecrates his hours
By vigorous effort, and an honest aim,
At once he draws the sting of life and death."—YOUNG

The superior advantages of this arrangement are illustrated as follows: If a piece of timber supported on two points, thus—



bear a weight upon it, it sustains this weight by different qualities in its different parts. For example, divide it into three equal parts, A, B, C; the upper part, A, supports the weight by its solidity and resistance to compression; the lowest part, B, on the other hand, resists by its toughness or adhesive quality. Between the portions acting in so different a manner, there is an intermediate, neutral, or central part, C, which may be taken away without materially weakening the beam, which shows that a hollow cylinder is the form of strength.

48. *How is it that the joints of the body undergo so much use for many years without diminution of their action?*

This durability is attributable to the provision which is made for preventing wear and tear, first, by the polish of the cartilaginous surfaces; secondly, by the healing lubrication of the mucilage, and in part to that astonishing property of animal constitutions, assimilation, by which in every portion of the body, let it consist of what it may, substance is restored and waste repaired.

49. The union of joints even where no motion is intended or required, carries marks of mechanism and mechanical wisdom. The teeth, especially the front teeth, are one bone fixed in another, like a peg driven into a board. The sutures of the skull are like the edges of two saws clapped together in such a manner as that the teeth of one enter the intervals of the other. We have sometimes one bone lapping over another, and planed down at the edges; sometimes, also the thin lamella of one bone re-curved into a narrow furrow of another. In all

"Each night we die,
Each morn are born anew: each day a life
And shall we kill each day? If *trifling* kills,
Sure *vice* must butcher."—YOUNG.

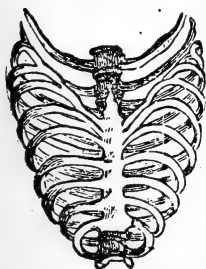
of which varieties we discover the same design; namely, firmness of junction without clumsiness of seam.

50. *How are the strength and lightness of the human body preserved independently of the bones?*

By the pressure of the atmosphere, consequent on the air-tight character of the bag formed by the synovial membrane (which secretes the oily fluid of the joints), and which is of itself more than sufficient to keep the articulating surfaces of the bones in contact.

51. This admirable fact is most readily demonstrated by the hip-joint. The round head of the thigh-bone is received into a socket, thus constituting what is familiarly known as a ball-and-socket joint; and all communication between the cavity of the joint and external fluids is cut off by the synovial membrane. The power thus exercised by the atmosphere is about one-fifth greater than would be necessary to support a limb weighing thirty pounds, and the barometer would require to fall twenty-five inches to place the limb and the atmosphere in exact equilibrium. The pressure of the atmosphere on the shoulder joint is capable of supporting a weight nearly twice that of the arm, and the force thus exercised upon the elbow-joint, knee-joint, and highest joint of the fore-finger are respectively six times, nine times, and thirty-five times greater than are requisite for the support of the fore-arm, leg, and finger.

52. *What is the structure of the ribs?*



The ribs are a frame of bones which enclose a hollow space. The lungs and heart are within them. The ribs are fastened in front to a bone called the breast-bone, and are joined at the back to the backbone. In front, the rib-bones are joined to the breast-bone by gristle, and this gives them a certain amount of flexibility, and enables them to move more easily when the lungs fill with air.

53. *Why is the skull the only cavity in the body that is not enclosed by a membrane?*

Because the importance of the brain to life, and the extreme tenderness of its substance, make a solid case more necessary for it than is required for any other part. The skull also completely surrounding its contents, is calculated not for motion, but solely for defense.

"Hope humbly then; with trembling pinions soar;
Wait the great teacher Death, and God adore."—POPE.

54. *Why are persons remarkable for their stupidity commonly termed "thick-headed?"*

The bones of the cranium which are in connection with those of the face, require to increase proportionately in their growth, so as to keep pace with the face, and preserve the symmetry of the parts. This they do, however, only in their external table, the internal remaining to preserve the symmetry of the bones of the cranium. From this inequality of development, spaces are left between the two tables termed sinuses. In the forehead, immediately under the eye-brows, there are two such named frontal sinuses. It sometimes happens that the brain shrinks from disease, as in idiocy. In such cases the internal table follows the brain, and the distance between the two tables is increased, the intervening space being either filled with a kind of refuse, or remaining empty, forming unusually large sinuses.

55. A female child about four months after birth was noticed to have an unusually large head. Till the fourth year, however, it did not excite much attention, and the mental powers up to this period seemed to be excited in the ordinary degree. At this period, however, the head began rapidly to enlarge, and the mind became more and more obscured, till complete idiocy supervened, and continued till her death, which occurred in her twenty-second year. The head became too large to be supported by the puny muscles of the neck; she therefore constantly lay on a pallet by the side of the fire. She appeared to have some slight glimmerings of mind, was readily amused, like a young child, with noise and brilliant objects, and for years kept rubbing a penny piece in her hands, which she would not part with day or night, and which became at length reduced to the thinness of a wafer.

56. *What purposes are served by the projection of the heel and the prominence of the knee-pan?*

They increase by mechanical adjustment the power of the muscles; for by such means the point of insertion of the muscles is removed to a distance from the center of motion in the joint, and the lever power thus obtained is greatly increased.

57. *Why is it, that although the bones are designed for the strengthening and support of the frame, yet they never touch each other?*

Because were it not for the fine elastic material, the cartilage, interposed between the bones, the frame would be

"How poor, how rich, how abject, how august,
How complicate, how wonderful is man."—YOUNG.

deprived of its elasticity. Without such elasticity, a jar would reach the more delicate organs, even in the very recesses of the body, at every violent motion; and every joint would crack by the attrition of the surfaces of the bones.

58. *What is a muscle?*

A muscle is composed of long slender fibers, which possess the power of contracting, and are everywhere enveloped in common cellular membranes; the fibers become fewer as they approach the extremity of the muscle, and ultimately terminate. The cellular substance that envelopes them being thus freed from the muscular fibers, joins more closely together, and forms itself into a white, round, or flattened tendon. When the muscular fibers contract, their power is united on the tendon, and drawing it up, makes it perform the action of a pulley.

59. Different muscles accomplish very different purposes. Some of them draw down the limb or part to which they are attached, if it has a moveable joint, and is placed under the part of the body in which it acts. Others elevate and extend the moveable parts to which they belong, and are placed on the superior surface. Some muscles, also, move on the parts obliquely, as the oblique muscles of the eye, and others make them describe a semi-circle, as in the motions of the neck, arms, legs, etc.; some elevate the upper eyelids; others contract them, as the eyebrows; or wrinkle them, as the extremities of the lips. The muscles also act on the legs, arms, fingers, toes, etc., in moving them to either side. Another example of their power is instanced in the forearm, legs, etc. The beauty of the mechanism of the muscles is also evinced in the abdomen, where some are transverse, others straight, oblique, etc.

60. *What are the nerves?*

They are a species of fine thread running from every part of the body, charged with exquisite sensibility, by which they convey the impression or commands between our will and our muscles.

The vital power of a muscle resides in the nerves, and is nervous. Its irritable power is the property by which it feels and acts, when stimulated without consciousness. It is an inherent principle belonging to its constitution, and remains some time after death. Ligaments and tendons support the same weight, whether dead or alive; but a living muscle that lifts one hundred pounds with ease, cannot, after death, raise twenty pounds without danger of rupture. When a muscle is newly cut from a limb, it palpitates and trembles for a considerable time—it cannot be nervous power that thus makes it irritable; for the nerves being separated from their organ, are dead and powerless. If the heart is newly separated from the body, it contracts if irritated.

"Look round our world; behold the chain of Love
Combining all below, and all above."—POPE.

The bowels continue their peristaltic motion after death, until they become stiff and cold. This quality belongs absolutely to the muscle, and exists, in some cases without nervous irritability altogether—hence, there is a distinction between nervous sensibility and muscular irritability. The former dies immediately with the animal; the latter lives for a short time after the animal is dead. Muscles are irritable and contractile by the inherent principle of their fibers, and are sensible by the vitality communicated through their nerves. Though nerves are sensible, they are not contractile, and cannot perform the functions of muscular fibers.

61. *Why do we find muscles under a multiplying of forms and attitudes, sometimes with double, sometimes with treble tendons, sometimes with none, sometimes one tendon to several muscles, at other times, one muscle to several tendons?*

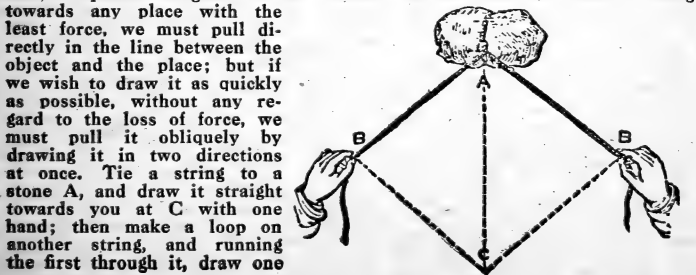
The reason for this great mechanical variety in the figure of the muscle, is owing to a fixed law that the contraction of a muscle shall be towards its center. Therefore, the object for mechanism on each occasion is so to modify the figure and adjust the position of the muscle as to produce the motion required agreeably with this law. This can only be done by giving to different muscles a diversity of configuration suited to their several offices, and to their situation with respect to the work which they have to perform.

62. The illustration of this principle is as follows: *A* is the tendonous organ; *B* the tendonous insertion, and the muscular fibers run obliquely between them. This obliquity of the fibers is almost universal in the muscles of the limb, and the effect is very important. If we pull obliquely



upon a weight, we sacrifice a great deal of power. For what advantage, then, is power resigned in the muscle? If we wish to draw a thing towards any place with the least force, we must pull directly in the line between the object and the place; but if we wish to draw it as quickly as possible, without any regard to the loss of force, we must pull it obliquely by drawing it in two directions at once. Tie a string to a stone *A*, and draw it straight towards you at *C* with one hand; then make a loop on another string, and running the first through it, draw one

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"Leisure is pain; takes off our chariot wheels;
How heavily we drag the load of life;
Blest leisure is our curse."—YOUNG.

string in each hand, B, B, not towards you in the line A, C, but sideways, till both strings are stretched in a straight line; you will see how much swifter the stone moves than it did before when pulled straight-forward. Now this is proved by mathematical reasoning to be the necessary consequences of forces applied obliquely; there is a loss of power but a great increase of velocity. The velocity is the quality required to be gained.

63. *By what mechanism are the motions of the arm performed?*

The arm is joined to the body, and moved by numerous powerful muscles; and is fixed to the breast by the ligaments of the collar-bone. The muscles that move the shoulder-blade lie upon the trunk; those that move the arm lie upon the shoulder-blade; those that move the fore-arm lie upon the arm; and those that move the hand and fingers lie upon the fore-arm. But as the arm requires easy, circular motions, it has a multiplicity of parts to perform them. It has the wrist, for turning it round; the elbow, for its hinge-like motions; and the shoulder-joint, on which it rolls; and to assist all those, the moveable shoulder-blade becomes the center of their motions; for, after a certain point of elevation, the motion of raising the arm is performed by the action of the shoulder-blade upon the trunk; when our shoulder-bone is raised to a horizontal position, it is checked by the upper part of the shoulder-joint which hangs over it; and if we elevate our arm still higher, the shoulder-blade rolls, turning upon the point of the collar-bone; and, as it turns, it glides easily upon those muscles, which lie like a fleshy cushion between it and the trunk over which it is placed.

64. *Why are the muscles often removed by means of slender strings from the parts they are designed to rest upon?*

Because, in many cases, the situation of the muscles where they are immediately required would be inconvenient. If the muscles which move the fingers had been placed in the palm or the back of the hand, they would have swelled that part to an awkward and clumsy thickness; the beauty and the proportion of the part would have been destroyed. They are, therefore, disposed in the arm, and even up to the elbow,

"Since God is ever present, ever felt,
In the void waste as in the city full;
And where he vital breathes there must be joy."—THOMSON.

and act by long tendons strapped down at the wrist, and passing under the ligaments to the fingers and to the joints of the fingers which they are severally to move. In like manner, the muscles which move the toes, and many of the joints of the foot, are disposed in the calf of the leg, instead of forming an unwieldy tumefaction in the foot itself. Thus, also, is it with the nictating membrane over the eye. Its office is in the front of the eye; but its body is lodged in the back part of the globe, where it lies safe, and where it encumbers nothing.

65. *What are tendons?*

Tendons are not only necessary as pulleys to the bones, but to give the limbs a proper form, and preserve their beautiful symetry. Tendons are seldom required, except where muscles are inserted into bones. There is no tendon in the heart, the stomach, the bowels, or the gullet; these do not require them, for the motions are wholly contractile, and need no lever power. But where tendons pass over bones and traverse joints, the force is concentrated into narrow bounds, and their long cords being fixed to the extremities of the muscles, pull the bones, and raise them in obedience to our will. Tendons have no visible nerves, and little or no motion.

66. *What is cartilage?*

Cartilage is intermediate in hardness with bone, and what are called the soft parts—it is firm and resisting, and yet it has a great deal of elasticity. In some parts of the body there are cartilages serving for continuations of bones, such as those which continue the ribs and connect them to the breast-bone, and they are exactly similar to bones from which the earthly parts have been dissolved by an acid.

67. The cartilaginous crusts which cover the auricular ends of bones are of a very beautiful and peculiar structure. If a piece of bone be sawn towards its articular end, till all be cut through, and then the remaining part, and the cartilage covering it be torn asunder, the cartilage will be found to present an infinity of fibers set perpendicularly on the surface of the bone. When a portion of the bone with its articular cartilage has been soaked in water for some weeks, the cartilage is

“We censure Nature for a span too short;
That span too short we tax as tedious too;
Fortune, invention, all expedients tire,
To lash the lingering moments into speed.”—YOUNG.

found to have lost its smooth surface and cohesion, and looks exactly as if the bone had been covered with white velvet.

68. *What are ligaments?*

Ligaments are composed of numerous straight fibers collected together, and arranged into short bands of various breadth, parallel or radiating, and interwoven with others which cross them. Sometimes the ligament is so formed as to surmount the articular ends of two bones which move upon one another, and here it is called a capsule. Ligaments are not extensible nor elastic; hence, when any attempt is made to stretch them too far, great pain is the result, and inflammation follows, and they are said to be sprained.

CHAPTER III.

THE INTERNAL ORGANS OF THE HUMAN FRAME: THE HEART, LUNGS, LIVER, STOMACH, BRAIN, ETC.

69. *How is blood formed?*

The food which we eat is masticated and afterwards swallowed; it is then received into the stomach, where it is prepared by digestion for the nourishment of the body. Here there is a fluid formed which changes the food into a substance called *chyme*, which, passing into the several intestines, is there converted into a milky liquor denominated *chyle*. This is the fluid matter from which the blood is formed.

70. *What is the composition of blood?*

The blood may be described as consisting of innumerable cells suspended in a gelatinous fluid. These cells or globules are formed of thin transparent sacs, evolving a reddish fluid, the quantity and quality of which undergo constant changes, in consequence of its passing to and fro vessels

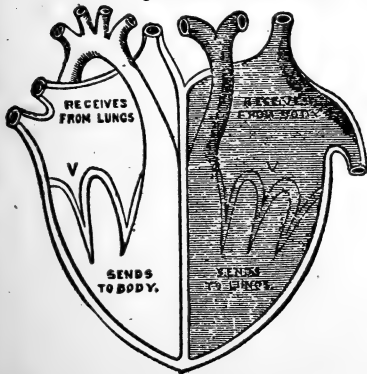
"Blest son of foresight, lord of fate!
That awful independent of to-morrow!
Whose work is done; who triumphs in the past;
Whose yesterdays look backward with a smile."—YOUNG.

containing a denser fluid. As a general rule, the deeper or lighter color of the blood may be said to depend on the greater or smaller number of the globules. The color may also become darker although the globules are diminished; and this is caused by the blood cells assuming a more globular form, through its action of passing in the vessel containing the denser fluids, and reflects the rays of light in a different manner.

71. *How is the blood in the human body circulated and purified?*

First, the heart sends the blood to all the capillaries through one set of blood-vessels called *arteries*. Then the blood is brought back to the heart by another set of blood-vessels called *veins*. Next by the blood which returns by the veins is impure, and is sent by another set of arteries from the heart into the lungs, to be purified by the air we breathe. Then it is brought back to the heart by another set of veins. Thus there are two sets of arteries and veins through which the blood is all made to pass; first, through the body and back to the heart for the purpose of nourishment, and then through the lungs and back for the purpose of purification.

72. The *right side* of the heart receives and sends out the impure



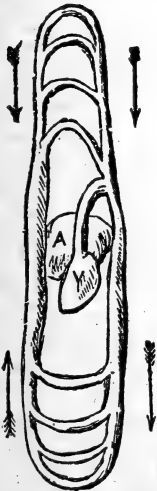
blood. The upper division receives it from the body through two large veins. Then the blood passes to the lower division of the heart, where it is sent to the lungs through one large artery with two branches, one for each lung. This is the *pulmonary artery*. The *left side* of the heart receives and sends out the *pure* blood. The upper portion receives it from the lungs through three large veins. Then the blood passes to the lower division of the heart when it is sent to the capillaries all over the body through one large artery called the *aorta*.

"All men think all men mortal but themselves;
 Themselves, when some alarming shock of fate
 Strikes through their wounded hearts the sudden dread."—YOUNG.

73. *Why is the blood regarded as so important an agent in animal economy?*

Because the blood is the vehicle of life to every atom of our organization. By properties peculiar to itself, all the various fluids of our body are produced from it, and every particle of bone, muscle, membrane, nerve, and vessel must have existed as an ingredient of the blood, and have been conveyed to its appropriate place by this circulating spring of energy and nourishment. No vital action is maintained without blood, and should it cease to flow through the brain, all the sense would be speedily shut up, and every function speedily superseded.

74. In the accompanying engraving the circulation of the blood as performed by a single heart is depicted: *V* represents the ventricle, or strong muscular bag of the heart, which when filled with blood contracts upon it, just as any other muscle does, and so forces out the contents through the pipe which arises from it, called the aorta, just as the contents of an india-rubber bag are squeezed out through a pipe fixed in its neck. The only difference is, that whereas an external force squeezes the bag, the heart, being muscular, has a power of contraction of its own, and, as it were, squeezes itself; and then, just like the india-rubber bag which regains its shape when the pressure is removed, so the heart, when it has squeezed out all the blood, dilates itself again, and is ready to contract anew. The blood having been poured into the great artery, goes through branches up to the head, and down to the lower part of the body, where its minute or capillary terminations are seen to end in veins. Those from the lower part of the body form an inferior great vein; those from the upper, a superior: and the two veins terminate separately into a bag *A*, called the auricle. The auricle is not nearly so strong as the ventricle, because it has nothing to do with forcing the blood over the body: it is intended merely as a receptacle for the venous blood, till the ventricle be ready to receive it. The auricle is constantly full of blood, which flows to it through the veins in an equable stream, so that whenever the emptied ventricle dilates, the blood from the auricle rushes in, and distends it for a renewed contraction. The arteries are a set of tubes both dilatable and elastic. Hence at the moment



when the ventricle contracts, the blood which is forced into them distends them, increasing their diameter, and producing the feeling communicated to the fingers placed over them, which is called the pulse. The number of the pulse is therefore the number of contractions which the heart is making in a minute; and at the moment when the ventricle dilates, the artery, having the distending force taken off, contracts on

"At thirty man suspects himself a fool,
Knows it at forty, and amends his plan."—YOUNG.

its contents. It would now drive part of the blood back again into the ventricle were it not for a valve placed in the artery at its origin, which shuts down the moment the pressure comes on it backwards, so that the force of the elasticity of the artery is expended in propelling the blood forward, not in an equable stream but in successive waves. Again; when the ventricle contracts to throw its blood into the aorta, it would throw back an equal portion into the auricle, were not a valve placed there also, which shuts the moment the ventricle contracts.

75. *Why have veins a blue or black appearance, although blood is of a red color?*

Because the oxygen which the blood originally contains is absorbed as it passes through its course of circulation, and the blood is discolored. But when it is again sent through the lungs, it receives a fresh supply of oxygen and regains its color.

76. *Why are veins sometimes seen to swell?*

As long as the veins that proceed from the organs are free, the blood that arrives in them from the arteries runs on and does not accumulate in them; but if the veins are compressed, or cannot empty themselves of the blood always arriving by the arteries, and finding no place in the veins, accumulates on the tissue of the organ, distends the blood-vessels, and augments, more or less, its volume, particularly if its physical properties can undergo these changes. The swelling of the brain, by the difficulty of the circulation happens every time that the blood has more difficulty in passing through the lungs; and as that generally takes place in expiration, the brain swells in this instance so much more in proportion as the expiration is more complete and of larger continuation.

77. *Why is a ligature tied round the arm when it is bled?*

Because the veins have valves placed in them at certain distances, which prevent the blood from flowing backward from the heart towards the extremities; when the ligature is tied the blood is constantly arriving from below, because the pressure is not great enough to obstruct the arteries, but it

"Then say not man's imperfect, Heaven in fault;
 Say rather, man's as perfect as he ought;
 His knowledge measured to his state and place;
 His time a moment, and a point his space."—POPE.

cannot get up past the bandage; the veins are therefore distended and become prominent, so as easily to be seen and punctured; and then as the blood cannot get down the arm again on account of the valves, it is necessitated to flow out at the orifice.

78. *Why does moderate cold act as a stimulant to the system?*

Because cold repels the blood from the surface, braces and contracts the integuments, and lessens the transpiration. The thinner and superfluous quantity of the circulating fluid is no longer thrown from the surface, but is drained off in the fluid state, and thus all the heat which would have been requisite for its conversion into vapor is preserved, and affords additional nourishment to the system.

79. *Why does fear cause the cheeks to turn pale, while rage makes them red?*

Because, when persons are affected by fear, the respiration and the afflux of arterial blood are diminished, and paleness of the skin consequently ensues; but when the passions are excited, respiration and the afflux of arterial blood are increased, and a flushed state of the cheeks follows.

80. *Why is a pale cheek and blanched lip an indication of disease?*

Because the lesser or greater number of globules present in the blood is made known in the one case by the pallor of the cheek, and in the other by its florid appearance. And as these red globules are the carriers of oxygen, and consequently in a great measure the excitors of vital action, it follows that the general state of the health is necessarily regulated by the supply of these important agents.

81. *Why is headache increased by a fit of coughing?*

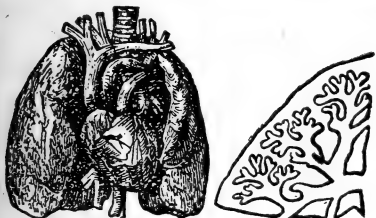
"We gaze around;
We read their movements; we sigh; and while
We sigh, we sink, and are what we deplored."—YOUNG.

Because expiration assists the heart in propelling the blood, and as the act of coughing considerably increases expiration, the flow of blood to the brain is greatly augmented, and the consequent distended state of the vessels adds to the aching of the head.

82. *What are the lungs?*

The two lungs are placed, on each side of the spine, in hollow spaces formed by the arching of the ribs. They may be compared to large pieces of sponge, which alternately suck in and squeeze out the blood of the body and the air of the surrounding atmosphere. The air passes and re-passes by the same tubes. The air-tubes, commencing with the wind-pipe, and branching off frequently in different directions, become gradually smaller and more numerous until they terminate in minute expansions, which are the air-cells

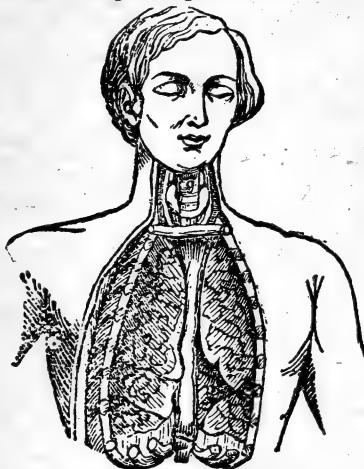
of the lungs. The blood is raised into the lungs by one set of tubes or vessels termed arteries, and passes back by another set of vessels termed veins. When the ribs are raised and the floor of the chest drawn



down by the muscles of inspiration, the walls of the chest fall in, or when they are brought nearer together by the muscles of expiration, the due proportion of air and blood is, by gentle pressure, sent out from the interior of the lungs. A firm and elastic membrane lines the inside of the chest, and the same membrane passing back, covers in the lungs, forming their outer coat. By this doubling of the membrane, the lungs without being attached except at their roots, where the lobes enter, are held by their own elastic action in close contiguity to the chest, and thus they move freely with its movements.

"Man flies from time, and time from man; too soon
In sad divorce this double flight must end."—YOUNG.

83. The right lung is divided into three parts or lobes; the left lung is divided into two lobes, between which is a space where the point of the heart lies. Each lung is contained in a small membranous bag called the pleura, and the air-vessels which are connected with the windpipe, through which we breathe, run along between the blood-vessels in the lungs, and so give to them that quantity of air which is required to change the color of the blood and to render it fit for circulation.



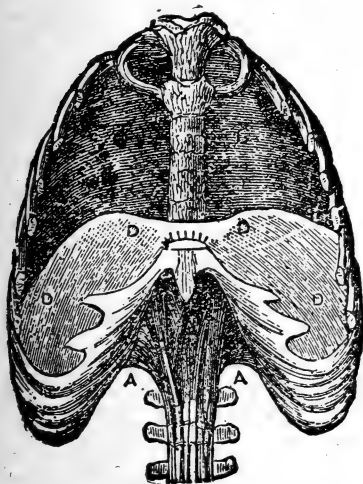
The accompanying engraving will serve to illustrate the structure and position of the lungs: in the center is a membrane which divides the chest. The ribs are cut off, so as to show the inside of the chest. The diaphragm which divides the chest from the abdomen has been removed. The three lobes of the right lung and the two lobes of the left lung are shown in their proper positions; *g* is the windpipe through which air is admitted.

84. *Why are the lungs capable of indicating whether an infant found dead has been still-born or not?*

Because lungs which have never breathed are heavier than water, and sink; but lungs which have breathed, if only once, are lighter than water, and swim.

85. The lungs, previously to birth, are compressed like a squeezed sponge, and expand whenever the pressure is taken off. The moment they expand the air rushes in by the nostrils and mouth; and the force with which it enters causes the expansion a little beyond the natural state. This acts as a stimulus upon the muscles, which immediately contract, diminish the cavity of the chest, and, in conjunction with the elasticity of the lungs, expel the air till the lungs are again reduced to less than their natural capacity, and this stimulates the antagonists of the former muscles, namely, those which expand the chest, and they assist the pressure of the atmosphere in again filling the lungs. The expansion of the lungs is always produced by their own elasticity, for no muscular apparatus could work so fine a structure; but the expansion of the chest gives room; and the contraction of the chest again occasions the expulsion. Thus the lungs are set going by atmospheric pressure and elasticity; and the action is kept up and regulated by this and muscular force conjointly.

"Life's cares are comforts; such by Heaven designed;
He that has none must make them or be wretched."—YOUNG.



86. *Why does the chest heave when we breathe?*

Because when we *inspire* the air, the ribs are drawn upward and outward, and the diaphragm at the same time is forced down. When we *expire* the air, the ribs return to their natural place, whilst the diaphragm is again drawn up.

87. In the accompanying illustration, the front half of the ribs being cut away, the interior of the chest is exposed. *CC* is the cavity of the chest, empty. *DDDD* the diaphragm, rising high in the center and

descending very low at the sides and behind. The white space is its tendonous portion. The lower part is muscle that contracts to draw it downward. *AA* is the abdomen.

88. *What is the liver, and how are its functions performed?*

The liver lies horizontally on the right side of the body immediately below the diaphragm, and is protected by the interior ends of the lower ribs. Its function is to secrete the greenish-yellow fluid, the gall or *bile*, which is conveyed from the liver by a canal called the hepatic duct. On the lower surface of the liver is situated a small pear-shaped bag, the gall bladder, which is also furnished with a duct, called the cystic duct, which unites with the duct from the liver, and forms the common biliary duct.

89. *What is the composition of the brain?*

The brain is composed of two substances, namely, of a gray-colored pulp, and of a white fibrous texture. The

"Far as creation's ample range extends,
The scale of sensual, mental powers ascends."—POPE.

gray pulp is the glandular or active substance, and is made up, like other glands, of minute points or cavities, from which proceed the finest conducting tubes. These tubes, intertwining and uniting in bundles within the brain, are called the cerebral fibers, and they constitute the white substance occupying, for the most part, the central and under portions of the brain. The gray substance lies chiefly on and near the surface, and also in the neighborhood of those cavities within the brain, which are called its ventricles. The brain is separated by a firm membrane into two distinct organs, the great brain and the small brain. The great brain is situated in the front and upper part of the skull, and its surface is marked by depressions and elevations which, resembling the folds of a garment, are called its convolutions. The small brain lies underneath at the back of the skull; its surface is formed by close layers of the gray substance, presenting a laminated appearance. Four united roots or stems of the fibrous substance, two from each brain, with distinct portions of the gray or glandular substance at regular intervals interspersed, constitute the spinal cord. Nerves pass out of the brain and spinal cord, and are distributed to every organ of the body.

90. The functions of the great and small brain appear to be regulated by a system of mutual dependence and co-operation. During wakefulness the great brain, aided by the influence of the small brain, and also by that of the spinal cord, conducts and regulates the conscious movements of the body. But during sleep, when the great brain relaxes the reins of government, and gives them over to the small brain, this organ, being left to its own laws, directs, through its own fibers and those of the spinal cord, the movements of the heart, lungs, and other internal organs, acting at the same time on the muscles; and while the small brain flows into all these, there results a plenary equilibrium of the body, and a general co-operation of all its parts for the mutual support of each other, and for the preservation of the whole.

91. *Why is it that although the brain and the spinal cord are so intimately connected, yet the brain is not affected by the violent movements which the spine is constantly making?*

The evil is partly obviated by the elastic and partly by the non-elastic properties of the matter interposed between

"But of this frame the bearing and the ties,
The strong connections, nice dependencies,
Gradations just, has thy pervading soul looked through!"—POPE.

the several layers of compact bone. By means of the elastic property of this matter, the head rides upon the summit of the column as upon a pliant spring, while the canal of the spinal cord remains secure and uninvaded. By means of the soft and pulpy portion of this matter, the vibrations excited in the compact bone are absorbed point by point as they are produced; as many layers of this soft and pulpy substance, so many points of absorption of the tremors excited in the compact bone, so many barriers against the possibility of the transmission of a shock to the delicate nervous substance.

92. *Why may the form of the skull be sometimes changed without injuring the brain?*

Because the peculiar softness of the cerebral mass enables it to undergo those changes of its envelope without inconvenience. The brain, in proportion to its softness, will suffer percussions and pressures with less danger; and, on this account, new-born children whose bones are soft and moveable, may have their heads compressed, and even deformed, without any bad effect.

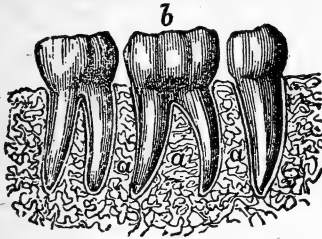
93. Among some of the savage tribes a low brow is regarded as a beauty; and to secure this, the heads of infants are subjected to pressure from plates fixed on the top of the head, by which means, the crown of the head becomes perfectly flat, while the back portion of it protrudes extensively.

94. *Why are the gums admirably fitted to receive the teeth?*

Because they not only serve as firm elastic cushions whereby they rapidly diffuse the force, and powerfully support the teeth when forcibly employed, but by the vascular connection between them, in part supply them with nourishment.

"From an eye of tenderness,
Let heavenly pity fall."—YOUNG.

95. By the manner in which teeth are implanted in the sockets, they are afforded an extensive surface of support. The force is not concentrated at the point, as in the case of a nail thrust into a board;



but is uniformly diffused over the whole surface of the fang, as may be seen in the annexed engraving, where the fangs of the middle tooth press on a surface, *aaa*, equal to four times that of the crown, *b*; so that supposing the pressure on the crown to be equal to four pounds, being extended over the surface of the fangs, it is reduced to one pound on any given point of the root, and with a similar force upon the sockets.

96. *Why are the teeth of infants hidden within the gums?*

Because the presence of teeth would not only be useless, but would interrupt the process of sucking, by which means the infant is for some time nourished, and which act can be performed more efficiently, and with greater ease and comfort to the nurse, whilst the inside of the mouth and edges of the gums are smooth and soft.

97. What renders it more probable that this is the effect of design is, that the teeth are imperfect while all the other parts of the mouth are perfect. The lips are perfect; the tongue is perfect; the cheeks, the jaws, the palate, the pharynx, the larynx, are all perfect; the teeth alone are not so. All these parts are called into use from the beginning.

98. *Why do new teeth sometimes make their appearance at an advanced age?*

In such cases the jaw was too small to contain the full number of the second set of teeth at the ordinary period of their renewal; some of the teeth, therefore, remain in the jaw, which when others drop out make their appearance.

99. *Why have tears a globular form?*

Because the superfluous fluid secreted by the eye, of which fluid tears are composed, is discharged through a hole in the bone, of about the circumference of a goose quill, in these the tears become molded to this form.

100. *What is the form of the stomach?*

The stomach has the shape of the pouch of a bag-pipe, lies across the body; and the passage by which the food

"Man marks not thee, marks not the mighty hand
That, ever busy, wheels the silent spheres;
Works in the secret deep."—THOMSON.

leaves it is somewhat higher in the body than the orifice by which the food enters; so that it is by the contraction of the muscular coat of the stomach, that the contents having undergone the application of the gastric juice, are gradually pressed out.

101. *Why is the free action of the pores of the skin essential to the health of the body?*

Because they act as a species of pipes through which the expended refuse matter is conveyed from the body. These tubes open through the cuticle or outer skin, and descend into the fine or underneath skin, and then form themselves into a coil as seen in the drawing. These tubes are hollow, like a pipe-stem, and their inner surface consists of wonderfully minute capillaries filled with impure venous blood. The capillaries of these tubes through the whole skin of the body are thus constantly exhaling the noxious and decayed particles of the body. It is calculated that



about three or four pounds of waste matter pass off through the skin every twenty-four hours.

102. *Why is watered milk the most suitable food for the nourishment of the infant?*

Because this aliment has a close analogy to blood, and the greatest amount of nutrition is therefore afforded in an agreeable form, and by an easy method, whereas any other mode of supplying the same amount and quality of food would overtax the powers and functions of the infant.

103. If a small drop of milk be submitted to the microscope it will be found to manifest nearly the same appearances as a drop of blood will present. A multitude of minute pearly sphericles with the most perfect outline, reflecting light brilliantly from their center, and varying in magnitude from the 12,500th to the 3,000th part of an inch in diameter, and even larger as seen floating in the fluid. The general

"My pulse as yours doth temperately keep time,
And makes as healthful music."—SHAKSPERE.

magnitude and number of these globules vary much, not only in the case of one species of animal compared with another, but with different individuals of the same species, and even with the same individual under different circumstances. The constituent upon which the nutritive properties of milk mainly depends is butter; in this respect woman's milk is found to be by far the richest, as will be seen from the following comparative results:—

	Woman.	Cow.	Goat.	Ass.
Fat -----	8.97	2.68	4.56	1.29
Sugar -----	1.20	5.68	9.12	6.29
Protein -----	1.93	8.95	4.38	1.95
Water -----	87.90	82.69	81.94	90.47
	100.00	100.00	100.00	100.00

104. *Why is it better for mankind that the action of the internal organs of the body is hidden from sight?*

Because were we sensible of the organic motions—did we know when the heart beats, the lungs play, and the stomach digests, the consciousness could not promote, but might disturb the due and orderly course of these processes.

105. We do not know when the heart dilates to receive the vital current, nor when it contracts to propel it with renewed impetus through the viscera; nor when the blood rushes to the lungs to give out its useless and noxious particles; nor when the air rushes to the blood to take up those particles, to replace them by others, and thus to purify and renovate the vital fluid. Many processes of this kind are continually going on within us during every moment of our existence, but we are no more conscious of them than we are of the motion of the fluids in the blade of grass on which we tread. On the contrary, when an external object produces in a sentient nerve that change of state which we denote by the words "an impression;" when the sentient nerve transmits this impression to the brain; when the brain is thereby brought into the state of perception, the animal life is in active operation, and percipient or conscious existence takes place.

106. *Why may the organic life exist after the animal life has perished?*

Because the animal life is extinguished when sensation is abolished, and voluntary motion can be performed no more. But disease may abolish sensation and destroy the power of voluntary motion, while circulation, respiration, secretion, excretion, and the entire circle of organic functions continue to be performed.

107. The disease known as catalepsy affords the most striking illustration of this extraordinary condition of the system; and the following is a case in point: A young lady was seized with a fit of

"With milky blood the heart is overflown,
Is soothed and sweetened by the social sense."—THOMSON.

cataplexy while employed in netting; she was in the act of passing the needle through the mesh: in that position she became immovably rigid, exhibiting in a pleasing form a figure of death—like sleep, beyond the power of art to imitate, or the imagination to conceive. Her forehead was serene, her features perfectly composed. The paleness of her color, and her breathing, which at a distance was scarcely perceptible, operated in rendering the similitude to marble more exact and striking. The position of her fingers, hands, and arms, was altered with difficulty, but preserved every form of flexure they acquired; nor were the muscles of the neck exempted from this law, her head maintaining every situation in which the hand could place it, as firmly as her limbs.

108. *Why is it erroneous to suppose that deep-seated vital organs have what is ordinarily termed "feeling?"*

Because (taking the heart as an illustration) the pulsation of the heart may be felt through the side, and those arteries which lie near the surface may be felt to beat. After violent exertion or excitement, too, the pulsation of the heart may be felt, and in imagination at least, if not in reality, heard without the application of the hand to any part of the body. But the circulation of the blood is never felt, and the heart itself gives us no internal evidence of its existence.

109. A well-authenticated case of the insensibility of the heart to feeling of any kind, is furnished by the celebrated Harvey, the discoverer of the circulation of the blood, as follows:—A young nobleman had a portion of the parietes of the side destroyed by an abscess, consequent upon a fall. The wound healed, but without the restoration of the parts which had been destroyed by the abscess, and the heart and lungs could be touched through the opening without imparting any feeling that they were touched. Harvey says: "When I paid my respects to this young nobleman, he made no concealment, but exposed the left side of his breast, when I saw a cavity into which I could introduce my fingers and thumb. Astonished with the novelty, I again and again explored the wound, and first marveling at the extraordinary nature of the cure, I set about the examination of the heart. Taking it in one hand and placing the finger of the other on the pulse of the wrist, I satisfied myself that it was indeed the heart which I grasped. I then brought him to the King (Charles I.), that he might behold and touch so extraordinary a thing, and that he might perceive, as I did, that unless when we touched the outer skin, or when he saw our fingers in the cavity, this young nobleman knew not that we touched the heart."

110. *Why do the interior organs of the body keep in the places assigned them, when the body itself is moved about in every direction?*

Because the various parts are tied or fastened to the body in such a manner as to prevent them slipping from their places.

"What a piece of work is man!
 How noble in reason! how infinite in faculties.
 In form and moving, how express and admirable!
 In action, how like an angel! in apprehension, how like a God."

111. The *heart* is placed between two soft lobes of the lungs, and is tied to the mediastinum and to the pericardium, which pericardium is not only itself a very strong membrane, but adheres firmly to the duplicature of the mediastinum, and, by its point, to the middle tendon of the diaphragm. The heart is also sustained in its place by the great blood-vessels which issue from it. The *lungs* are tied to the sternum by the mediastinum before, to the vertebræ by the pleura behind. It seems indeed to be the very use of the mediastinum (which is a membrane that goes straight through the middle of the thorax, from the breast to the back) to keep the contents of the thorax in their places; in particular to hinder one lobe of the lungs from incommoding another, or the parts of the lungs from pressing upon each other when we lie on the side. The *liver* is fastened in the body by two ligaments; the first, which is large and strong, comes from the covering of the diaphragm, and penetrates the substance of the liver; the second is the umbilical vein, which, after birth, degenerates into a ligament. The first, which is the principal, fixes the liver in its situation whilst the body holds an erect posture; the second prevents it from pressing on the diaphragm when we lie down; and both together sling or suspend the liver when we lie upon our backs, so that it may not compress or obstruct the vein to which belongs the important office of returning the blood from the body to the heart.

CHAPTER IV.

THE SENSES—SEEING, HEARING, SMELLING, TASTING, AND FEELING.

112. *Why are the senses of seeing, hearing, tasting, and smelling placed in the head?*

Because the head is the most elevated part of the body, and is capable of moving independently of the rest of the fabric. Thus the organs of sense, which puts us in connection with the external world, which render us susceptible of pleasure, and which give us notice of the approach of objects capable of exciting pain, are placed where external bodies may be brought most conveniently and completely in contact with them, and where alone they can be efficient as the sentinels of the system.

113. *How do we know that the powers of seeing depend more upon the mechanical exercise of the eye itself than upon mental capacity?*

"And in the silence of his calm abode,
In nature's works he worshiped nature's God."

—MATILDA HOUSTON.

Because many persons in certain departments of life, are capable of discerning objects more readily in connection with their pursuits than better informed or more intellectual persons who have seldom or never seen those objects; thus a sailor will descry the various phenomena of the elements, which are invisible to the learned and refined passenger; and the plowman will point out certain objects in a landscape to the wondering student who has just escaped from his labors. On the other hand, persons who are much accustomed to reading are enabled to take in, as it were, the contents of a whole page of a book, while another person less accustomed to reading has only been able to master two or three lines.

114. *Why is it erroneous to suppose that on entering a room we see all the objects in it at once?*

Because this apparently simultaneous view arises from the motions of the eye, which admit of great objects being successively presented to it with a rapidity of which we are unconscious.

115. It is easy to show that if the eye were without motion, steadily fixed in the socket, the vision would be quickly lost; that objects of the greatest brilliancy would be obscurely seen, or disappear. For example, let us fix the eye on one point—a thing somewhat difficult to do, owing to the very disposition in the eye to be constantly moving; but suppose that by repeated attempts we have at length acquired the power of directing the eye steadily on an object, when we have done so, we shall find that the whole scene becomes more and more obscure, and finally vanishes. Let us fix the eye on the corner of the frame of the principal picture in the room; at first everything around the room will be distinct; in a very little time the impression will become weaker, objects will appear dim, and then the eye will have an almost uncontrollable desire to wander; if this be resisted, the impressions of the figures in the picture will first fade; for a time we shall see the gilded frame alone; but this also will become faint. When we have thus ascertained the fact, if we change the direction of the eye but ever so little, the whole scene will at once again be perfect to us.

116. *Why is incessant motion of the eye essential to the continued exercise of the organ?*

Because when the eye is fixed upon a point, the lights, shades, and colors of objects continuing to strike upon the same part of the retina, the nerve is exhausted; but when

"He that is giddy thinks the world turns round."—SHAKSPERE.

the eye shifts there is a new exercise of the nerve; the part of the retina that was opposed to the lights is now opposed to the shades, and what was opposed to different colors is now opposed to other colors, and the variation in the exciting cause produces a renewed sensation.

117. *Why do we know that the ideas we obtain of the size, shape, and distance of objects depend mainly upon the education of the sight?*

Because optical illusions, however nearly they resemble realities when they first meet the eye, are satisfactorily proved to have no existence, by the attentive and correct use of that very organ which gave rise to the error.

118. Dr. Cheselden, by a surgical operation, procured sight to a very intelligent person who was born blind, and he observed the manner in which this sense was developed in the young man. "When he saw the light for the first time, he knew so little how to judge of distances, that he believed the objects which he saw touched his eyes, as the things which he felt touched his skin." During the time of his blindness he had received such an imperfect idea of colors which, by a very strong light, he was then able to distinguish, that a sufficient impression had not been left by which he could again recognize them. Indeed, when he saw them, he said the colors he then saw were not the same as those he had seen formerly; he did not know the form of any object; nor could he distinguish one object from another, however different their size and configuration might be; when objects were shown to him which he had known formerly by the touch, he looked at them with attention, and observed them carefully in order to recognize them again; but as he had too many objects to retain at once, he forgot the greater part of them, and when he first learnt, as he said, to see and to know objects, he forgot a thousand for one that he recollected.

It was two months before he discovered that pictures represented solid bodies; until that time he had considered them as planes and surfaces differently colored and diversified by a variety of shades; but when he began to conceive that these pictures represented solid bodies, in touching the canvas of the picture with his hand he expected to find something solid upon it, and he was much astonished when, upon touching those parts which seemed round and unequal, he found them flat and smooth like the rest.

He could not support much light at first, and every object seemed very large to him; but after he had seen larger things, he considered the first smaller; he thought there was nothing beyond the limits of his sight. The same operation was performed on the other eye about a year after the first, and it succeeded equally well. At first he saw objects with his second eye much larger than with the other, but not so large, however, as he had seen them with his first eye; and when he looked at the same object with both eyes at once, he said that it appeared twice as large as with the first eye.

119. *Why is sight essential to the firmness of most of our attitudes?*

"Time wasted is existence, used is life,
And bare existence, man, to live ordained,
Wrings and oppresses with enormous weight."—YOUNG.

Because we judge of the position of our bodies by other bodies which we see around us. Thus, when we are deprived of this means of judging of our equilibrium, as when we are on a house, or any elevated place where we are only surrounded by the air, our standing becomes uncertain, and it sometimes happens that we feel giddy, and cannot stand at all.

120. The utility of sight is still greater if the base of support is very narrow; a rope dancer could not stand erect if he were not constantly directed by the eye as to the position necessary to be preserved, in order that the perpendicular drawn from his center of gravity may fall upon the base of support. This connection between sight and attitude is further demonstrated by the uncertain postures which blind persons assume.

121. *Why does the pupil of the eye contract and dilate?*

Because when it is necessary to exclude excess of light, the pupil through which the light enters may gradually or wholly exclude it by contraction; and when a large amount of light is desired, the dilation of the pupil in a similar degree ensures the admission of a greater number of rays.

122. The chamber of the eye is a camera-obscura, which, when the light is too small, can enlarge its opening; when too strong, can again contract it; and that without any other assistance than of its own exquisite machinery.

123. *Why is a person unable to discern objects when passing from a strongly-illuminated room into one comparatively dark, or into the open air at night?*

Because the contraction of the pupil, which was adapted to the strong light to which it had been previously exposed, admits so little light to the retina that no sensation is produced. The pupil, however, after a while dilates, and, admitting more light, objects are perceived which were before invisible.

124. *Why does the eye of a person suffer inconvenience and pain in passing from a dark room into a light one?*

Because, while the observer remains in the dark or less illuminated room, the pupil is dilated to that degree so as to admit into the eye as great a quantity of light as the

"There are more things in heaven and earth, Horatio,
Than are dreamed of in your philosophy."—SHAKSPERE.

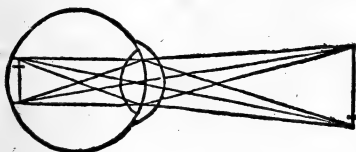
structure of the organ allows of. When he passes suddenly into the strongly-illuminated room the flood of light arriving through the widely dilated pupil acts with such violence upon the retina as to produce pain, which necessarily calls for the relief and protection of the organ. The iris, then, by an action peculiar to it, contracts the dimension of the pupil so as to admit proportionally less light, and the eye is gradually opened with impunity.

125. *Why is the pupil of the eye so called?*

Because if we look into the eye of another we shall perceive a little image of our own face, like a very minute child or *pupil*—hence the name.

126. *Why are some persons short-sighted?*

Because the rays of light are brought to a focus before they reach the retina, and consequently produce an indistinct picture on the retina. This will be more clearly illustrated by the accompanying engraving.



127. The *remote* causes of this defect of the eye may be various; as too great density of the humors—too great a convexity either of the cornea or the lens—and from the space between the retina and the lens being too short. Where it depends on too much convexity, as age approaches, it may disappear; but where too great density is the cause, age is apt rather to aggravate than to relieve it. For while in the young the convexity both of the cornea and the lens is greater than in advanced life, the less density of the humors counterbalances it; and again as life advances, the more scanty supply of humors, along with the diminishing convexity, are neutralized by the increasing density; therefore, if these keep pace with each other the eye remains to a very protracted period of life without the necessity for artificial assistance.

128. *Why do the eyes sometimes become "bloodshot"?*

Because when the eye is healthy its blood-vessels are so small that only the colorless portion of the blood finds its way through them. But when the eye is inflamed, the coats of these vessels becoming weaker, they are readily distended by the impulse of the blood against them; they

“’Tis greatly wise to walk with our best hours,
And ask them what report they’ve borne to heaven.”—YOUNG.

then become enlarged, the red globules find their way into them, and they are rendered red and visible to the naked eye.

129. *Why, when the sight is impaired in old age, are persons compelled to wear spectacles, or to hold objects at a distance from them in order to distinguish them perfectly?*

Because the diminished refractive power of the organ is accompanied by a divergence of the rays of light which tends to confuse and obscure the sight. By holding objects at a distance the divergence becomes diminished, and the same effect is produced by convex glasses.

130. It is customary with opticians to place in the hands of a person requiring spectacles a book or newspaper, and by the distance at which the one or the other is instantly held from the sight, the optician is enabled to judge of the degree of the defect of the vision and the kind of glass that is required.

131. *Why does the eye lose its luster in old age and sickness?*

Because the luster of the healthy eye is produced by the action of the muscles of the eye-ball maintaining it firmly in its place, pressing it against the fatty cushion on which it rests, and giving to it that tension necessary to render the corner prominent, clear, and full. In old age and sickness the muscles of the eye partake of the general debility of the system, and its functions are thus deranged.

132. *Why do some persons squint?*

Strabismus, or squinting, is caused by one or more of the muscles of the eye being shortened or elongated; and by the derangement of their action the pupil is consequently carried out of the proper axis of vision.

133. This defect is cured by a very simple operation. The shortened or elongated muscle is cut down by a skillful operator. The false position of the pupil is immediately rectified by the division of the disordered muscle that induced obliquity by its irregular action. The divided muscle in healing shortens or lengthens, and during the healing process suits itself to the exigencies of the case, and in a short time re-unites.

134. *Why when we look for some time at a white spot upon a black ground, and afterwards direct the eye to a white ground, do we perceive a black spot?*

"Each friend by fate snatched from us, is a plume
Plucked from the wing of vain humanity."—YOUNG.

Because the retina of the eye has become insensible in the point which was formerly fatigued by the white light. In the same manner, after the retina has been some time without acting in one of its points, whilst the others have acted, the point which has been in repose becomes of an extreme sensibility, and on this account objects seem as if they were spotted.

135. In this manner it is explained why, after having looked for a long time at a red spot, white bodies appear as if spotted with green; in this case the retina has become insensible to the red rays, and we know that a ray of white light, from which the red is subtracted, produces the sensation of green.

136. *Why does a flash of light from the eye generally follow from a violent blow on that organ or the surrounding parts?*

Because light, or some degree or modification of light, is the only impression of which the eye is susceptible; and therefore every effect upon the parts of the eye which are essential to vision only must be a sensation of light.

137. A violent blow on the eye appears as an instantaneous flash of light, and this effect is produced, not only when the eye itself is struck, but when there is a violent concussion of the head, which we may suppose to be transmissible to the surrounding parts of the eye, and so to the eyeball itself. If a person walking hastily and heedlessly in the dark strikes his forehead violently against an object of resistance, then instantly, and before any pain is felt in the part which has received the stroke, a flash of light is seen by both eyes, brighter in proportion as the stroke is more violent. Thus, any sudden agitation produced in the exterior coats of the eyeball, from whatever source it may arise, always tells upon the sentient part of the eye as light, and never as pain or any other sensation.

138. *Why cannot a person distinguish minute objects in the water with his head likewise immersed in the fluid?*

Because, although there is sufficient difference between the density of the humors of the eye and that of the air, to bring the rays transmitted by the latter to a focus on the retina, there is not sufficient difference between the density of these humors and that of water, to do the same by rays transmitted through this fluid, so that such rays are not brought to a focus sufficiently soon. Hence divers in some places are in the habit, when they descend into the water,

"And as he spoke a big round drop
Fell bounding on his ample sleeve;
A witness that he could not stop,
A witness that we all believe."—BLOOMFIELD.

of using extremely convex glasses, in shape almost like the lens of fishes, and turning their eyes by this means, as it were, into those of an aquatic animal.

139. *Why are the eyes furnished with lashes?*

Because they serve to ward off insects, and to protect the eye, from particles floating in the air. When the eyelashes are humid, the little drops of moisture decompose the rays of light, and, even independently of humidity, they also partly resolve the light passing into the interior of the eye.

140. When the eyelids are placed near each other, and the eyelashes admit only a small quantity of light to pass at a time, the eyelashes, by separating into pencils the light which penetrates the eye, make bodies in ignition appear during the night as if they were surrounded with luminous rays. This appearance does not take place if the eyelashes are inverted, or merely turned in another direction. The vision of those persons who have lost their eyelashes is always more or less imperfect.

141. *Why are the eyes protected by eyebrows?*

The eyebrows have many uses. The projection which they form protects the eye against external violence; the hairs on account of their oblique direction, and the oily matter with which they are covered, prevent the perspiration from flowing towards or irritating the surface of that organ: they direct it towards the temple and the root of the nose. The color and the number of hairs of the eyebrows have an influence upon their use. They have generally some relation to the climate. The inhabitants of hot countries have them very thick and black; the inhabitants of cold countries may have them thick, but they are rarely black. The eyebrows protect the eyes from excess of light, particularly when it comes from above, this effect is rendered still more conspicuous by the knitting of the brows.

142. *Of what use are eyelids?*

They cover the eye during sleep, and preserve it from the contact of extraneous particles flying about in the air, which might injure it; they defend it from sudden shocks,

"Give every man thine ears, but few thy voice;
Take each man's censure, but reserve thy judgment."—SHAKSPERE.

by their almost instantaneous closure, and by their habitual motions, which are renewed at nearly equal intervals, they preserve it from the effects of long-continued contact of the air. The eyelids also moderate the force of a too brilliant light, and prevent the passage of any more of this fluid than what is necessary for vision without offending the eye. On the contrary, when the light is feeble, we separate the eyelids to a considerable distance, in order to admit the passage of as great a quantity of light as possible to the interior of the eye.

143. *Why is the involuntary closing of the eyelid more advantageous than if it depended upon our will?*

Because, if the closing of the eyelid depended upon voluntary power, we might have gone to sleep forgetting to have closed it, thereby exposing the eye to considerable danger. But under the involuntary arrangement the lid is made to fall over the eye as drowsiness comes on, is kept there during sleep, and in the morning, owing to the delicacy of its structure, it transmits a sufficient quantity of light to the eye to arouse sensibility, and we awake.

144. *How is the process of hearing conducted?*

The folds of the outward ear conduct to its entrance, and into an outer passage, which, after running inward a short distance, is closed by a membrane called the drum. Behind this membrane is an inner passage, which terminates in the throat, which is called the trumpet. Warm air from the lungs therefore supplies the inner passage, and the surrounding atmosphere fills the outer passage. When the modification of the atmosphere by which sounds are produced, flow into the outer passage, the drum of the ear is put upon the stretch, more or less, according to the force or loudness of



"Life speeds away
From point to point, though seeming to stand still."—YOUNG.

the sound, as shown by the trick of calling loudly under the pretense of whispering in the ear. Behind the drum, in the hard bone, or the rock-like wall of the inner passage, are two small openings termed mastoid, which communicate with the inner cavities or chambers of the ear. There are two other openings closed by a thin transparent membrane, and the chambers excavated, as it were, in the rock-like bone, are, with the mastoid cells, filled with fluid. Within these chambers (called the labyrinth and semi-circular canals) the nerve of hearing spreads out between the folds of a most delicate membrane, receiving the impressions conveyed by the atmosphere or other conducting media, and communicating them to the sense of hearing in the brain.

145. *Why do infants hear indistinctly?*

Because the bones of their ears are soft and cartilaginous; and of course, the tremulation excited in them by the motion of the air are comparatively weak. Young children accordingly are extremely fond of noise. It arouses their attention, and conveys to them the agreeable sensation of mind; but feeble sounds are not perceived, which gives infants, like deaf persons, the appearance of dullness or want of intelligence.

146. *Why are we compelled to use both ears in order to determine the direction of a sound?*

Because every sound comes more directly to one ear than to the other, and it is only by comparing the intensity of the two impressions, that we are capable of deciding whence the sound proceeds.

147. If we close one ear perfectly, and cause a slight noise to be made in a dark place at a short distance, it would often be impossible to determine its direction; in using both ears this could be determined. If a person wakes in the night and hears a sound but cannot tell from what quarter it proceeds, he will turn his face full in the direction from which he supposes the sound to come, thus availing himself of both ears; having determined this, and wishing to *distinguish* the sound, he will incline one ear only for this purpose.

148. *Why do persons who are partially deaf place their hand behind the ear, in order to hear more distinctly?*

"A good nose is requisite, also, to smell out work for the other senses."
SHAKSPERE.

Because the hand thus placed acts upon the same principle as the sounding board; that is to say, the sound reverberates against it, and penetrates the ear, instead of passing by, which it would do, if no barrier existed.

149. *Why will a person who is partially deaf frequently hear more distinctly when addressed in a moderate tone, than when called to in a loud voice?*

Because in many cases of defective hearing, the impaired organs are so extremely sensitive, that a loud voice acts like a concussion upon them, and thus defeats its own end; whereas a moderate tone adapts itself to the limited power of hearing, and thus makes a suitable impression.

150. *Why may the ticking of a watch be heard distinctly when it is placed against the teeth?*

Because sound is capable of being produced by the vibration of solid bodies without the intervention of the atmosphere, and in this instance the sound is conveyed from the teeth, through the bones of the face and the head, to the auditory nerves.

151. *How is the sense of smell produced?*

When we put a flower or a sweet scent of any kind to our nose and enjoy the smell of it, it is because the nerves lining our nostrils are touched by very small particles which fly off from the flower or scent. In the same way unpleasant smells are detected by minute noxious particles floating in the air, coming in contact with the nostrils.

152. *Why do persons "sniff up the air" when any agreeable odors are floating in it?*

Because when the nostrils are thus exerted, they act as a species of syphon, and withdraw a larger amount of the odor from the atmosphere than they otherwise would, so that the action of sniffing increases the pleasureable sense thus imparted.

153. *Why does closing the mouth increase the sense of smell?*

"And next in order sad, Old Age we found:
His beard all hoar, his eyes hollow and blind:
With drooping cheer still poring on the ground."—SACKVILLE.

Because under that condition the respiratory current is drawn exclusively through the nose. On the contrary, when we wish to avoid a disagreeable odor, the end may be effected by keeping the mouth open, through which respiration will chiefly take place, and very little through the medium of the nose.

154. *Why are the organs of smelling and of tasting situated so near to each other?*

Because the vicinity of these two senses forms a double guard in the selection of food. Were they placed in distant parts of the body, they could not so readily give mutual aid.

155. *Why is taste the least deteriorated by age of any of the senses?*

Because so long as the body exists it must necessarily be fed, and the organ by which this process is primarily accomplished is mercifully spared, while other senses less essential are subjected to decay.

156. *Why is touch considered to be the most important of all the senses?*

Because by touch we are enabled to know with greater certainty the properties of bodies; our hearing, seeing, and smelling may frequently deceive us and lead us into error, touch seldom does this, and in all cases of doubt when the other senses are engaged, touch steps in as umpire, and resolves the difficulty.

157. The extreme sensibility of the touch of the blind is well known. A blind person deciphering a book by the aid of touch will, in general, read with fewer mistakes than are made by persons of ordinary intelligence when perusing a book by the aid of their sight. There are many remarkable instances of the intensity with which one portion of the senses may be exercised, and especially that of touch, when others are wanting; ordinary faculties taking upon themselves extraordinary functions, and thus in a great measure compensating for the deprivation which it has pleased Providence to inflict. A case in point is furnished by the following narrative:—

James Mitchell, the son of a respectable parish minister in the County of Elgin, was deaf, dumb, and blind from birth. As he grew up, he discovered a most extraordinary acuteness in the senses of touch and smell, being very soon able by these to distinguish strangers from the members of his own family, and any little article that was appropriated to himself from what belonged to others. In childhood the most

"One touch of Nature makes the whole world kin."—SHAKSPERE.

noticeable circumstance relating to him was an eager desire to strike upon his fore-teeth; this he would do for hours. When a stranger arrived, his smell would invariably inform him of the circumstance, and direct him to the place where the stranger was, whom he proceeded to survey by the sense of touch. In the remote situation where he resided male visitors were the most frequent, and therefore the first thing he generally did was to examine whether or not the stranger wore boots; if such were the case he would immediately quit the stranger and proceed to the stable, accurately examining the whip, and handling the horse with great care and the utmost seeming attention. It has occasionally happened that visitors have arrived in a carriage, and on such occasions he has never failed to go to the place where the carriage stood, examining the whole of it with much anxiety, and trying innumerable times the elasticity of the springs. When he felt hungry he would approach his mother or sister, touching them in an expressive manner, and pointing to the apartment where the victuals were usually kept. If a dry pair of stockings were wanting, he would point to his legs, and, in short, intimate his various wishes in a similar way. On one occasion a pair of shoes was brought, and on attempting to put them on he found they were too small. His mother took them and locked them in a closet. Soon after a thought seemed to strike him; he contrived to obtain the key of the closet, opened the door, took out the shoes, and put them on the feet of a young lad who attended him, and whom they fitted exactly. When he happened to be sick and feverish he would point to his head, or take his mother's hand and place it opposite his heart. He never attempted to express his feelings by utterance, except when angry, when he would utter a loud bellow. Satisfaction or complacency he expressed by patting the person or object which had excited that feeling. His smell being wonderfully acute he would be frequently offended through that sense when other persons near to him smelt nothing unpleasant. His elder sister seemed to have a much greater ascendancy over him than any other person. Touching his head with her hand was the principal method she employed in signifying her wishes to him respecting his conduct. This she did with various degrees of force and in different manners, and he seemed readily to understand the intimation intended to be conveyed.

158. *Why is the sense of touch more vivid when the circulation is warm and active than when it is chilled and stagnant?*

Because the papillæ are dependent for their life and action on a constant supply of blood, when, therefore, the nerves receive an abundant supply of the stimulating fluid the sense of touch becomes proportionately acute; and when this supply is stinted or withheld, sensation may in some cases become so blunted, as to allow wounds to be inflicted without exciting pain.

159. *Why is the sense of touch sometimes untruthworthy?*

Because it has its delusions like the other senses, so much so, that a body may be imagined to be felt, and yet have no real existence.

"The universal cause
Acts to one end but acts by various laws;
Connects each being, greatest with the least;
Made beast in aid of man, and man of beast."—POPE.

160. The following illusion of an extraordinary kind, which cannot be corrected even by the sight, proves that the senses alone unaided by the reasoning powers are not to be trusted; cannot indeed be believed on all occasions:—If we place on a table, or on the palm of the hand, a marble or any other small globular body, and crossing it

alternately with the fore and middle fingers so disposed that the marble shall touch only the outer edges or surfaces of the two fingers, the person will believe that he touches two marbles, although he knows that only one is present. The explanation of this illusion is as follows: The mind refers, involuntarily, all sensations experienced at different parts of the body to the position in which such parts are usually placed. Now the crossing of the fingers does not prevent us feeling either of them in contact with the marble, as if they were placed naturally side by side. But in the habitual position of the fingers side by side, it is impossible that the outer edges of any two fingers can be at the same time placed in sufficient contact with a single marble or other similar rounded body; and thus when such contact actually takes place simultaneously, by the contrivance of crossing the fingers, then the mind involuntarily believes the thing to be impossible, takes it for granted that two marbles, not one, must be present; and hence arises the sensation and perception of two distinct bodies.



CHAPTER V.

CLASSIFICATION OF THE VARIOUS ANIMALS.

161. *Why are animals arranged by naturalists into classes, orders, sub-orders, families, etc.?*

Classification prevents the necessity of frequently and fully describing any animal referred to; it ensures correct identity in the observations and communications of naturalists. It also answers as a sort of dictionary wherein, from the properties of things, we proceed to discover their names, thus forming the inverse of ordinary dictionaries, where the names direct us to the properties. But no arrangement of animals can be perfect; first, because we may not be acquainted with all the species; secondly, because of some of the species we may know very little; and, thirdly, because of those which we know best, the greater part are known

"To Him, no high, no low, no great, no small;
He fills, He bounds, connects, and equals all."—POPE.

as more or less domesticated; and, further, because the great masters of natural history, differing in their views, produce *systems of classification* more or less varying from each other. Notwithstanding these difficulties, an approach to uniformity and identity may be obtained, eminently useful where the objects to be distinguished are remarkably numerous.

162. *What are the significations of the terms class, order, sub-order, family, genus, species, etc.?*

A *class* is a primary or leading division, a number of beings having one or more features in common. An *order* is a *sub-division* of a class. A *sub-order* is a further division of an order. *Family* is a still further division, and is used synonymously with *tribe*. *Genus* and *species* are more limited and definite than family or tribe; they refer to groups of individuals that agree in all, or nearly all essentials. *Genera* is the plural of *genus*.

163. *Species* means tribes of animals or plants which have descended from the same stock, or from parentages precisely similar and in no way distinguished from each other.

The ancients applied the term *genus* to any collective number of organized beings which are akin to each other, or the offspring of the same ancestors. The idea of *genus* was then simple and definite, and just what we attach to the terms *kind* or *kindred*. By degrees, the meaning of *genus* was extended, and it was made to comprehend all such creatures as by reason of some real or fancied resemblance in their form or nature were conjectured to have belonged to one original stock. Such groups were the "dog-kind," the "cat-kind," the "ox-kind." For the more developed state of science, these clauses were too comprehensive, and included tribes so remote from each other that they could not be regarded as the progeny of the same original tribes. The term *species* was therefore adopted, and made to express nearly what *genus* now does,

164. According to the LINNAEAN SYSTEM, the whole animal kingdom is ranged under the following SIX CLASSES:—

I. MAMMALIA (from the Latin *mammae*, the breasts or teats of a female).—Animals with warm red blood, viviparous, and suckling their young.

II. AVES (birds).—Animals with warm red blood, oviparous, and feathered.

"To me be Nature's volume broad display'd;
And to peruse its all-instructing page,
Or, haply catching inspiration thence,
Some easy passage, raptur'd to translate."—THOMSON.

III. AMPHIBIA (from two Greek words, meaning *both and life*).—Animals with cold red blood, breathing by lungs, capable of subsisting for a time either on land or in water.

IV. PISCES (fishes).—Animals with cold red blood, breathing by gills, and not by lungs.

V. INSECTA (insects).—Animals with cold white blood, having antennæ (feelers) on the head, and articulated (jointed) horny organs of motion.

VI. VERMES (worms).—Animals with cold white blood, without antennæ, for the most part with tentacula (having simple threadlike organs for protusion around their mouths), and without articulated organs of motion.

165. According to the SYSTEM OF CUVIER, a leading grand division prevails over the whole of these, viz., the *vertebrated*, from the *invertebrated* (from the Latin *verto*, to turn); the first being distinguished by having a *back-bone*, the latter by the *absence* of this organ. The vertebrated animals are divided into four *classes*, thus:—

DIVISION I.—VERTEBRATA.

Class I. *Mammalia*. II. *Aves*. III. *Reptilia*. IV. *Pisces*.

DIVISION II.—MOLLUSCA.

[This is the commencement of the *invertebrated* division, but the term is disused.]

Class I. *Cephalopoda*. II. *Oteropoda*. III. *Gasteropoda*.
IV. *Acephala*. V. *Brachiopoda*. VI. *Cirrhopoda*.

DIVISION III.—ARTICULATA.

Class I. *Annelides*. II. *Crustacea*. III. *Arachnidas*
Insecta.

SUBDIVISION IV.—RADIATA.

Class I. *Echinodermata*. II. *Entozoa*. III. *Acalepha*
Polypi. V. *Infusoria*.

"When with a Reaumur's skill thy curious mind
Has classed the insect tribes of human kind,
Each with its busy hum, or gilded wing,
Its subtle web-work, or its venom'd sting."—ROGERS.

166. *Why is the term invertebrated unemployed?*
Because it is merely of a negative character.

[All animals may be referred to one or other of the foregoing classes, and those not included in the first Division are all *invertebrated*.]

SO MUCH OF THE CLASSIFICATION AS WILL BE GIVEN IN THE FOLLOWING PAGES IS A COMBINATION OF THE SYSTEMS OF LINNÆUS AND CUVIER, WITH SUCH MODIFICATIONS AS ARE NOW GENERALLY ADOPTED.

DIVISION I.—VERTEBRA. CLASS I.—MAMMALIA.

ORDER I.—BIMANA.

167. *What is the meaning of the term Bimana?*

It is derived from the Latin *bis*, twice, and *manus*, a hand: it means *two-handed*.

168. *Why is MAN the only individual included in this order?*

Because he is the only two-handed animal. This fact will be further enforced by reference to

ORDER II.—QUADRUMANA.

169. *What is the meaning of the term Quadrumana?*

It is derived from the Latin *quadra*, four, *manus*, hand, and means *four-handed*.

170. *Why are monkeys described as four-handed?*

Because those of their extremities which are apparently analogous to the feet of man, are provided with *thumbs*, free and opposable to the other toes—the toes themselves being long and similar to the fingers of the hand.



In consequence of this peculiarity, all the *species* of the *order* exhibit the utmost facility in *climbing trees*, but cannot sustain themselves, much less walk, in an erect posture without considerable difficulty.

"With monkey's ingenuity,
That love to practise what they see."—BUTLER.

171. In addition to this distinguished feature, the canine teeth of monkeys are longer than those of man; while the bones of the pelvis are too narrow to continually support their bodies in an erect position.

Mr. Partington regards it as incorrect to call the extremities of monkeys "hands;" they are, he says, properly *paws*. All the paws consist of four fingers and a thumb. The latter member is, however, very small, sometimes without a nail, and cannot, in all the species, be said to perform the functions of a true thumb, but often more resembles the callous pad which forms a point of resistance against the fingers in several other climbing animals. The anterior extremities are long, but much longer in some of the species than in others; the fingers are also long, the bones of some of the phalanges are often curved towards the palms, and the muscular power in grasping and pulling is much greater than, from the size of the animal or of the parts, one would be led to suppose. Similar grasping powers, in proportion to their size, are, however, common to all the quadrumana, and to all climbing animals.

172. *What is the difference between apes, baboons, and monkeys?*

Apes are such as are destitute of tails; *Baboons* have muscular bodies, elongated muzzles, and their tails are



usually short; *Monkeys* are those whose tails are in general long, some of them, the *Sapagos*, having prehensile tails, which can at pleasure be twisted around any object, and thereby, in many instances, answer the purpose of an additional hand.

173. *Why are monkeys divided into two principal subgenera, "the monkeys of the old world," and the "monkeys of the new world"?*

Because of a remarkable and uniform difference in the number of their teeth. All the monkeys of the old world have the same number of teeth as the human species; but the monkeys of America have four cheek-teeth more than the other monkeys—thirty-six teeth in all—besides some minor distinguishing features.

“Stand by there. What are you?”

“My lady’s *ape*, that imitated all her fashions; falling as she did, and running the same course of folly.”—NABBE.

174. *Why are monkeys confined to certain geographical limits?*

Because their chief office evidently is to prevent the too rapid increase of birds, which they do by destroying vast numbers of eggs that would otherwise be brought to maturity almost by the sun’s heat. This mission the monkeys carry out so perseveringly, that they are perpetually on the watch to rob birds’ nests, and when they want appetite or inclination to devour them, they will fling them on the ground. We therefore find that monkeys abound in those latitudes where birds are most abundant.

175. *Why should we not mistake the imitative propensities of monkeys for a natural love of mischief?*

Because in mimicking the actions of man they will as readily engage in useful employment as in willful sport. And during the whole time they are so engaged their countenances assume a reflective and serious air.

176. It is said that the Indians sometimes direct their imitative propensity to useful purposes; for, wishing to collect the cocoa-nuts and other fruits from the trees in the woods frequented by the apes, they repair to their places, setting the example of gathering a few heaps first themselves, and then withdrawing, leave the work to be performed by the animals at will. These creatures seeing a heap or two commenced, descend with the certainty of carrying on the business, and when the produce has been thus rather plentifully collected, the Indians approach and take away the harvest.

177. *Why have some monkeys tails of an extraordinary length?*

They are thus enabled to suspend themselves from the branches of one tree and reach food from another. By the same means the young of the animal sit securely on the back of the mother by turning their tails around her’s, and so escape from the pursuit of their enemies.

178. A sketch is here given of the Coaita, or Spider Monkey. The tail answers all the purposes of a hand, and the animal throws itself from branch to branch by means of its tail. The prehensile part

"This *apish* and unmannerly approach,
 This harness'd mask, and unadvised revel,
 This unheard sauciness and boyish trooper,
 The king doth smile at."—SHAKSPERE.



of the tail is covered with skin only, forming an organ of touch as discriminating as the proper extremities.

In monkeys the pectoral part of the body is by far the most muscular and robust in its form, while the ventral and sacral parts of its trunk are attenuated, so much so that this portion appears, in some of the species, as if it were nothing more than a stalk to the hind legs; at all events it is never such as to impede their motions or encumber them by its weight. Now the young monkey so applies itself to the body of its mother that it in no way impedes her motions, and is, in fact, the least possible burden to her that so much additional weight could be. The shoulder

bones are stout and long for her size, by which means the breadth of her chest is ample, and the shoulder joints are thrown wide apart. The fore legs of the young clasp her round her neck and hold on to the immoveable part of the shoulder, between the shoulder-bone and the blade-bone, so that their points of adhesion do not interfere with any of the moving parts. These members in the young monkey are so long that it can reach the pectoral mammæ of the mother without weakening its own hold or cramping her motions; and then its hind legs clasp the body so far forwards that they leave the hinder extremities free for every operation of climbing. Therefore, a female monkey loaded with a young one has very nearly, if not altogether, the same use of her organs as though she were without any load, because the young one adheres by its own exertions, which exertion strengthens in proportion to its weight.

179. *Why is a particular description of monkey* called the preacher?*

Because it is common for one of these creatures to ascend a lofty tree while a congregation of others of the tribe assemble in the lower branches; the monkey who is elevated above the rest then sets up a loud and shrill howl, which may be heard at a great distance. The assembled monkeys afterwards join in a noisy chorus.

* *Mycetes Beelzebub*,

"All these are ours; and I with pleasure see
Man strutting on two legs, and *aping* me."—DRYDEN.

180. *Why are lemurs included in the same order with the monkey tribes?*

Because although differing from the monkeys of the old and new worlds in their teeth, they are *quadrumanous*, having opposable thumbs on the fore as well as the hind paws.

181. *Why are they called lemurs?*

The Latin *lemurs* means sprites that walk by night; and these animals were so named by Linnæus, because of their nocturnal habits, and their large glaring eyes. They wander by night, and subsist upon fruit, insects, and small birds.

182. In the jungles about Tillicherry, there is a large species of monkey frequently tamed by the natives, and at a village a short distance from this celebrated seaport there occurred an evidence of the extreme sagacity of this animal. A few yards from the house of the person to whom it belonged, a thick pole, at least thirty feet high, had been fixed into the earth, round which was an iron ring, and to this was attached a strong chain of considerable length, fastened to a band round the monkey's body. The ring being loose, it slid along the pole when he ascended or descended. He was in the habit of taking his station upon the top of the bamboo, where he perched as if to enjoy the beauties of the prospect around him. The crows, which in India are very abundant and singularly audacious, taking advantage of his elevated position, had been in the habit of robbing him of his food, which was placed every morning and evening at the foot of the pole. To this he had vainly expressed his dislike by chattering, and other indications of his displeasure equally ineffectual; but they continued their depredations. Finding that he was perfectly unheeded, he adopted a plan of retribution as effectual as it was ingenious.

One morning, when his tormenters had been particularly troublesome, he appeared to be seriously indisposed; he closed his eyes, drooped his head, and exhibited various other symptoms of severe suffering. No sooner were his ordinary rations placed at the foot of the bamboo, than the crows, watching their opportunity, descended in great numbers, and according to their usual practice began to demolish his provisions. The monkey now began to slide down the pole by slow degrees, as if the effort were painful to him, and as if so overcome by indisposition that his remaining strength was scarcely equal to such exertion. When he reached the ground he rolled about for some time, seeming in great agony, until he found himself close to the vessel which contained his food, but which the crows had by this time well-nigh devoured. There was still, however, some remaining, which a solitary bird, emboldened by the apparent indisposition of the monkey, advanced to seize. The wily creature was at this time lying in a state of apparent insensibility at the foot of the pole and close to the pan. The moment the crow stretched out its head, and ere it could secure a mouthful of the inter-

"Far different there from all that charmed before,
The various terrors of that horrid shore;
Those matted woods where birds forget to sing,
But silent *bats* in drowsy clusters cling."—GOLDSMITH.

dicted food, the watchful avenger seized the depredator by the neck with the rapidity of thought, and secured it from doing further mischief. He now began to chatter and grin with every expression of gratified triumph, while the crows flew around, cawing in boisterous chime, as if deprecating the chastisement about to be inflicted upon their captive companion. The monkey continued for a while to chatter and grin in triumphant mockery of their distress; he then deliberately placed the captive crow between his knees and began to pluck it with the most humorous gravity. When he had completely stripped it, except the large feathers in the pinions and tail, he flung it into the air as high as his strength would permit, and, after flapping its wings for a few moments, it fell on the ground with a stunning shock. The other crows, which had been fortunate enough to escape a similar castigation, now surrounded it, and immediately pecked it to death.

The animal had no sooner seen this ample retribution dealt to the purloiner of his repast, than he ascended the bamboo to enjoy a quiet repose. The next time his food was brought, not a single crow approached it.

ORDER III.—CARNARIA.

183. *Why is the third division of the Mammalia called Carnaria?*

The name implies *lovers of flesh*, and is therefore employed to denote those classes of animals which are *flesh eaters*. The term *carnaria* is applied to the whole of a great ORDER, which is again divided into sub-orders: 1. *Cheiroptera*; 2. *Insectivora*; 3. *Carnivora*.

Sub-order I.—*Cheiroptera*.

184. *Why is the first sub-order of Carnaria called Cheiroptera?*



Because the wings of the species composing it, as well as serving the purposes of flight are to some extent capable of being used as

hands. The term is derived from two Greek words meaning *wing* and *hand*, and signifies *wing-handed*.

"On a bat's wing will I fly,
After sun-set merrily!"

185. *Why are bats not classed with birds, although they are capable of flight?*

Chiefly because they *suckle their young*, which habit refers them to the class *mammalia*. They breed at the hottest time of the year; and the young, which are usually two in number, are naked and helpless at their birth, capable only of clinging to the teats of their mother, which they do with the greatest firmness. There is no nest in which the mother can leave her young ones; so she bears them about attached to her body, until they are capable of flight.

186. *Why is the wing of the bat furnished with a hook?*

Without this hook, the bat would be the most helpless of all animals. It can neither run upon its feet, and can raise itself from the ground only with great difficulty. The hook takes the form of a bent claw, and is situated at an angle of the wing, by which means the bat attaches itself to the sides of rocks, caves, and buildings, laying hold of crevices, chinks, and protuberances. It hooks itself by this claw, remains suspended, and takes its flight from this position: which operations compensate for the decrepitude of its legs and feet.

187. *Why do bats conceal themselves in old ruins, fissures of walls, etc., by day?*

Because, being organized for nocturnal flight, the impressions of light are too powerful for them. Their wings being formed of a highly sensitive membrane, they seek sheltered places, where neither light nor currents of air can take effect upon them.

188. *Why have bat's wings numerous nerves distributed upon them?*

Their sight being defective, is compensated by the highly-sensitive nature of their wings, ears, nostrils, etc., which vary in different species. Their wings are so susceptible of impressions, that bats, even after their eyes have

"In chinks and holes
Ten thousand seek an unmolested end
As instinct prompts, self-buried ere they die."—COWPER.

been destroyed, can fly about amidst numerous objects, and avoid them all with the greatest precision. The extreme sensibility to light and touch is shown by bats even in their dormant state. Be their torpidity ever so great, they shrink from the touch, even before actual contact, and appear disturbed at the presence of a candle, or any other light.

189. *Why do bats fly by night?*

Because they feed upon night-flying insects. Hence they take the place by night which the swallow occupies by day. Some of the species occasionally fly by day, but that habit is by no means common, and is confined to some of the foreign bats, which are vegetable feeders.

190. Bats issue forth as darkness begins, and by their active flight capture such insects as are then on the wing—gnats, mosquitoes, moths, beetles, etc., and their wide gape with its formidable teeth is an excellent trap for the capture of such prey. The service which they render to vegetation, by the destruction of insects which in the larva state prey upon it, is very considerable, even in temperate climates; and some of the hot countries in which they swarm by myriads could not but for them be inhabited. In humid places on the margins of tropical forests, mosquitoes are troublesome enough as it is; but if the bats did not thin their numbers they would be utterly unbearable. Those species, too, which frequent the towns and settlements are useful in other respects. Most of the race are miscellaneous in their feeding, and not very delicate in their taste. They devour indiscriminately all animal substances, whether raw or dressed, and whether in a recent or putrid state.

191. *Why do bats hibernate during the winter months?*

Because, as they feed chiefly upon insects, their supply of food fails as the winter approaches, and their office in the great scheme of nature can no longer be fulfilled. Therefore, as the time when, for the same causes, the *swallow* departs for a sunnier clime where insect food may be found, the *bat* retires into its hiding places, and sleeps away the months of winter.

SUB-ORDER II.—INSECTIVORA.

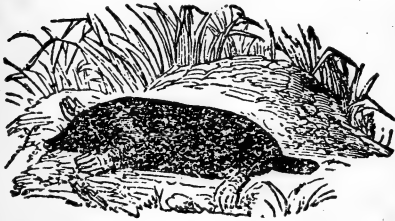
192. *Why is the second sub-order of Carnaria called Insectivora?*

Because they live principally, if not wholly, upon insects. The name is derived from two Latin words—*insecta*, insects, and *voro*, to devour.

"Well said, old *Mole*, can'st work in the earth
So fast? a worthy pioneer!"—SHAKSPEARE.

193. *In what respects is the anatomy of the mole admirably adapted to its mode of life?*

The animal burrows underground in pursuit of worms, upon which it feeds. Its feet are so many shovels; they determine the action of rooting in the ground; and everything about the animal's body agrees with this destination. The cylindrical figure of the mole, as well as its compact form, arising from the terseness of its limbs, proportionably lessens its labor; because, according to its bulk, it thereby requires the least possible quantity of earth to be removed from its progress. It has nearly the same structure of the face and jaws as a pig, and the same office for them. The nose is sharp, slender, tendinous, strong, with a pair of nerves going down to the end of it. The plush covering which, by the smoothness, closeness, and polish of the short piles that compose it rejects the adhesion of almost every species of earth, defends the animal from cold and wet, and from the impediment which it would experience by the mould sticking to its body.



194. Let us compare for a moment the *bats* with the *moles* with reference to their locomotion. Both are *insectivorous*, but how widely different in their conformation! The bat has to winnow its way through the air: the mole, like the bat, has to re-act against a given medium—a very different one, certainly—and is endowed with a power of moving through that medium by means of a modification of the locomotive organs beautifully adapted to its density. Instead of the lengthened bones of the fore-arm that so well assist the bat to make its way with outstretched wing through the air, all in this part of the organization of the mole is short and compact, to enable it to bore through the dense medium where it is to live and move and have its being. The development is all anterior. The fore part of the mole forms an elongated cone; the posterior part is narrow and small, and the whole of its proportions are admirably fitted to assist it, so to speak, in flying through the earth. The long and almost round scapula, the expanded humerus, the enormous power, in short, of the anterior extremities, and the great strength and compactness of the fingers, are all fitted for the digging duty they have to do. Add to this a soft, short-cut velvety coat, to which no

"The glass through which an envious eye doth gaze,
Can easily make a mole-hill mountain seem."—FLETCHER.

particle of soil ever adheres and you have the perfection of organization for rapid progress through the ground.*

195. *Why are moles beneficial to farmers?*

Because of the great number of worms which they devour, which more than compensates for the injury they are supposed to do to the soil, and to roots. It is said that where old mole-hills are most abundant in sheep pastures, the latter animal is generally in a healthy state, as it feeds on the wild thyme and other salubrious herbs, which flourish on these heaps of earth. It is also said that after the mole-hills had been destroyed in a park which belonged to the Earl of Essex, the deer never throve.

The Rev. C. A. Bury has pointed out that the good resulting to the farmer from the drainage afforded by the mole-hills is considerable.

196. Every one is aware of the fact that the mole burrows for its food, that its nest is formed underground, that a larger hillock than the rest is raised for the reception of its young; but it is not so generally known that its



subterranean excavations are of the most distinct and determinate character; that there are permanent passages or highroads for its ordinary travels from one part of its domain to another; that into these roads it follows its daily labors in search of food; that its fortress—the house in which it resides from the autumn to the spring—is of a complex and most ingenious structure, and that this domicile is always a distinct and almost remote building from that in which the nest is formed.

The district or domain to which an individual mole confines himself may be termed its encampment. Within its limits, or at least in immediate communication with the district, all the labors of the animal are pursued. It consists of the habitation or fortress, from which extends the high-road by which the animal reaches the opposite extremities of the encampment, and of various galleries or excavations opening into this road, which it is continually extending in search of food, and which constitute, in fact, its hunting-ground. The fortress is formed under a large hillock, which is always raised in a situation of safety and protection is either under a bank, against the foundation of a wall,

"Pray you, tread softly, that the blind *mole* may not Hear a foot fall!"—SHAKSPERE.

at the root of a tree, or in some similar locality. The earth of which the dome covering this curious habitation is composed is rendered exceedingly strong and solid by being pressed and beaten by the mole in forming it. It contains a circular gallery within the base, which communicates with a smaller one above by five nearly equidistant passages; and the domicile or chamber is placed within the lower and beneath the upper circular gallery, to which last it has access by three similar passages. From the chamber extends another road, the direction of which is at first downwards for several inches; it then rises again, to open into the high-road of the encampment. From the external circular gallery open about nine other passages, the orifices of which are never formed opposite to those which connect the outer with the inner and upper gallery: these extend to a greater or less distance, and return, each taking an irregular, semi-circular route, and opening into the high-road at various distances from the fortress. Such is a very hasty description of this most singular structure; and nothing surely can be imagined more admirably calculated to ensure the security or the retreat of the inhabitant than such an arrangement of internal routes of communication as this. The chamber communicating beneath directly with the road, and above with the upper gallery—this with the lower by five passages, and the latter again with the road by no less than nine—exhibit altogether a complication of architecture which may rival the more celebrated erections of the beaver. The nest is always distinct, and frequently remote from the fortress, and is usually, but not always, covered by a hillock, which, when it exists, is much larger than an ordinary mole-hill. It is formed simply by excavating and enlarging the point of intersection by three or four passages. The bed of the nest is composed of a mass of herbage, grass, roots, or leaves. In one which was examined by Geoffrey and Le Court, no less than two hundred and four blades of young wheat were counted. This, however, can scarcely be considered as an ordinary occurrence, as they generally prefer dry and soft substances. The period of gestation is supposed to be about two months or upwards; and the young are brought forth in April—sometimes earlier, at others later, according to the season: indeed, young moles have been found at all times from the beginning of April till August, which has led some persons to believe that there are more than one brood in the year. There are generally four or five, sometimes as few as three, rarely six.*

197. *Why were moles once thought to be destitute of eyes?*

Because, as organs of sight, if highly developed, would not only be useless to a burrowing animal, but a hindrance to its mining operations, the eyes are simply rudimentary, and are so hidden in the fur that their existence was for a long time doubted.

198. *Why have moles elongated muzzles, endowed with a refined sense of touch?*

* Maunder's "Treasury of Natural History."

"The brooke is ready to o'reflow the brim,
Or in the bancke the water having got
Some *mole-hole* runs, where he expected not."—BROWN.

Because, being nearly destitute of sight, they are gifted with an exquisite sense of touch, which compensates for the loss of the visual faculty, and enables them to find their food in the darkness under the earth's surface.

199. *Why are "fairy rings" attributed to moles?*

It is supposed by some naturalists that the verdant circles thus denominated are owing to the operations of these animals, who at certain seasons perform their burrowings in a series of circles, which, loosening the soil, give the surface a greater fertility, and consequent rankness of grass.

200. *Why is the collar-bone of the mole of extraordinary thickness and length?*

Because the peculiar habit of the animal rendered superior strength in this part of the body necessary in order to facilitate its progress when mining its way through the ground. The collar-bones are wanting in those animals that use their anterior extremities for progression only, and there are rudiments of them in such as hold a middle station.

201. *Why when a female mole is caught in a trap, is the male frequently found lying dead close beside her?*

Because the attachment between these animals is very great; and, in this instance, affection overcomes the calls of hunger, and the fast proves fatal to the animal.

202. *Why does the water-shrew appear to be of a bright silvery color when swimming?*

Because its hairy coat repels the water, and forms numerous bubbles upon the surface, producing a silver-like appearance. When the little animal quits the water, these bubbles fall off, and the coat remains dry.

"The *beast of prey*,
Blood-stained, deserves to bleed; but ye flocks,
What have you done; ye peaceful people, what,
To merit death!"—THOMSON.

203. *Why is the hedgehog covered with short bony spines?*

Being helpless and inoffensive these spines form a coat of armor effective against its principal enemies. They are firmly fixed in a tough skin, and are capable of resisting a great amount of force. The natural enemies of the *hedgehog* are weasels, stoats, ferrets, wild cats, and foxes. When attacked the *hedgehog* rolls itself up, and waits till the danger has passed. It is rarely that its enemies can gain advantage over it when once rolled within its coat of prickly armor.

204. The *hedgehog* is destructive of snakes, against which it wages war in the following curious manner:—The cunning quadruped makes a sudden attack on the reptile, and, giving it a hard bite, instantly rolls itself up for safety; then cautiously unfolds and inflicts another wound, repeating its attacks until the snake is powerless. Then the *hedgehog* feeds upon its prey, generally beginning with the tip of the tail, and proceeding upwards.

SUB-ORDER. III.—CARNIVORA.

205. *Why is the third sub-order of carnaria called carnivora?*

The term implies *flesh-eaters*, and is used to distinguish the sub-order *carnivora*, which consists of flesh-devouring *quadrupeds*, from the general order *carnaria*, which includes *insect* and *worm-eaters*, as well as *flesh-eating quadrupeds*, divided into three sub-orders, as already explained.

206. *Why have carnivorous animals large canine teeth?*

Being beasts of prey, they are furnished with these teeth as weapons for seizing the creatures upon which they feed.

207. *Why are their molar teeth tuberculated and fitted into the surfaces of each other?*

Because the flesh which they devour requires to be lacerated by a cutting motion. The jaws of carnivorous animals have simply an upward and downward motion, and do not move, also, sideways like the jaws of the ox, and other ruminants.

"Strong is the *lion*—like a coal
His eyeball—like a bastion's mole
His chest against the foes.—SMART.

208. *What anatomical features of the carnivora exhibit a remarkable adaptation of their modes of life?*

As they feed on living animals, they are generally swift to pursue; and, as well as being armed with canine teeth, have strong talons, adapted for seizing their prey. These talons are retractile, that is, they are capable of being drawn in between the toes, by which they are protected from being blunted by contact with the ground. Their sight is keen, and even more so by night than by day. Their senses of hearing and of smell are highly developed; their nostrils are studded with whiskers, which are susceptible of the slightest impression of touch, and their feet are padded, so that they can tread noiselessly.

209. *Why is the lion provided with such a large mane?*

The formidable clothing is with difficulty penetrated by an ordinary weapon. When the animal is prowling, or

using only his ordinary powers of locomotion, in the use of which he is generally slow and majestic, his mane lies a considerable way over the back, hangs down over the shoulders, and there protects the powerful muscles, which put his destructive arm in motion, from all changes of temperature, so that they are never stiffened by cold,

or relaxed by heat, even when the animal finds it necessary to prowl in the open deserts during the heat of the day, or in the dead of night.

210. *Why is the lion termed the king of the forest?*

Because there is a certain majesty in his mien and a



"'Tis the royal disposition of the beast, to prey on nothing that doth seem as dead."—SHAKSPERE.

nobleness in his nature which raise him far above the scale of wild beasts in general. The courage and resolution of the lion are conspicuous and he possesses such an incredible degree of strength, that he can bear off a large heifer, or an antelope, as easily as a cat would carry a rat.

211. *Why when a person is attacked by a feline animal may he be able to save his life by non-resistance after the first blow is struck?*

Because it is the habit of this class of animals, having once overcome their prey, to cease for a certain time to inflict injury on it. The mere act of felling their victim to the earth appears for a time to appease the rage of a feline animal. Thus a cat will sit by the mouse it has captured for some minutes without venturing to molest it until it tries to make its escape; and the lion and the tiger will, in the same manner, couch by the side of its prostrate victim without offering to harm him until some movement is made.

212. The following interesting narrative, related by an eye-witness of the scene will be found to illustrate the above-mentioned peculiarity of the feline race:—In the month of July, 1831, two fine lions made their appearance in a jungle some twenty miles distant from the cantonment of Rajcate, in the East Indies, where Captain Woodhouse and his two friends, Lieutenants Delamain and Lang were stationed. An elephant was despatched to the place on the evening on which the information arrived; and on the morrow, at the break of day, the three gentlemen set off on horseback full of glee, and elated with the hope of a speedy engagement. On arriving at the edge of the jungle, people were ordered to ascend the neighboring trees, that they might be able to trace the route of the lions in case they left the cover. After beating about in the jungle for some time, the hunters started the two lordly strangers. The officers fired immediately, and one of the lions fell to rise no more. His companion broke cover, and took off across the country. The officers now pursued him on horseback as fast as the nature of the ground would allow, until they learned from the men who were stationed in the trees, and who held up flags by way of signal, that the lion had gone back into the thicket. Upon this, the three officers returned to the edge of the jungle, and having dismounted from their horses, they got upon their elephant, Captain Woodhouse placing himself in the hindermost seat. They now proceeded towards the heart of the jungle, in the expectation of rousing the royal fugitive a second time. They found him standing under a large bush with his face directed towards them. The lion allowed them to approach within range of his spring, and then he made a sudden dart at the

"When the gaunt *lioness*, with hunger bold,
Springs from the mountains tow'rd the guarded fold;
Through breaking woods her rustling course they hear;
Loud and more loud the clamors strike the ear!"—POPE.

elephant, clung on his trunk with a tremendous roar, and wounded him just above the eye. While he was in the act of doing this the two lieutenants fired at him, but without success. The elephant now shook him off; but the fierce and sudden attack on the part of the lion seemed to have thrown him into the greatest consternation, and much exertion was used before his riders succeeded in urging him on again in quest of the lion. At last he became somewhat more tractable; but as he was advancing through the jungle all of a sudden the lion, which had lain concealed in the high grass, made at him with redoubled fury. The officers now lost all hopes of keeping their elephant in order. He turned round abruptly and was going away quite ungovernable, when the lion again sprang at him, seized on his hinder parts with its teeth, and hung on them until the affrighted animal managed to shake him off by repeated kicking. The lion then retreated further into the thicket. The officers now determined upon dismounting, and Captain Woodhouse took the desperate resolution of proceeding on foot in quest of the lion. After some difficulty he succeeded in tracing the print of the animal's feet, and resolved to follow the track at all hazards. In the meantime Lieutenant Delamain, who stood outside the jungle, caught sight of the lion and fired at him. This irritated the beast and caused him to rush towards his assailant; in doing so he must inevitably cross the path where Captain Woodhouse was. The Captain saw this and resolved to stand still, hoping that the lion would pass by without perceiving him; in this, however, he was undeceived, for the enraged animal saw him in passing, and flew at him with a dreadful roar. In an instant the Captain's rifle was broken and thrown out of his hand, his left arm at the same moment being seized by the claws, and his right by the teeth of his desperate antagonist. While this conflict was going on Lieutenant Delamain ran up and discharged his piece at the lion. This caused the combatants to come to the ground together, while Lieutenant Delamain hastened out of the jungle to reload his gun. The lion now began to worry the Captain's arm; who, notwithstanding the pain he suffered, had the presence of mind to lie still; the lion thereupon *let the arm drop out of his mouth and quietly placed himself in a crouching position, with both his paws upon the thigh of his fallen foe. No sooner, however, had he moved it, than the lion seized the lacerated arm a second time, crushed it as before, and fractured the bone still higher up.* This reminded the Captain that he had committed an act of imprudence on stirring which he determined to profit by. He now lay bleeding and disabled under the foot of a mighty and irritated enemy; and with the terrors of death before his very eyes. At this moment the two lieutenants were hastening to his assistance, and he heard the welcome sound of feet approaching; but, unfortunately, they were in a wrong direction, as the lion was betwixt them and him. Aware that if his friends fired the balls would hit him, after they had passed through the lion's body, Captain Woodhouse quietly pronounced in a low and subdued tone, "To the other side! to the other side!" Hearing the voice they looked in the direction from whence it proceeded, and to their horror saw their brave companion in his utmost need. Having made a circuit they cautiously came up on the other side, and Lieutenant Delamain, from a distance of about a dozen yards, fired at the lion over the person of his prostrate friend. The lion merely quivered; his head dropped upon the ground, and in an instant he lay dead on his side close to his intended victim.

"Wythin a large wylderness,
Where was *lyon* and *lyonesse*,
The *leparde*, and the *tygre* also."—GOWER.

213. *Why may we conclude that the sense of hearing in panthers, tigers, etc., is very acute?*

Because many of them prey only in the woods, and all of them lurk in brakes and thickets, and, therefore, quick



hearing is essential both to their discovering their prey and to prevent their prey from discovering them. It is also a confirmed law in the economy of animals that those which walk softly in proportion to their weight are always quick of hearing. This extends even to human beings, among whom it is found that

those who walk lightly have quick ears, while a dull ear and a heavy step are always associated.*

214. *Why is the tongue of the tiger, lion, and some other animals so rough upon its upper surface?*

Because this condition of the tongue enables the animal to scrape off the minute particles of flesh adherent to the bones. The moderate degree in which this peculiar conformation in the tongue exists in the tongue of the common cat is familiar to every one; in the lion and tiger, however, the roughness is so great that one stroke of the tongue is sufficient to tear the skin from off a man's hand.

215. *Why do beasts of prey generally roar before they spring upon their victim?*

Because they desire to terrify their prey, and thereby to overcome them more easily. Some animals, however, such as the cat, seize their prey silently, and growl while

* Partington's "Cyclopædia."

“So when a *lion* shakes his dreadful mane,
And angry grows,—if he that first took pain
To tame his youth approach the haughty beast,
He bends to him.”—WALLER.

they devour it. In these cases the growl is probably dictated by a fear of losing what they have seized, and as a menace to others of their own species who might seek to steal it from them.

216. *Why are the pupils of the eyes of carnivorous animals variously shaped?*

Because the various habits of the animals require a different exercise of the faculty of sight. The *round* pupil, contracting from a large to a very small orifice, is found in animals which have occasion to use the eyes with nearly equal readiness in all directions—vertical, horizontal, or oblique; the eye with the *upright* pupil is found in those animals which have most occasion to use their eyes in a vertical plane, especially above them; and eyes with the *horizontal* axis is found in those which have most occasion to use them in the horizontal plane.

217. Thus in the *dog*, which ranges the wide field for its subsistence, the pupil is *round*; in the *cat*, which, in a state of nature, feeds in copses, either upon small quadrupeds upon the ground under it, or on birds in the branches above, has the greatest power of the eyes in the *vertical* direction; and in the *hare*, which has most occasion for view in the lateral direction only, the pupil contracts to a *horizontal line*. This is even more remarkable as between the *lion* and the *tiger*; the former, though he hides in bushes and thickets, generally preys upon animals which are in the open places, and also has his haunt in places so bare as that he can see what is going on about him, has the pupil *round*. The *tiger*, on the other hand, which frequents the grassy bottoms of jungles, where the vegetation interrupts the lateral view, has the pupil elongated in the vertical direction.*

218. *Why does the lion lie in wait for the giraffe in the neighborhood of water?*

Because when the giraffe stoops to drink it is obliged to assume a position from which it cannot readily start, while it loses the advantage of the large and watchful eyes which, when its head is erect, at once detect the approach of the enemy from any direction.

219. *Why are there creatures of carnivorous habits in all the classes of the animal kingdom?*

* Partington's "Cyclopædia."

“But, as an old booke saith, who will assay
About the *cat's* necke to hang on a bell,
Had first need to cut the *cat's* claws away.”

Because the prolific tendency of the herbivorous races would, if unchecked, speedily create famine. The design, therefore, in the universal distribution of *carnivorous* creatures is to restrain the *too rapid increase of vegetable feeders*, by which scarcity of our own food would soon be created.

220. The myriads of *insects* which find their subsistence on our forest-trees, if allowed to increase without restraint, would soon destroy the life that supports them, and must all then perish together; but another tribe (that of the insectivorous birds as the *woodpecker*) is adapted to derive its subsistence from them, and thus to keep within salutary bounds the numbers of these voracious little beings. Sometimes, however, they increase to an enormous extent. Whole forests have been destroyed by the ravages of a single species of *beetle*, which is less than a quarter of an inch in length.

221. *Why do the eyes of certain animals “glare” in the twilight or dark?*

It was once supposed that the eyes of animals in which this phenomena appears possessed the power of emitting light, and acted as lanterns in the direction of the animal to seize its prey. But this appears to be not the case. The light is reflected from the choroid tissue, which has a sort of metallic luster, and reflects, after the manner of a concave mirror, a portion of the light which enters the widely-distended pupil. It is not improbable that this *reflected light* is thrown upon the object which the animal desires to investigate or to seize. Although small in amount, it may sufficiently illuminate an object to impress the highly sensitive retina of the eyes of such of the feline species in which this peculiarity is most exhibited.

222. *Why do not their eyes glisten in the daylight?*

Because the aperture of the pupil is then contracted. The light being thus excluded, the quantity which finds admission to the eye, and falls upon the coat from which the reflection proceeds, is very small. But when the animal stands in a dark shade, the pupil dilates, the reflecting coat is, as it were, exposed, and the eyes glisten just as much during the day as in the night.

"You dread reformers of an impious age,
 You awful *cat-o-nine-tails* to the stage,
 This once be just, and in our cause engage."—VANBURGH.

223. *Why, when playing with a cat, does she turn upon her back and seize your hand with her claws?*

The cat, thus in play, imitates the habit of wild animals of her species, which, when they seize an animal large enough to make the capture difficult, hold it with their fore paws, turn on their backs, and then by working rapidly with the claws of the hind feet, they tear open the abdomen of their prey.

224. *Why does cropping the ears of cats close to the head prevent their climbing trees and destroying birds?*

Because the interior ear of the cat is extremely sensitive, especially to moisture. When, therefore, the external ear is removed, the animal in moving about is subjected to constant and painful annoyances, through the exposure of the ear.

This practice of clipping cats' ears is much resorted to in British Guiana, where the settlements are near the woods, and birds so numerous that the cats are continually straying after them.

225. Cats thus cropped cannot go into the open air at all during the rains; and even in the dry season they cannot pursue their feathered prey in the woods at night, which is their favorite hunting time, because even then the leaves are generally covered with heavy dew, which the progress of the cat causes to drop into the openings of the ears, and thus the cat is obliged to stay at home and pursue her mouse and rat-catching.*

226. *Why does the fur of cats emit electrical sparks when briskly rubbed?*

Electricity is common to all animal bodies. Although not fully understood, it may be regarded, if not as one of the elements, as at least one of the conditions of life. With regard to the electricity of the cat, it is probable that the emission of sparks under friction arises from the peculiar dryness of the fur, which is free from the oily substance common to the coats of other animals.

227. Hair of this kind is a very bad conductor of electricity, and as such it can be made electric by friction. It will be readily under-

"She stretched in vain to reach the prize;
 What female heart can gold despise?
 What *cat's* averse to *fish*?—GRAY.

stood that this non-conducting power in the fur of the cat must act as a barrier between what goes on internally and the external atmosphere. If great energy is by means excited, this property must prevent that energy from being dispersed in the air; and this condition results in the well-known phenomena, under this circumstance, of electrical discharges assuming the form of sparks.

228. *Why are cats seen to change their position frequently, and to lick themselves incessantly just previously to a storm?*

Because when a storm is approaching the air is overcharged with the electrical fluid, to which cats are extremely sensitive. The hair of the animal is the first thing to be affected, and instead of lying down smoothly, it becomes ruffled, and probably produces the sensation of itching; hence she is constantly rubbing her coat and ears to smooth down the hair, and wipe off the cause of the irritation.

229. *By what means is a cat enabled to extend or withdraw its talons?*

In the foot of the cat, the bone to which the claw is attached has a rotary movement upon the preceding one; this movement is effected in one direction by a powerful muscle, which draws the bone downward and causes the claws to project; whilst there is a ligament composed of elastic fibrous tissue which draws the bone in the other direction, and retracts the claw within a kind of sheath.

230. When the animal is walking, running, or leaping, the claws are thus drawn in, without any exertion on the part of the animal, by the simple elasticity of the ligament; and they are thus secured, either from receiving injury by wear against the ground, or from impeding the movements of the animal by becoming entangled in the inequalities of its surface, or in the vegetation that covers it. In this state of the claws the animal bears upon a number of soft cushions, one beneath each toe, which enable it to steal with a noiseless step upon its prey, and thus, by surprising them, to vanquish animals whose size would make their resistance formidable, or whose swiftness would afford them a chance of escape from direct pursuit.

231. *Why will a cat refuse vegetable food while a dog will sometimes accept it?*

Because the cat is the more carnivorous animal of the two, and its teeth and other apparatus are not fitted for the reception of vegetable matter; while the dog being less car-

"What though care kill'd a *cat*, thou hast metal enough in thee to kill care?"—SHAKSPERE.

nivorous, will sometimes accept vegetable food, although ordinarily he prefers flesh.

232. *Why do cats lap fluids so slowly?*

Because when they drink, they lap, not with the tongue bent upwards at the tip and the sides, so as to form a kind of spoon, as is the case with the dog, but with the tongue bent downwards at the tip; and hence they lap more slowly. They lap in this manner for the purpose of filling the cup-shaped papillæ of the tongue.

233. *Why is a cat said to live "nine lives"?*

Because they escape without injury from falls and concussions that would either kill or maim most other animals. This immunity from peril may be attributed mainly to the freedom or liveness of the joints of the animal; for whatever part of them is struck or made to strike against any obstacle gives way like a spring; and the weight of the bones of their fore paws partly conduces to bring them to the ground on their feet.

234. *Why does the coati burrow beneath the roots of trees?*

Because from the peculiar nature of its snout, which it employs as a burrowing instrument, it cannot construct a burrow *with a roof*, as is the case with those animals which dig downward, or laterally, with the paws. They, therefore, select the roots of trees, the ramifications of which afford them roofed retreats, which they could not themselves construct. These animals burrow in company, and it is said that they often undermine trees to such an extent that when even a moderate wind comes, they are overturned in great numbers.

235. *Why have bears such an awkward and shuffling gait?*

Because there are no clavicles to keep the shoulder bones steadily apart, and thus, as the fore-legs are moved, the blade bones "work" much more on the sides than is

"They have tied me to a stake; I cannot fly;
But, bear-like, I must fight my course."—SHAKSPERE.

usual in animals. The hind legs have what is usually the finest flexure—or ankle joint in other quadrupeds—at the ground, in bears, and thus the first joint of their hind legs bends the contrary way to that with which we are most familiar.

236. From these peculiarities of formation, we are apt to imagine that the bear walks with pain and difficulty. Such, however, is not the case. The broad base which the foot of the bear forms enables it to walk very securely, even in difficult paths; its progress is more rapid than we could suppose, and the firmness with which it can stand on the flat soles of its hind feet, enables it to use the fore paws in grasping. The want of clavicles enables it to grasp and hug between the fore legs much more powerfully than could be performed by a clavieled animal; and this power is of great service to it, not only in climbing, an operation to which it must often have recourse for its food, but in hugging its enemies, which it does so intensely, that a strong animal is in their grasp strangled by compression of the chest. Climbing is, however, the proper function of the want of clavicles, and climbing by grasping the bole of the tree between the paws, and not by grasping with the single paws as monkeys do. And this mode of climbing answers remarkably well in those places where bears most abound. Pine forests are its haunts, and where pines grow closely together, they have no lateral branches till a considerable height from the ground. Such trees could not easily be climbed by animals which grasped out with the hands.

237. *Why are bears able to live uninjured in exposed places?*

Because they possess a coat of almost impenetrable thickness, and have also a quantity of fat accumulated under it. These protections prevent the temperature from sinking, and prevent them from feeling the cold and other effects of the elements.

238. *Why is a bear enabled to stand in an upright position, and to hug objects with his fore-paws?*

Because he possesses a more perfectly developed collar-bone than most animals; the office of this bone being to keep the shoulders apart from the chest, and to throw the action of the muscles proceeding from the ribs upon the arm bone, which, with a very imperfectly formed collar-bone, would be drawn inwards, and contract the upper part of the trunk.

239. *Why is it a vulgar prejudice against badgers, that they burrow into graves, and devour the bodies of the dead?*

"Some in scarlet, some in purple cloth, all in *badgers'* skins, as is prescribed."—SPELMAN.

This vulgar error arises from the burrowing habits of the badger, coupled with its peculiarly offensive odor. Badgers, however, burrow, not for the purpose of *eating*, but to obtain a place of shelter and safe retreat. Their food consists only of those creatures which come out to feed during the night, such as snails, worms, and other nocturnal creatures.

240. *Why is the female badger more careful than the male in burrowing in secure places?*

Because the male requires the burrow only as a place of shelter during the day and the winter; the female requires the additional accommodation of a nursery for her young. Therefore, the female is in part influenced by her natural instinct, and works in accordance with that before she is of age to become a mother; while the male, into whose composition no such instinct enters, takes the work more easily.

241. Two young badgers, a male and a female, were taken out of the burrow of their mother, and placed in a paved yard, which was so fenced in that they could not escape, and yet allowed them considerable range. They unpaved a portion of the yard and dug a burrow in which they spent the day, and came out in the night only to eat the food which was placed for them. After continuing a year in the court they were put into a small enclosure walled round with stone, and having a mound of earth in the center. True to their habit of digging on sloping banks where there are stones to support their entrance, they first tried the walls all around, to find a place where they could dig a habitation. They then chose an opening between two stones which was a little elevated above the ground, and had the upper stone projecting over it. In nature the entrance to the badger's burrow is often under a projecting stone, which partially conceals it, and protects it from the rain. They had some difficulty in reaching this place, as it required nearly the whole length of their bodies standing on the hind feet, and the fore feet had in consequence little influence on the plaster and stones. They tried a resource, however; the male lay down close by the bottom of the wall, and the female, standing on him, could reach the desired place with more effect. All would not do, so they abandoned the place and tried the result at others, always selecting a place under a projecting stone. In these attempts, which, though they all proved unsuccessful, were carried on with great energy and perseverance, the female was the most active, selecting the places and being the principal operator. After many fruitless attempts they abandoned the walls and betook themselves to the mound of earth, the female, as in other cases, leading the way. Even here they did not at once begin to form the burrow, but ran trial lines or trenches over a considerable part of the surface, till they came to a place which suited them, and here they began their regular operations. In the first loosening of the earth they used the nose, then they dug deeper with the fore paws, flinging the earth backwards between the hind ones, and afterwards using them to remove the heap still further in the rear. When the heap behind them accumulated, they

"In hollow caverns vermin make abode,
The hissing serpent, and the swelling toad,
The corn-devouring *weasel* here abides,
And the wise ant her wintry store provides."—DRYDEN.

retreated backwards upon it, and using all the paws gradually removed it from the hole. Sometimes one of them would lie down to rest by the side of the other at work and remain, though half-buried in the earth, and apparently giving considerable interruption to its fellow. The male was most prone to indulge in these lazy fits, while the female was by far the most industrious in the labor.

242. *Why was badger hunting an amusement of former times?*

Because the animal is of a very pugnacious disposition, possessing great muscular power and astonishing strength of jaws; its strong leathery hide also provides it with a defensive coat of mail, and from these combined characteristics the animal is rendered a formidable enemy to attack or to cope with.

243. The badger is taken in various ways. The favorite mode, and that which is perhaps the most successful, is by catching him in a sack placed at the entrance of his hole. The haunt of the badger being ascertained, a moonlight night is chosen, when he is out feeding, and a small sack is placed within the mouth of the hole, fastened at the outside, with the mouth of the bag outwards, and having a running string round it. Two or three couples of hounds are then thrown off at some distance, and as soon as the badger hears their cry, he makes for his home with all speed, and runs into the sack, which closes behind him by the tightening of the running string round it. Another method is by digging him out. This, however, is laborious, and not always successful, particularly in sandy soils, in which the badger will easily foil the dogs which pursue him in his subterranean passage, by throwing the earth back upon them and blocking up their way, whilst he takes advantage of their loss of time, and makes his way to the surface.

244. *What gave rise to the old proverb of "Catch a weasel asleep," etc.?*

When awake weasels are particularly expert in eluding capture. But it is scarcely possible to imagine an animal sleeping more soundly than the weasel does when once it gives itself up to rest. It may be taken up by the head, the heels, or the tail, and swung about for a considerable time before it begins to awake. In fact, although it is a snappish little animal when awake, there is not one with which greater liberties may be taken when once asleep.

245. *Why is the weasel peculiarly adapted for hunting mice in wheat ricks?*

"Out of my door, you witch, you rag, you baggage, you *pole-cat!*"
—SHAKSPERE.

Because it possesses a long flexible body and an extraordinary length of neck; the closeness of its fur, and its extreme agility and quickness of movement, combine to adapt it to such habits, in which it is also much aided by its power of hunting by scent.

246. In pursuing a rat or a mouse the weasel not only follows it as long as it remains in sight, but continues the chase after it has disappeared, with the head raised a little above the ground, following the exact track taken by its destined prey. Should it lose the scent, it returns to the point where it was lost, and quarters the ground with great diligence till it has recovered it, and thus, by dint of perseverance, will ultimately hunt down a swifter and even a stronger animal than itself. But this is not all: in the pertinacity of its pursuit it will readily take the water, and swim with great ease after its prey.

247. *What gave rise to the saying of "Stinking like a polecat"?*

The pole-cat is provided with small glands on the posterior part of the body which secrete a fluid possessing a most offensive odor. The purpose of this odor has been held to be the protection of the pole-cat from animals that otherwise would prey upon it.

248. A similar power is possessed by numerous animals called *mephitic* (offensive to the smell). Of these the *chinche* appears to possess it in a high degree. The offensive odor is confined exclusively to the apparatus by means of which it is produced and emitted; and when this is removed, the offensiveness ceases. When the animal is pursued and annoyed the battery is discharged, not in mere gas, but in a liquid, which instantly evaporates, and is so buoyant and dispersive, and at the same time so powerful, that it will taint the air for a mile or for several miles round. When near at hand, it is perfectly intolerable, and the staunchest dog is instantly arrested by it.

The following brief story is told by Kalmer:—"In the year 1749, one of these animals came near the farm where I lived. It was in winter, during the night, and the dogs that were on the watch pursued it for some time, until it discharged against them. Although I was in my bed a good way off, I thought I should be suffocated; and the cows and oxen by their lowings showed how much they were affected by the stench. About the end of the same year another of these animals crept into our cellar, but did not exhale the smallest scent, because it was not disturbed. A foolish woman, however, who perceived it at night by the shining of its eyes, killed it, and at the moment its stench began to spread. The whole cellar was filled with it to such a degree that the woman kept her bed for several days afterwards, and all the bread and meat and other provisions that were kept there were so affected that they were thrown out of doors."

249. *What originated the proverb, "He builds closely with dry stones who can build out the weasel"?*

Because the animal has such extreme flexibility of body

"I ordered the proper officer of my court to *ferret* them out of their respective lanes, and bring them before me."—TATLER.

that it has been known to worm its body through a hole less than three inches in diameter. It is also a very expert climber and can ascend a wall or a tree with the utmost celerity.

250. *Why are ferrets dangerous animals to keep in a state of domestication?*

Because they are animals incapable of discriminating attachment, and the tameness they evince is deceptive, being nothing more than the indifference and absence of fear and anger, which are the result of hereditary dependence upon and association with mankind. But when an opportunity arrives, and this animal is tempted by the taste or smell of blood, the ferret becomes indiscriminate and savage in its attack even on human beings.



251. The following anecdote related by Mr. Jesse in illustration of the ferocity of the ferret is recorded here with a view of discouraging persons from making pets of these vicious creatures:—Some few years ago, a poor woman, holding a mangled infant in her arms, rushed, screaming with agony and fright, into my friend's house, who is a surgeon, imploring him to save the child's life, who, she said, had been almost killed by a ferret. The face, neck, and arms, were dreadfully lacerated, the jugular vein had been opened, as also the temporal artery; the eyes were greatly injured, and indeed, the child, who is still living, has lost the entire sight of one of them, and has very imperfect vision in the other. Having stopped the still bleeding vessels, my friend accompanied the mother to her cottage, on entering which the child, in some degree recovering from its state of apparent death, began to cry, when the ferret was in an instant seen rushing from behind some basins where he had taken shelter, and, with its head erect, boldly came forward and met the infuriated parent in the middle of the room, still holding the infant in her arms. On my friend's kicking the ferret, as the first impulse of protection, the animal endeavored to seize his leg, and not until his back was broken by repeated kicks did he give over his earnest and reiterated attempts to renew his sanguinary feast; indeed, whilst in the agonies of death, the piteous screams of the child seemed to rouse him to vain efforts to regain his prey. The ferret was of large growth, and much distended with the infant's blood; and, although formerly of peculiar shyness, yet he lost sight of fear and became ferocious in the pursuit of the unfortunate infant. It appears the poor woman had left her child (about six months old) in a cradle whilst she went to market, when it is supposed the infant's cry had arrested the attention of the ferret, who managed to make his escape, and thus effected his purpose. There is good reason to believe he must have passed more than half an hour in the indulgence of his appetite, from the circumstances of the neighbors having heard the piercing shrieks of the child for a long time without the slightest suspicion of the mother's absence.

"Th' amphibious otter bold, the weasel sly,
Pilfering the yolk from its enclosing shell."—DODSLEY.

252. *Why do otters, when hunting for fish, always swim against the stream?*

Because fishes, when reposing or waiting for food, have their heads up the water; and thus the otter can come upon them and capture them unawares.

Another reason is, that as otters return to the neighborhood of their burrow with the fish they have captured, they can more easily do so by swimming with their burthen in the direction of the stream.

253. *What are the points of similarity and difference between the dog and the wolf, to which animal the origin of the dog is attributed?*

The skeleton of the wolf does not differ materially from that of the dog more than that of the different kinds of dogs vary; the cranium is similar, and they agree in nearly all the other essential points; the dog and wolf will readily breed with each other, and their progeny thus obtained will again mingle with the dog. The most prominent circumstance which marks a decided difference between the two animals is the eye: this organ in the dog of every country and species has a circular pupil; but the position or form of the pupil in the wolf is oblique. It should also be remembered that in every part of the globe in which the wolf is found, a peculiar setting on of the curve of the tail, and a singularity of voice, cannot fail of being observed; to which may be added, that the dog exists in every latitude and in every climate, while the habitation of the wolf is confined to certain parts of the globe.

254. There is, also, a marked difference in the temper and habits of the two. The dog is, generally speaking, easily manageable, but nothing will, in the majority of cases, render the wolf moderately tractable. There are, however, exceptions to this. M. F. Cuvier gives an account of a young wolf who followed his master everywhere, and showed a degree of affection and submission scarcely inferior to the domesticated dog. His master being unavoidably absent, he was sent to the menagerie, where he pined for his loss, and would scarcely take any food for a considerable time. At length, however, he attached him-

"The poor *dog!* in life the firmest friend,
The first to welcome, foremost to defend;
Whose honest heart is still his master's own,
Who labors, fights, lives, breathes for him alone."—BYRON.

self to his keepers, and appeared to have forgotten his former associate. At the expiration of eighteen months his master returned, and, the moment his voice was heard, the wolf recognized him and lavished on his old friend the most affectionate caresses. A second separation followed, which lasted three years, and again the long-remembered voice was recognized, and replied to with impatient cries; after which, rushing on his master, he licked his face with every mark of joy, menacing his keepers, towards whom he had just before been exhibiting fondness. A third separation occurred, and he became gloomy and melancholy. He suffered the caresses of none but his keepers, and towards them he often manifested the original ferocity of his species.

255. *Assuming the original identity of the dog and the wolf, why is there a difference in the pupils of their eyes?*

Professor Bell attributes the forward direction of the eyes in dogs, and the circular pupil, to the constant habit, for many generations, of looking forwards towards their masters.

256. *Why may we infer that all the varieties of dogs spring from a common origin?*

Because we have many opportunities of observing the varieties produced by accidental causes, and we see those accidental varieties diligently cultivated into new species, altogether different in form and use from any that preceded them.

257. We see the changes climate and breeding effect in dogs illustrated by the rough Irish or Highland greyhound and the smoother one of the southern part of Britain; the more delicate one of Greece, and the diminutive one of Italy, and the hairless one of Africa and Brazil. One of the most striking proofs of the influence of climate on the form and character of this animal occurs in the bull-dog. When transported to India he becomes, in a few years, greatly altered in form, loses all his former courage and ferocity, and becomes a perfect coward.*

258. *Why is the Isle of Dogs so called?*

Because in the reign of King John it was made the receptacle and breeding ground of the greyhounds and spaniels of that monarch. It was selected on account of its contiguity to Waltham and other royal forests, where coursing was a frequent amusement.

* "Youatt on the Dog."

"The greyhounds forth are brought, for coursing then in case,
And choicely in the slip, one leading forth a brace;
The finder puts her up, and gives her coursers law."—DRAYTON.

259. *Why does the greyhound hunt by sight alone?*



Because he has been trained to depend upon his speed, and that speed is utterly incompatible with the tracing of scent.

260. Packs of hounds run by sight when the nature of the country allows them to have a full view of the hare. When thus running they nearly double their speed, but are liable to lose ground by being thrown out in consequence of a sudden turn, or change of country; they have to seek the scent before they can again take up the running. The English greyhound, on the contrary, is called off the moment he loses sight of the hare, the re-finding of which is left to the spaniel.

261. *Why should the neck of the greyhound be long?*

Because it is necessary that this portion of the frame should correspond with the length of the legs, and thus enable the dog to seize and lift the game as he rapidly pursues his course, without throwing any undue or dangerous weight on the fore extremities. In the act of seizing the hare the short-necked dog may lose the center of gravity and fall.

262. *Why are greyhounds less attached to their masters than are other dogs?*

Because the greyhound has less opportunities of forming individual attachments than other dogs; the whole purpose of his life being to follow game. The keeper exercises over him a tyrannical power, and the owner seldom notices him in the manner which begets affection or scarcely recognition.

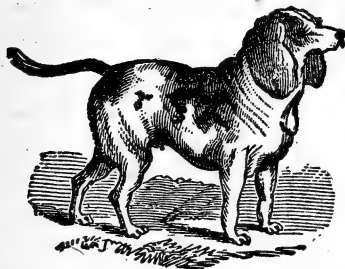
263. *Why in coursing are two dogs employed?*

Because hares make sudden turns, by which they frequently escape from single dogs. A good greyhound will reach a hare if she runs straight; but the moment he is

"So flew, so sanded, and their heads are hung
 With ears that sweep away the morning dew;
 Crook-knee'd, and dew-lapp'd, like Thessalian bulls;
 Slow in pursuit, but matched in mouth like bells."—SHAKSPERE.

about to strike at her she turns short, and the dog, unable to stop himself, is thrown from ten to twenty yards from her. When, however, pursued by a couple of dogs, the hare has a more difficult game to play, as it frequently happens that when she is turned by the leading dog she cannot avoid the strokes of the second.

264. *Why should beagles have large heads?*



Because they depend almost wholly upon scent for their success in the hunt. A large broad head is accompanied by expanded nasal organs, contributing to acute smelling; while the same form of head is adapted for the reverberation of the sound for which the beagle is remarkable.

265. *Why should sporting dogs generally be kept to their own game?*

Because by such restriction they become improved for their special duty, having only one scent, and one style of hunting.

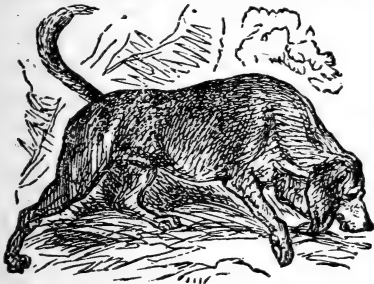
266. *Why have bloodhounds proved so efficacious in the pursuit of fugitives?*

Because special means have been carefully employed with the horrible design of training these dogs to entertain an insatiable thirst for human blood.

267. Bloodhounds were formerly much employed in pursuing criminals escaped from justice, or in tracing out robbers or enemies, whose

"Soon the sagacious brute, his curling tail
 Flourished in air, low bending, plies around
 His busy nose, the steaming vapor snuffs."—SOMERVILLE.

course was invariably discovered, when once the bloodhound was placed upon their trail. In the border country of Scotland, they were formerly



much employed for such uses, but at present the race has become almost forgotten. In the countries of South America, the Spaniards employed fierce dogs to aid them in conquering the Indians, but it is not certain that the dogs, trained by them to this cruel business, belonged to the present variety.

All the varieties of hound, however, have much sagacity, and most of the larger and stronger breeds have great acuteness of scent, and might, without much difficulty, be trained to act as bloodhounds.

268. *Why is the sense of smell so acute in dogs?*

The olfactory nerve in the horse, the dog, the ox, and the swine, is the largest of all the cerebral nerves, and of much greater comparative bulk in the quadruped than in the human being. The sense of smell, in proportion to the size of the nerve upon which it depends, is still more acute. The relative size of the nerve bears an invariable proportion to the necessity for an acute sense of smell in the various animals—large in the horse, compared with the olfactory nerve in the ox, which is sent into the fields to shift for himself—larger still in the swine, whose food is buried under the soil, or deeply immersed in refuse—and still larger in the dog.

269. *Why do dogs lose their scent for game-birds during the season of incubation?*

It is a common notion that this arises from some temporary defect in the organ of smell of the dog; but it would appear more probable that birds lose, or rather do not emit, scent during the time in question, and this may be owing to the habits or condition of the birds being changed during the period of incubation. In this may be perceived a wise and merciful provision of nature to protect the birds from harm during this trying and important season.

"Neglected Tray and pointer lie,
And covies unmolested fly."—PRIOR.

270. *Why do sporting dogs make what is termed a "point"?*

Because they are conscious of having got too close upon the birds, and halt suddenly for fear of disturbing them before a shot can be given; and this action not only accomplishes the end in view, but serves to acquaint the sportsman that there is game in the immediate locality.

271. The moment the pointer falls upon the scent, he not only makes a sudden halt, but assumes at once an attitude of very great peculiarity, and such as must be seen before it can be fully appreciated or understood. In an instant he may be seen standing on three legs, one of the fore feet being raised, and his face, back, and tail all drawn into a line. This is his invariable position when the scent is taken naturally, but when it is interfered with, such as running with the wind, or barred by an impenetrable fence, or by other circumstances, and the dog stumbles in consequence suddenly upon the game, he then pulls himself up so instantaneously that not one of his limbs is suffered to move after the instant the scent is discovered; and however singular the conformation of his body at that moment, or however painful to him that attitude, he will maintain it with unswerving steadiness until the sportsman arrives. Sometimes it has happened that when the pointer has been in the act of springing over a strong fence, such as a stone wall, he has hit upon the scent of the birds lying close to it on the other side, and he has then been seen to halt suddenly on the top of it with his four feet all collected together, and his body almost all doubled up, thus fixing himself like a statue.

272. *What is "scent"?*

It is the odor, or effluvium, which is constantly issuing from every animal, and especially when that animal is in more than usual exercise. In a state of heat or excitement, the pores of the skin appear relaxed, and a fluid or aqueous vapor is secreted which, escaping in large quantities, adheres to the persons or substances upon which it falls, and is particularly capable of impressing the olfactory nerves.*

273. That an animal emitting odorous exhalations should leave behind it a somewhat abiding scent, is no matter of surprise when we consider what some solid substances are capable of doing, and that the odorous excretions of animals derive their property from minute particles of similar solids. Some substances possess very strong odorous properties, without losing weight in any appreciable degree by the diffusion of their particles through the air. This is the case, for example with musk, which is obtained from the *musk-deer*, a grain of which has been kept freely exposed to the air of a room, whose doors and windows were kept constantly open for a period of ten years, during which

* "Youatt on the Dog."

“To every shrub the warm effluvia cling,
 Hang on the grass, impregnant earth and skies,
 With nostrils op’ning wide, o’er hill and dale,
 The vig’rous hounds pursue.”—SOMERVILLE.

time the air, thus continually changed, was completely impregnated with the odor of musk; and yet, at the end of that time, the particle was found to have not perceptibly diminished in weight.

274. *Why is a moist atmosphere the best for scent?*

Because moisture not only imbibes and holds the peculiar matters yielding the odor, but presents it to the nerves of smell, which are spread out upon the internal chambers of the nose in that state which is best adapted to impress the nerves.

275. We know that just before rains set in, when the atmosphere is humid, but not *wet*, drains give forth unpleasant smells. Certain bodies possess the property of exciting sensations of a peculiar nature, which cannot be perceived by the organs of taste or touch, but seem to depend upon the diffusion of the particles of the substances through the surrounding air in a state of extreme minuteness. As the solubility of a substance in liquid seems a necessary condition of its exciting the sense of taste, so does its volatility or tendency to a vaporous state appear requisite for its possession of odorous particles.

276. *Why is a wet day unfavorable for scent?*

Because then the odorous effluvia becomes, as it were, “drowned” by excess of moisture. It is *absorbed* and neutralized by water, instead of being *suspended* in vapor. We know that persons having colds, in which condition the mucous membranes of the nose are in an extreme state of humidity, lose their power of smell.

277. *Why, when the ground is hard and the air dry, is there little scent?*

Because the vapor which serves as the menstrum of communication is absent.

278. *Why does scent sometimes lie breast high?*

Because sometimes a stratum of humid air lies over the earth a little above the surface. This arises from the difference between the temperature of the earth and the

"But the milder ayre with season moderate,
Gently attempred, and disposed so well
That still it breathed forth sweet and wholesome smell."—SPENSER.

air, and is frequently made manifest by the "creeping mists" of morning and evening. The scent is most manifest where a favorable condition of humidity prevails, and hence it is strongest in the upper stratum.

279. *Why does scent rarely lie with a north or cold wind?*

Because those winds being generally dry, as well as cold, are unfavorable to the retention of scent, which becomes diffused and weakened instead of retained, as it were, in solution.

280. The different manners or attitudes in which the dog runs afford satisfactory and pleasing illustrations of the nature of the scent. Sometimes they will be seen galloping with their noses in the air, as if their game had flown away, and an hour or two afterwards every one of them will have his muzzle on the ground. The condition of the atmosphere has changed, and the scent has arisen or fallen in proportion.*

281. *Why is scent generally good when the wind is southerly?*

Because the south wind is generally humid and warm. For a similar reason, a westerly wind is, next to the south wind, in its favorable conditions.

282. In the evening when dews are forming, we recognize the fragrance of flowers and the odor of sweet hay. This is a sufficient confirmation that a moderate degree of humidity is best adapted to the transmission of scents.

283. *Why, when cob-webs hang on the bushes, is scent seldom good?*

Because spiders spread out their webs in dry air, and gather them in when it is moist or wet. Therefore, when the webs are out it is a sure indication that the dryness of the air is unfavorable to scent.

284. *Why, in a hard rain, if the air is mild, will scent sometimes be very good?*

Because after a heavy rain the air is left in a dry state, ready immediately to absorb vapor. The mildness of the temperature at once causes evaporation, and produces the

* "Youatt on the Dog."

" 'Tis raging noon; and, vertical, the sun
Darts on the head direct his forceful rays,
O'er heaven and earth, far as the ranging eye
Can sweep."—THOMSON.

same atmospheric condition immediately *after* rain as generally occurs *before* it.

285. *Why do sudden storms destroy scent?*

Because they rapidly change the conditions upon which it depends. Storms of rain produce a superabundance of wet; storms of wind dry the air, and disperse the effluvia; storms of hail and snow produce cold, and, if succeeded by an immediate thaw, result in a wet surface, with sluggish evaporation; but if no thaw occurs, then a cold dry air rests over the earth.

286. *Why are sunshiny days not good for scent?*

Because then there is a rapid movement of the vapors of the earth, from the surface to a considerable elevation in the atmosphere. This may be observed in what is called the "steaming" of the earth on a hot day. The scent is, in such a condition, borne away, and dispersed above the reach of the dogs employed in the hunt.

287. *Why is a warm day without sunshine good for scent?*

Because then the evaporation from the earth's surface proceeds gradually. Instead of rising rapidly under the glaring heat of the sun, the vapors lie for a time upon the surface; and when the vapors lie the scent lies also.

288. *Why does scent lie badly upon fallows and beaten roads?*

Because there is nothing to detain it; every blade of grass, or moss, or frond of fern, serves to give stillness to the stratum of air immediately over the earth's surface. But where there are no such checks to atmospheric motion, every impulse of the air spreads far and wide, and disperses all local exhalations.

289. *Why is scent frequently good by hedgerows, when bad in the coppice or in the open field?*

Because the coppice may be too wet, and the scent be

“And, all within, it full of wyndings is
 And hidden wayes, that scarce a *hound* by smell
 Can follow out those false footsteps of his.”—SPENSER.

drowned; and the open field, being quickly dried by the sun, or swept by a brisk wind, the scent may be dispersed; while the hedgerow sheltered from the wind, and partially so from the sun, may preserve the conditions required.

290. *Why do dogs of different breeds exhibit a peculiar faculty for particular scents?*

These peculiarities are dependent partly upon organization and upon training. The short thick nose of the beagle is adapted for a ground-scent, while the longer nose of the setter is better adapted for catching the impregnated air.

In the breaking-in of dogs it is necessary to correct their false points at first; they will stand at larks, black-birds, thrushes, and, indeed, at anything emitting an unusual odor. By discipline they are taught to disregard all scents but those of their particular game. The foxhound, well broken-in, will rarely challenge at the scent of the hare, nor will he even change his fox.

291. The scent of different animals possesses very various degrees of pungency and distinctive qualities. Scents that are appreciable by some animals are imperceptible by others: thus the exhalations of the fox, badger, or pole-cat, are obvious to man; but those of the hare, rabbit, and winged game, to their enemies only. The animal effluvia themselves differ, not only according to the variety of the animal they escape from, but also as the exhalations of each animal vary with circumstances. The hunted stag is never changed—the hunted fox and the hunted hare may be changed many times. “The Country Squire” on the same head remarks:—“It is to be remembered that there is no small accidental difference in the very particles of scent; I mean, that they are stronger, sweeter, or more distinguishable at one time than at another, and that this difference is found not only in diverse, but often in the same individual creature, according to the changes of the air or the soil, as well as of her own motions or conditions. That there is a different scent in other animals of the same species is evident from draught hounds, which were formerly made use of for tracking and pursuing thieves and deer-stealers; or rather from any common cur or spaniel, which will hunt out their masters or their master’s horse distinctly from all others; and that it is the same with the hare is no less visible with the old beagles, which will not readily change for a fresh one, unless she starts in view, or unless a fault happens that puts them in confusion, and inclines them in despair to take up with the next they can come by.” Had the Country Squire been a stag-hunter also, he would have noted this peculiarity of the scent of the hunted stag, which, as already observed, is never lost, though scores of this kind are near. This veteran judiciously remarks on the nature of scent, that many circumstances may change it; according to his opinion, it is at one time composed of very fine particles, and at another of particles equally gross, and that this difference is frequently occasioned by accidental circum-

"It was a comfort, too, to see
 Those dogs that from him ne'er would rove,
 And always eyed him reverently,
 With glances of depending love."—HALLAM.

stances. Thus, he says, the coursing of a cur dog, which may follow the hare during the run, will commonly produce a different effluvium to the rest, and a fault is therefore almost always the consequence of this accident in the hare chase. "The hounds," he says, "must be again put on the scent before they will acknowledge it for their game; the reason is, the changing the motion causes one in the perspiring particles. The alterations of scent in a yielding hare are less frequently productive of faults, because they are more gradual, and insensibly grow smaller; but that alterations there are every dog-boy knows, by the old hounds pressing forward with greater earnestness as the hare is nearer her end.*

292. *Why are foxes that are found early in the day easily caught?*

Because, as they feed by night, they are incapable of fast running before their nocturnal meal has been digested.

293. *Why is the Newfoundland dog of greater service to man than any other, especially as a water-dog?*

Because he not only displays sagacity and willingness in assisting drowning persons, but he is also provided with semi-webbed feet, which make him a good swimmer.

294. Innumerable instances of Newfoundland dogs having saved human life are on record. The following is a case in point:—A person was once traveling in Holland, accompanied by a Newfoundland dog. Not taking proper heed of his steps on an evening walk along a high bank by the side of one of those deep canals common in that country, his foot slipped, and he fell into the water; and, being unable to swim, he was soon deprived of his senses. In the mean time, the dog no sooner discovered the danger to which his master was exposed, than he was in the water, and engaged in the struggle to rescue him from peril. A party at a distance saw the sagacious creature at one moment pushing, and at another dragging the body towards a small creek, where at length he succeeded in landing his charge, and placing it as far from the water as possible. This being done, the dog just shook himself, and then licked the face and hands of his apparently dead master. The body being conveyed to a neighboring house, the efforts to restore animation were successful. From the marks of teeth on the body, it appeared that the dog had taken his first hold on the shoulder; but finding that this did not keep the head out of water, the instinct of the animal prompted him to change his grasp from the shoulder to the neck, by which he was enabled to raise the head, and to keep it so for a distance of a quarter of a mile.

295. *Why does a dog toss his head about in such a variety of attitudes when endeavoring to masticate a tough substance?*

Because, owing to a limited power of the mouth, he

* Blaine's "Encyclopædia of Rural Sports."

"When I frown, they hang their most dejected heads,
Like fearful *sheephounds*; show 'em a crust of bread,
They'll saint me presently, and skip like asses."

—BEAUMONT and FLETCHER.

can divide a portion of tough matter only by repeated vertical bites; but if he has much labor with the substance, and his hunger urges him to eat it, he may be seen shifting his head, now higher at one side and then higher at the other alternately, in order to bring the whole under his teeth; and he also flings his head upwards and downwards, and gives a snap, so that the lower jaw may bite with a momentum, while the substance to be divided rests against the teeth of the upper jaw.

296. *Why may it be inferred that the habits of the shepherd's dog are the result of instruction rather than instinct?*

Because the actions of these dogs appear to be governed by an intelligence nearly allied to human reason; and what is much too artificial, and too greatly opposed to the nature of the animal, is to be attributed to instruction.

297. Very different propensities are found in various breeds of dogs, and they are always such as are particularly suited to the purposes to which each of these breeds has long been and is still applied. No one can suppose that nature has given to these varieties of the same species such very different instinctive propensities, and that each of these breeds should possess those that are best suited for the uses to which they are respectively applied. It certainly seems more probable that these breeds, having been long treated as they now are, and applied to the same uses, should have acquired habits by experience and instruction which, in course of time, have become hereditary. In short, that by far the greater part of the propensities that are generally supposed to be instinctive, are not implanted in animals by nature, but are the result of long experience, acquired and accumulated through many generations, so as in course of time to assume the character of instinct.

298. *How may dogs be taught to distinguish playing cards, and to pick them out from the pack correctly as they are named?*

The dog is taught to do this by frequently offering him food on a card he is unacquainted with, after which they send him to find it out from the rest, and he never mistakes. The habit of profiting by that discovery and receiving caresses enables him by degrees to grow acquainted with each particular card.

"So true, so brave, a lamb at home,
A lion in the chase."

299. *Why do dogs betray fear when a person who has a lame and stooping gait approaches?*

Because the action which the lame person uses in walking has a close resemblance to the attitude of a person stooping to pick up a stone.

300. *Why does a dog generally turn round three or four times before he lies down to sleep?*

It is supposed that this singular and almost invariable practice is one of the dog's natural instincts, altered or modified to his domesticated life; for, when in a wild state, he takes up his night's quarters in a field of tall withered grass or among reeds or rushes, thus wheeling round he separates the vegetation in the spot where he is to lie, and forms a bed with overhanging curtains all round for his protection and warmth.

301. *Why should the treatment of dogs be regulated more by moral than by brute force?*

Because the nervous system in this creature is largely developed, exerting an influence over all his actions and giving character to the species. The brain of the dog is seldom in repose; even when asleep the twitching of the legs, and the suppressed sounds, inform us that the dog is dreaming. No animal is more actuated by the power of imagination. To diseases of cerebral or spinal character it is more liable than any other domesticated animal. Its very bark is symbolical of temperament, and its mode of attack energetically declares the excitability of its nature. The most fearful of all diseases to which it is exposed (rabies) is essentially of a nervous character. Delirium usually precedes its death, and nervous excitability is the common accompaniment of most of its disorders. This peculiar temperament of the animal at once suggests how much may be done by gentle treatment; while on the other hand it makes known to us the fact that words spoken to a dog in a harsh and unkind tone, and the infliction of blows or kicks, may occasion indescribable pain.

"The dog, loud barking, 'mid the glittering rocks,
Hunts, where his master points, the intercepted flocks."—WORDSWORTH.

302. *Why have dogs and cats great difficulty in masticating vegetable substances?*

Because, being carnivorous animals, their teeth and the motion of their jaws is ill-adapted to the mastication of vegetable substances, which they sometimes eat when domesticated.

303. As even those carnivorous animals which are best adapted for living upon vegetable food, and live most upon it, have no grinding motion of the jaws, they divide vegetable substances with much more difficulty than those races which have the grinding motion and the short teeth, or true molars; and, as the number of comparatively flattened teeth diminishes, the difficulty increases. One case of this gradation may be seen in the domestic dog and cat. The dog is the less carnivorous of the two, and as he uses the mouth only in the capture and killing of his prey, he has much more powerful and varied action of the neck. He can divide a portion of tough vegetable matter, as for instance a crust of bread, only by repeated vertical bites; but if he has much labor with the substance, and his hunger is strong enough to induce him to eat, he may be seen shifting his head, now higher at the one side, then higher at the other, alternately, in order to bring the whole under his teeth, and he also flings the head upwards or downwards, and gives a snap, so that the lower jaw may bite with a momentum, while the substance to be divided rests against the teeth of the upper jaw. The cat has a great deal more trouble in this imperfect mastication, as she cannot snap and derive advantage from the momentum of the jaw as the dog does; thus with her the division of hard vegetable food, so as to prepare it for the stomach, is no easy matter.

"The dog," says Mr. Youatt, "is the only animal that is capable of disinterested affection. He is the only one that regards the human being as his companion, and follows him as his friend; the only one that seems to possess a natural desire to be useful to him, and from a spontaneous impulse attaches himself to man. We take the bridle from the mouth of the horse, and turn him free into the pasture, and he testifies his joy in his partially recovered liberty. We exact from the dog the service that is required of him, and he still follows us. He solicits to be continued as our companion and our friend. Many an expressive action tells us how much he is pleased and thankful. He shares our abundance, and he is content with the scantiest and most humble fare. He loves us while living, and has been known to pine away on the grave of his master."

A few anecdotes of this faithful animal will be interesting:—

TYKE THE FIRE DOG.

304. A few years ago the public were amused with an account given in a newspaper of a dog which possessed the strange fancy of

"That instinct suggests for them everywhere what is most for their safety, and makes them many times sagacious above our apprehension."—MORE.

attending all the fires that occurred in the metropolis. The discovery of this predilection was made by a gentleman residing a few miles from town, who was called up in the middle of the night by the intelligence that the premises adjoining his house of business were on fire. "The removal of my books and papers," said he, in telling the story, "of course claimed my attention; yet, notwithstanding this, and the bustle which prevailed, my eye every now and then rested on a dog which, during the hottest progress of the conflagration, I could not help noticing running about, and apparently taking a deep interest in what was going on; contriving to keep himself out of everybody's way, and yet always present amidst the thickest of the stir. When the fire was got under control, and I had leisure to look about me, I again observed the dog, which, with the firemen, appeared to be resting from duty, and was led to make some enquiries respecting him. 'Is this your dog, my friend?' said I to a fireman. 'No, Sir,' answered he; 'it does not belong to me, or to any one in particular. We call him the firemen's dog.' 'The firemen's dog!' I replied. 'Why so; has he no master?' 'No, Sir,' rejoined the fireman, 'he calls none of us master, though we are all of us willing enough to give him a night's lodging and a pennyworth of meat. But he won't stay long with any of us. His delight is to be at all the fires in London; and, far or near, we generally find him on the road as we are going along, and sometimes, if it is out of town, we give him a lift. I don't think there has been a fire for these two or three years past which he has not been at.'

"This communication was so extraordinary that I found it difficult to believe the story until it was confirmed by the concurrent testimony of several other firemen. None of them, however, were able to give any account of the early habits of the dog, or to offer any explanation of the circumstances which led to this singular propensity.

"Some time afterwards I was again called up in the night to a fire in the village in which I resided (Camberwell, in Surrey), and to my surprise here I again met with 'the firemen's dog,' still alive and well, pursuing, with the same apparent interest and satisfaction, the exhibition of that which seldom fails to bring with it disaster and misfortune, oftentimes loss of life and ruin. Still he called no man master, disdained to receive bed or board from the same hand more than a night or two at a time, nor could the firemen trace out his resting-place."

Such was the account of this interesting animal, as it appeared in the newspapers, to which were shortly afterwards appended several circumstances communicated by a fireman at one of the police offices. A magistrate having asked him whether it was a fact that the dog was present at most of the fires that occurred in the metropolis, the fireman replied that he never knew "Tyke," as he was called, to be absent from a fire upon any occasion that he (the fireman) attended himself. The magistrate said the dog must have an extraordinary predilection for fires. He then asked what length of time he had been known to possess that propensity. The fireman replied that he knew Tyke for the last nine years; and, although he was getting old, yet the moment the engines were about, Tyke was to be seen as active as ever, running off in the direction of the fire. The magistrate inquired whether the dog liked any particular fireman. The fireman replied that Tyke liked one

"But bold Tydides to the *rescue* goes,
A single warrior 'midst a host of foes."—POPE.

fireman as well as another. He had no particular favorites, but passed his time amongst them; sometimes going to the house of one, and then to another, and off to a third when he was tired. Day or night, it was all the same to him; if a fire broke out, there was he in the midst of the bustle, running from one engine to another, anxiously looking after the firemen; and, although pressed upon by crowds, yet, from his dexterity, he always escaped accidents, only now and then getting a ducking from the engine, which he rather liked than otherwise. The magistrate said that Tyke was a most extraordinary animal; and, having expressed a wish to see him, he was shortly afterwards exhibited at the office, and some other peculiarities respecting him were related. There was nothing at all particular in the appearance of the dog. He was a rough-looking, small animal, of the terrier breed, and seemed to be in excellent condition—no doubt from the care taken of him by the firemen belonging to the different companies. There was some difficulty experienced in bringing him to the office, as he did not much relish going any distance from where the firemen are to be found, except in cases of attending with them at a conflagration, and then distance was of no consequence. It was found necessary to use stratagem for the purpose. A fireman commenced running; Tyke, accustomed to follow upon such occasions, set out after him; but this person having slackened his pace on the way, the sagacious animal, knowing there was no fire, turned back, and it was necessary to carry him to the office.*

The Author recently saw a fire-dog (but is not aware whether it is the same as described by Mr. Jesse in the above narrative, though he thinks not from the description); it wore a collar, bearing a suitable inscription, recording its feats in connection with various fires. This dog would run up the steps of the fire-escapes, enter rooms, and, crouching along the floor, its head below the clouds of smoke, would find out persons lying in their beds in a half-suffocated state, and then, setting up a loud howl, would inform the firemen. At the time the Author saw it, the dog suffered from falls, and wounds caused by the wheels of fire-escapes and engines passing over it. It was no longer able to ascend the steps of the fire-escape; but, whenever a door was opened, it rushed in and ascended the stairs, and explored every part of the house to which it could find access.

A PIECE OF MONEY SINGULARLY RESTORED BY A DOG TO HIS MASTER.

305. A gentleman in Suffolk, on an excursion with his friend, was attended by a Newfoundland dog, which soon became the subject of conversation. The master, after a warm eulogium upon the perfection of his canine favorite, assured his companion that he would, upon receiving the order, return and fetch any article he should leave behind, from any distance. To confirm this assertion, a marked shilling was put under a large square stone by the side of the road, being first shown to the dog. The gentlemen then rode for three miles, when the dog received

* Jesse's "Anecdotes of Dogs."

“So scented the grim feature, and upturn'd
His nostrils wide into the murkie air,
Sagacious of his quarry from so far.”—MILTON.

a signal from his master to return for the shilling he had seen put under the stone. The dog turned back; the gentlemen rode on and reached home, but to their surprise and disappointment the hitherto faithful messenger did not return during the day. It afterwards appeared that he had gone to the place where the shilling was deposited, but the stone being too large for his strength to remove, he had stayed howling at the place till two horsemen riding by, and attracted by his seeming distress, stopped to look at him, when one of them alighting, removed the stone, and seeing the shilling, put it into his pocket, not at the time conceiving it to be the object of the dog's search. The dog followed their horses for several miles, remained undisturbed in the room where they supped, followed the chambermaid into the bedchamber, and secreted himself under one of the beds. The possessor of the shilling hung his trousers upon a nail by the bed-side; but when the travelers were both asleep, the dog took them in his mouth, and leaping out of the window, which was left open on account of the sultry heat, reached the house of his master at four o'clock in the morning, with the prize he had made free with, in the pocket of which were found a watch and money, that were returned upon being advertised, when the whole mystery was mutually unravelled to the admiration of all the parties.*

MEMORY AND GRATITUDE OF A DOG.

306. Mr. Youatt relates the following anecdote of a Newfoundland dog, who was greatly attached to him. He says, as it became inconvenient to him to keep the dog, he gave him to one who he knew would treat him kindly. Four years passed, and he had not seen him, when one day as he was walking towards Kingston, and had arrived at the brow of the hill where Jerry Abershaw's gibbet then stood, he met Carlo and his master. The dog recollected Mr. Youatt in a moment, and they made much of each other. His master, after a little chat, proceeded towards Wandsworth, and Carlo, as in duty bound, followed him. Mr. Youatt had not, however, got half-way down the hill, when the dog was again by his side, lowly but deeply growling, and every hair bristling. On looking about he saw two ill-looking fellows making their way through the bushes which occupied the angular space between Rochampton and Wandsworth roads. Their intention was scarcely questionable, and, indeed, a week or two before, he had narrowly escaped from two miscreants like them. “I can scarcely say,” proceeds Mr. Youatt, “what I felt, for presently one of the scoundrels emerged from the bushes, not twenty yards from me; he no sooner saw my companion, and heard his growling, the loudness and depth of which were fearfully increasing, than he retreated, and I saw no more of him or his associate. My gallant defender accompanied me to the direction post at the bottom of the hill, and there, with many a mutual and honest greeting, we parted, and he bounded away to overtake his rightful owner. We never met again; but I need not say that I often thought of him with admiration and gratitude.”

* Jesse's “Anecdotes of Dogs.”

"At Bruin flies the slavering, snarling cur,
But only fills his famished jaws with fur,"—FALCONER.

A DOG CONSTABLE.

307. Mr. Tewes, who keeps a restaurant in Williams-street, New York, has a large Newfoundland dog, a finer specimen of this kind than is ordinarily met with. Among his other wonderful marks of intelligence, we witnessed this a day or two ago. A gentleman entered the restaurant holding by a cord a dog which served as watch on board a ship. While in the place, the gentleman supposed the dog was safe, released his hold upon the string. The door was opened while the parties were in conversation, and the dog made his escape. Mr. Tewes said to his Newfoundland, "Go bring him back, Sir." The dog obeyed the mandate, and within a block or two overtook the fugitive. He first proceeded to give the object of his charge a slight reprimand for his delinquency by means of a smart shake or two, and then took the rope in his mouth to lead the dog back to his master. Some holding back was manifested, the string was dropped, and another shaking administered. Finally, by alternate chatishments and pullings at the cord, the runaway dog was brought into the restaurant, and the Newfoundland, with a sly wink to his master, seemed to say, "There he is." The scene was witnessed by many, and created no little excitement.—*New York Paper.*

A NEWFOUNDLAND'S REVENGE.

308. A cousin of the Author of this work was a timber merchant in a sea-port town of England. He had two remarkably fine dogs that frequently afforded striking evidences of sagacity. "Hector" and "Wallace" had often, in quitting the timber-yard, to pass through a narrow lane which ascended a hill leading from the sea. In this lane lived an old woman, who kept a snappish little cur, that always ran out and barked at the Newfoundlands. Of this they took no notice, or only answered the insolence of the cur by a dignified growl. At last the little culprit, emboldened by the forbearance of the Newfoundlands, snapped at the hind leg of one of them and bit it severely. Hector, the dog who was bitten, turned round, and, seizing the cur by the neck, carried him leisurely down to the sea-side, plunged in, and swam with him to what is called "boat's moorings"—about a hundred yards or more from the shore. There he let the unhappy cur go, and as he attempted to swim ashore, Hector every now and then struck him with his paw. The cur was drowned; the Newfoundland brought his body ashore and laid it out upon the beach—a solemn warning to all curs against offending the dignity of the Newfoundland. Mr. Youatt tells a similar story, but in this latter instance capital punishment was not inflicted, a severe ducking having been considered a sufficient penalty.

CLEMENCY OF THE NEWFOUNDLAND.

309. An instance of a somewhat different character is related by Mr. Partington. While the Government harbor or pier at Donaghadee, Ireland, was building, a battle took place between two powerful dogs. One was a Newfoundland, the other a mastiff. They had a prolonged fight upon the pier, from the point of which they both fell into the sea; and as the pier was long and steep, they had no means of escape

"Whereunto I can none otherwise answer, but that he who will throw a stone at every *dog* which barketh, hath need of a great satchel or pocket."—GASCOIGNE.

but by swimming a considerable distance. Each began to make for the land as best he could. The Newfoundland, being an excellent swimmer, very speedily gained the shore, on which he stood shaking himself, but at the same time watching the motions of his former antagonist, which, being a bad swimmer, was struggling exhausted in the water, and just about to sink. In dashed the Newfoundland, took the other gently by the collar, kept his head above water, and brought him safely on shore. There was a peculiar kind of recognition between the two animals, they had often fought before, but never did so afterwards; and upon the Newfoundland dog being accidentally killed by a stone-wagon on the railway passing over him, the mastiff languished and lamented for a considerable time.

A CUR PERFORMS THE PART OF A DETECTIVE.

310. Mr. Youatt tells the following anecdote, vouching for its truth: A young man, an acquaintance of the coachman, was walking, as he had often done, in Lord Fife's stables at Banff. Taking an opportunity, when the servants were not regarding him, he put a bridle into his pocket. A highland cur that was generally about the stable saw him, and immediately began to bark; and, when he got to the stable door, would not let him pass, but bit him on the leg, in order to prevent him. As the servants had never seen the dog act thus before, and the same young man had been often with them, they could not imagine what had been the reason of the dog's conduct. However, when they saw the end of a valuable bridle peeping out of the young man's pocket, they were able to account for it; and, on his giving it up, the dog left the stable-door, where he had stood, and allowed him to pass.

DOG PHILANTHROPISTS.

311. Upon Mount St. Bernard, and near one of the most dangerous mountain passes, is a convent, in which is preserved a breed of large dogs, trained to search for the benighted and frozen wanderer. Every night, and particularly when the wind blows tempestuously, some of these dogs are sent out. They traverse every path about the mountains, and their scent is so exquisite that they can discover the traveler, although he may lie many feet deep in the snow. Having found him, they set to work and endeavor to scrape away the snow, uttering a deep bark that reverberates from rock to rock, and tells those who are watching in the convent that some poor wretch is in peril. Generally, a little flask of spirits is tied round the neck of the animal, by drinking which the benighted traveler may recruit his strength until more effectual rescue arrives. The monks hasten in the direction of the sound, and often succeed in rekindling the vital spark before it is quite extinguished. Very many travelers have been thus rescued from death by these benevolent men and their intelligent and interesting quadruped servants.

One of these Berardine dogs, named Barry, had a medal tied around his neck as a badge of honorable distinction, for he had saved the lives of forty persons. He at length died nobly in his vocation. A Piedmontese courier arrived at St. Bernard on a very stormy day, laboring to make his way to the little village of St. Pierre, in the valley beneath the mountain, where his wife and children lived. It was in vain that the monks attempted to check his resolution to reach his family. They at last gave him two guides, each of whom was accom-

"Behold yon mountain's hoary height,
 Made higher with new mounts of snow;
 Again behold the winter's weight
 Oppress the laboring woods below."—DRYDEN.

panied by a dog, one of which was the remarkable creature whose services had been so valuable. Descending from the convent, they were overwhelmed by two avalanches or heaps of falling snow, and the same destruction awaited the family of the poor courier, who were traveling up the mountain in the hope of obtaining some news of the husband and father.*

312. *Why is the jackel called "the lion's provider"?*

Because, when jackals hunt their prey, they make hideous noises. The lion, knowing that these sounds are signs that the jackals are on the hunt, prowls about in their wake, and when they have killed an animal, he puts them to flight, and feeds upon the carcass. The jackals keep aloof until the lion has satisfied his hunger, and then they return and devour the fragments that may remain.

313. The tiger, as well as the lion, follows the track of the jackal, and robs it of prey. The idea that the jackal is instinctively "the lion's provider" is one of the ingenious fictions that gather around every imperfect history.

314. *Why has the Nubian ferret valves to its ears?*

Because it burrows in sandy ground; the peculiar structure of its ears is therefore adapted to preserve those most important organs.

315. The ferret has unusually large ears, which renders it more than ordinarily liable to inconvenience while burrowing in sandy ground. The valve of the ear, as it has been termed, consists of a plait or fold, which shows itself externally at the bottom. The interior borders of the ears are covered with thick white hair, but the middle part is bare, and of a pink or rose color. The auditory cells of the ferret are larger than those of the common fox, though the former is two-thirds less than the fox in size. It



is probable that the ferret hears much more acutely than most quadrupeds.

* "Youatt on the Dog."

“Out, out, *hyena*; these thy wonted arts,
And arts of every woman false like thee;
To break all faith, all vows, deceive, betray,
Then as repentant to submit.”—MILTON.

316. *Why are hyenas denominated “scavengers”?*



Because they are so voracious that they will feed upon putrefying substances. They therefore clear away putrid carcasses which in a hot climate would produce dangerous consequences to mankind.

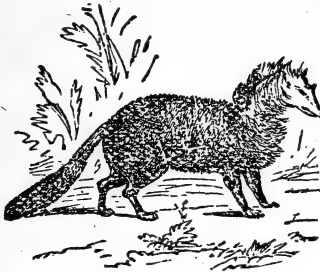
317. As carrion feeders, they seem destined to fill up an important station in the economy of nature, by clearing the earth of the decaying carcasses of beasts, whose remains might otherwise infect the air with pestilential effluvia. Their numbers is commensurate to the importance of their office; although solitary animals in general, they will sometimes assemble in troops and follow the movements of an army, in order to feast on the bodies of those who perish on the battle-field. It is asserted, and is not at all impossible, that they tear newly-buried bodies out of the graves.

Mr. Bruce, the Abyssinian traveler, thus speaks of them:—“I do not think there is any one that has hitherto written of this animal who ever saw the thousandth part of them that I have. They were a plague in Abyssinia in every situation, both in the city and in the field, and, I think, surpassed the sheep in number. Gondar was full of them from the time it turned dark till the dawn of day, seeking the different pieces of slaughtered carcasses which this cruel and unclean people expose in the streets without burial, and who firmly believe that these animals are Falasha from the neighboring mountains, transformed by magic, and come down to eat human flesh in the dark in safety.”

318. The spotted hyena is the most common species in the Cape of Good Hope; and although its presence requires caution on the part of the shepherds in regard to their cattle, yet it is a very valuable animal scavenger, as it is well known to come nightly to Cape Town and clear away the offal, bones, etc., which are thrown out in large quantities; and Spurrman says that the dogs are so well accustomed to it that they feed side by side without molestation, and the hyena is rarely known to do mischief when thus satiated.

"Lady, I would descend to kiss your hand,
But that 'tis gloved; and *civet* makes me sick."—MASSINGER.

319. *Why is the civet commonly called the "civet cat"?*



Merely from some slight resemblance in the fur of the body, and the form of the tail; and from their habit of catching mice. The name *cat* is, in all other respects, inapplicable. They are great destroyers of eggs, are expert in catching birds, and some of them occasionally pursue their prey by coursing. They frequent the banks of streams, the woodlands, or open glades, preying upon the smaller reptiles and the eggs of the larger in the first of those places, on birds and small quadrupeds in the second, and on the smaller lizards in the third.

320. The perfume called *civet* is produced from an orifice under the anus in both sexes, secreted by peculiar glands. The persons who keep them are said to procure the civet by scraping the inside of their legs twice a week with an iron spatula, getting about a drachm each time; but it is seldom sold pure, being mixed with suet or oil to make it more weighty. The males yield the most, especially when they are irritated. The inhabit India, the Philippine Isles, Guinea, Africa, and Madagascar.

321. *Why is the leopard so called?*

The name is composed of two words, *leo* (lion), and *pardus* (panther), and has a fabulous application: the fable being that the leopard was a mule or hybrid between these two species, partaking of the fabled generosity of the one, and the savage disposition of the other.

322. *What is the distinction between the panther and the leopard?*

The only difference between them are in the size and marking, and in the more active and playful disposition which seems to be connected with smallness of size in this genus of animals. It is possible that they are only varieties of the same original species.

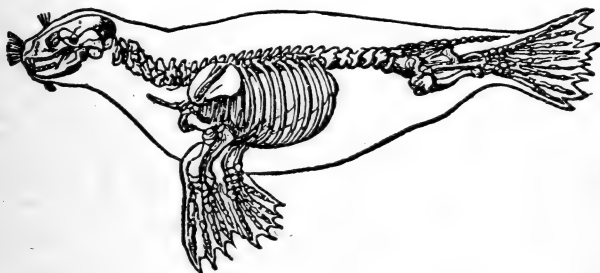
"Some say a sea-maid spawned her."—SHAKSPERE.

323. *Why is the ocelet so called?*

From the Latin *ocellus*, a small eye; it refers to the animal being spotted with small marks, or eyes.

324. *Why are seals classed among carnivorous "quadrupeds"?*

Because they are *flesh eaters*, possess *carnivorous teeth*,



and in their skeletons the *four extremities* that distinguish quadrupeds are represented in the fin-like members.

325. The principles pursued in the classification of animals may be thus familiarized:—*Seals* belong to the first great division of the animal kingdom, *Vertebrata*, because they possess a true back-bone formed of *vertebrae* (from *verto*, to turn). They belong to the class *Mammalia* (from *mamma*, the breast), because they have teats and suckle their young. They belong to the sub-order *Carnivora* (from *caro*, flesh, and *voro*, to eat), because they are flesh-eaters, and possess carnivorous teeth. They are of the family *Phocidae* (from a Greek word meaning a *sea-calf*), because of their fancied resemblance to a calf, and of their marine habits; they are made the type of numerous animals that resemble them; and they are ranked with *Quadrupeds* (from *quadra*, four, and *ped*, foot), because in their skeletons the four lower extremities that distinguish quadrupeds are well defined.

The *dog*, as another example, belongs to the *Vertebrated* division, as the sea dog; and for the same reasons, it belongs also to the class *Mammalia*, and the suborder *Carnivora*. But here the resemblance ceases, and the dog enters the order *Digitigrades* (from *digita*, a finger or toe, and *gradioe*, to walk), because it walks principally on its toes; and to the genus *Canis*, the Latin name for a dog, on account of certain peculiarities of the teeth.

"Proteus, thy song to heare,
Seas list'ning stand, and windes to whistle fear;
The lively dolphins dance, and bristly *seales* give care."—FLETCHER.

326. *Why are seals found in greatest numbers in estuaries and straits?*

Because the fishes upon which they feed are dispersed in the open sea, but congregate in greater numbers in the currents of narrow places.

327. In some districts seals are very numerous. In the Caspian Sea, for instance, and in the Isle of Juan Fernandez. "Here," says Captain Dampier, "are always thousands, I might say possibly millions of them, either sitting on the crags, or going and coming with the sea round the island, which is covered with them (as they lie at the top of the water playing and sunning themselves) for a mile or two from the shore. They produce in the autumn two young ones, which for some time are white and woolly, and are suckled for six or seven weeks, after which they take to the sea; and when the dams come out of the sea they bleat like sheep for their young, and though they pass through hundreds before they reach their own, will not permit any of them to suck."

328. *Why do Greenland seal-hunters place themselves by holes in the ice?*

Because the seals being obliged to breathe air make for themselves holes in the ice, that they may rise for this purpose. The hunter, therefore, knows when he sees a hole that seals are about, and that some of them must soon come up to breathe.

329. Another stratagem employed in the capture of seals is as follows:—In the Gulf of Bothnia, when spring is approaching, and the ice is forced from the shores by the rivers emptying themselves into the sea, the seals are often found upon the larger masses; and in order to obtain them, the hunters set off in a boat. Having taken the precaution to whiten the boat with lime, and put on white dresses to render themselves less suspected, they go in search of their prey, and continue rowing about from one block of ice to another, destroying many seals.

330. *Why are the nostrils of seals surrounded with long bristly hairs?*

These hairs, or whiskers, are instruments of touch, and serve a similar purpose to the seal in its submarine excursions, as do those of lions, tigers, and cats, in forests and jungles. No doubt these instruments are exceedingly useful in exploring the crevices and irregular surfaces of icebergs, beneath the water, where fishes may sometimes take shelter and conceal themselves.

331. In some of the species these hairs are jointed, and formed in a manner resembling the antennæ (feelers) of beetles. They have their

"These *seales* be hardly killed, unlesse a man dash out their braines. In their sleepe they seem to lowe or bleat, and thereupon they be called *sea-calves*."—HOLLAND.

roots in a sort of cylindrical capsule, of horny consistency at the bottom, and meet there with some small vessels connected with the muscles, and also with a fine membrane which lines the whole of the internal surface. These bulbous roots of the bristles, especially in the fine membrane with which they are lined, are closely connected with many ramifications of nerves.

332. *Why are the nostrils of seals made to close habitually?*

Because, as the amphibious habits of the seal require the nostrils to be sometimes open and at other times closed, an effort of the animal must be required to produce one or other of these ends. The *natural state* of the nostrils is to remain closed, and an *effort* is required to open them when the seal reaches the air.

The wisdom of this provision is evident: the animal hunts its prey beneath the water, and its nostrils being closed by their own exquisite machinery, the seal has no care concerning them while capturing its food. But when the capture is completed, and the animal has no more effort to make for that purpose, it returns to the air, and bestows an effort upon the necessity for breathing.

333. *Why are the eyes of seals very fully and peculiarly developed?*

Because it is by sight principally that they pursue their prey. Their nostrils are necessarily closed when under water, so that they probably have no sense of smell in that situation. Their ears are also small, and become contracted under water; the sense of sight is therefore their chief guide.

334. The eye of the seal is fitted for a double action, for seeing either in the water or the air. There is no eye which can be said to have, upon the whole, to perform these offices so equally. They have to use their eyes deep in the water, and when there is very little light, or indeed none, the water being sometimes frozen over, and a deep stratum of snow lying upon the ice. The eyes are placed very near to each other, thus indicating that they follow their prey from a forward view. The sclerotic coat is composed of a thick, hard, and firm membrane, by which strength is given to the eye under the pressure of water; and there is a provision for adjusting the focus of sight to the dissimilar conditions of seeing in air and in fluid. While, to modify the change, the cornea of the eye is flat, there being less difference of light from a flat cornea than from a convex one of the same surface.

"With snow, frost, hail, and sleet, and found stern winter strong,
With mighty isles of ice, and *monsters* huge and strong."—DRAYTON.

335. *Why has the walrus large tusks descending from its upper jaw?*

These tusks consist of an enlargement of the canine teeth, which in the carnivorous tribes are chiefly employed to capture and kill the prey upon which they subsist.

They are thus enlarged in the walrus to enable the animal to mow down, or to throw aside, the great fields of sea-weeds among which it finds crustaceous and molluscous animals, such as lobsters, crabs, shell-fish, etc., upon which it feeds.

They are also useful to enable the animal, the body of which is cumbrous and heavy, to clamber over the blocks of ice, among which it lives. This it accomplishes by fixing its tusks in the ice, using them as a lever to assist its movements. They enable the animal to raise itself out of the water, by holding on upon the rock or iceberg, just as the parrot steadies himself by its bill. The tusks are also used as weapons of defense.

ORDER IV.—MARSUPIALIA.

336. *Why are kangaroos, opossums, etc., included in the order Marsupialia?*



Because they are distinguished by a pouch-like appendage on the under-part of the females, which pouch is supported by two peculiar bones called Marsupial—from the Latin word *Marsupium*, meaning a purse or pouch.

337. *Why are these animals provided with pouches?*

Because their young are born in a very helpless state. They are far more minute and formless than the young of any

"That natural affection, so connatural to all or most creatures toward their young, what an admirable, noble principle it is, implanted in them by a wise Creator!"—DERHAM.

other of the mammalia, not excepting those which come into the world blind and naked. The pouch answers as a description of second womb, in which the young animals are brought to maturity.

338. The young of all the animals of this order are remarkable for their imperfect development at the time of their birth. Even in the species without pouches (for some have a mere fold of the skin, scarcely visible) the young hang under the belly of the mother for a certain time; then they mount on her back, and twist their tails round hers to fix themselves. The young of the kaola, which has no tail, fixes itself on the parent's back, and fastens there with its hands. It is remarkable that, in the unpregnant animal, the pouch is closed, being glued, as it were, to the body of the parent by a peculiar secretion. As the pregnancy advances, this secretion becomes absorbed, and the folds of the pouch are set free, so that just at the time when the young within the body of the animal are prepared to leave it, the pouch or nursery on the outside is fitted to receive them.*

339. *Why are the young of these animals born in such a helpless condition?*

Because by far the greater number of the marsupial animals are either *leapers* or *climbers*; and this peculiar arrangement of the organs of gestation is evidently to enable the loins to have more powerful action than they could have if the body of the animal were encumbered with full-grown young.

340. It has not hitherto been noticed by naturalists (the Author believes) that the peculiar gestation of the marsupialia forms an intermediate design between the complete gestation of mammalia and the egg-laying capacity of birds. To animals of flight, bearing their young, apart from any consideration of the number of the offspring, must be a serious impediment; they are, therefore, endowed with the power of excluding the ova and maturing their young apart from their own bodies. To animals that are terrestrial, and endowed with leaping powers, the encumbered womb must prove almost as great an impediment as to creatures of the air. The gestation, therefore, is imperfect, and is completed after the young has passed from the womb. It is also worthy of remark that as birds lay from two to fifteen or eighteen eggs, marsupial animals bear from one to twelve young ones.

The pouch of the *opossum* is thus described by M. D'Argaza:—"The female has the whole length of the belly cleft or slit, and appearing like a person's waistcoat buttoned only at the top and bottom. This cavity the animal has the power of firmly closing. Within it are thirteen teats, extremely small, one in the center and the rest ranged

* Cuvier's "Regne Animal."

"The trees, devouring caterpillars bare:
Parched was the grass, and blighted was the corn."—DRYDEN.

round it." The same authority speaks of one which he saw that had thirteen young ones. They had ceased to suck, and the pouch, since they were so much grown, was not large enough to contain them, but the mother carried them about fixed to her tail, legs, and body.

The structure of these animals agrees with the contingencies under which they exist. They are subjected to considerable hardships, arising from the alternate parching and flooding of the countries in which they abound—countries which are not adapted for the common mammalia in a state of nature—and accordingly we find that in New Holland, which may be considered the headquarters of marsupial animals, there are no native *placental* mammalia, and such are not very common in the other localities of these animals. New Holland, New Guinea, some of the other Islands of the Archipelago, South America, and the warmer part of North America, in the case of a single species only, are the localities of these animals, and it is not a little remarkable that not one of them has been hitherto found in Africa, though they occur on both sides of it.*

341. *Why has the kangaroo such powerful posterior organs?*

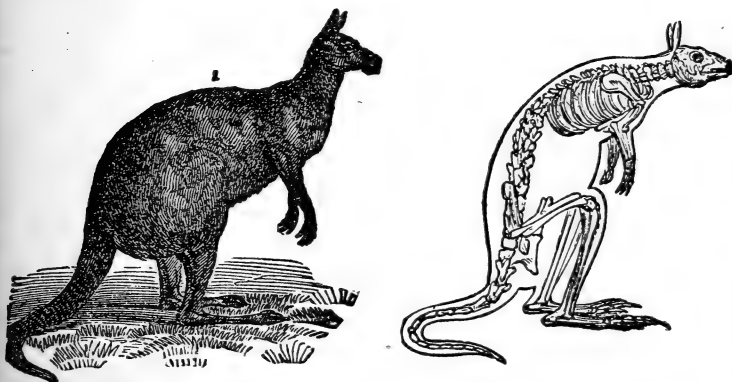


Because the hind feet and the tail are employed as leaping organs, and also as weapons of defense. The leap is of very great length, and is accomplished by the action of the tail, almost as much as by the legs.

By the pliability of its spine and the flexibility of its posterior members, the animal can place itself preparatory to a bound so that, the lower bones of the leg being horizontal, the two superior bones shall be inclined to them at something less than a right angle, as shown in figures 1 and 2, representing the profile and the skeleton of the kangaroo; by which it will be seen how greatly the structure of the animal favors its principle of locomotion.

* Partington's "Cyclopædia."

"And on the playn of these valleys there were merualouse, great marshes, and dangerous passages."—FROISSART.



342. These proportions are reversed in quadrupeds of slow locomotive powers, of which the giraffe is one of the most remarkable examples. In this animal a great proportionate length is given to its fore-legs; so that, notwithstanding the length of its neck, it would be incapable of taking its food from the surface upon which it stands. Nature has, however, beneficially adapted the wants of the animal to its structure; and, while its head is elevated to a height of twenty feet above the ground, nourishment situated at a corresponding elevation is supplied in the foliage of the trees.

343. *Why is the bounding movement of the kangaroo admirably adapted to the localities they inhabit?*

Because kangaroos inhabit a country where there are enormous tufts of the coarsest grass, growing on swamps or marshy ground, several feet in height, and at a considerable distance from each other; or else they frequent rocky or bushy ground. By means of the bound which they are enabled to execute they can clear from twelve to twenty feet in length and several feet in height, from one tuft of grass, or from one rock or bush, to another, and thus escape from the pursuers.

344. In kangaroos which have been bred and domesticated in this country, the size and strength of the tail diminishes, and the animals more frequently use all four of their feet in running. This is a strong illustration of the care taken by a beneficent Providence of

"It was observed of this animal, that he leaped or bounded forward on two legs, instead of running upon four."—CAPT. COOK.

its creatures, in furnishing them with the means best adapted for their relative conditions and situations in the protection of themselves and diminishing those means when they become no longer of the same importance to them.

345. *Why are the kangaroo's* head and fore paws so small?*

Because this conformation of the body is peculiarly adapted to its leaping habits; this form contributes to keep the body of the animal almost erect in the air, while the weight of the lower quarters brings it to the ground with precision, and in a natural position, prepared immediately to repeat the leap.

346. *Why does the long-tailed belidens seldom descend to the ground?*

Because its structure, and especially the enormous length of its tail, is ill adapted for terrestrial habits; but it sometimes descends for the purpose of passing to a tree too distant to be reached by a spring.

The tops of trees are traversed by this animal with as much ease as the most level ground is by such as are destined for *terra firma*. If chased or forced to flight, it ascends to the highest branch, and performs the most enormous leaps, sweeping from tree to tree. It has a membrane at its sides, which extends and forms a description of parachute, and which enables it to proceed to a considerable distance, always ascending a little at the extremity of the leap; by this ascent the animal is prevented from receiving the shock which it would otherwise sustain.

347. This fine little animal is common in all the bushes of New South Wales. In those vast forests, trees of one kind or another are perpetually flowering, and thus offer a never-failing supply of blossoms, upon which the little creature feeds; the flowers of the various kinds of gums, some of which are of great magnitude, are the principal favorites.†

* Commonly spelled "kangaroo," but more properly *kangaroo*.

† Gould's "Mammals of Australia."

"By dremes, by chirking of dores, or craking of houses, by *gnawing* of *rattes*, and swiche like manner of wretchednesse."—CHAUCER.

ORDER V.—RODENTIA.

348. *Why are the animals of this order named rodents?*

Because of the peculiar formation of their teeth, and their habit of gnawing—the Latin verb *rodo* meaning to *gnaw*.

349. In the order Rodentia the front teeth cut with a sharp edge. We know that this is contrived in the tool of the carpenter, and we know that he must from time to time apply his chisel to the grindstone. The front teeth of the beaver, the porcupine, and the rat, are sharp, and yet not blunted by use; the bone of the tooth is the densest possible, consistent with the material; but, were the whole tooth of the same material, it would be ground down uniformly, and the original form of the instrument would be lost. Accordingly, a different substance, the enamel, which yields more slowly to friction than the bone, is, as it were, let in on the anterior surface of the tooth. The consequence is, that the enamel stands up sharp and exposed, so as to protect the bone of the tooth, and to give the surface which is worn down a certain shape, suited to act like nippers. The friction and the arrangement of the material of the tooth so far correspond, that the cutting form is preserved, however much the surface may be worn down.

350. *Why are the jaws of rodents remarkably light?*

Because strength in the jaws is not requisite, but rather lightness, because the action is continued gnawing, or rubbing, and not powerful biting. This may be seen in the different ways in which a monkey and a squirrel go about to get at the kernel of a nut. The monkey takes it between his strong jaws, and cracks it at once by one lusty gripe, while the squirrel nibbles away till it makes a hole in the nut.

351. *Why do squirrels convey food to their mouths with two paws while monkeys generally use but one?*

Because their fore-arms have but little motion in the elbow joints, and their two bones are often united. The paw, therefore, cannot turn, but has merely a hinge motion in this particular joint. Many of them, however, have tolerably perfect clavicles, and others have imperfect ones, so that they can bring the paw to the mouth without any turning of the elbow; but, as they cannot turn up the sole of the paw, they cannot bring any substance to the mouth except by holding it between the two paws sideways.*

* Partington's "Cyclopædia."

"Coridon unto her brought,
Or little sparrows stolen from their nest,
Or wanton squirrels in the woods farre sought."—SPENSER.

352. *Why are squirrels grouped as the genus sciurus?*

The scientific name *sciurus* is derived from *skia*, a shade, and *oura*, a tail, and refers to the tail of some of the species covering the head, as with a shade. The common name squirrel is merely a corruption of *sciurus*.

353. *Why are the hind legs of squirrels only a little shorter than the front ones?*

Because, although leaping animals, like the kangaroo, their style of running along the branches of trees requires that they should have nearly equal command and use of all their legs. In this may be seen the difference between them and the hares and jerboas on the one hand, and the tree apes, which have not the tails prehensile, on the other. The *leaping* animal has the hind legs long, and the muscular action of the body very much concentrated upon them. The *climbing* animal has the fore-legs long, and the concentration upon them. The squirrel holds an intermediate place; and this is the reason why we consider its motions on the ground more graceful than the leaping of the jerboa, and its motion in the tree more so than the climbing of the ape. Their motions are quite a study in animal mechanics; and, on account of the lightness, the gentleness, and the cleanliness of the animals, they are very pleasing objects.

354. *Why are the eyes of squirrels very fully developed?*

Because they have to find their food, and also their footing—the latter very quickly—in the shade of thick leaves.

355. *Why are the tails of squirrels so large and bushy?*

The tails of these creatures are exceedingly well adapted, and indeed necessary, to their mode of life; they serve to balance the body while springing, and, acting as a kind of parachute, prevent those jerks and falls which the animal would otherwise be likely to receive.

"The morning came when neighbor Hodge,
Climbed like a *squirrel* to his dray,
And bore the worthless prize away."—COWPER.

356. *Why do squirrels lay up stores of provisions?*

Because in the winter nuts, acorns, beech-nuts, the seeds of pines, peas, beans, and other large seeds upon which they live, cannot be found.

357. There does not appear to be much truth in the common saying, that squirrels are great planters of the oak, by the acorns which they bury in the ground and are afterwards unable to find out; for, when an animal has the instinct of hiding any substance as a supply of food, it has, as a matter of course, the instinct of finding it again; and that a squirrel should range the forest, burying acorn after acorn in places where they would be apt to germinate, is very incredible. The store is always placed in dry situations, where it can be preserved from growing.*

It was said of old that "squirrels also foresee a tempest coming, and where the wind will blow: for look in what corner the wind is like to take a stand; on that side they stop up the mouth of their holes, and make an overture on the other side against it." †

358. *Why are some of the members of this tribe called "flying squirrels"?*

Because the skin of their sides is capable of great extension, and being attached to both the anterior and posterior extremities, is capable of being spread out, and answering the purpose of a parachute. There is a bony appendage to the hind feet, which furnishes an additional support to this membrane, in the extended springs made by the animal from one tree to another. These flying squirrels seem to differ physically in nothing from the squirrels, properly speaking, except in the flying apparatus, and the bony appendage which supports it. ‡

359. *Why has the *souslik* § pouches in its cheeks?*

Because these pretty little rodents lay up for the winter seeds, acorns, nuts, etc., which they convey to their burrows. Having no other means of transporting them, their feet being all employed in their movements, and their teeth ill-adapted to holding nuts while the body is in motion, they are provided with little pockets or pouches in their cheeks, in which they carry their winter's store to their burrows.

*Partington's "Cyclopædia."
‡ Cuvier's "Regne Animal."

† Holland: "Plinie."
§ *Spermophilus citillus*.

"Valour's a mouse-trap, wit a gin,
Which women oft are taken in."—HUDIBRAS.

360. *Why does the dormouse* become fat during its period of hybernation, while other hybernating animals become thin?*

Because its hybernation is imperfect; it occasionally wakes and eats of the store of food it has previously laid up. Thus feeding, and being wholly inactive, its fat increases. But in the case of animals that hybernate perfectly, and do not eat, the fat of their bodies is consumed for the support of their organic functions.

361. *Why is a small number of mice beneficial in some houses?*

Because they are great eaters of the beetles which infest houses during the night.

362. *Why are rats beneficial in certain instances?*

Because they frequently make the sewers or drains their principal haunts, and by devouring putrefying substances contribute materially to cleanliness and health.

363. As matters are at present, the drainage of London stains the water of the Thames; but when we take into consideration the countless millions of brown rats which are supported in the sewers, and of which the greater part are produced, live, feed, and thrive there, without any other store for their support, we can readily understand what would be the case if it were not for them. Thus, whether these animals come under the name of rats or mice they are, under certain circumstances, highly useful, playing the part of scavengers for man in cases where he either cannot or will not play it for himself. Every animal, indeed, which follows man in all his migrations, and multiplies in proportion as his numbers multiply, is always useful to him. Most of these animals are, no doubt, annoying, and many of them are positively offensive; but, in all cases where they are so, man will find that he himself is generally to blame. *They come to consume that which is at variance with health and cleanliness; and if the latter is properly attended to, there is no place for them.* †

Rats are exceedingly clean animals; they invariably wash themselves all over after eating, no matter what. The operation is performed in the same manner as the cat does—by licking the paws. When a rat eats, he, by means of his sharp front teeth, gnaws away a mouthful, which he deposits in a sort of pouch formed between his grinding-teeth and his cheeks. Then he ceases gnawing, and masticates his food,

* *Myoxus glis.*

† Partington's "Cyclopædia.

"Our natures do pursue,
Like *rats* that ravine down their proper bane,
A thirsty evil, and when we drink, we die."—SHAKSPERE.

by moving his jaws incessantly and without pausing. They move ten times faster than the jaws of a rabbit. When a rat drinks, he laps up the fluid like a dog. A rat generally tastes his food with his tongue previous to eating it. When sleeping, the rat coils himself up into a ball, and places his nose down between his hind legs; his tail is curled up round the outside of the body, no part of him projecting but his two delicate ears, which are beautifully adapted for catching the least sound.

364. *Why may black rats be most securely caught by means of a wire snare fixed on a beam or rafter?*

Because the black rat does not frequent low haunts, such as cellars, pigsties, etc.; nor does he burrow and run into holes, but lives chiefly in the ceilings and wainscoats of houses, and under rafters and beams. The snare alluded to, therefore, favoring their peculiar habits, is better calculated to secure them than any other contrivance.

365. *Why is the tail of the rat so long and perfectly formed?*

Because it performs an important part in the animal's progress, becoming a sort of hand by means of which he is enabled to crawl along the tops of railings and along narrow ledges of walls, balancing himself by it or entwining it round the projecting portions of the difficult passages along which his course lies. By means of it, too, he is enabled to spring up heights otherwise inaccessible, using it on these occasions as a lever, or rather a projectile spring.

366. *Why does the disappearance of the black rat prove the greater solidity and cleanliness of our modern habitations?*

Because the black rat was never much of a city rat, nor resorted to houses built of masonry, and roofed with tiles or slates. But it frequented thatched houses with boarded or plastered walls, and became numerous in dwellings where the rooms were uncleanly. They were, in fact, the scavengers of dirty recesses and floors, just as the brown rat is of sewers; and the extermination of the black rat is due to the absence of the conditions which once fostered it—not to its having been driven away by the brown rat.

"And forth he goth, no longer would he tary,
 Into the town, unto a potecary,
 And praied him that he him wolde sell
 Some *poison* that he might his *ratouns* quell."—CHAUCER.

367. *Why is it said that rats always quit a falling house?*

The popular saying is founded upon the obvious fact that when houses become old and tottering, they are abandoned by human beings, and then the rats finding no longer their usual subsistence, quit the tenement also.

368. But the popular mind has thwarted this very palpable fact into a kind of superstition, believing that rats have the power of *anticipating the sudden fall of a house*, and quitting it some hours before. Granting that a rat were of all animals the most sensitive to coming changes, and that it felt in the very dawn of their existence, the fall of a house does not come within the class of occurrences of which the sensibility of the animal would give it early warning.* In like manner it is said that *rats leave a sinking ship*; they have been seen to do so by walking along the rope which fastened the ship to the shore, but they did this only when the water had absolutely forced them from every other place.

369. *Why is a person shifting from one party or from one cause to another said to be "ratting"?*

This saying is founded on the previous notion of rats deserting falling houses and sinking ships. It implies that as the individual can no longer suit his own purposes, he deserts his former place or cause. Tergiversation of this kind, more especially when it consists in deserting one party in its weakness, and going over to the opposite one in its strength for the sake of personal advantage, is invariably called "ratting"; and it is held, and very properly held, to be the worst species of political crime of which a public man can be guilty, and characteristic of the very meanest cast of mind, and lowest depth of political corruption.*

370. *Why may we suppose that rats can communicate intelligence to each other when they find food?*

Because the depredations committed usually commence with one rat, which soon afterwards is joined by other companions, and in a few days large swarms frequently appear.

* Partington's "Cyclopædia."

"This purpose is sometimes carried on by a sort of *migratory* instinct, sometimes by the spirit of conquest; at one time avarice drives men from their homes, at another they are actuated by a thirst of knowledge."—BURKE.

371. *Why has the hamster such enormous cheek pouches?*



Hamsters are a genus of rodent animals, remarkable for the possession of cheek pouches, which in some of the species are of considerable size. The one figured in the illustration * has pouches so large that they will hold a quarter of a pint. These pouches are useful as stores of food for the animal, which inhabits the sandy districts of

the North of Europe and Asia, Austria, Silesia, and many parts of Germany, Poland, etc., is liable to periods of deprivation from food, and also undergoes an imperfect winter hibernation.

372. The quantity of grain which they consume is very great. On the approach of winter, the hamster retires into his subterranean abode, the entry of which he closes with great care; and thus, remaining tranquil and secure, feeds on his collected store till the frost becomes severe: he then falls into a profound slumber. It will be seen that this hibernation differs from that in which the animals immediately fall asleep, and either continue torpid during the whole of the cold season, or awake occasionally to partake of food. There is a long underground preparation for the winter sleep, during which a considerable quantity of food is needed. Hence it is that the animal is provided with these ample pouches, which act as panniers for the conveyance of its winter food to the place into which it retires. The fur of the hamster is valuable; and the peasant who goes "a hamster hunting" obtains not only the skin of the animal, but his hoard, which amounts to as much as two bushels of grain to each magazine.

373. *Why do lemmings migrate from their settlements?*

Because they multiply so rapidly that they experience a deficiency of vegetable food. They therefore set off in large bodies in search of new grounds adapted to their habitations, and there they found new colonies. In this

* *Mus barsarius.*

"It is not iron bands, nor hundred eyes,
Nor brazen walls, nor many wakeful skyes,
That can withhold their wilfull wandering feet."—SPENSER.

we see a more striking illustration of the instinct which prompts rats to quit an uninhabited house, and to abandon an unseaworthy ship.

374. Lemmings are allied to the rat tribes. There are several species of them, varying in size and color, according to the regions they inhabit. They are found in Norway, Lapland, Siberia, and the northern parts of America; those of Norway being nearly the size of the water-rat, and of a tawny color, variegated with black, the sides of the head and the under parts being white; while those of Lapland and Siberia are scarcely larger than a field-mouse, and much less distinctly marked. They subsist entirely on vegetable food;



they form shallow burrows, in the summer time, under the ground, and in winter make long passages under the snow in search of food. Their hairy heads and short ears and tails admirably adapt them for the latter labor. Their migrations are not regularly periodical, but are undertaken at irregular epochs—upon an average about *once in ten years*.

The inclination, or instinctive faculty, which induces them, with one consent, to assemble from a whole region, collect themselves into an army, and descend from the mountains into the neighboring plains in the form of a firm phalanx, moving on a straight line, resolutely surmounting every obstacle, and undismayed by every danger, cannot be contemplated without astonishment. All who have written upon the subject agree that they proceed in a direct course, so that the ground along which they have passed appears at a distance as if it had been plowed; the grass being devoured to the very roots in numerous stripes or parallel paths of one or two spans broad, and at the distance of some ells from each other. This army moves chiefly by night, or early in the morning, devouring the herbage as it passes in such a manner that the surface appears to have been burnt. No obstacles will materially alter their route; neither fires, nor deep ravines, torrents, marshes, nor lakes; they proceed obstinately in a right line, and hence it happens that many thousands perish in the waters, and are found dead by the shores. If a rick of hay or corn occurs in their passage, they eat through it; but if rocks intervene which they cannot pass, they go round, and then resume their former straight direction. If disturbed or pursued while swimming over a lake, and their phalanx is scattered by oars and poles, they will not recede, but keep swimming directly on, and get into regular order again. They have even been known to endeavor to board, or pass over a vessel.

On the passage overland, if attacked by men they will raise themselves up, uttering a kind of barking sound, and fly at the legs of their invaders; and will fasten so fiercely at the end of a stick as to suffer themselves to be swung about before they quit their hold. Sometimes an intense war breaks out in these armies during their march, when they fight desperately and destroy each other.

On the march they are attacked by various enemies, and particularly by owls, hawks, and weasels, so that but a small proportion of

"Of beasts—the *beaver* plods his task,
While the sleek tigers roll and bask,
Nor yet the shades arouse."—SMART.

their number survive the peril of their journey. In some instances they have been observed, after a lapse of time, to return to their native mountains. Sometimes the females have borne young during their migration, and have been seen carefully carrying them on their backs. After crossing a stream, or an arm of the sea, upon landing on the opposite bank they halt to sun and dry themselves, and after feeding again proceed upon their journey.

It was once believed that these animals fell from the clouds at particular seasons; and some persons positively affirmed that they had seen a lemming fall from the skies—a not improbable occurrence, when it is remembered that birds of prey follow these troops on their journey, and swooping down upon them, carry into the air as many as their talons can seize. One of these escaping, and falling to the earth, would at once give rise to the above misconception. An eye witness once stood for two hours watching a multitude of lemmings passing by.

375. *Why have beavers remarkably broad and thin tails?*



Because they spend the greater part of their time in the water, and pursue a busy life by the side of streams, and in the small mounds or islands formed by meandering waters. To guide their movements in the variable eddies and currents which they have to meet, they require a powerful rudder; and this

is furnished by their broad, flat, and scaly tails.

376. The formation of their tails is the more remarkable, because, while their bodies are covered with fur so fine that it constitutes a valuable article of commerce, their flattened tails are not endowed with fur, but have scaly surfaces, which render their action upon the water most efficient. (See 377.)

377. *Why are the incisor teeth of beavers remarkably developed?*

Because they require the branches and trunks of trees in the construction of their houses, and these natural implements are necessary to assist them in felling the timber.

"I was surprised at all this civility, and knew not to what I might ascribe it, except to my bright *beaver* and shining scarf that were new that day."—THE TATLER.

These teeth are broad, flattened, and protected anteriorly by a layer of orange-colored enamel, the rest of the tooth being a comparatively soft substance, where a cutting chisel-like edge is obtained.

378. Not only does the beaver use its teeth with wonderful instinct, but the method adopted in the application of these instruments is equally remarkable. It begins the business of felling by gnawing round the branch of the tree; but, in order to save its self a great deal of work, and to overcome an otherwise insuperable difficulty—for it is necessary that the branch should fall across the stream, that it may float with the current—the beaver operates mostly on one side, and that always on the right one, and gnaws nearly through that side, leaving the other almost untouched. The branches cut down are sometimes of considerable thickness, and the beavers select those which stand up the stream, from the place of their habitations, not those below it, because, in the latter case, they could not haul them up against the current.

The beaver presents one of the strongest instances of instinctive sagacity and industry which can be met with in the animal creation. It is gregarious living in societies of two or three hundred, whose labors are employed for the general good, and their settlements are made in ponds so deep as not to allow of their being frozen to the bottom, and which have a stream of water running through them, or in rivers themselves. Having determined on the place in which to erect their habitations, the first business consists in forming a dam; and for this purpose they stop the stream in the most favorable place for their operations. The dam is raised by driving stakes of five or six feet length into the ground at different distances, interweaving them with branches of trees, and filling up the interstices with clay, stones, and sand, which they ram down very firmly *with their tails*; the foundation of the dam is ten or twelve feet thick, the top is not more than two or three feet broad, presenting a perpendicular face to the stream, whilst the slope is placed on the outside, where, as grass grows, the dam is rendered more solid. In this way they build a dam not unfrequently a hundred feet in length. Within the embankment near the edge of the shore are built the houses, which are from ten to twenty-five in number; these are raised upon piles, and sometimes consist of two or three stories, for the convenience of change in case of floods. The houses are of a round or oval form, with a vaulted roof; the walls about two feet thick, formed of earth, stones, and sticks, but neatly plastered within, and to each are two entrances, one toward the water, and the other facing the land. Their height above the water is about eight feet. In one habitation reside from two to thirty beavers, each animal having its own bed of moss, and each family its own winter stock of provisions, consisting of the bark and small branches of trees, which are kept in the water and fetched within as required.

"To effect these works," says Pennant, "a community of two or three hundred assembles; each bears his share of the labor; some fell, by gnawing with their teeth, trees of great size, to form the beams or

"His beaver brushed, his shoes and gown,
Away he trudges into town."—SWIFT.

piles, these are gnawed all round in as regular manner as a cutter cuts in felling a tree, bringing the bottom of the wood to a point; others roll the pieces along to the water, others dive and with their feet scrape holes, in order to place them in, while others exert their efforts to rear them in their proper places; another party is employed in collecting twigs to wattle the piles with; a third collecting earth, stones, and clay; a fourth is busied in beating and tempering the mortar; others in carrying it *on their broad tails* to proper places, and with the same instrument run it between the piles, or plaster the inside of their houses. Whilst at work, one of the party acts as an overseer, and by striking his tail indicates which parts are weakest. A certain number of smart strokes with the tail is a signal given by the overseers for repairing to such or such places, either for mending any defects, or at the approach of any enemy; and the whole society attend.

379. *Why are the hind feet of the beaver far better adapted for swimming than the front ones?*

Because when making way through lakes and streams it has frequently to use the fore feet for purposes not connected with swimming, but to assist in holding, directing, or propelling the billets of wood, or such other matters as the animal may have gathered, either for building or for food. The beaver has the swimming power more highly developed in its hind feet than has any other quadruped.

380. *Why do beavers build their dams sometimes straight across the stream, and at other times in an oblique direction?*

When the current is slow the dam is carried straight across; but if the current be rapid, the dam is carried in an oblique line. The dam straight across is the shortest possible, and, therefore, costs the least labor; but it is the one upon which an equal volume and velocity of water would act most powerfully; therefore it is used in those cases where the force of the current is least. The oblique dam requires more labor in its construction, because it must be longer for the same breadth of the river; but as the action of the water upon it diminishes in proportion to the obliquity with which the current meets it, it resists better than the straight dam, and its resistance increases with its obliquity; therefore it is used against the more rapid and powerful currents.

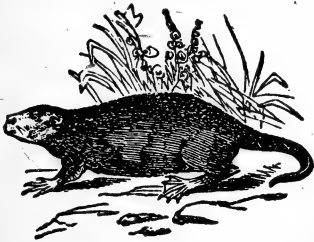
"Make thy two eyes, like stars, start from their spheres;
Thy knotted and combined locks to part,
And each particular hair to stand on end,
Like quills upon the fretful porcupine."—SHAKSPERE.

381. *Why are beaver hats commonly called "castors"?*

Because they are made from the fur of the beaver, the animal, in zoological nomenclature, being called the *castor fiber*, from the Greek name *castor*, and the Latin *fiber*, because it inhabits the *edges* of the water.

382. *Why has the coypou, though identical with the beaver in many of its habits, a dissimilar tail?*

It has already been explained that the broad flat tail of the beaver, as well as being used as a *rudder*, is employed by the animal in the *construction of dams and houses*. Now, the coypou differs from the beaver in this respect, that it *never builds*, but *burrows*; nor does it construct dams. For a burrowing animal, the



broad flat tail would be not only of no utility, but a positive incumbrance, and hence the organ is modified to the uses of the creature.

383. *Why is the porcupine covered with such formidable quills?*

As in the case of the hedge-hog, the spines of the porcupine are weapons of defense, the animal having the same power of rolling itself into the form of a ball. Why the spines of the hedge-hog should be so short, and those of the porcupine so long, may find explanation in the fact that the latter, being a native of Africa, India, and the Indian Islands, is exposed to the attacks of *far more formidable enemies* than such as the cat, the weasel, the ferret, and the martin, by which the hedge-hog is attacked. The porcupine is so called from *porcus* (a pig), and *spinis* (prickles or thorns).

"Well—one at least is safe. Our shelter'd hare
Has never heard the sanguinary yell
Of cruel man exulting in her woes."—COWPER.

384. *Why do hares when pursued generally make for rising ground?*

Because the length of their hind legs, as compared with their front ones, gives them a great advantage in ascending an inclined surface.

385. *Why do hares run down hill in a zig-zag course?*

Because the length of their hind legs, which gives them an advantage over their pursuers in ascending a hill, is a disadvantage to them when descending. They therefore modify the line of descent by making a series of diagonal runs.

386. Hares are remarkable for their extreme timidity; but their inability to save themselves from the attacks of their enemies has been in some degree compensated by their endowments for speed. When they run, their motions consists of a series of leaps more or less extended according to the speed with which they move. Indeed the animals of this genus make a near approach in their general form, their gait when walking, and their mode of life to the *kanguroos*. The length and strength of their hind legs very much exceeds that of their front; they are further assisted by the extreme flexibility of their spines, which enables them to bring the hind feet even before the front, and thereby throw the body forward with a much stronger and greater spring. To give an idea of the prodigious leaps they make, it may be here mentioned that a hare has been known to pass over a space of twenty-five feet at a single bound. This structure, though well adapted for moving on a level surface, and much more for going up a hill, is disadvantageous for descent; and, consequently, if a hare descended a steep place at speed, she may be noticed rolling over and over frequently, before she reaches the bottom.*

387. *Why is the hare unable to run well upon fallows and wet soils?*

Because hares are unprovided with the smooth elastic padding which covers the soles of the feet of dogs and other quadrupeds, they are *hairy-footed*, which renders them ill-adapted for speed upon wet and adhesive soils. When left to choose their own track, they always select a dry one for treading on; and it is plain that their hairy socks admirably adapt their feet to resist the ill effects of pressure from the rough surfaces they must pass over by this preference.

* "Encyclopædia Metropolitana."

"The hare.
 Tho' timorus of heart, and hard beset
 By death in various forms, dark snares, and dogs,
 And more unpitying men, the garden seeks,
 Urg'd on by fearless want."—THOMSON.

388. *Why is the hare, though more fleet than the fox, generally the soonest caught?*

Because when the hare is started, she frequently exhausts herself by her excessive efforts to immediately escape. The fox, on the contrary, less timid than the hare, breaks away only at a moderate speed, which gradually increases as he finds himself pressed by the hounds.

389. *Why is the hare generally lean, while rabbits are frequently fat?*

The habitual timidity of the hare, and its perpetual apprehension of danger, preserve it in a lean state; but rabbits, having safe places of retreat in their burrows, are less influenced by fear, and are called upon for less exertion to escape from danger. It may also be observed that the leanness of the hare, which is caused by its timidity, is the condition of body best adapted for flight from danger.

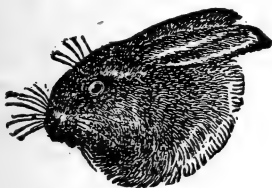
390. Of the great speed of which the hare is capable, some idea may be gathered from the following facts:—In February, 1800, a brace of greyhounds, in Lincolnshire, ran a hare from her seat to where she was killed, a distance, measuring straight, upwards of *four miles*, in *twelve minutes*. During the course there were a great number of *turns*, which very considerably increased the space gone over. The hare ran herself dead before the greyhounds touched her.

391. *Why is the cavity of the chest of the young hare larger than the contained lungs?*

The condition of the lungs of the hare are liable to extreme variation. When the animal sits upon its form in an inactive state for many hours, the lungs are comparatively passive; but when chased, the lungs are in a continual state of violent expansion and contraction. This ultimately increases the size of the lungs, which, in the old hare, will be found to fill the entire cavity of the chest.

"You are the *hare* of whom the proverb goes,
Whose valor plucks dead lions by the beard."—SHAKSPERE.
"The prowling *fox*,
Whose nightly murders thin the bleating fold."—DODSLEY.

392. *Why are the ears of hares unusually long, and capable of more varied motion than those of most other animals?*



This fact illustrates a principle in the great design observable in nature, referring to many animals, but to the hare in particular.



The external ears of animals of *flight* are turned *backwards* to give notice of the approach of an enemy from behind, whence he may steal upon them unseen; while the ears of beasts of *prey*, such as lions, tigers, wolves, foxes, etc., have their trumpet part standing *forwards*, to seize the sounds which are be-

fore them; viz., the sounds of the animals which they pursue.

The ears of the hare are long, and stand erect when the animal is listening. Upon other occasions, when concealment is necessary, they lie down close upon the animal's back. When being hunted, and well a-head of the hounds, the hare will frequently throw one ear forward and the other backward, that it may discriminate not only whence to fly but whither to go.

393. The anatomy of the internal ear also favors its reception of sounds from every direction. The auditive canal is in part soft, and in part bony, so that the tube may be turned in the direction of the outer ear. In general the ears are naked, or very thinly covered with short hairs, and the membranes of which they are composed are so thin that they are nearly transparent.

In order to enable this creature to perceive the most distant approaches of danger, nature has provided it with these very long ears, which, like tubes applied to the auditory organs of deaf persons, con-

"What man art thou? quod he,
Thou lokest as thou woldest find an *hare*,
For ever on the ground I see thee stare."—CHAUCER.

vey to it such sounds as are remote; and the motions of the hare are directed accordingly. Its large prominent eyes being placed so far backward as to receive the rays of light on every side, it can almost see distinctly behind while it runs directly forward. The muscles of its body being strong, and unencumbered with fat, it has no superfluous burden of flesh to carry; and to assist it in escaping from its pursuers, the hinder legs are considerably longer than the fore, which adds to the swiftness of its motions. When the hare hears the hounds at a distance, it flies for some time from a natural impulse, till having gained some hill or rising ground, and left the dogs so far behind that their cries no longer reach its ears, it stops, rears on its hinder legs, and looks back for the purpose of satisfying itself whether its enemies are still in sight or not; but the dogs having once gained the scent, trace it with united and unerring skill; and the poor animal soon again receives indications of their approach. Sometimes, when hard hunted, it will start a fresh hare, and squat in the same form; at others, it will creep under the door of a sheep-cot, and conceal itself among the sheep; sometimes it will enter a hole like the rabbit; at others, it will creep up one side of a quickset hedge, and down the other; and it has been known to ascend the top of a cut edge and run a considerable way, by which stratagem it has effectually evaded the hounds. It is also not unusual for the hare to betake itself to furze bushes, and leap from one to another, whereby the dogs are frequently misled; and as it swims well, and takes the water readily, it will cross a river with the same intent, if it has the opportunity. It may be observed, however, that the first doubling which a hare makes generally affords a key to all its future attempts of that kind, the latter exactly resembling the former. The hare is a short-lived animal, and is supposed rarely to exceed the term of seven or eight years. Its voice, which is seldom heard but in the distress of sudden surprise, or when wounded, resembles the sharp cry of an infant. Its enemies are numerous and powerful. Every species of the dog kind pursues it by instinct; the cat and the weasel tribes exercise all their arts to ensnare it; and birds of prey, snakes, adders, etc., drive it from its form, particularly during the summer season; these, with the more destructive pursuits of mankind, contribute to thin the number of these animals, which from their prolific nature would otherwise multiply to an extravagant degree.*

394. *Why do rabbits burrow, while hares make forms upon the surface?*

The burrowing of the rabbit is an instinctive contrivance consequent upon its defective speed. The rabbit cannot outrun its enemies, therefore it obtains immunity from attack by contriving a retreat in the ground.

Another distinction renders this difference of habit necessary: the eyes of young hares are open at birth, and the dam suckles them only for about twenty days, when they leave her and procure their own subsistence. Young rab-

* "Maunder's Treasury Nat. History."

"Never mole, *hare-lip*, nor scarre,
Nor make prodigious, such as are."—SHAKSPERE.

bits are born blind, are very scantily covered with hair, and for nearly six weeks the doe continues to suckle them.

395. It is a curious circumstance that the individuals composing this genus present very great differences in their habits. Some, as the hare, are found throughout the day resting on one particular spot, frequently in a kind of arbor formed of the high rank grass occasionally scattered over fields; at other times in hedgerows, or against a clod of earth, but never attempting to burrow; others, as the rabbit, are most expert miners, sinking long galleries, without any regular order, in which they rest during the day, and bring up their young; and it is said that they never forsake the burrow which they have once inhabited; whilst, again, others make nests and squat either amongst heaps of large, loose stones, or in the clefts of rocks, seeming to have a disposition to live in holes, without taking the trouble of burrowing. It is a very curious fact with regard to rabbits, that if once domesticated, they lose this disposition to burrow, and the produce of tame rabbits do not attempt such a proceeding. Mr. Barrington accounts for this by supposing that they do not burrow because not previously taught by the old rabbits. This may be the reason, in some degree. We have all witnessed the efforts of an old cat to teach its kittens to catch mice; and, although kittens not so instructed still retain the instinct to seize their natural prey, doubtless those that are properly instructed become the best mousers.

396. *Why is a divided lip in the human being called a "hare-lip"?*

Because the upper lip of the hare is slit or divided on the mesial line; and from its resemblance to this, the divided lip, when it occurs in the human being, is so called.

397. *Why is it commonly said that persons of flightly conduct are "mad as March hares"?*

Because in the month of March hares are characterized by greater activity and boldness than at other times. It is their rutting season; the male pursues the female by the sagacity of its nose, and when following the scent appears to lose its usual timidity and sagacity. The country, too, is dry, and in the best state for the running of the hare; and the leverets of the last season have acquired strength and agility.

398. *Why is the hare so called?*

It is suggested that the name arises from the declaration of Pliny that the hare is the "*hairiest* creature of all

"Thus gay, the *hare* with many friends,
Twice seven long years the court attends;
Who, under tales conveying truth,
To virtue formed a princely youth."—SWIFT.

others." It is not improbable that the noun is of the same origin as the verb to *hare*, and that the name was given to the animal because it is *harried*, or pursued by *harriers*.

399. *Why do hares leap to and fro before they jump upon their forms?*

Because their instinct tells them that their enemies pursue them by scent. Hares themselves pursue their kind by scent, and being practiced in the exercise of that faculty, must know that a leap from the ground breaks the trail. Hence, when they lay themselves up for the day, they do not run in a direct line to their seat, but work around it, and when near enough make a spring by which they reach their form. In like manner, when pursued they will sometimes throw themselves up by springing, and then remain still on the spot upon which they alight; and rabbits do the same.

400. The *doublings* of the *hare*, before she goes to form, thereby to dodge and deceive the dogs, is a notable instinct for an animal less famed for cunning than the fox and some others. The means of defense and escape provided by the Creator for various animals are worthy of consideration. Some are sufficiently guarded against all common dangers by their natural clothing, by their armature of shells, or such like hard and impregnable covering of their body. Others, destitute of this guard, are armed, some with horns, some with sharp quills and prickles, some with claws, others with stings. Some can shift and change their colors, some can make their escape by the help of their wings, and others by the swiftness of their feet; some can screen themselves by diving beneath the waters, others by tinging and disordering the waters can make their escape; some by their accurate sight, smell, or hearing, can foresee dangers; others by their natural craft can prevent or escape them; and some even by the power of their excrements can deter their enemies from pursuing them.*

Nature appears to have gifted the hare with some singularly preservative properties, of which her diversified tintings offer a proof; these so harmoniously blend with the matters which surround her as to make her escape from all but the practised eye very common. It is not that she lies concealed by cover; on the contrary, she frequently forms on the low side of a clod in a plowed field, and yet, although so situated her mass looks so shapeless that she is, by those not habituated to look for her, more frequently passed over than discovered. Her ears also are so mobile that she can take in sounds from every

* Derham's "Physico Theology."

"Immortal maid!

I own thy presence, and confess thy aid;
Not fear, thou know'st, withholds me from the plains,
Nor sloth has seized me, but thy word restrains."—POPE.

quarter; her eyes are never shut, and although she without doubt sleeps, yet her visual organs are so framed as never to be veiled, and her sleep is also so light as to instantaneously communicate through them and her ears the approach of danger. If discovered, her speed would in most cases save her from common foes; but she is assailed on one part by dogs artificially bred with superior scenting powers, or on the other with such as, though almost scentless, are fleet as the wind.
—Poor puss! !*

401. *Why are the eyes of hares never closed?*

Because they are unprovided with eye-lids. Instead thereof they have a thin membrane which covers the eye when asleep, and probably, also, when at rest. This membrane (like that which will hereafter be described in connection with certain birds) folds like a curtain in the corner of the eye, and by an instantaneous action flies back, when sight is required, and leaves the eye immediately and fully open for the exercise of sight.

ORDER VI.—EDENTATA.

402. *Why is the sixth order of animals named Edentata?*

Because they are toothless; the name being derived from the Latin *edentatus*, deprived of teeth.

Although this order includes animals which differ widely in their habits, they all agree in the absence of teeth from the front jaw; all resemble each other in the great claws which encompass the ends of their toes; and they are distinguished by remarkable slowness, or want of activity, arising from the peculiar organization of their limbs.

403. *Why is the ai, or sloth, so called?*

Because it utters a peculiarly plaintive note, of which the sound of the vowels *ai* is a close imitation.

404. *Why do sloths utter this sound upon the approach of storms?*

Because storms refresh the foliage upon which they feed, and put the sloths in motion to seek their cool and

* Blaine's "Rural Sports."

“For all he did was to deceive good knights,
And draw them from pursuit of praise and fame,
To slug in *slouth* and sensual delights,
And end their daies with irrenowned shame.”—SPENSER.

moistened meal. During the day they suspend themselves in a motionless state beneath the branches of trees; but when the cooler night approaches, and the leaves are covered with dew, they rouse and regale themselves. Their note is, therefore, an expression of joy, which is heightened on the approach of a storm.

405. *Why is the sloth, and some other animals, enabled to exist throughout the winter without food or motion?*

At the end of autumn, from the abundant supply of food which these animals are able to procure, they retire to their winter retreats loaded with fat. This serves as a reservoir of nourishment adequate to the supply of the small expenditure that takes place during their torpid state. On the return of spring, they are aroused from their lethargy, the fat being generally greatly diminished.

406. In animals thus circumstanced voluntary motion is altogether suspended, so also in the process of digestion; several of the secretions are suppressed, as the saliva and gastric juice, etc., the senses are likewise sealed up, and the circulation is diminished. The *hamster*, in which the pulse beats 150 per minute in a state of activity, has it reduced to 15 in its torpid condition. The *dormouse*, whose pulse is so rapid as scarcely to be counted when in its ordinary state, has it reduced to the same low standard when torpid. Respiration is also affected in a remarkable degree, not only in the number, but in the fullness and regularity of recurrence. *Marmots* in a state of health and activity, perform about 500 respirations in an hour, but in the torpid state these occur only fourteen times during the same period, and are performed at intervals of four or five minutes absolute rest; neither is the chest enlarged to any considerable extent. Sensibility is much diminished; parts of the limbs may be cut off without the animal showing any signs of feeling.

407. *Why, although the sloth is apparently ill provided with the means of defense and of procuring its food, is it in reality well provided for these exigencies?*

Because, in the first place, their long shaggy hair defends them from the insects which in the climate they inhabit are so troublesome; and, in the next place, the texture of its coat is very peculiar, more resembling dry

"Still, with your voice, the *slothful* soldiers raise,
Urge, by thy father's fame, their future praise."—POPE'S HOMER.

hay, or grass shrivelled and withered by the sun, than the hair of ordinary quadrupeds; and its appearance so much resembles that of the bark and moss of the branches on which it lives as to prevent the animal from being easily detected, except when moving.

408. *Why is it erroneous to consider the sloth an awkwardly-formed animal, and unfit for locomotion?*

Because the shortness of its hind legs, and the extraordinary length of the arms and claws, although they impede the progress of the animal upon level ground, are peculiarly calculated to assist it in climbing the branches of trees, where the sloth finds food, and rests secure from his enemies.

409. If the sloth can with his claws reach the branch or rough bark of a tree then will his progress be rapid; he will climb hand over hand along the branches till they touch, thus getting from bough to bough, and from tree to tree; in the storm he is most alive; it is when the wind blows, and the trees stoop, and the branches wave, that he is most active.

410. *Why have sloths great difficulty in walking on the ground?*

This difficulty arises from the peculiar structure of their feet; their hind ones are much smaller and shorter than their fore feet, and they are articulated somewhat in the same way as those of the handed animals which are the most expert climbers. In consequence of this, the side of the hind foot and part of the leg come in contact with the ground, and the animal cannot walk but with the greatest difficulty. The toes, which are two on the fore feet of the one and three on those of the other, are united together so as to form one single piece, and have no division of the foot except the claws, which are long and crooked, and remain bent like hooks by the action of ligaments, except when the animal stretches them out by muscular exertion, which appears to be a slow and painful operation.

"The first point of *slouth* I call
Lachesse, and is the chief of all,
And hath this property of kinde
To leaven everything behinde."—GOWER.



411. From this structure the sloth is entirely helpless on the ground; but among the branches of a tree, where it catches by the feet, and suspends itself without the least exertion or fatigue, this animal is completely at home, and as beautifully adapted to its place in nature, as the fleetest creature which sports in the meadow, or bounds over the heath. The sloth is decidedly the best climber among mammals, though upon the ground it is the worst walker.

412. *How is the supply of blood in the legs of climbing animals specially regulated for the purpose?*

In animals which are the best climbers and the worst walkers, the arteries which supply the limbs with blood are divided into a number of small branches, which branches are again united to form the principal artery of the limb. This structure renders the circulation in the limbs much slower than that in the body, and as both the energy and exhaustion of an animal, or part of an animal, are in proportion to the rapidity of the circulation, the legs of the sloth and animals of a similar character, though moved with extreme slowness, may be regarded as possessing greater power of endurance than any other organs among vertebrated animals.

413. *In what respect is the form of the sloth remarkably adapted to the localities which it inhabits?*

Wherever the earth is green, there are browsing animals appointed to consume the pasturage or the foliage, and to aid the great scheme of nature in its successional changes.

In the tropical forests, the green is not upon the surface of the ground, but upon the tops of trees; and the browsing animals destined to consume it, must have an inverted position to enable them to make the foliage of the trees their pasture.

“So she him lefte, and did herselfe betake
 Unto her boat again, with which she clefte
 The slouthful wave of that great griesy lake.”—SPENSER.

A pasture suspended in the air must have those which feed upon it suspended in the same element; and they cannot be placed *above* the leaves, because the latter afford no *footing* for an animal *in size adequate to the consumption it is necessary to accomplish*: they are, therefore, *suspended* beneath the foliage, and in this manner they are brought in closer connection with the *branches*, which alone could afford them support.

414. *In what respect are the habits of the sloth, as well as being adapted to its own wants, in accordance with those of external nature?*

The sloth inhabits the deep, extensive, and luxuriant forests of South America, in which the trees are of giant growth, always green, and so close that rarely a beam of the vertical sun reaches the earth; they extend over districts so wide, and so festooned and interlaced with twining plants, that winds, which would level a single tree to the ground, barely agitate their tops, or disfigure a few on the sides of the openings.

In order that there may be seeds, and successions of races in those luxuriant forests, it is necessary that there should be consumers of the superabundant foliage, which otherwise would completely exclude the sun and air, and the forest would perish of excess of its own exuberance, leaving the naked and carpetless earth to be converted, by the fervor of the tropical sun, into an arid waste, upon which no living thing could exist.

If the forests were to be destroyed in this manner, or, indeed, in any way but one in which their place should be occupied by a close surface of vegetation, the rain would depart also, and the land would be put beyond the power of human skill and labor to bring it back to usefulness, either for himself, or for any other living creature. “Once a desert, always a desert”—until one of those mightier movements of nature, of which the records are written in

"Weariness can snore upon flint,
When resty sloth finds the down pillow hard."—SHAKSPERE.

the strata of the deepest mines and the loftiest mountains, break the rain to pieces, and mold and temper its elements anew. *

415. Mr. Waterton, in his "Wanderings in South America," gives some interesting particulars of the sloth. He says:—"One day, as we were crossing the Essequibo, I saw a large two-toed sloth on the ground upon the bank; how he had got there, nobody could tell. The Indian said he had never surprised a sloth in such a position before; he would hardly have come there to drink, for both above and below the place, the branches of the trees touched the water, and afforded him an easy and safe access to it. Be this as it may, though the trees were not above twenty yards from him, he could not make his way through the sand in time enough to escape before we landed. As soon as we got up to him, he threw himself upon his back, and defended himself in gallant style with his fore-legs. 'Come, poor fellow,' said I to him, 'if thou hast got into a hobble today, thou shalt not suffer for it: I'll take no advantage of thee in misfortune; the forest is large enough both for thee and me to rove in: go thy ways up above, and enjoy thyself in these endless wilds; it is more than probable thou wilt never have another interview with man. So fare-thee-well.'

"On saying this, I took up a long stick which was lying there, held it for him to hook on, and then conveyed him to a high and stately mora. He ascended with wonderful rapidity, and in about a minute was almost at the top of the tree. He now went off in a side direction, and caught hold of the branch of a neighboring tree: he then proceeded towards the heart of the forest. I stood looking on, lost in amazement at his singular mode of progress. I followed him with my eye till the intervening branches closed in betwixt us, and then I lost sight for ever of the two-toed sloth. I was going to add, that I never saw a sloth take to his heels in such earnest; but the expression will not do, for the sloth has no heels."

Having captured another of these animals, he had a good opportunity of making some observations:—"The sloth was in my house with me for a day or two. Had I taken a description of him as he lay sprawling on the floor, I should have misled the world, and injured natural history. On the ground he appeared really a bungled composition, and faulty at all points; awkwardness and misery were depicted on his countenance; and when I made him advance he sighed as though in pain. Perhaps it was, that by seeing him out of his element, as it were, that the Count de Buffon, in his 'History of the Sloth,' asks the question,—'Why should not some animals be created for misery, since, in the human species, the greatest number of individuals are devoted to pain from the moment of their existence?' Were the question put to me, I would answer—I cannot conceive that any of them are created for misery. That thousands live in misery there can be no doubt; but then misery has overtaken them in their path through life, and wherever man has come up with them, I should suppose they have seldom escaped from experiencing a certain proportion of misery.

"After fully satisfying myself that it only leads the world into error to describe the sloth while he is on the ground, or in any place except in a tree, I carried the one I had in my possession to his native haunts. As soon as he came in contact with a branch all went right with him. I could see, as he climbed up into his own country that he was on the right road to happiness; and felt persuaded more than ever, that the world has hitherto erred in its conjectures concerning the sloth,

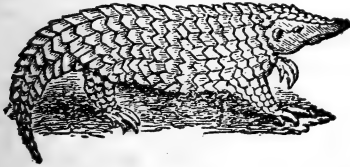
* Partington's "Cyclopædia."

"It is remarkable that man, who is endowed with reason, is born without *armature*, and is destitute of many powers which irrational creatures have in a much higher degree than he."—DERHAM.

on account of naturalists not having given a description of him when he was in the only position in which he ought to have been described—namely, clinging to the branch of a tree."*

416. *Why is the armadillo so called?*

The name, which was given to these animals by the Spaniards, means "clad in armor," and refers to the singular covering with which nature has provided them. It consists of a triangular or oval plate on the top of the head, a large buckler over the shoulders, and a similar buckler over



the haunches, while between these solid portions there intervenes a series of transverse bands or shelly zones, which accommodate this coat of mail to the various postures of the body; the tail also is covered by a series of calcareous rings; and the animal altogether exhibits a striking deviation from the usual structure and outward appearance of quadrupeds.

417. *What are the most striking indications in the form of the animal of adaptability to its mode of life?*

The stiffness given to the neck and to the whole spinal column by the armor, and the bearing of the processes of the vertebræ against that, evidently enables the armadillo to push forward into the earth, so as to keep itself advanced to the full action of the claws in burrowing downwards in an oblique manner, which it does with very great rapidity, so fast, indeed, as almost to elude pursuit; for as he gets the body buried, it takes so powerful a hold of the earth, that the tail may be pulled away, without bringing out the animal.

In these cases it is probable that it holds on with the whole body, and not merely with the feet. While digging, the legs are not stretched, so that when it raises itself upon these, the body is brought into firm contact with the upper

"You might have seen them throng out of the town,
Like *ants* when they do spoil the bin of corne,
For winter's dred, which they beare to their den."—SURREY.

part of the burrow; and the armor holds like a screw by means of its transverse prominences. *

There are other points of adaptability worthy of observation. The head is sharp and wedge-like, the eyes are small, and, in some of the species, covered with a membrane which can be put in use while the animal is burrowing, and so covered and protected.

418. *How are the armadillos, being unprovided with extensile tongues, able to capture ants, upon which they partly subsist?*

As the structure of the tongues of *armadillos* is not so well calculated for the capture of ants as those of the true *ant-eaters*, they do not devour these insects in such numbers; but they are said to exterminate them more speedily and completely from places where they abound. They effect this by mining *obliquely* into the ant-hills in all directions, and especially by digging down to those places where the *chrysalids* of the young ants are collected.

The holes which they make are also too deep and large to be easily filled up by the ants; and as they admit water to the very lowest inhabited part of the hill, the ants are either driven out, or drowned the first rain that falls.

419. *Why has the number of armadillos increased in the vicinity of colonies, while that of other wild animals has decreased?*

Because, as well as eating insects and roots, *armadillos* devour the carcasses of animals. In the neighborhood of colonies a great many wild animals are killed for their skins, and the increase of the number of carcasses thus promotes the increase of the number of *armadillos*, who act as scavengers to the fields of slaughter.

* Partington's "Cyclopedia."

"Then as nede is, they weren nothing idel;
Gnawing, and fast the *armurers* also,
Like file and hammer, pricking to and fro."—CHAUCER.

420. *Why do Indians ascertain the presence of armadillos in their burrows by observing the movements of mosquitoes?*

Because *mosquitoes* enter the holes of *armadillos* for the purpose of sucking their blood. When, therefore, the Indians see that a number of mosquitoes come out of a hole, they know that it is inhabited.

421. As it often takes a considerable time, to dig an *armadillo* out of his hole, it would be a long and laborious business to attack each hole indiscriminately without knowing whether the animal were there or not. To prevent disappointment the Indians carefully examine the mouth of the hole, and put a short stick down it. Now, if on introducing the stick a number of mosquitoes come out, the Indians know to a certainty that the *armadillo* is there; whenever there are no mosquitoes in the hole, there is no *armadillo*. The Indian having satisfied himself that the *armadillo* is there by the mosquitoes which come out, he immediately cuts a long and slender stick, and introduces it into the hole; he carefully observes the line the stick takes, and then sinks a pit in the sand to catch the end of it; this done, he puts it farther into the hole and digs another pit, and so on, till at last he comes up with the *armadillo*, which has been making itself a passage in the sand till it had exhausted all its strength through pure exertion. I have been sometimes (says Mr. Westerton) three-quarters of a day in digging out one *armadillo*, and obliged to sink half-a-dozen pits, seven feet deep, before I got up to it. The Indians and negroes are very fond of the flesh, but I consider it strong and rank.

422. *Why has the American ant-eater such a long snout and protrusive tongue?*

Because, like the *armadillo*, it devours ants, but has not the power of burrowing like that animal. The long tongue, which is covered with a viscid fluid, therefore enables the ant-eater to capture the ants *before they have time to run into the ground, after being surprised*.

The way in which the ant-eater proceeds is to approach the ant-hill, and with its large hooked claws to destroy a portion of it. By this partial spoliation of the building thousands of ants are exposed, as they run to and fro in a state of alarm. Then the long tongue, which is capable of being thrown out some eighteen inches, goes rapidly to work, being projected about twice in a second, and each time drawing in many dozens of ants.

"On every side are seen, descending down,
Thick swarms of souldiers loaden from the town;
Thus, in Battalia, march embody'd ants,
Fearful of winter, and of future wants."—DRYDEN.

473. The ant-eater has two very large glands situated below the roof of the tongue. From this is emitted the glutinous liquid with which the long tongue is lubricated when he puts it into the ants' nests. These glands are of the same nature as those found in the lower jaw of the wood-pecker. The secretion when wet is very clammy and adhesive, but on being dried it loses those qualities, and may be pulverized between the finger and thumb.

424. *Why are ant-eaters of great importance in the economy of nature?*

Because, without the check which they put upon the multiplication of ants, the produce of the soil, even in the most fertile parts of the world, would inevitably be destroyed. It seems almost incredible that so robust and powerful an animal as the ant-eater, or ant-bear, can procure sufficient subsistence from ants alone; but this circumstance has nothing strange for those who are acquainted with the tropical parts of America, where the ant-hills often almost touch one another for miles together.



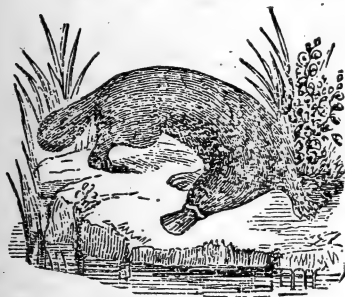
425. The ant-hills of South America are often more than twenty feet in diameter, and many feet in height. These wonderful edifices are thronged with two-hundred-fold more inhabitants, and are proportionally far more numerous than the small ones, with which we are better acquainted. Breeding in vast numbers, and multiplying with great celerity and profusion, the increase of these insects would soon enable them to swarm over the greatest extent of country, were not their propagation and diffusion stunted by the active exertions of that part of the animal creation which continually subsist by their destruction.

The following short passage from Mr. Darwin's "Observations on the Natural History of Rio de Janeiro" will give the reader a good idea of the magnitude of ants' nests there:—"Traveling onward we passed through tracts of pasturage, much injured by the enormous conical ants' nests, which were nearly twelve feet high. They gave to the plain exactly the appearance of the mud volcanoes at Jorulla, as figured by Humboldt."

"And that if he wol sayn it is not thus,
I wol it prove, and finder good witsesse,
That soth is that my *bille* wol expresse."—CHAUCER.

Mr. Waterton also remarks:—"In the far-extending wilds of Guiana, the traveler will be astonished at the immense number of ants which he perceives on the ground as well as in the trees. They have nests in the branches four or five times as large as that of the rook; and they have a covered way from them to the ground. In this covered way thousands are continually passing and repassing, and if you destroy part of it they immediately repair it. Other species of ants have no covered way, but travel exposed to view upon the surface of the earth. You will sometimes see a string of these ants a mile long, each carrying in his mouth to its nest a green leaf the size of a sixpence.

426. Why is the *ornythorynchus* so called?



From two Greek words, signifying a *fowl* and a *beak*, in allusion to the peculiar form of its muzzle, which resembles the bill of a duck; it is called also the *duck-billed platypus*, and the *water mole*. It is also web-footed, its feet being equally adapted for digging or swimming.

427. Why is the *ornythorynchus* provided with this duck-like appendage?

Because, although a quadruped, the animal inhabits the water, living in burrows on its borders, and being *insectivorous*, finds its food, as the duck in part does, by exploring the plants and herbs along the margins of fresh-water rivers and lakes. The broad beak acts as a kind of shovel. It is peculiar to Australia and Van Dieman's Land, and has been regarded by naturalists as a link between the aquatic birds and the mammalia.

428. So peculiar is the formation of its muzzle, that when a specimen was first sent to this country a general suspicion was excited that a hoax was designed. Dr. Shaw expressed the opinion, that of all the mammalia, the *ornythorynchus* was the most extraordinary in its conformation; exhibiting a perfect resemblance to the beak of a duck, engrafted upon the head of a quadruped.

"As for such as are whole-footed, or whose toes are *webbed* together (excepting some few) their legs are generally short, which is the most convenient size for swimming."—DERHAM.

The *ornithorynchus* is about twenty inches long, having a long and flattened body, like that of the *otter*, covered with a thick soft fur, moderately dark brown above, and whitish beneath. The beak, like the bill of the duck, is furnished with transverse plates. The teeth are situated in the back of the mouth, two on each side, with flat tops and no roots. The feet are furnished with a membrane uniting the toes, and in the anterior feet extending beyond the nails. The tail is flat and obtuse. From the form of this animal it is fitted to reside in the water; and it must feed on soft food, as the structure of the beak will not enable it to grasp anything firmly. The central portion of the mandibles is a bony continuation from the skull, and anteriorly and laterally, a cartilaginous substance, perfectly moveable, extends some little distance from the bony portion. Feet, five-toed and webbed. In the fore feet the web extends a short distance beyond the claws, is loose, and falls back when the animal burrows; claws strong, blunt, the two lateral shorter than the three middle ones. Hind feet short, narrow, turned backwards, and, when the animal is at rest, somewhat resembling a fin. The male *ornithorynchus* is armed with a spur on each hind leg, having a canal in it similar to that in the poison fang of venomous serpents, and, like this, also furnished with a gland at the base, secreting a fluid; hence it has been thought likely, though there is no evidence of the fact, that wounds produced by them would be dangerous. They have no external ear, and their eyes are very small, but brilliant. The motions of the mandibles in this animal, when seeking its food in the mud and water, are the same as those of a *duck* when feeding in similar situations.

The young are produced in a very imperfect state, and are very unlike the fullgrown animal. The skin is entirely destitute of fur; the eyes are not formed, and their place is merely indicated by the presence of a few wrinkles on the skin. The margin of the bill is at that time soft and the tongue advances to its front edge, so that the young animal can obtain nourishment by sucking, which was at first thought impossible. The mammary gland is very simple in structure, and is divided into a large number of separate lobes. The *ornithorynchus*, when asleep, rolls itself up like a hedgehog, keeping its back warm by bringing over it the flattened tail. It dresses its fur, combing it with its feet, and pecking at it with its beak, and seems to take great delight in keeping it smooth and clean.*

ORDER VII.—PACHYDERMATA.

429. *Why is the seventh order of mammalia called Pachydermata?* †

Because they are characterized by thick skins or hides. The term is derived from the Greek, and means *thick-skinned*.

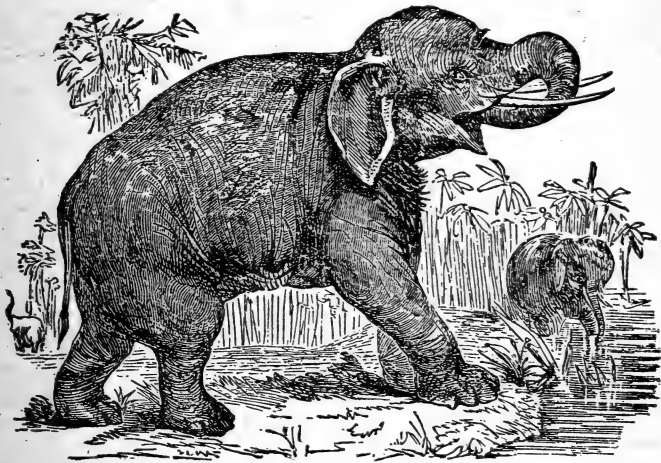
* Maunder's "Treasury of Natural History."

† Pack-e-der-ma-ta.

"Where the *elephant* browses at peace in his wood,
And the river-horse gambols unscathed in the flood,
And the mighty rhinoceros wallows at will,
In the pool where the wild ass is drinking his fill."—PRINGLE.

430. A very imperfect notion of the appearance and texture of the skin of the leading species of the *pachydermata*, the *elephant*, *rhinoceros*, etc., is obtained from examining the specimens which are confined in menageries, even in places where they are treated with the greatest kindness and care. The skin of the *elephant* in confinement is invariably callous, and often apparently chapped or cracked into pieces, which have little or no sensibility. But when the animal is in good health, and in its proper climate, the skin is smooth and soft, and is probably almost as sensitive to the bite, even of a small-insect, as the thinnest skin that can be imagined. When the animal is in this condition, there is, indeed, a wonderful power in the muscles of the skin, so that by agitation of these alone an elephant is capable of shaking off a wild beast which may have sprung upon it.

The hide of the *rhinoceros* is probably thicker than that of any other pachydermatous animal. Yet the creature is remarkably sensitive of the condition of its skin, which though not possessed of a high degree of feeling, exerts a considerable influence over the comfort of the animal. Hence the *rhinoceros* and other thick-skinned quadrupeds inhabiting hot climates, will remain for hours in the water, laving their skins, for which purpose it is absolutely necessary to provide baths for these animals when they are kept in confinement.



431. The *pachydermata* are subdivided into—
1. *Proboscidea*, or those possessing a prolonged snout or proboscis and having five toes on each foot, included in

——“The unwieldy *elephant*
To make them mirth used all his might, and wreathed
His lithe proboscis.”—MILTON.

a very firm horny skin, as certain extinct gigantic species, and the *elephant*, etc.

2. The *Pachydermata ordinaria*, in which the feet have two, three, or four toes on each foot.

3. The *Solidungula*, or quadrupeds with only one apparent toe, and a single hoof to each foot, although beneath the skin there are bony points which represent two lateral toes.

By many naturalists, however, the *solidungula* are regarded as a distinct order.

432. *Why is the elephant furnished with a proboscis?*

Because the enormous head of the animal is so heavy that were it placed at the end of a neck of a length proportionate to the dimensions of that organ in other animals, an almost incalculable amount of muscular force would be necessary to elevate and sustain it. The shortness, and almost total absence of a neck, obviates the difficulty; *the provision of a trunk compensates the absence of a neck.*

433. Animals in general which feed on herbage or other productions situated near the ground, require that the head should be attached to a neck the length of which is proportionate to that of its fore legs, so that on lowering the head it can apply its mouth to the ground without bending its legs. These conditions are obviously incompatible with a large and ponderous head like that of the elephant, and we accordingly find animals, such as the giraffe, having fore legs of considerable length, and consequently a neck in proportion, furnished with small light heads.

434. *Why is the elephant's trunk capable of a great variety of motions?*

Because it is made up of a great number of muscles with their tendons. Those muscles have their insertions in the internal and external coverings of the trunk; and they lie in a great variety of directions, some longitudinal, some nearly circular, and others oblique.

"Lo! from his *trunk* upturn'd aloft he flings
The grateful shower; and now
He plucks the broad-leaved bough."—SOUTHEY.

There are in this trunk no less than *four thousand muscles*, which is considerably greater than the number in the whole human body. It is divided through its length by a septum, forming a sort of double tube, terminating in a kind of finger-like appendage, or moveable hook.



435. The trunk of the elephant may justly be considered as one of the miracles of nature, being at once the organ of respiration as well as the instrument by which the animal supplies itself with food. Nearly eight feet in length, endowed with exquisite sensibility, and stout in proportion to the massive size of the animal, this organ will uproot trees or gather grass—raise a piece of artillery or take up a nut, kill a man or brush off a fly. It conveys the food to the mouth and pumps up enormous draughts of water, which by its *curvature* are turned into and driven down the capacious throat, or showered over the body. Its length supplies the place of a long neck, which would have been incompatible with the support of the large head and weighty tusks. A glance at the head of an elephant will show the thickness and strength of the trunk at its insertion; and the massy arched bones of the face, and thick muscular neck, are admirably adapted for supporting and working this powerful and wonderful instrument.*



436. *Why is the elephant provided with tusks?*

They are weapons of defense, combining enormous powers upon a fixed and irresistible base, in connection with a flexible trunk, by which the moveable tusks are brought into effective operation.

That they are weapons of defense is obvious from the fact that they are larger in the *males* than in the *females*, which is generally the case with the *horns* of *ruminants*, some of the *males* only of the latter order having these appendages.

*Mauder's "Treasury of Natural History."

—“With turcoises divinely blue,
 (Though doubts arise where first they grew,
 Whether chaste *elephantine* bone
 By min'rals tinged, or native stone.)”—JONES.

437. It is remarkable that while a great number of writers have fully discussed the uses and curious anatomy of the elephant's trunk, they have been almost silent as to the *uses* of the tusks. It is obvious, however, that these prominent and ponderous weapons must be of material consequence in the economy of the animal's existence. In Partington's "Cyclopædia" we find the following speculations upon the subject:-

In the living elephants of both varieties the tusks are either nearly straight or curved upwards; or if their direction be nearly that of the line of the face they are inclined forward at the points. In the fossil elephant, on the other hand (at least in all the specimens which have been found), the curvature of the tusks is the other way, or downward. What may be the use of this difference of structure it is not easy to say, because we know nothing of the habits of the extinct elephant, and very little of what the state of the country may have been when it was alive; but as the tusks in it are so constructed as that *they might act as hooks in pulling down substances* higher than itself, and it is probable that the northern marshes were at that time covered with tree ferns, and those other palm-like plants, of which the remains are abundant in the fossil state, though not a vestige of those plants now appears on the surface of the same regions, we may perhaps venture to conclude that such tusks had been employed in pulling down the fronds of the plants in order that the animal might feed upon them.*

The elephant rarely uses his *trunk* as a weapon, but his tusks enable him not only to clear his way through the thick forests in which he lives, by rooting up small trees and tearing down cross branches, in doing which service they effectually protect his face and proboscis from injury; but they qualify him for warding off the attacks of the wily tiger and the furious rhinoceros, often securing him the victory by one blow, which transfixes the assailant to the earth.

438. *Why are the eyes of the elephant remarkably small?*

By their smallness they are more easily protected from injury while the animal is engaged in breaking down branches of trees. And they are also rendered more secure from the attacks of insects which, in the geographical range of the elephant, are exceedingly troublesome.

The eye is not only protected by the comparative smallness of its size, but it is provided with a *nictating membrane*, by which the elephant is enabled to free it from all accidental fragments that may fall upon it. This membrane, which is similar to that possessed by birds, is not

* Partington's "Cyclopædia."

"Trampling his path through wood and brake,
And canes which crackling fall before his way,
O'eropping the young trees,
On comes the *elephant*."—SOUTHEY.

the ordinary eye-lid, but a third provision, which is specially adapted for *cleansing* the eye, but not for closing it.

439. *Why are the ears of the elephant unusually large?*

The office of the external ear in all animals is to facilitate the transmission of sounds—to catch the impulses of the air, and by condensing and transmitting them to a given point, to impart intensity to the impression.

An animal which habitually browses upon trees must be liable to have its hearing frequently interrupted by the crackling of branches and leaves. It seems highly probable that the size of the external ear favors the reception of *distant* sounds; in other words, lengthens the focus of the ear. If this conjecture be correct, the ear is adapted to receive *sounds from a distance* with less interruption from noises that are *near at hand*, than would be the case if the ear were smaller.

440. The structure of the elephant's ear has been investigated with great accuracy by Sir Everard Home. ("Comparative Anatomy," Vol. III., Lecture ix.) The drum and every other part of the organ, are much larger in proportion than in other quadrupeds, or in man; and there is a remarkable difference in the arrangement of the muscular fibers of the drum of the elephant's ear when compared with man and some other quadrupeds. In the human ear these fibers are radii of a circle, and in the horse, the hare, and the cat, they are of an uniform length. But in the elephant's ear these fibers are so placed that some are more than double the length of others. Sir E. Home argues from this remarkable construction that the elephant has not a musical ear; but that it has a peculiar compensating power in this form of fiber, as its slower vibrations enable it to *hear sounds at a greater distance*; and this opinion is still further sustained by the structure of the different parts of the internal organs, more particularly the cells between the tables of the skull. Sir E. Home illustrates his position that the elephant hears farther than any other animals, and particularly that his hearing is more acute than that of man, by several interesting narratives.

We may also perceive the utility of the large flap of the ear as regards the symmetry and appearance of the animal. The huge form of the elephant is broken by less lines of beauty than may be observed in most other quadrupeds, and the large ear, which falls gracefully over the shoulders, at once presents a point of relief, and gives character and dignity to the whole.

"The *elephant* hath joints; but none for courtesy; his legs are for necessity, not flexure."—SHAKSPERE.

441. *Why does the elephant seize a man with his trunk, yet never use it when he attacks a tiger?*

The elephant is gifted with a high order of instinct, which prompts him to entertain great concern for the preservation of his trunk, the most essential of his external members. The animal knows that the terrible claws of the tiger might at one stroke lacerate and destroy that essential organ; but he does not fear to attack man with it.

442. When the elephant is provoked to take vengeance on man, he does not scruple to seize him with his trunk, but never employs that member to grapple with a tiger, nor to hurl him in the air with it. He scents the tiger's lair at a distance, and instantly *elevates his trunk on high*, so that it may be as far as possible removed from the reach or spring of his stealthy adversary. So much does he dread the spring of the wild beast's attack upon this important organ, that he will throw it out of reach even when a dead tiger is brought into his presence. The following paragraph in an account of an elephant accidentally burnt at Dublin serves to illustrate the elephant's care for his trunk still more strongly:—"Doubtless the elephant's care to preserve his trunk was great, for when we dissected him we found it *thrust nearly two feet into the very ground*, upon which account we thought it had been burned, till the head was divided from the body, and then we found it was kept fast to the ground by the trunk, which had *actually been buried therein*."

443. *Why has the elephant the unusual power of bending the hind leg forward at the knee joint?*

By this arrangement, which brings all the muscular force of the leg to act immediately underneath the body, the animal is enabled to raise its enormous bulk much more quickly and certainly than it could possibly do if its hind legs bent outwards, as is the case with other animals.



The elephant is very fond of rolling its unweildy form in the ooze and mud of groves and jungles; and in this enjoyment it is assisted by the facility by which it gets up or lies down.

"On high-rai's'd decks the haughty Belgians ride,
 Beneath whose shade our humble frigates go;
 Such port the *elephant* bears, and so defy'd
 By the *rhinoceros* her unequal foe."—DRYDEN.

444. A tame elephant is really the most docile, gentle, and obedient of all animals. He forms an attachment to his keeper; comprehends signs; learns to distinguish the various tones of the human voice, as expressive of anger, approbation, or command; is generous, grateful, and humane. Many ludicrous stories, compounded of truth and fable, have been related of the elephant. But there are sufficiently well-attested proofs of his sagacity without resorting to the marvelous.

The following anecdotes and facts will be found interesting:—

AN ELEPHANT PROTECTS THE SICK AND DYING

445. In the Laknaor, the captial of Soubah, during the rage of an epidemic distemper, the principal road to the palace gate was covered with sick and dying people, extended on the ground and incapable of moving, though at a time when the Nabob was to pass on his elephant. The indifference of the prince about the lives of his perishing subjects, the haste with which he sought to pass, and the towering motions and heavy steps of the elephant, seemed to threaten inevitable death to those unhappy wretches who chanced to be in his way. But the generous quadruped, without receiving any command to the purpose, and even without slackening his pace, dexterously assisted the poor creatures with his trunk, removing some, raising others, and stepping over the rest; so that none suffered the slightest injury.

AN ELEPHANT GOES REGULARLY TO A HOSPITAL TO HAVE HIS WOUNDS DRESSED.

446. An elephant, who, in the course of the war between the French and English in the East Indies, in 1759, had received a wound by a cannon ball: after being once or twice conducted to the hospital to have his wound dressed, constantly attended for himself at the proper time, till it was healed. That the surgeon might operate, he readily extended himself on the ground. He bore with patience the application even of burning caustic to his wound. The acuteness of the pain would sometimes force from him a plaintive groan; but to the person who, by inflicting momentary torments, sought to accomplish his cure, he expressed none but emotions of gratitude.

AFFECTION OF THE ELEPHANT FOR ITS SPECIES

447. A shot from one of the hunters had broken a male elephant's left foreleg, which completely disabled him from running. On this occasion, there occurred a touching instance of affection and sagacity in the elephant, which well illustrates the character of this noble animal. Seeing the danger and distress of her mate, the female, regardless of her own peril, quitted her shelter in the bush, rushed out to his assistance, walked round and round him, chasing away the assailants, and still returning to his side and caressing him; and when he attempted to walk she placed her flank under his wounded side and supported him. This

"Beneath his over-shadowing orb of hat,
And ample fence of *elephantine* nose."—F. PHILLIPS.

scene continued nearly half-an-hour, until the female received a severe wound, which drove her again to the bush, where she speedily sank exhausted from the loss of blood; and the male soon after received a mortal wound.

AN ELEPHANT'S REVENGE

448. Carel Krieger, a celebrated elephant hunter, met with his death in the following manner:—He had been an indefatigable and fearless hunter; and, being also an excellent marksman, often ventured into the most dangerous situations. One day, having with his party pursued an elephant which he had wounded, the irritated animal suddenly turned round and singling out from the rest the person by whom he had been wounded, seized him with his trunk, and lifting his wretched victim high in the air, dashed him with fearful force to the ground. His companions, struck with horror, fled precipitately from the fatal scene, unable to turn their eyes to behold the rest of the tragedy. But on the following day they repaired to the spot, where they collected the few bones that could be found, and buried them near the spring. The enraged animal had not only trampled his body literally to pieces, but could not feel its vengeance satisfied till it had pounded the very flesh into the dust, so that nothing of this unfortunate man remained excepting a few of the larger bones.

SAGACITY OF THE ELEPHANT.

449. When an elephant is employed upon the banks of a muddy river, he frequently begins to sink from his excessive weight. He will then endeavor to throw himself upon his side to prevent his sinking deeper. The manner in which he secondly the efforts which are made to extricate him, when situated as above stated, is very remarkable. Liberal supplies of straw, boughs, and grass are thrown to the distressed animal; and these he forces down with his trunk till they are lodged under his fore feet in sufficient quantity to resist his pressure. Having thus formed a sufficient basis for exertion, the sagacious animal next proceeds to thrust other bundles under his belly, and as far back under his flanks as he can reach; when such a basis is formed as may be, in his mind, proper to proceed upon, he throws his whole weight forward, and gets his hind feet gradually upon the straw, etc. Being once confirmed on a solid footing, he will next place the surrounding bundles before him, pressing them well with his trunk so as to form a causeway by which to reach the firm ground. The instinct of the animal, and probably the experience of his past danger, actuates him not to bear any weight definitely, until, by trial with his trunk and the next foot that is to be planted, he has completely satisfied himself of the firmness of the ground he has to tread upon. When he succeeds in reaching dry ground, he evinces his pleasure in unmistakable signs.

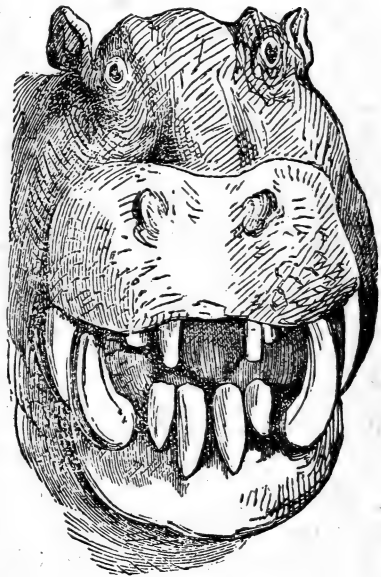
"On every side
They trembling stood, and made a long broad dyke,
That his swift charet might have passage wide,
Which foure great *hippodames* did draw in teem-wise tide."—SPENSER.

450. *Why is the hippopotamus so called?*

From two Greek words, meaning *horse*, and *river*, and having reference to the habits of the animal.

451. *Why are the waters seen to bubble when the hippopotamus dives beneath them?*

Because the animal has the power of expelling the air contained in its lungs, for the purpose of facilitating its descent, and increasing its specific gravity, so that it may more readily walk at the bottom.



452. The hippopotamus sleeps in the small reedy islets which are found in the rivers it frequents. In these spots it also produces its young, having only one at a birth, which it nurses with great care.

453. *Why has the hippopotamus such enormously large teeth?*

Because the coarse vegetable matter which it eats is enormous in quantity—much greater than is consumed by any other animal. Its mouth is adapted for tearing and dividing hard and tough plants. The stomach of the hippopotamus is capable of containing five or six bushels, and the large intestine is at least eight inches in diameter.

These enormous teeth are also used as weapons of defense. Dampier related that he had known the hippo-

“Only these *marishes* and myric bogs,
 In which the fearful ewites do build their bowres,
 Yield me an hostry, 'mongst the croaking frogs,
 And harbor here in safety from these rav'nous dogs.”—SPENCER.

potamus to set one tooth in the gunwale of a boat, and another at the distance of more than four feet, and thus bite a hole through the plank, and sink the boat.

454. Neither the elephant nor the rhinoceros, coarse as their subsistence may be, could live on the same kind of food as the hippopotamus. Its life is the rudest, and its food the coarsest of all the mammalia. Its office is, to clear the rivers of all those vegetable remains which, if allowed to accumulate in countries where vegetation is rapid, would choke up all the passages, and turn all the flat lands into at least periodical marshes.*

455. The hippopotamus is understood to be the *behemoth* of Scripture:—

“Behold now behemoth which I made with thee; he eateth grass as an ox.

“His bones are as strong pieces of brass; his bones are like bars of iron.

“He lieth under the shady trees, in the covert of the reeds and fens.

“The shady trees cover him with their shadow; the willows of the brook compass him about.

“Behold he drinketh up a river, and hasteth not: he trusteth that he can draw up Jordan into his mouth.

“He taketh in with his eyes: his nose pierceth through snares.”

—JOB XL, XV, etc.

456. *Why does the hippopotamus walk awkwardly upon the land?*

Because the shortness of its legs, which are well adapted for walking underneath the water, presents an impediment to its free movements upon the land. But it is also asserted that the body of the hippopotamus is specifically heavier than that of any other animal. This, while it promotes the movements of the animal in the water, gives an awkward and cumbrous appearance to its motions on the land.

The usual motion of the hippopotamus in the water is *walking* upon the bottom, although it is capable of swimming, when it desires to change its quarters, or to rise to the surface.

* Partington's "Cyclopædia."

“Man hath his daily work of body or mind,
And the regard of heaven on all his ways;
While other animals inactive range,
And of their doings God takes no account.”—MILTON.

457. *Why has the hippopotamus been called the river “horse,” although possessing a very un-horselike body?*

The name is of very ancient origin, and was probably applied before the form of the animal was well-known. Being generally seen in the water, with its ears, eyes, and nostrils only emerging therefrom, it is found that the partial profile thus afforded, presents a considerable resemblance to the *head of a horse*; and hence the popular idea.

458. *How are the eyes and nostrils of the hippopotamus adapted in their structure and position to the habits of the animal?*

It is necessary that the muscles of the eye should be powerful, endowed with great versatility, and capable of protruding or withdrawing the eyeball, which can be either projected remarkably, or sunk within the orbit considerably, so as to adapt it for vision in the different media where it is to act, whether the animal be on land, just under water, or far down beneath its surface. The nostrils, which are so placed that they just appear above the surface of the water, when the animal rises from below, can be closed when the animal descends into the deep, and opened when it comes up to take in a supply of air.

459. These two portions of the animal machinery of the hippopotamus are of the greatest consequence to the well-being and safety of a creature that spends so much of its time in the water. The beautifully contrived eye has the power of rolling round when it is in a state of protrusion, and is admirably adapted for the requirements of the animal. If danger threatens, the hippopotamus instinctively rushes to the river; and while there hidden can manage to just lift its head among the water plants and take his observation. If all is safe, he can quit his retreat, or if all be not right he can quietly sink and remain in his cool and unapproachable retreat at the bottom, occasionally rising and protruding his muzzle only for the necessary air supply, and then down again.

460. *Why is the rhinoceros so called?*

From a Greek word signifying nose-horn, in reference to the horny projection upon the snout, which is a characteristic of these animals. The *rhinoceros unicornis* has one horn, and the *rhinoceros bicornis* has two.

"There is no beast but hath his enemy; as the cony the polecat, a sheepe the wolfe, the elephant the *rhinoceros*, and so of other beasts the like."—HACKLUYT.

461. *Why is the rhinoceros provided with these horny appendages?*

Because the animal feeds upon the branches of trees and other vegetable matter. Some of the trees yielding considerable resistance, the rhinoceros uses its horn, or horns, to dig under and uproot the tree and bring down its food.



Having obtained a branch, he first devours the leaves and smaller stems, and then placing his snout as low in the trunk as he finds his horns will enter, he *rips up the main trunk*, splitting it into thin pieces, like so many laths; and he then crushes the pieces so prepared with his powerful jaws.

462. When we speak of *horns* our imagination pictures such as we are familiar with in the ox; but it must not be supposed that the nasal horn of the rhinoceros presents a similar structure. The nasal horn of the ox consists of a bony cone, or process from the skull, encased in a horny sheath. The nasal horn of the rhinoceros is a solid mass, structurally composed of agglutinated fibers, analogous to hair, and much resembling those into which whalebone is so easily separable.

The horn of the rhinoceros, originating as it does in the skin only, has none of its sensibility. The form of the disc of skin to which it is attached, and the fact of its attachment equally to all parts of that disc, give it a strength of base which no other horn possesses; and its fibrous structure throughout make it secure from fracture from any cross strain. The circumstance of its being placed over the bone of the nose completely prevents any concussion of the brain, even from the most violent use of it; and its central position admits of its being employed with the whole power of the animal,

"Down sank the *monster* bulk, and press'd the ground,
His arms and clattering shield on the vast body sound."—DRYDEN.

The horns are also used as *weapons of defense*; and in one of the species, at least, the horns, which are moveable in a quiescent state, *become fixed and immoveable when the animal is enraged*. When moving through dense jungles, rhinoceri carry their heads low, and plow their way through *the matted and entangled vegetation*.

463. *Why are the eyes of the rhinoceros placed so low down in the head?*

Because, from the great bulk of the body, the range of sight would be much more limited were they placed higher in the head at a point having a more restricted orbit of motion. Set upon a lengthened axis, every partial turn of the head extends the range of sight.

464. *Why are the ears of the rhinoceros very moveable and quick of motion?*

Because, notwithstanding the advantageous position of the eyes, from the great bulk of the body, and low position of the head, the range of sight is more restricted than in other animals. The rhinoceros, therefore, *relies to a great extent upon the sense of hearing*; the ears are, consequently, exceedingly sensitive, and endowed with moveable powers, which enable them to be instantly turned to the point of danger. This mobility of the ears is all the more remarkable when we consider the hardness of the general covering of the rhinoceros.

465. *Why does the skin of the rhinoceros exhibit numerous folds?*

Dr. Parsons observes that if the hard and inflexible skin of the rhinoceros were continued all over the creature, as the skins of other animals, without any folds, he *could not bend any way*, nor perform any necessary action; but that suppleness in the skins of other quadrupeds which renders them flexible in all parts, is very well compensated in this animal by those folds; for, since it was necessary his skin should be hard for his defense, it was a noble contrivance

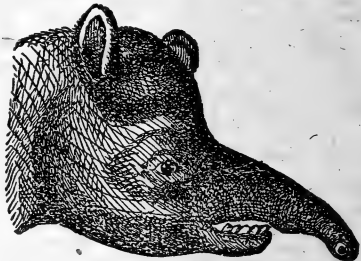
"The nose was ugly, long, and big,
Broad, and snouty like a pig;
Which showed he would in dunghills love to dig."—OTWAY.

that his skin should be soft and smooth underneath, that when he bends himself any way, one part of his board-like skin should slip or shove over the other; and that these several folds should be placed in such parts of his body as might facilitate the performance of every voluntary motion he might be disposed to make.

466. This view is further enforced by the fact, that in the *rhinoceros bicornis*, the hide of which is not so hard, the same extent of folding does not exist. The Indian rhinoceros is the most remarkable for the density of its skin. In this species it is thrown into large folds, which add to the uncouth appearance of the animal, and form a sort of armor, very difficult to be pierced: hence it is manufactured into shields and the like. The arrangement of the folds, or rather solid plates with folded edges, is as follows:—Around the neck, which is short and deep, the skin forms two large folds, of which the last hangs over the front of the chest. The shoulders are covered with a thick hard plate, falling in a fold over the top of the fore limbs, and separated also by a posterior fold for the plate covering of the body. This is folded across the top of the crupper, the fold running down just below the haunch-bones, and loosing itself on the belly. The crupper-plate is divided by a longitudinal fold running to the root of the tail on each side from a large crural plate, which hangs in a deep fold over the thighs. Between the folds the skin is soft and flexible, and of a pale pink or flesh color; but everywhere else it is hard and dense, and covered with horny incrustations. Hence, were it not for these folds, the animal would necessarily be restricted in his motions.

467. *Why has the tapir an indurated skin over the head and neck?*

Because, in seeking its food, it pushes its way through dense brush-wood. Being almost defenseless, it also flies from its enemies into the densest thickets, which it does with considerable ease and speed.



Its head is remarkably well adapted for boring through tangled places, being in the form of a conical wedge, and so thick toward the posterior part, that wherever it opens a way, the rest of the body can pass.

The head and neck, as far as the shoulders, being fortified with a shield of thickened skin, the tapir can the more

"The bristled *boar* . . .
 New grinds his arming *tusks* and digs the ground,
 He rubs his sides against a tree—prepares
 And hardens both his shoulders for the wars."—CAREY.

readily plunge through the thicket, than if its fore quarters were covered only with an ordinary skin.

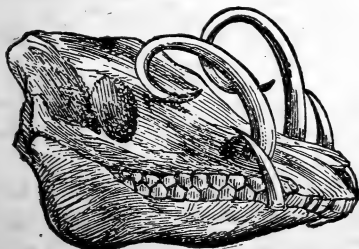
468. *Why have hogs thick muscular necks?*

Because their habit of rooting up the ground in quest of the vegetable stores that lie beneath its surface, renders considerable force necessary. The form of the snout, the motions of which its cartilaginous tip is capable, and the efficacy of the hind hoofs, and powerful hocks, in throwing the neck and shoulders well up to their work, are equally tributary to this natural habit.

Sir Charles Bell, adverting to the peculiar anatomy of the hog, says:—

"The formation of the skull and of the spine, and the mass of muscle in the neck, all show the intention that he shall drive onward with his whole weight and strength, so that he may rend with his tusks. Accordingly, we see that the back part of the skull rises in remarkable spines or ridges for the attachment of muscles, and that, corresponding with these, spinous processes of the vertebræ of the neck and back are of extraordinary length and strength. These processes distinctly indicate the power of the muscles which pass from the neck to the head. We now understand the reason of the shortness and inflexibility of the neck, because the power of the shoulders is directed to the head, and, we may say, to these large tusks. An elongated and flexible neck would have rendered these provisions useless. The characteristic form of the wild boar, then, consists in the height of the back, the shortness and thickness of the neck, the wedge shape of the head, the projection of the tusks, and the shortness of the four limbs, which must always be in proportion to the neck."

469. *Why is the Indian hog furnished with long crooked tusks?*



It has been asserted by some authors that the animal is in the habit of sleeping standing, and that in doing so, it steadies its body by hooking the tusks on to the branch of a tree.

Independently of this

“And up and downe as he that forest sought,
He met, he saw, a bore, with *tuskes* great
That slept agenst the bright sunne's heat.”—CHAUCER.

doubtful application, the tusks, which rise out of the mouth, and curl upwards before the eyes in a very singular manner, *afford protection to the organs of vision*, while the hog rushes through thick brushwood. These tusks are also used in extremity as weapons of defense.

470. All weapons of attack which animals use when danger is apprehended, contribute directly to the killing or capture of that upon which they feed. But the tusks of the hog species do not in any way assist them in the procuring of their food. They never use them but for the purpose of defense, and though we are apt to suppose that they make wanton and vicious attacks, we should, were we able to analyze all the cases, invariably find that the apprehension of danger, of some description or other, is the cause. If the defense of the animal is personal only, it seldom, if ever, shows fight, unless directly assailed; but almost all animals have occasionally, at least, other defenses besides that of their own persons. The female, the young, and even their pasture, are at times objects to be fought for; and those animals which are not carnivorous are generally more forward and more valiant in those cases than when the object is simply their own safety. Hogs, probably, have more powerful instruments of defense than most other vegetable feeders. Their young are numerous, and quite defenseless, and their flesh at all ages is, in a state of nature, sweeter, perhaps, than that of any other race of animals.*

471. *Why do pigs run about with straws in their mouths when a high wind is approaching?*

Because they dread the discomfort which the blast will occasion them, and are induced to take up the straws with an undefined purpose of collecting a sufficient store to protect them from the inclement storm. This object, however, they seldom or ever accomplish. Instinct impels the animals to take up the straws, but intelligence is wanting to direct them where to deposit their store. The wild hog probably *makes a bed for its shelter*, upon the approach of a storm; and we see the same instinct lingering in the domesticated animal.

472. *Why is it commonly said that when two hogs are feeding together, one of them is “sure to have his foot in the trough”?*

* Partington's "Cyclopædia."

"Neere to the shore that bord'ed on the rocke,
 No merry swaine was seene to feed his flocke,
 No lusty neat-heard thither drove his kine,
 No boorish hog-heard fed his rooting *swine*."—BROWNE.

Because when the hog meets with anything that requires cutting or tearing, it brings the foot into action, in order to strengthen the hold, and for this purpose frequently sets its foot in the trough.

473. *Why is it said that pigs "cut their throats" when swimming?*

Because they are bad swimmers; their fore legs being set closely under them, whenever they accidentally fall into the water they lacerate their throats with the sharp points of their cloven feet.

ORDER VIII.—SOLIDUNGULA.*

474. *What is the meaning of the term solidungula?*

It is derived from the Latin—*solidus*, solid, and *ungula*, a hoof. A *solidungulous* animal is one the hoofs of which are entire. The same animals are sometimes called *solipeds*, from *solus*, alone, or *solidus*, and *pes*, foot.

475.—Though there is only one toe fully developed, there are rudiments of two others under the skin, but they make no appearance externally.

476. *Why are solidungulous animals in a wild state found chiefly in plains?*

Because their solid feet enable them to bound tightly along hard pastures and sandy plains; and the comparative swiftness of some of the species, and the power of endurance in others, fit them for ranging over long distances in search of their food.

477. The *wild ass*, the *zebra*, the *quagga*, and also the *wild horse* of Central Asia, are all found on the margins of great sandy deserts, or, at least, in those regions where there is a great breadth of country, which is alternately drenched with rain and burned with drought; or where, as in Central Asia, the general character is dryness. They are not found on mountains, among rocks, or in close forests, like deer and goats; neither do they follow the lines of the great rivers and the rich savannahs so much as the ox tribe.

* This order is by some naturalists made a sub-division of the *Pachydermata*.

"Fixed on the goal, his eye fore-runs the course,
His band, unerring, steers the steady horse;
And now contracts, or now extends the rein,
Observing still the foremost on the plain."—POPE'S HOMER.

478. *Why do wild horses congregate in flocks?*

Because, as they shift their ground with the change of seasons in pursuit of new pasturage, the same necessity operating upon large numbers at once, they become gregarious, and acquire habits of association.

479. *Why are the colorings and markings of horses so varied?*

Numerous conjectures have been entertained as to what was the original color of the horse, and what have been the causes of the varieties that have since appeared, but the inquiry has not been attended with success.

480. The various colors of horses would seem to be truly original and inherent; for such of them as have, from a state of domestication, been suffered again to run wild, have retained the color they carried with them, although their form has altered by being submitted to the agencies of climate. Neither have the original horses of different countries, according to the accounts of travelers, exhibited in this particular any individual characteristic. The horses of the east are not darker than those of the north; on the contrary, we have white Arabians; and we procure the darkest breeds from the north of Europe, while in Russia, bright bay is as common a color as any other. Geographical distribution is not, however, wholly without its influence on the hair; for our heavy breeds, drawn from the northern parts of Europe, are very frequently black; but a full-blood black horse is very seldom met with. Age has likewise a powerful effect on the tinting of the hair; that of the colt alters many shades; in some cases it becomes much lighter, and in others altogether much darker as the adult period arrives. But the alteration which takes place between the time of full growth and that of old age, is invariably from a darker to a lighter hue.

481. *Why, when two horses are in a pasture, do we frequently see one of them nibbling the shoulder or neck of the other?*

This action is performed for the purpose of extricating the irritating fly known as the *bot*, which commonly attacks horses in the parts mentioned. There cannot be a doubt that the animals indicate the presence of this annoyance to each other, for when one horse has had the fly removed from him, he will immediately render the same service to his companion.

"Think, when we talk of horses, that you see them, printing their proud hoofs in the receiving earth."—SHAKSPERE.

482. *Why are horses furnished with strong hairs on the upper and lower lips?*

These instruments are designed for keeping flies and insects from annoying them, by getting into their nostrils while they are grazing. They are sufficiently close together for that purpose; and moving as they do while the horse is feeding, serve to brush away anything offensive.

483. *Why does the appearance of much "white" in the eye of a horse, indicate a vicious nature?*

Because a high-tempered horse constantly looks about, apprehensive of danger, or desiring to do mischief. The quick motion of the eyeball in opposite directions exposes an unusually large surface of the white, which thus becomes an evidence of the temper of the animal.

484. *Why has the horse no eye-brows?*

Because, from the situation of the eyes, and the direction of the horse's head, either when running or feeding, such organs would be useless.

There are hairs on the upper eye-lid, and especially towards the outer corner, because the light comes from above; and as the animal stands, particularly when he is grazing, and from the lateral situation of the eyes, the greater portion of the light, the attacks of insects, and the running down of moisture, would be chiefly from the outside or temples. Towards the inner corner of the upper lid there is little or no eyelash, because there is no probable danger or obstruction in that direction. Only a small quantity of light can enter from below, and therefore the lashes are there short; but as in the act of grazing, insects may more readily climb up and be troublesome to the eye, towards the inner angle, there the principal or only hair is found on the lower lid.

485. Although the horse has no eyebrows, there are several hairs or bristles scattered on the upper eyelid, and there is a projecting fold

"Epirus for th' Elean chariot breeds
(In hopes of palms) a race of running *steeds*."—DRYDEN.

of the lid which discharges the same office. This is by some persons erroneously associated with weakness or disease of the eye. But it is, in fact, a provision of nature to accomplish a certain purpose, and is in no way connected with either health or disease.

486. *Why is the best form of horse, such as the English racer, peculiarly fitted for swift running?*



Because the mechanism of the frame is based on the most correct geometrical principles, presenting a series of lengthened levers acting by means of a condensed muscular and tendonous organization of great power, on angles capable of great flexion and extension; while his pointed form fits him to cleave the atmosphere,

from which his deep chest enables him to take extensive inspirations to invigorate his exertions.

487. The essential points in the form of a horse differ as much as the uses he is put to vary. That which would approach perfection in one variety would be defective in another. The finest-formed racer that ever bounded over the turf at Newmarket, would cut a sorry figure in a London coal-wagon; while one of Barclay's splendid specimens of the heavy draught-horse would be even more misplaced if entered for the Derby. To be able to form a tolerably correct estimate of the capability of each variety of the horse to perform the duties required of it, from a view of the general figure, constitutes the very feather in the cap of the horse amateur. But to accomplish it requires much experience, and a long habit of observation, comparison, and reflection.*

488. *Why has the horse a large square jaw under the ear?*

To enable the teeth to bear great pressure, they are socketted very deeply in the jaw; and as the strength of the muscles of mastication is applied, is not merely to close the

* Blaine's "Rural Sports."

“There from the sunburnt hay field homeward creeps
The loaded wain; while, lightened of its charge,
The wain that meets it passes swiftly by;
The boorish driver, leaning o'er his *team*.”—DRYDEN.

jaws, but to grind, or to rub the teeth both laterally and to and fro, extraordinary space is provided in the jaws for the lodgment of a powerful muscle which has the double action of closing the teeth, and of drawing the lower jaw across the upper.

489. *Why does a “heavy shoulder” in a horse indicate that he is slow, and apt to tumble?*

Because this heaviness, as it is commonly termed, results from the upright position of the shoulder blade, which position prevents it from revolving freely, and so retards the forward motion of the foot.



illustration, and that the transition from the neck to the shoulders instead of being abrupt, should display a smooth undulating surface.

The main condition of swiftness in a horse is that the shoulderbone should be oblique, as shown in the

490. *Why are horses with deep bellies, such as the Suffolk punch, the best calculated for continuous employment?*

Because when their bodies are thus formed, they carry their food for a long time, and consequently are enabled to bear a longer and a harder day's work.

491. The Suffolk punch is particularly esteemed by the farmers of Norfolk, Suffolk, and Essex; and it is well known that in these districts where this kind of horse is used, that the farmers are able to plow more land in a day than can be performed in any other part of England.

Of all creatures, the horse has the smallest stomach relatively to its size. Had he the quadruple ruminating stomach of the ox, he would

“And early with thy *team* the glebe in furrows turn,
That, while the turf lies open and unbound,
Succeeding suns may bake the mellow ground.”—DRYDEN.

not have been at all times ready for exertion; the traveler could not have baited his steed, and resumed his journey. The stomach of the horse is not so capacious, even when distended, as to impede his wind and speed; and the food passes onward with a greater degree of regularity than in any other animal. If a horse drinks a pail of water, in eight minutes none of this water is in the stomach; it is rapidly passed off into the large intestine, etc.

492. *Why has the horse no gall-bladder?*

Because the process of digestion in the horse is almost incessant, and the bile passes off as rapidly as it is formed. In other cases there is a gall-bladder, in which the bile is stored until required.

Where the digestive process is performed in a large stomach, and the food descends in large quantities, and at long intervals, a gall-bladder is necessary; and there is the sympathy between the stomach and gall-bladder, that they are filled and emptied at the same time.*

493. *Why have aged horses cavities just above their eyes?*

Because in old horses most of the fat of the body, which is more superficially placed in the young, becomes absorbed; in this way, the eye, which is usually embedded in a large quantity of this matter, losing its assistance, sinks within the orbits, and thus the cavities, called eye-pits, show themselves.

494. *Why may the age of a horse be judged by the appearance of the teeth?*

Because on the upper surface of the incisors a hollow is to be seen in the young tooth, which, not extending through the whole substance, naturally wears out with the wear of the tooth, and as a considerable degree of regularity occurs in the wearing away in all horses, it has been adopted as the general criterion of age.

495. *Why should the grain which is given to horses be previously crushed?*

* Paley's "Natural Theology."

"Now, do thy speedy utmost, *Meg*,
And win the key-stane of the brig;
There at them thou thy tail may toss,
A running stream they dare not cross."—BURNS.

Because, owing to the unsuitableness of the teeth for masticating pure grain, which in a state of nature the horse would never be called upon to do, the grains frequently find their way into the stomach whole, and consequently yield comparatively little or no nourishment.

496. *Why, when horses are early and hard-worked, do they never arrive at their full size?*

Because the earthy deposit of the bones is usually proportioned to the wants of the animal, and is most abundant in those whose exertions are considerable. But from this very circumstance, when the animal is subjected to premature exertion, the consolidation of the bones becomes more complete before their softer portion has increased to its full dimensions, and hence growth is arrested.

497. *Why will a horse, if unchecked and unguided, find its own way on a dark night?*

Because its eye, in addition to being well adapted for vision during the day, is, from the form of the retina, peculiarly adapted to receive impressions by night.

498. In the darkness of night, when the traveler knows not the way, and would be incapable of reaching his home, his faithful horse will carry him in safety through the most difficult places; and be the path ever so intricate, and the obstacles ever so many, if the rein is entirely given up, not a foot of his will slip or be misplaced in the most difficult ground, and not one of the obstacles will he come in contact with. This is a curious point in physiology, but it is as true as it is worthy of admiration. The firm and entire hoof of the horse, even when shod with iron, seems to acquire in the dark a sense of touch equal to the most delicate finger; and, though we cannot account for it, every hair upon the skin of the animal appears to be instinct with all the senses necessary for guiding him along, with the same certainty as though it were clear daylight all about him. If the horse and the rider have been long acquainted with each other, and have frequently made nocturnal journeys, it is of no consequence, if the journey is a homeward one, whether the rider pays the slightest attention to the matter or not; for there have been many instances in which an old and trusty horse has carried his rider asleep for a distance of more than twenty miles. There have been also instances of favorite ponies carrying blind musicians from house to house for the purpose of giving lessons; and indeed it would be impossible to enumerate half the instances which are

“He taught men the forth drawynge
Of bestaile, and eke the makyng
Of oxen, and of *hors* the same,
How men should them *ride* and *tame*.”—GOWER.

well authenticated, of quiet and slow-going horses finding and keeping the way without any assistance from their riders, and the same applies to horses habitually used in draught.*

499. *Why is the system pursued by Mr. Rarey so efficacious in taming vicious horses?*

Because, without inflicting pain upon the animal, it fixes upon his memory the fact—that *man* is his *master*. All animals are subdued that once become aware of this; and they owe their subjection to each other to a similar consciousness.

500. Mr. Rarey's system consists of rendering a horse perfectly helpless—not by punishment in the ordinary sense—but by depriving him of the use of one of his legs by the simple contrivance of a buckle and strap, which doubles the near fore leg upon the fore arm, and renders the animal helpless without inflicting pain. While in this subdued condition the horse is laid or thrown upon his side, and is then attended, spoken to, caressed, shown different objects which he had hitherto dreaded, and made familiar with sounds that, under other circumstances, would alarm him. In connection with all these trials he is constantly caressed by the operator until he gains assurance, and when at last he is released from subjection by the hand of his attendant, he regards man as not only *his master* but *his friend*. The communication of such a lesson demands patience, and an occasional repetition; but there can be no doubt of its efficiency in subduing, if not in eradicating, the vice of horses.

The principles of Mr. Rarey's system are embodied in the following proposition:—

1. That any horse may be taught to do anything that a horse can do, if taught in a proper manner.
2. That a horse is not conscious of his own strength, until he has resisted and conquered a man; and that man, having the advantage of reasoning powers, can handle a horse in such a manner that he shall not know his superior strength.
3. That by enabling a horse to examine every object with which we desire to make him familiar, with organs naturally used for that purpose, viz., *seeing*, *smelling*, and *feeling*, you may take any object around, over, and on him, that does not actually hurt him.†

Many animals live in a state of perhaps more close domestication than the horse does; and the dog especially, being one which in a state of nature requires more art and stratagem for finding his food, is capable of evincing his attachment to his master in a variety of ways. The dog will fight for his master, will fawn upon his master, and will watch and defend his master's property with a fidelity perhaps unequalled by the human race. The horse does not fight for himself, for his nature is the very opposite of pugnacious; the horse does not fawn, for the spirit of the horse is noble; but, if the expression may be used, he stands to

* Partington's "Cyclopædia."

† "Art of Taming Horses."

"As when a dull mill *asse* comes near a goodly field of corne,
Kept from the birds by children's cries: the boys are overborne
By his insensible approach, and simply he will eat,
About whom many wands are broke, and still the children beat."

—CHAPMAN.

his rider more in the relation of companion and equal than any other animal stands to man. There is, also, in the gratified look, the erected ears, the arching neck, and the subdued and murmuring neigh of the horse, at the sight of that rider with whom he has been long associated, something more touching—or, if you will, more poetical—than in the fawning of all the dogs in the world. Then there is no danger which the horse will not brave along with his rider, and on those occasions man very often borrows courage of the spirit of the animal.*

501. *Why is the ass better kept on commons, than in meadows and pastures?*

Because it is naturally an inhabitant of the wilderness, and is most at home browsing among rough and tall plants. In pastures, although it becomes sleek and fat, it at the same time gets indolent and less strong and enduring. Besides, if the ground is soft, the hoofs of the ass, which are by nature adapted for hard and dry surfaces, become enlarged and unnaturally extended, which makes the feet unsightly, and the gait of the animal awkward—circumstances which do not happen when it is located upon the dry common.

502. *Why is ass' milk so well adapted for invalids?*

Because it contains much saccharine matter, and but little butter; hence it is capable of being digested by stomachs unequal to the task of assimilating the richer milk of the cow.

503. *Why are mules said to be stubborn?*

Mules are commonly used for traveling over mountainous countries and dangerous precipices. They are chosen for this purpose, because they are sure-footed, and have great powers of endurance. Being frequently heavily burdened they acquire a habit of treading with great caution; and this necessity influencing the habits of successive generations, has imparted to them, when traveling on ordinary roads, an air of sluggishness and self-will.

* Partington's "Cyclopædia."

"This said, his brass-hoofed winged horse he did to chariot binde,
Whose crest was fring'd with manes of gold, and golden garments shin'd."
—THE ILIAD.

504. When these animal come to one of the descents alluded to, they stop of themselves, without being checked by the rider; and, if he inadvertently attempt to spur them on, they remain immovable. They seem to contemplate the danger which lies before them, and prepare themselves for the difficulty. They not only attentively view the road, but will sometimes tremble and snort at the danger. Having prepared for their descent, they place their fore feet in a posture as if they were stopping themselves; they then also put their hinder feet together, but a little forward, as if they were about to lie down; then, moving with unerring caution, they proceed forward.

505. *Why are the zebra and onaga found in hilly and mountainous places?*

Because, although closely allied to *horses* and *quaggas*, which are never found but on plains, their hoofs are differently formed, being adapted to the nature of the footing afforded by hilly and mountainous districts.

The hoofs of *horses* are round and flat; in the *ass* they are oval and hollow, and in *zebras* and *onagas* they are oval at the toe, and square at the heel, by the spreading of that part which is termed the "frog." This causes the limb to stand more vertically upon the postern, and gives a sharp, firm tread upon declivities.



506. The zebra is, perhaps, of all quadrupeds the best made and the most beautifully clad by the hand of nature. To the figure and graces of the horse, it adds the elegance of the stag; and the black and white bands with which its body is ornamented are arranged with such wonderful symmetry that we might almost be disposed to imagine that rule and

"Others, filled with pasturage, gazing sat,
Or bedward *ruminating*."—MILTON.

compass had been employed in their formation. These alternate bands are narrow, parallel, and exactly separated; they extend not only over the body, but the head, thighs, and legs, and even over the ears and tail. They follow so exactly the contours of the different parts, enlarging more or less according to the development of the muscles, and the roundness of the different forms, that they exhibit the entire figure in the most advantageous point of view. In the female these bands are alternately black and white, in the male they are black and yellow, but always of a lively and brilliant tint. They also rest upon a ground of short, fine, and copious hairs, whose luster considerably augments the general beauty of the colors.*

ORDER IX.—RUMINANTIA.

507. *Why are the animals of the ninth order called ruminants?*

Because they chew again the food which has been swallowed, slightly masticated. The word is derived from the Latin *rumino*, from *rumen*, the *cud*.

508. *Why do numerous herbivorous animals "chew the cud"?*

Because in a state of nature they are liable to be surprised and preyed upon by their carnivorous enemies while feeding. They are therefore endowed with stomachs capable of receiving a large quantity of food in a crude state, and with the power of returning it again, to be brought under the action of the teeth, when the animal has retired to a place of comparative security.

509. The class of ruminants feed on the coarser kind of herbage where they are in abundance; but the actual nutritious matter is small in quantity compared with the mass. There is, therefore, an obvious necessity for a more complex apparatus to extract the smaller proportion of matter capable of being animalized; hence the various preparations for digestion. When the mass is digested, the nutritious part is still small in proportion to the whole; and, to permit that smaller part to be prepared and carried into the system, the intestinal canal must be long and complex, offering resistance to the rapid descent of the food, and giving it lodgment: and thus there is always a correspondence between the complication of the stomach and the length of the intestines, and between both and the nature of the food.

It is further remarkable, that when animals of the same species live in different climates, where there is more or less abundance of vegetable food, there is an adaptation of their digestive organs. When it is

* Buffon.

"The condemned English
Sit patiently, and inly *ruminate*
The morning's danger.—SHAKSPEARE.

abundant, the configuration of the intestines which is intended to delay its descent is less complex; when the food is scarcer, the intestine is longer, and the obstruction afforded by the valves is greater.

510. *How is the process of rumination conducted?*

The stomachs of ruminating animals are divided into *four chambers*, of which the first three are so disposed that the aliment can enter at the will of the animal into any one of them.

511. The first stomach, or paunch, is divided outwardly into two bag-like appendages at its extremity, and is slightly separated into four parts on the inside. Here are received the masses of herbage, rudely broken up by the first mastication. But no true digestion occurs here; only a slight maceration, such as water would produce in a degree of moderate heat. The herbage is afterwards transmitted in this state to the second stomach, or honeycomb-bag, so called from the honeycomb similarity of the surface of its coats. Here the herbage is arrested, and compressed into small maws, or balls, which are thence returned at leisure successively to the mouth for re-mastication.

During this operation the animal remains in a state of repose until all the herbage swallowed has undergone the action of the molar teeth a second time. The aliment thus re-masticated is transmitted into the third or smallest stomach, the laminae on the walls of which bear a resemblance to the edges of the leaves of a book when slightly opened. From the third stomach the food is transmitted into the fourth, which is next in size to the first stomach, or paunch, and with an internal villous coat similar to that of the human stomach, with large longitudinal wrinkles. This last is the chief organ of digestion.

The first three stomachs are connected with each other, and with the *oesophagus*, or throat, in a very remarkable way. The latter tube enters just where the paunch and the second and third stomachs approach each other; it is then continued with the groove, which ends in the third stomach. This groove is, therefore, open to the first stomach, which lie to its right and left. But the thick, prominent lips, which form the margin of the groove, admit of being drawn together, so as to form a complete canal which then constitutes a direct continuation of the *oesophagus* into the third stomach. The functions of this very singular part vary, according to its use as a simple groove, or a closed canal. In the first case, the grass, etc., is passed, after a very slight degree of mastication, into the paunch, as into a reservoir. Thence it goes, in small portions, into the second stomach, from which, after further maceration, it is propelled into the *oesophagus*, and conveyed by a muscular backward motion into the mouth.

It is here *ruminated*, and again swallowed, during which *the groove is closed*, and the food, after this second mastication, is thereby conducted directly into the third stomach. During the short time which it

“By Cinthia’s light, and on the pleasant lawn,
The wanton fairy we were wont to chase,
Which to the nimble *cloven-footed* fawn,
Upon the plain durst boldly bid the race.”—DRAYTON.

stays in this situation, between the folds of the internal coat, it is still further prepared for digestion, which is completed in the fourth or digestive stomach. The closing of the groove, as already described, which determines the chamber or stomach into which the food shall be passed, is an *act of will* on the part of the animal. While *young ruminants* remain at the teat, and live upon milk, the fourth stomach is the largest. The first stomach, or paunch, only develops itself into its enormous volume, in proportion as it receives supplies of herbage, which increases with the growth of the animal.

It is remarkable that this faculty of rumination, so important to the animals in their wild state, is no less valuable in their domesticated condition:

Cows stand patiently while being milked, chewing the cud the while, and deriving gratification therefrom.

Being driven to market, they are able to take with them a store of food, which serves to mitigate their hunger during a period of abstinence from grazing.

Sheep disperse their flocks and fill their paunches, and then draw together to chew the cud, by which they derive warmth during cold hours of the night, and obtain shelter from occasional storms.

512. *Why have all animals which chew the cud cloven feet?*

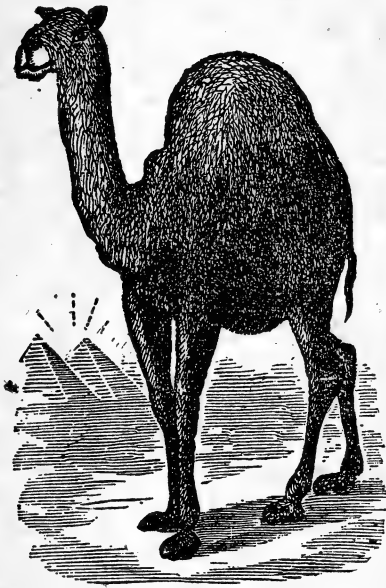
Because the splitting of the foot into two parts adds to its spring and elasticity, prevents its sinking deeply into soft ground, and permits it to be more easily withdrawn. As these animals usually feed upon pastures and other fertile places, it will be seen that this conformation of the foot not only favors the movements of the animal, but renders the tread less destructive to vegetation.

513. *What is the difference between the dromedary and the camel?*

The *dromedary*, or Arabian camel, has one hunch on the back; the *Bactrian camel* has two hunches. The dromedary is a lighter variety of camel, bearing much the same relation to the ordinary camel as a race-horse or hunter does to a cart-horse. It is used principally for journeys in which dispatch is required, and carries only a single rider or a very light burden. It can maintain a trot at the rate of from six to eight miles an hour, for twenty-four hours consecutively; and a gentle easy amble

"Or camels knelt
To take their loads, or horsemen scour'd the plain."—CAMPBELL.

of five miles an hour can be kept up by the dromedary for several days and nights almost uninterruptedly.



514. *Why are the "camel" and the "dromedary" so called?*

The Arabic verb from which the name *camel* is derived, signifies *to please*, or to behave with kindness and humanity, and, in its application, has reference to the docility of the animal. The Greek word from which the name of the *dromedary* is derived, means *swiftness*, running; and has reference to the speed of the beast.

515. *Why are the camel and dromedary furnished with callosities (or hardness of the skin);*

namely, one on the breast, and two on each side of the fore legs, and one on each side of the hind legs?

They are thus endowed because they do not lie on their sides, but rest and sleep with their knees bent under their bodies, and their breast upon the ground; these parts require to be particularly guarded and strengthened, to resist the weight of the body, which is brought to bear, both when the animal assumes its attitude of repose, and when it rises up.

516. *Why is the neck of the camel of great length, and extremely flexible?*

"The trees, devouring caterpillars burn:
Parch'd was the grass, and blighted was the corn."—DRYDEN.

Because this structure allows the animal to crop leaves from the tall trees upon which it feeds, and also to bend the neck when drinking from springs, and other places where water is found?

517. *Why has the dromedary a hump upon its back?*

This hump is an accumulation of a peculiar species of fat, which is not liable to be acted upon by the great heat to which the animal is exposed. It consists chiefly of *stearine*, or hard fat. It is, in fact, a *store of nourishment* beneficently provided against the day of want, to which the animal in a wild state is often exposed, and from which he is not entirely exempted in a state of domestication. The dromedary or camel can exist for a long period upon this hump alone, without any other food; and it does not die of want until the hump has been entirely absorbed, and applied to the nourishment of the system.

518. Animals which exist chiefly upon vegetable matter, and which are subject to seasonal vicissitudes in their supply of food, all make accumulations of fat on some part of their bodies, as a provision against the failure of the supply of food; and their tendency to this habit is exactly in proportion to the need they have for it. The parts of the body in which this accumulation is made, and the consistency of the accumulated substance, are both very important points in the geographical distribution of animals. If the animal winters in cold latitudes, the accumulation of fat is generally distributed over the surface, and the substance is of a soft and oily nature. If, on the other hand, it inhabits warm latitudes, the accumulation is chiefly composed of a crystallizable fat, and is generally situated on some part of the animal where it is least likely to interrupt its labor and progress.

519. *Why is the formation of the stomach of the camel and the dromedary admirably adapted for enabling the animal to take long journeys over parched deserts?*

Because the stomachs of these animals are capable of retaining large quantities of water unchanged for a considerable length of time. A number of distinct sacs are observed to lie between the membranes of the second stomach, and to open into the stomach near the top by small square apertures. Through these orifices, after the stom-

"Precisious and plain plodders such
Is this, and so is that
In love do swallow *camels*, whilst
They nicely straine a gnat."—WARREN.

ach is full, the annexed bags are filled; and the water so deposited is, in the first place, not liable to pass into the intestines; in the second place is kept separate from the solid element; and, in the third place, is out of the reach of the digestive action of the stomach, or of mixture with the gastric juice. It appears that the animal, by the conformation of its muscles, possesses the power of *squeezing back* this water from the adjacent bags into the stomach, whenever thirst excites it to put this power into action.

520. Mr. Partington, from whose "Cyclopædia" we have several times quoted, calls in question this endowment of the camel. We have no doubt, however, of the capability of the animal in this respect, though we think the fact has been exaggerated and wrongly described. That travelers have ever killed camels, and taken supplies of water from their second stomachs, is unfounded, though frequently stated. But that the animal is capable of *long abstinence from water*, and that it derives this power from being able to receive and retain a store of the fluid either in the cells or coats of one or all of his stomachs, there cannot be the slightest question.

521. *Why are the camel's feet provided with large cushions or pads?*



Because a foot thus furnished is best adapted for treading upon sand. The foot of the camel is planted with a heavy downward stamp, and lifted up straight and high. The oval cushion underneath meets the sand with a dead pressure, and therefore has little tendency to sink into it. The extremities of the toes are fortified by flat nails, which have a very slight resemblance to proper hoofs. These give firmness to the cushion that lies underneath. The cushion also, being a non-conductor of heat, prevents the heat of the sands from distressing the animal upon its journey.

522. *With what other peculiar functions is the camel endowed, suitable to its habits and employment?*

The elevation of the camel's head and the acuteness of its sight and smell, enable it to *discern the green oasis*, and to *scent the refreshing water*, at a great distance.

"Like as a mastiffe having at a bay
A salvage bull, whose cruell hornes do threat
Desperate daunger, if he them assay."—SPENSER.

The eye is shielded from the intense glare of light by a prominent over-hanging brow, and by long eyelashes, and the nostrils are so constructed as to be closed by the animal at pleasure, so as to *keep out the fine sand* which is being continually driven by the wind.

Its natural food consists, not of the meadow herbage and fat pastures, in which most of the ruminants delight, but of thorny shrubs, date leaves, and the leaves and branches of the tamarisk; these, when it meets with them, together with dates, beans, and cakes of barley, pounded by its master, constitute its supply of food during the toilsome journey.

Hence we see the utility of its strong incisors, its canine teeth, and its canine-like molars, which enable it to browse on the coarsest shrubs with ease; while its long prehensile lip serves to draw the twigs and leaves to its mouth, or to hold the tuft of herbage which is undergoing mastication.

These explanations with reference to the *camel* are equally applicable to the *dromedary*.

523. *Why are the toes of the llama separated and pointed?*



Because the llama is a *mountaineer*, cropping the herbage of elevated ranges, but having sometimes in its wanderings to cross barren and heated tracts.

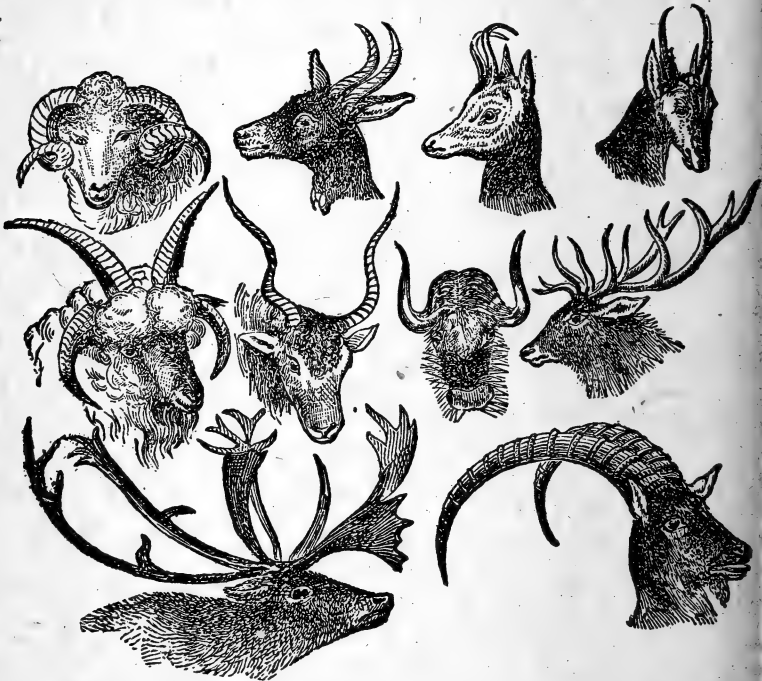
Its foot, therefore, instead of having the toes bound to one solid oval cushion, as in the case of the camel, is distinguished by having the toes well separated, each one being provided with a complete pad.

This foot is remarkably well-adapted for holding on upon the rough surfaces of precipices; whilst it is also fitted for occasional use upon heated and barren tracts.

524. *Why are numerous animals of the order ruminantia provided with variously-shaped horns?*

—“To the strong ram
Tie fast the rash offender. See at first
His *horned* companion, fearful and amazed,
Still drag him trembling o'er the rugged ground.”—SOMERVILLE.

It is obvious that these organs are, with all the tribes, *weapons of defense*: but that explanation does not suffice for their various and singular shapes, and for certain circumstances connected with their history. In the *deer tribe*, for instance, horns belong only to the male in most of the species; in the *rein-deer* the female is furnished also with



horns, but they are smaller than those of the other sex. The horns are composed of a bony substance, grow periodically, fall off annually, and are again renewed of a larger size than in the preceding year. Their forms are various; sometimes they spread into broad palms, which send out sharp snags around the outer edges; sometimes

"That very portion which (by faithful skill Employ'd) might make the smiling public rear Her ornamented head."—THOMSON.

they divide fantastically into branches, some of which project over the forehead, whilst others are reared upwards in the air; or they may be so reclined backwards that the animal seems almost forced to carry its head in a stiff, erect posture. Yet, in whatever way they grow, they appear to give an air of grandeur to the animal.

It may, then, speaking in general terms, be said that the easy elegance of their form, the lightness of their motions, their size, their strength, their fleetness, and the extraordinary development of those branching horns, which seem *fully as much intended for ornament as defense*, all contribute towards placing horned animals in the foremost rank of quadrupeds.

525. Paley remarks upon the general question: A third property of animal form is *beauty*. I do not mean relative beauty, or that of one animal above another of the same species, or of one species compared with another of the same species; but I mean, generally, the provision which is made in the body of almost every animal to *adapt its appearance to the perception of the animals with which it converses*. He supports this hypothesis by an example:—The *irides* (colors) of the eyes of animals are very beautiful, without conducting at all, by their beauty, to the perfection of vision; and Nature could in no part have employed her pencil to so much advantage, because no part presents itself so conspicuously to the observer, or communicates so great an effect to the whole aspect.

This argument seems to be borne out by the fact, that the period when the deciduous horns arrive at perfection, is the season of love between the sexes. They continue in the male until the season of pairing, and in the female during the whole period of gestation; and as they drop off in both as soon as these great labors of the year are over, it is evident that they have some connection with the sexual system, and consequently with the affections.

But in point of *utility* much may be said. The horn of the deer tribe differs materially in substance from the horn of the ox. The former supplied man with some of his earliest and rudest instruments and weapons, and in the present days of luxury and refinement contribute largely to ornamental and useful manufactures, especially that of knife-handles, in which they are used in nearly their natural state. The horns of the ox, goat, sheep, etc., are largely used for the manufacture of combs, boxes, lanterns, and other articles. The consumption in these various uses throughout the world must be enormous. We see, therefore, in the horn of the ruminant, all those offices combined which are exhibited in other remarkable productions of nature: use to the animal; individuality of character and appearance; and utility to man.

526. The term horn is commonly applied to any hard projecting body on the head of animals, serving as a weapon of defense; but it is strictly applicable only to a certain class of such weapons. For instance, the

"The *stag*, too, singled from the herd, where long
He rang'd the branching monarch of the shades,
Before the tempest drives."—THOMSON.

antlers of the *stag* consists entirely of bone, and have no right to the denomination "horns;" the weapons of the *ox* the *sheep*, and the *antelope*, consist of a sheath of true horny material on a bony core; while the horns of the *rhinoceros* are wholly composed of horny matter. Bone and horn are as distinct from each other, as both are from *ivory*; yet the three are often confounded by the application of the general term "horn" to antlers, tusks, and true horns. Besides the horns on the head of the animals, there are other horny processes in the hoofs, claws, nails, etc., and there are various modifications of horn in the scales of the *armadillo*, the plate armor of the *tortoise*, the spines of *porcupine* and *hedgehog*, and the quills of *birds*.

Horn consists principally of membranous animal matter, being a compound of coagulated albumen, gelatine, and a small portion of phosphate of lime. It has been well remarked of these proportions, "had the horns much more earth, they would be brittle like bones; had they much more gelatine, they would be soluble like jelly or glue;" as it is, they are easily convertible to the purposes of the manufacturer, by whom they are so largely used, that considerable importations of horns are necessary, in addition to the supply afforded by this country.

The horns chiefly applied to manufacturing uses are those of the bull and cow, with the hoofs of those animals. Large quantities are imported from Russia, South America, and Southern Africa. The horns of the *bison* and *buffalo* are also in demand, the latter being frequently reserved, on account of their beauty, for superior purposes. The horns of the *chamois* and *antelope* are polished and used in their natural forms.*

527. *Why does a stag prefer to reach water before he stands at bay?*

Because, from his greater height, he can maintain a footing, while the dogs, obliged to swim, become comparatively helpless. He therefore strikes at them with his horns with great effect, while they have little power to attack him.

528. *Why are the horns of buffaloes of peculiar utility to them?*

Because these animals feed in close jungles, where their eyes are of comparatively little use; and though the ears may be of service, in enabling them to avoid hostile animals and find friendly ones, they can be of no use in guiding a grazing animal to its food. Hence, the sense upon which they have chiefly to depend for their subsistence is that of smell; and, as the scent of their food comes in the air, and is not on the surface of the ground, they require

* Tomlinson's "Encyclopædia of Useful Arts and Manufactures."

"In time the *savage bull* doth bear the yoke."—SHAKSPERE.

the nose elevated while they are ranging the jungles. In doing this, *the horns act as powerful auxiliaries*, as their weight assists in balancing the weight of the head when the line of the face is carried in a horizontal position.

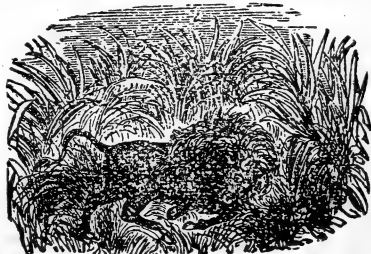
529. The horns of buffaloes are of use to them in another way. These animals change their pastures by crossing rivers which flood when the rains fall on the mountains, and when it is dry there they run low. The animals float along apparently at their ease, till they arrive at those places which suit their habits. The manner in which they carry their heads in swimming is shown in the accompanying engraving; from which it is obvious that they use the weight of their horns as a lever to elevate their eyes and nostrils.



530. *Why is the bison able to use his horns with more effect than the ox?*

Because in this animal the horns are so situated that when its neck is brought into that position which has its greatest strength, the horn appears on the anterior and lateral part of the convex skull as on the crown of an arch, and the axis of the whole body passes between the two horns, and parallel to the direction of them, so that the animal can deliver its whole momentum from a rush or bound either upon both horns, or upon one of them, with full effect, and without injury to itself.

531. The characteristics of the *bison*, which chiefly appear in the head, are: the forehead arched or convex, instead of being nearly flat, as in the domestic ox; the breadth, measured between the orbits of the eyes, greater than the height; the bases of the horns before the ridge of the occiput; the whole outlines of the cranial bones more curved or convex; the occiput being rounded instead of quadrangular, and passing into the line of the forehead by an obtuse and rounded angle instead of an acute one. This



“While doe and roe, and red deer good,
Have bounded by through gay greenwood.—SCOTT.

form gives much greater strength to the skull, and more firmness to the bases of the horns; so that the bison can dash the head with much more impetus than the ox, either against an enemy or any obstacle, without the danger of equal injury either from fracture of the skull or concussion of its contents.

532. *How are the structure and the habits of the rein-deer admirably adapted to the climate which it inhabits?*

The rein-deer possesses a keen scent by which it discovers the lichens on which it feeds deep beneath the snow, and subsists easily in a climate where the face of nature is sealed through long-continued months of winter. As a beast of burthen it is invaluable to the inhabitants of the dreary northern regions, its broad *expansive hoofs* enabling it to pass over the yielding surface of snow with ease. For domestic purposes, where no substitute can be found to meet even the limited wants of the inhabitants, its importance is incalculable; its milk furnishes them with cheese, its flesh with meat, its hide clothes them, and its horn supplies the material for implements of use.

533. *In what manner do the horns of the rein-deer prove instrumental to the animal in procuring its food?*

By the aid of these instruments the rein-deer removes the deep snow from the ground, and thus arrives at the food destined for its subsistence. The velvety down which covers the antlers prevents the snow from adhering to them.

534. *Why is the neck of the elk so short, and the head so near to the trunk?*

Because the weight of the elk's horns is enormous, and if the head and horns were placed at the extremity of an elongated neck, they would inevitably *overbalance the body*.

535. *Why are stags said to shed tears?*

Such allusions are very frequent with the poets. Shakspeare says:—

—“the big round tears
Coursed one another down his innocent nose
In pitious chase.”

The eyes of the stag, and nearly all the deer tribe, dis-

Tear-falling pity dwells not in this eye."—SHAKSPERE.

play a peculiarly weeping aspect. It depends on a remarkable glandular sinus, or *tear-pit*, situate at the inner angle of each eye, close to the nose, without having any communication with the eyes, or without what are termed the lachrymal passages.

536. *Why are deer furnished with tear-pits?*

They are composed of folds of the skin, and are *capable of being opened or closed at the pleasure of the animal*. At the bottom they are furnished with a gland, which secretes an oily viscous substance, of the color and consistence of the wax of the ears, and which hardens and becomes black when exposed to the air. The moistened moving edges of the sinus have been mistaken for tears.

537. *Why are the feet of the rein-deer deeply fissured, and liable to open and close?*



Because the deer browses upon lichens or mosses which it finds on the mountains of Lapland; it has occasionally to walk upon deep snows, and at other times upon craggy mountainous places. The

spreading foot is efficacious in preventing its *sinking into the snow*, while the firm and pointed toes, when the foot is closed, serve to obtain a *firm footing upon the crags*.

538. *Why is the ox, one of the most valuable and useful beasts to man?*

Because it not only affords wholesome and agreeable food in this country, but is also serviceable as a beast of burden and of draught in many lands; and in some is commonly employed for riding.

539. The readiness of acclimation which distinguishes the ox in every part of the world, and in almost every range of temperature, is one of the most obvious causes of its extensive distribution and usefulness. In the northern and frozen parts of Europe, and under a tropical sun, the ox is found and cherished, and is applied, in a greater or less degree, to the many purposes of utility. The cow, during her life, provides us, in her copious and abundant supply of milk, with one of the most nutritive and wholesome aliments. Thus useful when living, its death seems to render it even more extensively servicable. The flesh, the various portions of the stomach, and the viscera, constitute the most important articles of

"Some *ruminating* lie; while others stand
Half in the flood, and, often bending, sip
The circling surface."—THOMSON.

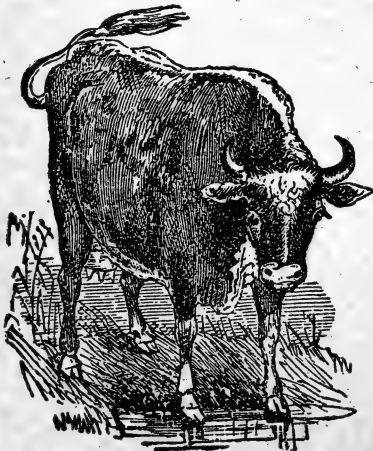
food; the intestines and the bladder are employed for different uses in domestic economy; the horns are extensively used in manufacturing numerous articles of utility, ornament, and amusement; the ears and hoofs furnish the important article of glue; the bones form a strong manure, or are carved into various implements, and are thus an excellent substitute for ivory; or they yield by decomposition several essential articles in medicine, domestic economy, and the arts; the hair is used in mortar; the hide is tanned into leather; and, in fact, there is not a part of this most useful animal which does not, living or dead, contribute to the advantage of mankind.

540. *Why does the sight of blood, or anything of a red color, excite and infuriate the ox tribe?*

Because *red* is the complementary color of *green*; and the eyes of oxen being long fixed upon the green herbage while feeding, when they espy anything red it impresses their sight with a *greatly-increased intensity*.

The same *effect* is doubtless produced upon all grazing animals by a red color; but oxen, *being more pugnacious than others*, show greater excitement, and often attack that which surprises them.

541. *Why do oxen frequently stand in shallow waters in hot weather?*



Because, having the power of *ruminating*, they can take in a store of food, and by retiring to shallow waters, which generally lie in shady places, they obtain *coolness*, and escape to a great extent the annoying *bites of insects*, while they contentedly chew the cud. The water also softens and cools their hoofs, and prevents cracks and humors to which they are liable in hot weather.

"One way a band select from forage drives
A herd of beeves, faire *oxen* and faire kine
From a fat meadow ground."—MILTON.

542. *Why do oxen use a peculiar motion with the tongue, when gathering herbage?*

Because their *upper lip* is not prehensible, like that of the horse. They therefore use the *tongue* to gather in the grass, which is afterwards divided by chewing.

543. *Why is it customary to hang bells around the necks of cattle in Switzerland?*

Because, as they are allowed to roam among the acclivities and windings of the mountains, the sound of the bells tends to keep them together, and also to inform the *vachers*, or herdsmen, of their whereabouts. The bells vary in form and size, from a small tinkling instrument to a large deep-toned bell, worn by the leader of a herd.

544. So accustomed and attached do the animals become to these bells, that the deprivation of them is felt as a punishment. The cow, whose superior beauty, sagacity, and good conduct, fit her to be the leader of the herd, is always on gala-days distinguished by the largest and finest-toned bell, and the bravest ornamental collar, and so down, through all the gradations of good, to the small appendage that marks the indifferently good or clever animal, and the total absence of ornament and distinction which points out the self-willed or vicious. If any cow has been guilty of straying, of unseemly behavior, breach of discipline, or any vicious trick, the displeasure of the *vacher* is not testified by blows, but by the temporary deprivation of her bell; and this seldom fails to reduce her to order and prevent a repetition of the offense. It is only necessary to see the cow on a gala-day, with her badge of distinction strapped round her neck, and then to see her deprived of it, for some fault or other, to be convinced that this is true. She is now gay, good-humored, and frolicsome, and then, sulky and gloomy.

A certain cow, that had long worn the bell of honor round her neck, had but recently given birth to a calf, and was considered too weak to bear the weight of the large bell, or, indeed, of either one. Her master turned her out to go with the herd to the upland pastures. This summer removal of quarters is always held as a holiday. The peasants were dressed in their best clothes, the cows had on their bells, and all went on gaily, except the poor matron who was deprived of hers. After proceeding a few paces, she began to show signs of great uneasiness; this increased. It was vainly attempted to coax her forward, and soon she lay down on her side, and would not move. In this dilemma one of the old *vachers* came up and seeing how the case stood, coolly went to the house, and brought out the bell and collar, which the animal no sooner felt about her neck than she rose, shook herself, and raising and

“As from fresh pastures and the dewy field
 (When loaded cribs their evening banquet yield)
 The *lowing herds* return: around them throng,
 With leaps and bounds, their late imprisoned young.”—POPE.

throwing her tail over her haunches, in token of complete satisfaction, went off prancing, kicking, and curvetting, with every appearance of health and gaiety; and, taking her place in the van, was from that moment as well as ever.*

545. *Why has the ox (the most valuable of quadrupeds to man) been so easily and universally domesticated?*

Because of its gregarious nature, which leads it readily to associate with any other animal that evinces no disposition to offer it direct injury.

546. *Why has the ox, in common with other ruminating animals, a divided hoof?*

Because feet thus furnished take a firmer hold upon soft, yielding, or irregularly disposed ground, supporting the body better, and being less liable to injury than any other kind. Feet thus formed also do less injury to vegetation than would result from flat solid hoofs.

547. *Why has the cow, which usually produces but one calf four or more teats?*

Because the calf, born with teeth, and requiring a large quantity of nourishment, the excess in the number of teats enables the cow, by altering her position, to change the teat used by her young one, and thus to prevent its becoming sore by continual sucking.

548. It is a well-known fact that human mothers change the side upon which children suck, for a similar reason. When a child is very hungry and tenacious of the breast, soreness is prevented by thus acting; and the appearance of teeth in the gums of the offspring is the usual indication that the time proper for weaning is at hand.

In dairy economy, there is great advantage in the number of teats, because one cow may be made to suckle two calves; the second cow being kept for milch.

In the domesticated state, udders and teats are very liable to become disordered. As the udder consists of four distinct glands, each having a teat, the inflammation arising from one may not be communicated to the other, which can be milked or sucked, and the mammary system relieved.

* Latrobe's "Alpenstock or, Sketches of Swiss Scenery and Manners."

"Th' ignoble never lived; they walk awhile
Like swine, or other *cattle* here on earth!
Their names are not recorded on the file
Of life, that fall so."—B. JOHNSON.

For the purposes of the calf, the division of the udder into four glands, each having a teat, the advantage is, that the calf can always be supplied. One gland forming milk, while another is being exhausted.

549. *Why do wild cattle, when fleeing from the hunter, keep to the sides of fields and copses?*

Because they are then *sheltered on one side from attack*, and can the more readily take to the cover when they are sufficiently ahead of their pursuers, or when a good "run" offers an opening.

550. *Why do wild cattle, when meditating an attack upon an enemy—especially man—make their approaches in gradually diminishing circles?*

Because, in all probability the animal intends, previously to attacking its foe, to *intimidate it* by a show of its own power and means of injury; calculating that the obnoxious object will, under the influence of fear, turn and present its most vulnerable side, or retreat altogether, without the necessity of an actual combat.

551. Many animals before making a dart at an enemy paw the ground, foam at the mouth, lash themselves with their tail, and otherwise excite themselves to a seeming anger. All these acts are doubtless intended to have the same effect as the circuitous approaches, to *appal the enemy*.

552. *Why is the hair of tame and domesticated cattle softer and smoother than that of the wild varieties?*

On account of the protection afforded by the farmer and grazier against the severity of the seasons, as also from the more *regular and choice supply of food* which domesticated animals receive.

553. There is a marked difference between the texture of the hair of the highland cattle and those bred in the lowlands of Scotland; and even the same breed under different circumstances differs in this respect. On their native pastures, where they are not housed, they are extremely rough, shaggy, and wild-looking; but when driven to the lowlands, they become more polished, and, on a richer pasture in a warmer climate, and with shelter at night, show a rich and glossy covering.*

"If milk be thy design: with plenteous hand
 Bring clover grass; and from the marshy land
 Salt herbage for the foddering rack provide,
 To fill their bags, and swell the milky tide."—DRYDEN.

554. *Why are horns of tame cattle generally shorter than those of wild?*

Because these appendages, being obviously intended for weapons of offense and defense, their development naturally followed the ratio of their necessity, and decreased in proportion to their domestication.

555. It would seem that while domestication softens the manners of animals, it also smooths the asperities of their forms. All animals, when under the influence of strong and angry passion, become much more rugged than when they are pleased. The hair stands up, the muscles swell into ridges, the skin is puckered, and the animal puts on an aspect as forbidding as possible.*

556. *Why do wild cattle feed in flocks, while the tame varieties scatter and browse separately?*

Because the former experience a sense of insecurity and dread of attack; they act instinctively upon the maxim that union is strength, and thus guard against surprise. The domesticated ox has no such dread, and follows its individual caprice, or sense of enjoyment.

557. *Why has the giraffe such a long slender neck?*

Because it browses upon the branches of tall trees, for which purpose its long neck is admirably adapted.

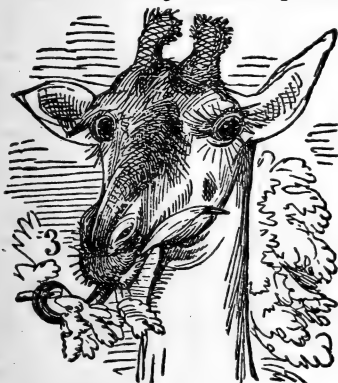
558. *Why has the giraffe a head so small in proportion to its size?*

Because a larger head at the extremity of the lever formed by the long neck would possess a weight disproportioned to the muscular power of the animal, and be a serious encumbrance.

* Partington's "Cyclopædia,"

"Whose height the rising forest overlooks;
And on tree-tops the *eye-sight* downward casts;
Where distant rivers seem bestrided brooks."—DAVENANT.

559. *Why is the giraffe endowed with a long prehensible tongue?*



For the purpose of collecting together the tender twigs and leaves upon which it feeds. But for this tongue, which gathers the leaves into large bunches, the giraffe could only bite the single ends of the sprays, and in this way could obtain only a limited supply of food.

560. A giraffe more than two-thirds grown will eat daily in confinement eighteen pounds of clover, hay, and eighteen pounds of a mixed vegetable diet, consisting of carrots, mangold-wurzel, barley, split beans, and onions; and will drink four gallons of water.

561. *Why is the head of the giraffe surmounted by short erect horns?*

These horns are occasionally used as *weapons of defense*. We have seen them wielded by the males against each other with fearful and reckless force; and they are much dreaded by the keepers of the present living giraffes in the Zoological Gardens, because they are sometimes very suddenly put into use.

The giraffe does not butt by depressing and suddenly elevating the head, like the deer, ox, or sheep, but strikes the callous obtuse extremity of the horns against the object of his attack with a sidelong sweep of the neck. The female in the gardens of the Zoological Society once drove her horns through an inch board.*

* Maunder's "Natural History."

"The elephant with pond'rous tread,
The giraffe with exalted head."—NEWMAN.

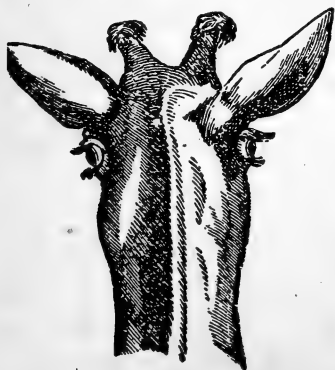
562. There is another use which may be assigned to the horns. Surrounded as they are with a thick tuft of hair, we are inclined to think that they are used as instruments of *feeling*. The ox looks down upon the pasture; but with the giraffe, the order is inverted, its food being *over* and *around* its head. As the giraffe carries its head beneath and through the branches of the trees, the long hairs upon the erect horns come in contact with the leaves above them, and the animal, without a constant effort to *look up*—in fact, with its eyes turned downward and backward, to guard against enemies, is able to apprehend its food. Buffaloes, oxen, deer, etc., have similar hairs upon their *nostrils*; the giraffe is provided with them *also* upon the points of its *horns*.

563. *Why are the nostrils of the giraffe thickly intersected with stiff hairs?*

Because, while it browses among the branches of trees, it disturbs a *great number of insects*, whose attacks would cause great annoyance without this defense. For the same protective purpose, the eyes are surrounded with unusually large eyelashes, and also provided with a third or nictating membrane, which sweeps all foreign matters from their surface.

564. *Why are the eyes of the giraffe set prominently near the back of the head?*

In that situation they are best adapted to keep watch



against enemies, which usually spring from behind. The chief defense of the giraffe lies in that direction; from the vigor of its muscles, the length of its legs, and the consequent velocity of the hoof, when it comes to the position in which it can take effect, the kick is truly a formidable one, and is said to be sufficient to break the skull of a lion.

"A herd of goats, each shining morn,
Midst scraggy myrtle, pointed thorn.
Quick glancing, to the sun display'd
Their spotted sides, and pierced the shade."—WHITEHEAD.

565. *Why does the lion generally attack the giraffe while the latter is drinking?*

Because at such times, the head being depressed, the giraffe cannot see the approach of the enemy; and its fore-legs being widely spread, so that its head may reach the water, the animal is then in a very helpless position.

566. The *lion* lies in wait, usually in the morning, at some place near a stream, and in a situation somewhat elevated over its intended prey. There the lion waits in concealment the approach of his intended victim. As soon as the *giraffe* puts down its head to drink, all the advantage which its prominent eye gives it when the neck is elevated is gone. In this situation the lion springs, and fastens upon its back; and although the giraffe bounds off with terrific speed, the weight of the lion, and the pain of laceration, bring him to the ground.

567. *Why is it imagined that goats, kept in stables with horses, improve the health of the latter?*

This is one of those popular fancies which, seemingly absurd at first, are found upon reflection to have some foundation. *All animals are kept in better temper and greater cheerfulness by the presence of a companion, than in solitude; and the active and good-humored goat may, in this way, really perform the benefit which has been attributed to its open mistaken grounds.**

568. *Why can goats subsist upon vegetables that are noxious, or even poisonous, to other animals?*

This is probably a part of the great creative scheme, to provide for the consumption, and the keeping within necessary limits, those species of vegetables which having their special utilities, would acquire an *undue preponderance* if not kept in check.

569. In feeding, *goats* are very indiscriminate, and many plants which are not only shunned by other ruminating animals, but act as poison to them, are not only eaten with impunity, but relished by them. There have been instances in which tame goats have chewed tobacco; and, in the wild state, they eat the most bitter and narcotic plants, such as euphorbium, hemlock, henbane, and even digitalis, without suffering any injury.

* Bell's "British Quadrupeds."

"That *sheep-cot*, which in yonder vale you see
(Beset with groves, and those sweet springs hard by),
I rather would my palace wish to be
Than any roof of proudest majesty."—DANIEL.

Few plants are more disrelished by cattle than the common ragweed, and therefore the pastures on those lands in upland and humid situations are very much infested by it; but goats clear it off, if allowed to browse the plants before they come into flower. There are many of the *compositae* which are the pests of our pastures, and which are, generally speaking, biennials, making roots the first year, and bearing flowers the next, which might probably be cleared off by pasturing with goats at proper times. The alternation with each other of animals, one set of which can eat the plants that are disliked by another, is an important point in the economy of our grazing districts, though it does not appear to have received that attention to which it is entitled.*

570. *Why do sheep make a nodding motion of the head when feeding?*

This motion is owing to the peculiar formation of the jaw and teeth. Sheep have *no teeth in the upper jaw*, but the bars or the ridges of the palate thicken as they approach the fore part of the mouth; there is also the dense, fibrous, elastic matter of which they are constructed, which becomes condensed, and forms a cushion or bed that covers the convex extremity of the upper jaw, and occupies the place of the upper incisor or cutting teeth, and partly discharges their functions. The herbage is firmly held between the front teeth in the lower jaw and this pad, and is brought away by a half biting, half tearing action, which occasions the peculiar motion of the head alluded to.

571. The stalks of the common herbage of the field, bitten closely as they are by *sheep*, are harder and more fibrous than the portions that are divided and cropped by *cattle*: and not only so, but some breeds of sheep are destined to live, in part at least, on harder food than falls to the lot of cattle—as the different kinds of heath, or substances almost as difficult to be broken off as the branches of heath. The incisor teeth are evidently formed for browsing on these tough productions of the soil, which would otherwise be altogether useless and lost. The part of the tooth above the gum is not only, as in other animals, covered with enamel to enable it to bear and to preserve a sharpened edge, but the enamel on the upper part rises from the bone of the tooth nearly a quarter of an inch; and, presenting a convex surface outwards, and concave one within, forms a little scoop or gouge, capable of wonderful execution. He who will take the trouble to compare the incisor teeth of cattle and of sheep—both ruminants—both by means of the half cutting and half tearing action, having the stomach, in which the process

* Partington's "Cyclopædia."

"First, with assiduous care, from winter keep
Well foddered in the stalls, thy tender *sheep*;
Then spread with straw the bedding of thy fold;
With fern beneath, to fend the bitter cold."—DRYDEN.

of mceration is going forward, abundantly, supplied with absorbent or alkaline earth—the one, however, destined to crop little more than the summit of the grass, and the other to go almost to the roots, and occasionally to browse on harder food—will have an interesting illustration of the manner in which every part of every animal is adapted to the situation in which he is placed, and the destiny he has to fulfill. The pad, also, is firmer and denser than in cattle, yet sufficiently elastic, so that it is in no danger of injury from the sharp chisels below, while the interposed substance is cut through with the greatest ease.

572. *Why will sheep follow each other even into evident danger?*

For two reasons. From the strength of their social instinct, which leads them to move together in flocks, and seldom if ever singly, or in an isolated manner. Secondly, there is no animal in which the faculty of imitation of the movements of their own species is so strong as in sheep.

573. These instincts appear to have been wisely implanted in one of the most valuable and defenseless of domesticated animals, in order that they might be taken advantage of by intelligence of man.

The leaders of the flock having been instructed and rendered manageable, *the obedience of the rest is secured*. Every one has seen an illustration of this, where a butcher has succeeded in housing a large number of sheep by simply dragging in one of them. So great is their dislike of solitude, that if an individual is thus kept, it pines and very soon dies.

574. *Why is the upper lip of the sheep divided?*

Because it is thereby enabled to bite the herbage at a point *nearer to the roots than it otherwise would*.

The sheep bites closer than the ox, and is enabled to follow the latter, and to procure a sufficient sustenance where the latter would starve. Two purposes are answered by this: all the nutriment that the land produces is gathered from it, and the pasture is made to produce more herbage than by any other means.*

575. *Why is there less difference between wild and cultivated sheep than between wild and tame cattle of the ox kind?*

* For very many interesting questions respecting the economy of sheep, cattle, etc., see "The Reason Why: Gardening and Farming."

"To his woundes worken, that with louely dart
Dinting his breast had bred his restlesse paine,
Like as the wounded *whale* to shore flies from the maine."—SPENSER.

Because sheep, however highly cultivated, seldom or ever become thoroughly tame, and are consequently less amenable to the laws which accompany domestication.

576. Sheep, however domesticated, never evince any attachment to their keepers. When food is presented to them they come to that, but do not heed the person who is in the habit of feeding them unless the food is shown. They require the care of a shepherd to conduct them, and lead the flock to where it may be wanted; for, although they keep together, the whole would wander off, and never return to the fold, unless conducted.

ORDER X.—CETACEA.

577. *Why is the order Cetacea so named?*

From the Greek word *ketos*, and latin *cete*, signifying a *whale*. The cetaceous animals include the genera *Monodon* (one tooth), of which the narwhal is an example; *Balaena*, or whalebone whale; *Physeter*, or spermaceti whale and *Delphinus*, or dolphins, which include the porpoise and grampus.

578. They have no gills, but are furnished with an aperture for respiration on the top of the head; and they have a flat or horizontal tail. Their habits are in general predacious, that is, they subsist by preying upon other animals. The whale tribe, however, has been broadly divided into *herbivorous* and *carnivorous* cetacea. The teeth of the herbivorous whales have a flat crown which determines their character. These accordingly often leave the water to creep and feed upon the land, and are without the distinguishing mark of the carnivorous cetacea, namely, the singular apparatus by which they cast up jets of water.

579. *Why has the order of Cetacea been separated from the classification of fishes?*

Because, although their outward shape bears considerable resemblance to the fish tribe, their anatomical conformation, joined with various other characteristics, proclaim them to be true aquatic *mammalia*.

580. True *fishes* breathe by means of *gills*, in which the blood is sufficiently acted on by the air that is contained in the water around them: on the other hand, the *cetacea* breathe by means of *lungs*, which

“And one of them I saw myselve sunke downright with the abundance of water that this monstrous fish *spouted*, and filled it withall.”—HOLLAND.

require to be filled with air from the atmosphere; so that these animals are obliged to come occasionally to the surface to breathe. Thus the function of respiration is conducted on a plan entirely different in these two groups.

Again, the heart of the fish has only *two cavities*, and the blood does not return to it after passing through the gills, but is immediately distributed to the body; whilst the heart of the whale has *four cavities*, and the blood returns to it after passing through the lungs. Hence, the plan of circulation also is entirely different in the two classes—being single in the one and double in the other.

Again, the blood of the fishes is *cold*, and that of the whale is *warm*; another character of great importance, in regard to the relative activity of the vital operations in general, in these two classes respectively.

Further, fishes are *oviparous*, propagating by eggs, from which the young come forth in due time, with little or no attention on the part of the parent; whilst whales are *vivaporous*, producing their young alive, and nourishing them afterwards by *suckling*, precisely as other mammalia.

581. *By what means is the whale enabled to eject water in the form of a spout?*

The apparatus by which this is accomplished, consists of two pouches or reservoirs, situated beneath the nostrils, and communicating with the back of the mouth by the usual nasal passage, which is furnished with a valve.

When the animal wishes to eject water contained in its mouth, it moves its tongue and jaws as if about to swallow the fluid; but by closing the pharynx, it compels the water to ascend through the nasal passage, the valve of which it forces open, and also distends the reservoirs. There it may be retained until the animal wishes to eject it; and this is effected by a *forcible compression of the pouches*, which compels the water to escape by the nostrils; its return to the mouth being prevented by the valve just mentioned.

582. *What provision have whales for the retention of their internal heat?*

The whale tribe have smooth and polished skins, which do not readily throw off the heat; underneath these, there is a large *deposition of oily fat*, which is very bad conductor of caloric.

"And as he pranced before, still seeking for a snake,
As who would say, 'There is none here, I trow, will me forsake';
I might perceive a wolf, as white as *whales-bone*."—SURREY.

583. *Why is the enormous size of its head no impediment to rapid locomotion?*

Because, being very light in proportion to the rest of the body, it serves rather to *buoy up the animal*, and to act in the nature of a balloon upon the vast mass with which it is connected.

584. In the spermaceti whale the great part of this bulk is made up of a large, thin membranous case, containing during life a thin oil, of much less specific gravity than water, below which, again, is the substance called the "junk," which, although heavier than the spermaceti, is still lighter than the element in which the whale moveth. Consequently, the head, taken as a whole, is lighter specifically than any other part of the body, and will always have a tendency to rise, at least so far above as to elevate the nostril, or "blow-hole," sufficiently for all purposes of respiration; and, more than this, a very slight effort on the part of the fish only would be necessary to raise the whole of the anterior flat surface of the nose out of the water. In case the animal should wish to increase its speed to the utmost, the narrow inferior surface of the head, which bears a strong resemblance to the cutwater of a ship, and answers the same purpose to the whale, would be the only part exposed to the pressure of the water in front. Thus, he would be able to pass with the greatest celerity and ease through the boundless tracks of his wide domain.

585. *What is whalebone?*

The substance known under this name, sometimes called *baleen*, is found in the monstrous mouth of the *Balaena mysticetus*, or whalebone whale, where it forms the substitute for teeth, of which otherwise the animal is destitute.

586. The whalebone depends vertically, or nearly so, from the palate like a portcullis; is rather elastic; and its lower points are received by the tongue and lower gums. Its function is to act like a *sieve* or *strainer*, or perhaps in the nature of a mill, reducing the food which flows into the open mouth of the whale to a state proper for digestion. It consists of an immense number of fibers slightly soldered together, and covered with an epidermis (cuticle or skin). The maxillary (jaw) and palatal (palate) bones of the whalebone whales form on their interior surface two inclined planes, which are concave, but resemble slightly the roof of a house inverted. It is to these bones that the blades or plates of whalebone are attached. They are widest at a point of the mouth which is nearer to the bottom of the gape than to the snout; and they diminish in size as they approach both extremities. They are attached to the bone by an elastic cartilaginous substance. The plates of the whalebone move upon these elastic hinges. When the mouth is shut, these blades lie one over the other like the folds of a fan, or the leaves in a flower-bud.

"Pampered with meats full, *spermacetic*, and fat."—DRAYTON.

Whalebone forms one of the objects of the Greenland whale fishery, but it is not the chief. The principal reward arising from the perilous employment of so many men and ships is to be found in the large quantities of oil which are obtained from the thick cutaneous layer of fat, or blubber, as it is usually termed. A whale sixty feet in length will frequently yield more than twenty tons of pure oil; and some of the pieces of baleen are twelve feet long. It is for these prizes that men willingly expose themselves to the rigor of an Arctic winter, the chance of falling victim to the united effects of cold and hunger, or shipwreck in its most horrid form, occasioned by the irresistible crush of icebergs; and should the hardy mariner escape from dangers such as these, the harpooner not unfrequently perishes from the upsetting of the boat, owing to the violent plunges which the wounded animal makes in the water, or the whirlpool produced by his rapidly rushing down into the deep.*

587. *What is spermaceti?*

It is a substance which concretes and crystallizes spontaneously out of the oil of the *spermaceti* whale. It forms a very pure oil for lamps, and is used in various ways in the arts and medicine.

588. In the right side of the nose and head of the cachalot or *spermaceti* whale, is a large, almost triangular-shaped cavity, called by whalers the "case," which is lined with a beautifully glistening membrane, and covered by a thick layer of muscular fibers and small tendons running in various directions, and, finally, by the common integuments. This cavity is for the purpose of secreting and containing the *spermaceti*. The size of the case may be estimated, when it is stated that in a large whale it not unfrequently contains upwards of a ton, or more than ten large barrels of oil.

The pursuit of the sperm whale is accompanied with great danger. "In calm weather, great difficulty is sometimes experienced in approaching the whale, on account of the quickness of his sight and hearing. Under these circumstances the fishers have recourse to paddles instead of oars, and by this means can quietly get near enough to make use of the harpoon. When first struck, the whale generally 'sounds,' or descends perpendicularly to an amazing depth, taking out, perhaps, the lines belonging to four boats, 800 fathoms! Afterwards, when weakened with loss of blood and fatigue, he becomes unable to sound, but passes rapidly along the surface, towing after him perhaps three or four boats. If he does not turn, the men in the boats draw in the line by which they are attached to the whale, and thus easily come up with him, even when going with great velocity, he is then lanced, and soon killed."

—“An Antony it was,
That grew the more by reaping: his delights
Were *dolphin*-like; they show'd his back above
The element they lived in.”—SPENSER.

589. *Why has the shape of the dolphin been frequently and fancifully misrepresented?*

From two probable causes. 1. The principle action of cetaceous animals is the vertical plane, or *upwards and downwards*, while that of the true fishes is in the *horizontal*. The dolphin is also a very sportive animal, sometimes leaping entirely out of the water.

2. The spouting of dolphins, in common with other cetacea, lent itself naturally to the artistic mind in the construction and adornment of *ornamental fountains*; and once in the hands of the sculptor, the true form of the animal was soon lost.

590. The eye of a casual observer is, however, apt to be deceived in witnessing these leaps, and the spectator imagines the back of a dolphin to be greatly curved, while it is almost straight. The cause of this deception is in the eye following the general curve in which the average mass of the body is carried during the leap; and, as the real shape is not very well seen while the animal is in motion, it is readily, and indeed necessarily, associated with this curve.*

591. *Why does the dolphin utter a sound somewhat resembling the human voice?*

Because it has lungs, and an air-tube leading to them. The dolphin cannot exist long in the water without coming frequently to the surface to exhale and inhale air; and it is in the performance of this act that the sound is occasioned.

592. No animal but man has the faculty of articulate speech; which consists of vowels pronounced by means of the larynx, and of consonants formed by the tongue and the lips. The dolphin having no lips, and with a tongue not readily moveable, cannot therefore articulate.

593. *Why is the porpoise said to “roll”?*

Because its mode of progression, in common with the other cetacea, when near the surface of the water, consists of a series of leaps, its body appearing and disappearing at intervals with a wheel, or barrel-like motion.

"With such accoutrements, with such a form,
Much like a *porpoise*, just before a storm."—CHURCHILL.

594. This is the mode of swimming in all the whale tribe; and it is easy to see, from the formation of the tail, the most powerful organ of motion they possess, this must be the case. Their action, like that of land mammalia, is vertical, as distinguished from the horizontal one of fishes. Their tails strike upward and downward, and those of fishes laterally. The resistance to the stroke upwards is less than the stroke downwards, because the pressure of the water increases with its depth: and thus, when cetaceous animals make great exertions in swimming, they always have a tendency to "roll."

595. *Why is the porpoise (or porcpesse) so named?*

The name, signifying *sea-hog*, was given to this animal from a fancied resemblance to the hog in the character of its head, and in its habits of rooting for food.

596. *Why is its appearance at sea in numerous packs thought by mariners to forewarn a storm?*

Because it has been frequently found that previous to rough weather, when few sea animals can procure food, an instinct has led porpoises to take advantage of the opportunity afforded by the calm, and so to provide for a period of deprivation.

597. *Why have whales, dolphins, etc., the flat surface of their tails placed horizontally, instead of vertically?*

This difference to the ordinary fishes is to favor the important function of respiration; for these inhabitants of the sea must rise to the surface to breathe the air, and their tails are thus directed to enable them to elevate their heads above water.

MISCELLANEOUS.

598. *Why is the omnivorous character of man beneficial to the lower terrestrial creation?*

Because, by his appetite for various kinds of flesh, he is incited to subdue and utilize every kind of animal sub-

"For forms are *variable*, and decay
By course of kinde, and by occasion."—SPENSER.

stance. This tends to prevent the *redundancy* of *species*; and equally prevents their *total extinction*, which, on account of the unlimited powers of destruction which man possesses, would sometimes occur, were his choice more restricted.

From a love of *vegetable food*, man is led to cultivate and render the productions of the soil abundant and wholesome; and, in like manner to the operation of his appetite upon animal productions, he is impelled, by his *love of variety*, to cultivate every kind of herb, shrub, and tree.

599. The instinct of hunting—if such a term may be applied to a being gifted with the superior faculty of reason—is universally diffused among men. We find the most untutored savage expert after his degree in the pursuits of the chase; and, under a *regime* of the most complete civilization, the gentleman is still a hunter. Fortunately for him, he follows the chase no longer from necessity, or to procure food, but simply to obtain from its mimic warfare a certain amount of relaxation and excitement. The cultivation of the soil is a gauge of civilization. Where agriculture and its kindred arts flourish, peace, health, and wealth are its attendants upon man, while the fiercer and more ferocious animals either cease to exist, or are kept within strong and impassable bounds.

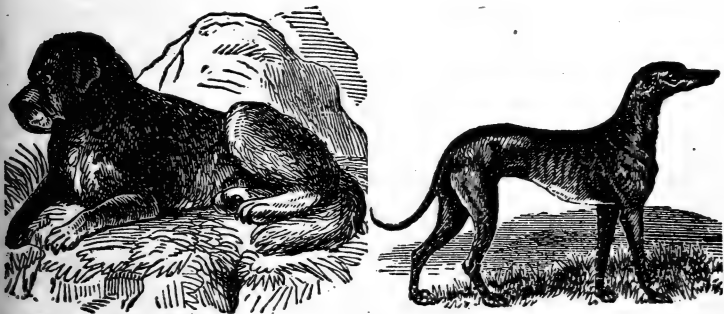
600. *By what means is man enabled to influence the forms and qualities of various animals which belong to them at their birth; and to create, as it were, new varieties at will?*

Because all the individuals of the same species do not possess, to the same degree, the physical and instinctive qualities with which the species are generally endowed; and by the exercise or the influence of physical conditions, man can develop a particular faculty, and consequently increase these differences.

He may, within certain limits, modify races at his pleasure; for he is able to choose, or even to produce, individual differences, which are transmissible from one to the other; and to regulate the succession of generations, so as to remove from them all that would tend to separate the race from the type which he wishes to produce; and he can thus influence the hereditary qualities of the young, as he had done those of their parents.

"As Jacob used an ingenious invention to make Laban's cattle speckled or ring-staked, so much the skill in making tulips feathered and *variegated*, with stripes of divers colors."—FULLER.

601. This is especially the case with our various domesticated animals; and there are none that show it more strongly than dogs. Not only do the different races of dogs vary in the color and quantity of their hair, but also in the proportions of the different parts of their bodies, and even in their instincts. How different, for example, are the greyhound and the mastiff,



the bloodhound and the spaniel. We could scarcely imagine that any period of time, or external influence, could ever convert one into the other. And yet they had *one common origin*; and it is found that their distinct forms are preserved only so long as they are matched in breeds.

Among the problems of high theoretical interest which the recent progress of geology and natural history has brought into notice, no one is more prominent, and, at the same time, more obscure, than that relating to the origin of species. On this difficult and mysterious subject Mr. Charles Darwin has bestowed long and anxious attention; and the result of some twenty years' observation and experiments in zoology, botany, and geology, has established in his mind the conclusion *that those powers of nature which give rise to races and permanent varieties in animals and plants, are the same as those which, in much longer periods, produce species, and in a still longer series of ages, give rise to differences of generic rank.**

602. *How is the distribution of animals over the surface of the globe accounted for?*

Several hypotheses have been set up to account for this distribution. But it may not be unreasonable to assume

* Professor Lyed.

“The heavenly bodies (as growne now lesse strong)
 Doe seeme more stalke (as weary of their race)
 All *climats* still new temperatures embrace,
 What strange effects must follow them ere long!”—STIRLING.

that at the beginning of the actual geological period, the various species were limited to narrow regions, and that by degrees they afterwards spread to a distance, so as to occupy a more or less considerable portion of the surface of the globe.

603. The circumstances which favor the dissemination of species are of two kinds. The first is connected with or dependent on the nature of the animal; the second, with causes foreign to it. In the number of the first, the development of the locomotive power holds an important place. All things being equal, the species which live fixed to the soil, or which possess but imperfect instruments for locomotion, occupy but a restricted portion of the surface of the globe, compared with the species whose movements of translation are rapid and energetic. Thus, birds have a most extended area, whilst reptiles, on the contrary, are generally confined to narrow limits.

604. *Why do differences of climate serve to arrest the march of animals from one region to another?*

Because there are throughout all nature, *mutual adaptations* of animate and inanimate existences—of organic and inorganic forms. This is seen in the growth of vegetables, as well as in the development of animals.

605. *Apes*, which crowd the tropical regions, almost always die of pulmonary consumption when they are exposed to the coldness and humidity of our climate; while the *rein-deer*, formed to support the rigors of a long and rude Lapland winter, suffers from heat at St. Petersburg, and in general sinks quickly under the influence of a temperate climate.

Man and the dog are the only species that can support the two extremes of Arctic cold and tropical heat.

The influence of temperature on the animal economy explains to us why certain species remain cantoned in a chain of mountains, without being able to spread abroad into analogous localities. We know that the temperature decreases by reason of the elevation of the soil; and that, in consequence, animals which live at considerable elevations could not descend into the low plains to reach other mountains without traversing countries where the temperature is much superior to that of their ordinary habitation.

606. *Why are the largest quadrupeds found in Africa and the largest reptiles in America?*

Africa abounds in dry deserts, and is the most luxurious as to its vegetable productions, which circumstances are

“What means the bull, unconscious of his *strength*, to play the coward, and flee before such a feeble thing as man?”—BLAIR.

favorable to the growth of such animals as elephants, rhinoceri, and hippopotami. The vast swamps which border the great American rivers naturally favor the development of the reptile order, and there abound the largest species and the greatest variety.

607. *What relation exists between the elevation of temperature in different zoological regions, and the organic perfection of the animals inhabiting them?*

In the hottest climates the animals are found most to approach man; and those which in each great zoological division possess the organization the most complex, and the faculties most developed; whilst in the polar regions we meet only with beings occupying a rank but little elevated in the zoological series. The *apes*, for example, are limited to the hottest parts of the two continents; the *crocodile* and *tortoise* amongst reptiles; and of *land-crabs* amongst the crustacea—all animals the most perfect in their respective classes.

608. *Why may we infer that animals are ignorant of the strength which they possess?*

Because if animals knew their strength, it would be impossible to harness the horse to a vehicle, or drive an ox to the slaughter. It is the fact of man being able to *acquire knowledge*, and animals being incapable, which gives the former that power over the latter by which their movements are made subservient to his will.

609. *Why are the fiercer preying animals generally solitary in their habits?*

Because their nature, but for this instinct, would lead them to exert their combativeness upon each other, and so *extinguish their own species*.

Because, also, their chief purpose in creation seems to have been to act as *checks upon the redundancy of other animals*, or as scavengers clearing away the offal left upon

"So dismal and amazing a *devastation*, as in all the circumstances of it, is scarcely to be paralleled in history."—TILLOTSON.

"That *trample* down the flowers and brush the dew."—DRYDEN.

the earth's surface. To this end their solitariness contributes by spreading their numbers over a wider surface, and with greater equality.

610. *Why are carnivorous animals, and the larger quadrupeds, less prolific than other species of the animal kingdom?*

If the number of carnivorous animals were excessive, their rapacity would *devastate the earth*, while the larger quadrupeds would *desolate the land* by trampling down vegetation, and by the enormous quantity they would consume.

611. It should also be observed that these two classes have no natural enemies to contend with; the sanguinary character of the one, and the bulk of the other, securing them from violence. Of herbivorous and other animals essential to man, either as food, or for his other purposes, the increase is surprising, and exactly proportioned to his necessities and to the means the earth affords for their subsistence; and this rule applies equally to the wild districts, where the savage tribes, in supporting their existence, check the exuberance of what would otherwise be an evil rather than a blessing.

612. *Why do animals usually seize their prey by the throat?*

Because their instinct guides them to select some *vital part*, or at all events some part where death can be caused in the most summary manner.

The *weasel tribe* divide the blood-vessels in the side of the neck, even of animals much larger than themselves, with as much accuracy and precision as if they had carefully studied the anatomical structure of their prey; and though the larger *cats* throw themselves on the backs of those animals which they are unable to beat to the ground by the force of their spring, they tear the muscles of those parts on which the power of escape of their prey depends, and thus bring it most easily to the ground, when they speedily dispatch it, by lacerating the vital parts.

"First take his head, then tell the reason why;
Stand not to find him guilty by your laws:
You easier shall with him your *quarrel* try,
Dead than alive, who hath the better cause."—DANIEL.

613. *Why do animals hunt amicably in company, and quarrel immediately the pursuit is over?*

Because the temporary association is generally occasioned by the pressing calls of hunger, and by an instinct which leads individuals to unite their strength for accomplishing an act of rapine or of bloodshed. While engaged in this pursuit, good fellowship continues; but when the booty is obtained, all community is dissolved, and they either quarrel over their prey, or at once disperse.

614. *Hyenas, wild dogs, wolves, jackals, and the hunting leopards, are all striking and familiar instances of such associations. So long as food can be supplied by individual exertion, each appears to provide for itself; but when food becomes scarce, or a herd of peaceful antelopes are passing on their migration, they instantaneously unite into bands, and commence a simultaneous attack upon their prey.*

615. *How do we find that the safety of the weakest animals is provided for as effectually as that of the strong?*

The power of defense given to animals is peculiarly adapted to meet those exigencies to which every species is more especially exposed. The powers of protection are of two kinds:—

The first are *offensive*: these consist in the exertion of force, by which assaults are made by weapons or instruments possessed by the animal itself, and requiring his active exertion in their use; and such powers may obviously be employed either in offensive or defensive warfare. The horns and the teeth of quadrupeds, the stings and jaws of insects, and the poisonous fangs of reptiles, are of this description.

The second class of defenses are strictly *passive*; they are as effectual in most cases as the first class, but they require no exertion of the animal to bring them into operation. We accordingly find that these protections are given to the weakest and most helpless animals.

616. The power which the *toad* has of inflating his body to prevent the possibility of his being swallowed by snakes;

"The name of *reason* she obtains by this:
But when by reason she the truth has found,
And standeth fixed, the Understanding is."—DAVIES.

The diffusion of an offensive smell by the *pole-cat*;

The emission of a black fluid by the *cuttle-fish*;

The spiny hides of the *hedge-hog* and the *porcupine*, and the stinging hairs which envelope many *caterpillars*, are a few out of the innumerable instances of the *passive defenses* spoken of.

But there is still another property which does not come under either of these definitions, namely, the *astonishing vitality* possessed by such beings as are most exposed to injuries, and by which life is not only supported without food for an amazing length of time, but dislocated portions grow and become new animals.

617. *Why have quadrupeds feet of small dimensions in comparison with their bodies?*

Because when an animal is supported on four feet, the extent of its base of sustentation, and therefore its stability, cannot be augmented in a sensible degree by extending the magnitude of the feet. In fact, to have done so would have increased their weight and diminished their speed and activity, without conferring upon them any counteracting advantage. The Creator, therefore, while he gave bipeds stability by making them walk on the soles of their feet, gave quadrupeds *lightness and swiftness* by causing them to walk on their toes.

618. *What is the difference between reason and instinct?*

Reason means the comparison of one thing with another; and in its more general sense, as applicable to the thoughts and conduct of man, it means the comparison of that which he purposes to do, with that experience in the past, either felt in himself or learned from others, and the result of which comparison is to be the guide of his actions.

Instinct, though possessed by man up to a certain point, is the proper badge and characteristic of the lower animals. Taken in its general sense, it means *the capacity which is within*; which borrows nothing from *comparison* and cannot profit by *experience*; but acts from the impulse of perfect objects on its organs of sense; also is indifferent to, and ignorant of, the past and the future.

"But honest *instinct* comes a volunteer,
 Sure never to o'ershoot, but just to hit;
 While still too wide or short is human wit."—POPE.

The laws which govern *reason* are moral laws; instinct is alone under *physical influence*. A moral law is given to man only because man alone has a moral nature, i. e., a nature distinct from his physical nature. The lower animals have only a physical law, which they strictly fulfill. Man is said to be the only ungrateful being which God has created, because, having received a moral nature, he frequently chooses to follow the law of physical nature only: ignoring, or openly disobeying, the law of his moral being.

619. Of *instinct* we can know nothing further than that it is a name which we give to those movements and actions of animals of which we can give no explanation. The word *instinct*, though we can hardly avoid using it, is never anything else than a subterfuge for our ignorance of the means by which any action of an animal is brought about; and we may rest assured that natural actions are no more performed without means in the unexplained cases, than in the explained ones.*

620. *Why will one species of animal allow the young of another species to suckle it?*

Because it has been most beautifully and providentially ordered that the process of suckling should afford pleasure to the parent. So that when a dam has been deprived of its own offspring, it derives some amount of gratification from the suckling of another.

61. Cats have been known to suckle hares; pigs to give nurture to puppies; and cows to goats. It has even been asserted that human beings, exposed to death in woods by unnatural parents, have been indebted to wild beasts for their nurture, an occurrence which is not a whit more marvelous than animals of one species allowing the offspring of a species totally opposed to it in habits and instinct to suckle them.

622. *Why does the attachment between young animals and their parents decline when the former arrive at maturity?*

Because, if the affections were allowed to operate for a longer period, the dispersion of animals, which is as essential as the scattering of the seeds of plants, would be materially checked.

* Partington's "Cyclopædia."

"O imitators, servyle beastes,
 How have your tumultes vyle
 Full oftens rasde my collar vp,
 And oftens made me smyle."—DRANT.

There are also *physiological reasons*, which relate to the health, increase, and purity of the species; and *economical reasons* comprehending the means of subsistence.

623. *Why is the faculty of imitation in animals sometimes subservient to their necessities?*

Doubtless, in the wilds of nature, many instances of imitation occur unobserved. An animal, unaccustomed to that habit, may, in great extremity, climb a tree in search of prey; or an herbivorous animal may dig into the earth to find roots. This may arise, either from imitation, or from a latent instinct called into operation only under the promptings of extreme hunger.

But there are evidences of animals in the domestic state frequently imitating some action they have witnessed, when extremity compels them to do so. Thus a *dog* will attempt to turn the handle of a door, and sometimes successfully, when he wishes to obtain egress; and a *cat*, seeing a person eating, will extend its paw, as a human being would his hand, for food.

624. The following is a remarkable account of a *dog* obtaining food by *ringing a bell*:—At a convent in France, twenty paupers were served with a dinner at a certain hour in the day. A dog belonging to the convent did not fail to be present at this meal to receive the odds and ends which were now and then thrown down to him. The guests, however, were poor and hungry, and of course not very wasteful; so that their pensioner did little more than scent the feast, of which he would fain have partaken. The portions were served by a person at the ringing of a bell, and delivered out by what in a religious house is called a *tour*, which is a machine like the section of a cask, that, by turning round upon a pivot, exhibits whatever is placed upon the converse side without discovering the person who moves it.

One day this dog, who had only received a few scraps, waited till the paupers were all gone, with the rope in his mouth, and rung the bell. This stratagem succeeded. He repeated it the next day, with the same good fortune. At length the cook, finding that twenty-one portions were delivered out instead of twenty, was determined to discover the trick, in doing which he had no great difficulty; for, lying hidden, noticing the paupers as they came in, in great regularity, for their different portions, and finding that there was no intruder except the dog, he began to suspect the real truth, which he was soon confirmed in when he saw the dog wait with great deliberation till the visitors were all gone, and then pull the bell. The matter was related to the community; and, to reward the dog for his ingenuity, he was permitted to

"What is his creation less
 Than a capacious reservoir of means
 Form'd for his use, and ready at his will."—COWPER.

ring every day for his dinner, when a mass of broken victuals was purposely served out to him.

To illustrate further the use of the imitative faculties under extremities, we have only to adduce the *simulation of death*, practised by so many species, with intent to weaken the instinctive vigilance of their foes or prey. The *fox* has been known to personate a defunct carcase, when surprised in a hen-house; and it has even suffered itself to be carried out by the brush, and thrown upon a dung-heap, whereupon it instantly rose and took to its heels, to the astounding dismay of its human dupe. In like manner, this animal has submitted to be carried for more than a mile, swung over the shoulder, with its head hanging; till, at length, it effected its release by suddenly biting. The same animal has been known, when hunted, to crouch exposed upon a rock of nearly its own color, in the midst of a river, and so to evade detection by its pursuers; and we perpetually hear such cases brought forward as decisive proofs of its extreme sagacity.

625. *How are the wisdom and goodness of Providence displayed in the relation which subsists between the external organs of an animal, by which it procures its food, and the internal organs by which the food is digested?*

This beautiful relation is observable in several species of the animal creation. *Birds of prey*, by their talons and beaks, are qualified to seize and devour many species, both of birds and quadrupeds. The construction of the stomach agrees exactly with the form of the members. The gastric juice of a bird of prey, an owl, a falcon, or a kite, act upon the animal fiber alone; it will not act upon seeds or grasses.

On the other hand, the conformation of the mouth of the *sheep* or the *ox* is suited for browsing upon herbage. Nothing about these animals is fitted for the pursuit of living prey. Accordingly it has been found by experiments, tried with perforated balls, that the gastric juice of ruminating animals speedily dissolves vegetables, but makes no impression upon animal substances.

626. *How does the structure of the jaw and teeth of various animals indicate the kinds of food upon which they subsist?*

The form of teeth may easily be understood to indicate

“For, ere the beech and elm have cast their leaf
 Deciduous, when now November dark
 Checks vegetation in the *torpid* plant,
 Expos'd to his cold breath, the task begins.”—COWPER.

whether they are designed for *cutting* or *grinding*. The relation of the jaw, and the muscular forces by which it is moved, requires a closer examination.

In *herbivorous animals*, which have to grind down their food by constant trituration, the jaw is fixed to the skull, so as to allow the former to have a rotatory movement; but such a movement would be useless to *carnivorous animals*, where the grinding operation is not required.

In *carnivorous animals* the jaw is locked in the cavity of the skull by ligaments, in the same manner as the parts of a hinge are fixed together. The cavity is deep and elongated, and the articulating surface of the jaw-bone corresponds, so that the joint can have only a hinge-like motion.

627. This is remarkably conspicuous in the condyles of the lower jaw of the *sea-otter*. The jaw of the *sea-wolf* is composed of several pieces, instead of being one entire bone; and these pieces are connected by ligaments, so that a greater freedom of motion is allowed, and the concussion to the brain arising from the reduction of crabs, muscles, and other shell-fish upon which the animal feeds, is diminished, the jar being broken by being divided over a number of bones.

628. *Why do some animals undergo a state of torpor during the winter?*

Because during the winter they cannot produce more heat than is sufficient to raise their temperature from 20 deg. to 26 deg. above the surrounding atmosphere. It follows, therefore, that while in the hottest part of summer their temperature is nearly the same as that of other warm-blooded animals, it falls to a much lower point in the cold season; and whenever the depression of temperature attains a certain limit, the circulation and respiration decrease in frequency and energy, so that the animal falls into a state of torpor, or lethargic sleep, which continues until the temperature of the atmosphere is sufficiently elevated to re-establish the activity of the vital functions.

"The *migration* of birds from a hotter to a colder country, or a colder to a hotter, according to the seasons of the year, as their nature is, I know not how to give an account of it, it is so strange and admirable."—RAY.

629. *Why are certain species of animals destined to perform their functions only periodically?*

Because it has been allotted to them to *check superfluities and remove nuisances.*

When vegetation develops its vast powers of reproduction, there issue forth from their winter retreats innumerable creatures that live variously upon the roots, leaves, or seeds.

When the vitality of vegetation diminishes, the natural office of these creatures ends; and they return again to their torpid condition.

During the season when animal existence is vigorous, and the destinies of nature are being fulfilled, the great harvest of death strews millions of bodies upon the face of nature. Then the *scavengers* are busy day and night; and either devour upon the surface, or bury in the earth, those substances which would otherwise diffuse pestilential influences.

630. *Why do some portions of the animal creation migrate?*

For two reasons: first, the welfare of the migrating animal is promoted by finding *milder regions*, and a continual *supply of food*; second, the *blessings of creation are thus diffused*, by seasonable visitations of creatures useful to man, to those localities where he stands in need of them.

631. Had the Creator so willed, all these animals might have been organized so as not to require a warmer or colder climate for the breeding or rearing of their young; but His will was, that some of His best gifts should thus oscillate, as it were, between two points, that the benefit they conferred might be more widely distributed, and not become the sole property of the inhabitants of one climate. Thus the all-wise and beneficent Being has so organized certain classes of animals, and circumstanced them, as to be directed annually, by some pressing want, to seek distant climates, and, after a certain period, to return to their former quarters; and that this instinct should be productive of so much good to mankind, and, at the same time, be necessary, under its present circumstances, for the preservation or propagation of the species of these several animals.*

* Partington's "Cyclopædia."

"The *wisdom* of the Deity, as testified in the works of creation, surpasses all idea we have of wisdom, drawn from the highest intellectual operations of the highest class of intelligent beings with whom we are acquainted."—PALEY.

632. *How is the wisdom of Providence shown in so constituting the lower animals that they can exist for a long time on a limited supply of air and moisture?*

Because animals thus circumstanced would otherwise find it impossible to exist during the long intervals that many of them are periodically or occasionally enclosed in inaccessible places; so that when confined in solid rocks, or sealed up in the hearts of trees, so long as the smallest quantity of air or moisture is supplied them, they live for an indefinite period of time.

633. One of the most remarkable accounts of the long duration of the vital principle in animals is mentioned by Dr. Silliman, who, on the authority of Professor Eaton, of New York, states that the diluvial deposit through which the Erie canal was made, contains ridges of hard compact gravel, and that on cutting through one of these near Rome village, sixteen miles west of Utica, the workmen found several hundreds of *live* molluscous animals. The workmen fried and ate them. He adds: "I was assured they were taken alive forty-two feet deep in the deposit. Several of the shells are now before me. The deposit is diluvial. These animals must have been there from the time of the deluge; for the earth in which they were is too compact for them to have been produced by a succession of generations. These fresh-water clams of three thousand years old precisely resemble the species which now inhabit the fresh water of that district; therefore the lives of these animals have been greatly prolonged by their exclusion from light and air for more than three thousand years." A *toad* was buried in a flower-pot for twenty years, and when taken out was found to be healthy and increased in size. That *snails* can exist for a long period by means of the exclusion of air and the retention of moisture, which they are enabled to accomplish by a sort of door at the aperture of the shell, has been proved by Mr. Simon, who mentions the circumstance of having had one in his cabinet for fifteen years; and, for aught he knew, it might have been in his father's possession many years before, as it was in his collection of fossils. Speaking of this snail, he says it had come out four several times, in the presence of different people, each of whom assured him that they saw it. A day or two after this, he brought the identical shell, as he declared, into the presence of several other persons; that they might try if the snail would again make its appearance. After the shell had lain ten minutes in a glass of warm water, the snail began to appear, and in five minutes more they perceived half the body fairly pushed out from the cavity of the shell. It afterwards crawled about, erected its horns, and seemed in perfect health.

"If chance at length he find a greensward smooth,
And faithful to the foot his spirits rise,
He cherups brisk his ear-erecting steed,
And winds his way with pleasure and with ease."—COWPER.

634. *Why are the ears of some animals turned forwards, and those of others backwards?*

The external ears of beasts of prey, as lions, tigers, and wolves, have their trumpet part or concavity standing forward, *to seize the sounds which are before them*—namely, the sounds of the animals which they pursue or watch. The ears of animals of flight are turned backward, *to give notice of the approach of an enemy* from behind, that he may not steal upon them unawares. (See 392.)

635. *Why, in animals of great speed, is the shoulder connected to the trunk by the agency of muscles, and not by a collar-bone?*

Because, if animals possessing great speed had been formed with a collar-bone, it could not have withstood the shock from the descent of the whole weight of the animal when thrown forwards; and even though the structure of the fore legs had been as powerful as the posterior extremities, they would have suffered fracture or dislocation. This beautiful provision not only serves to diminish the shock of descending, but contributes to the elasticity of the anterior extremities.

636. *Why are the knee-joints of the hind legs of most swimming animals turned round, as in a person who is knock-kneed?*

Because by this mode of articulation the hind legs form a kind of swimming sail; and, in consequence of this they act more horizontally, and thereby impel the animal forward in the water with more velocity and with less exertion.

637. *Animals which are constructed principally for walking on the land and make the chief exertion with the fore feet when they swim; and, therefore, they are sooner fatigued than when they move even faster upon land; but quadruped animals having a regular swimming habit, impel themselves chiefly by means of the hind feet, and on this account they are no more fatigued in water than they are on land. The reason*

—“Whose *snout* hath rooted up
The fruitful vineyard of the commonwealth.”
BEAUMONT AND FLETCHER.

of this will be readily understood by those who are aware how much more easily a boat is pulled by oars nearly on a level with the water than when the oars have to dip deeply into the water, and are used near the bows.

638. *Why have certain species of animals sharp-pointed snouts?*



To enable them to seek their nourishment from the ground. Thus the tapir species, nearly allied to the hog, have their noses much prolonged in front of the mouth, constituting a little trunk, capable of lengthening and shortening itself. The shrews and small insectivorous animals, nearly allied to the shrew, but formed to swim

with ease, and to live at the bottom of burrows hollowed in the banks of rivers, also exhibit a similar conformation. (See 466.)

639. *Why is the fur of some animals changed in the winter from a dark to a white color?*

Because, although the darker colors absorb heat to a greater degree than the lighter ones, so that dark-colored clothing is much warmer than light-colored, where the wearer is exposed to the sun's rays, the radiation of heat is also much greater from dark than from light-colored surfaces, and consequently the animal heat *from within* is more completely retained by a white than by a dark covering. The temperature of an animal, therefore, having white fur, would continue more equable than that of one clothed in darker colors, although the latter would experience a greater degree of warmth when exposed to the sun's rays. Another reason may be that the mottled

"Nor with less waste the *whisker'd* vermin race,
A countless clan, destroy the lowland cane."—GRAINGER.

browns, which form the principal colors of the animals alluded to, although well adapted for their concealment amongst the brown heaths and fern of the summer and autumn, would be too conspicuous by contrast for the safety of the animals amongst the winter snow.

640. *Why are certain quadrupeds—such as the argali (mountain sheep of Armenia), the hare, and the sable, furnished with a mixed coating of hair and wool?*

Because, while wool preserves the animal heat in winter, an outer covering of hair is required to *throw off moisture*; and without the latter these animals would suffer both from wet, and from the underwood through which they have to force their path.

641. *Why is there so much bleating and confusion among sheep after the ewes and lambs have been shorn?*

After this operation, neither the dams nor the young are able to *distinguish one another* as before. The embarrassment arises not alone from the loss of the fleece, which may occasion an alteration in their appearance, but from a *defect in the odor*, by which animals discriminate each individual personally. The confusion is also the greater on account of the strong scent of the tar or other substance wherewith they are newly marked.

642. *Why are some species of animals furnished with bristly hairs, called whiskers?*

Because the skin of the upper lip, from which these hairs grow, is so very sensitive as to feel the slightest bending or touch of any one of those hairs; and by this means they act as very important instruments in *keeping the animal free from contact* with obstacles, while it is advancing with its eye fixed intently on its prey.

643. *Why is the situation of the nose eminently adapted to its uses in all animals?*

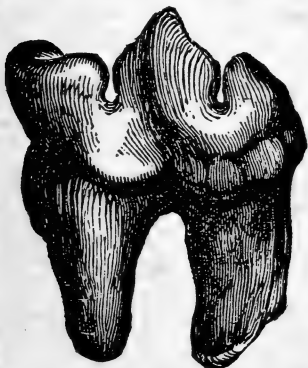
Being turned *downwards* in all animals to which smell is important, it receives the ascending effluvia. Being situ-

"From forests, fields, from rivers, and from ponds,
All that have webs, or cloven-footed ones,
To the grand Ark together friendly came,
Whose several *species* were too long to name."—DRAYTON.

ated *near the mouth*, it is ever active and watchful in determining the proper qualities of food; and, being *located near the eyes*, it is instantly directed to objects which they examine, and assists them in discriminating the qualities of objects.

644. *How may the species of animals be determined by an inspection of the detached organs?*

It is from the *correspondence* between *single characters and general plans* of structures, that the nature of the whole animal is determined, from a single fragment of its skeleton, or from one of its teeth. In no animal is the body made up of a number of disconnected parts, united, as it were, at hazard; for all its organs have a more or less intimate connection with each other, so that there is a kind of harmony amongst them all, and between every part and the entire structure.



645. Thus, the simple inspection of the tooth represented in the accompanying figure, suffices to disclose to the scientific naturalist the following facts regarding the animal to which it belonged. In the first place, there must have been a *bony framework*, in which this tooth was planted, and which gave support to the rest of the body; and as this internal framework does not exist in any other animals than those of the *vertebrated* series, we know that the animal in question had the brain and spinal cord, the complete set of organs of the senses, the red blood, etc., etc., which belong to the sub-kingdom only.

Further, there are certain characters about the roots of this tooth which enable the anatomist to feel certain that it must have been implanted in a *deep socket*, which is only the case in *mammals* and *reptiles*; and he may further determine from them, that the animal belonged to the former, and that it must have, therefore, possessed the organization which is peculiar to it.

Again, by the form of the *crown of the tooth*, it is easily shown that it was destined to divide animal flesh; and that it consequently

"He hath so well beset his ordinance,
That *species* of things and progressions
Shullen endure by successions,
And not eterne, withouten any lie."—CHAUCER.

belonged to a *carnivorous quadruped*. To digest the flesh, the animal must have had a stomach and intestinal canal formed upon a certain plan; and, in order to obtain its prey, it must have had appropriate organs of locomotion and prehension. Its extremities must have terminated in separate toes, and these must have been *armed with claws*. The limbs must have been furnished with very powerful muscles to enable the animal to give chase to its prey, or to spring upon it unawares, and afterwards drag it to its den. The *head*, also, must have been connected with the spinal column by ligaments and muscles of great power, attached to elevated portions of the vertebræ, in order that it might have the power of lifting the heavy bodies which the animal desired to remove. The *lower jaw* must have been connected with the upper by a hinge, admitting but a scraper-like action, by which the edges of the cutting teeth were constantly kept sharp; and the muzzle must not have been very protruberant, otherwise the strength of the muscles which raise the jaw would be applied at a great disadvantage. The cranial cavity must have been comparatively large, in order that the size of the brain might correspond with the degree of vitality which the habits of the animal required. By inferences of this kind, and under the guidance of our knowledge of the forms at present existing, all the leading peculiarities of an animal may be deduced from any characteristic portion of it; for if any part essential to the action of the remainder had been deficient, the animal could not have maintained its existence.

646. We have heard an anecdote related of Cuvier, the great naturalist. Some hair-brained students had determined to play a trick upon him, and to try the strength of his nerves. Accordingly one of them was disguised in a cow's skin, and concealed under a table in the dissecting-room. At a moment when the Baron was engaged in closely examining some portion of anatomical structure, a loud roar came from beneath the table. The Baron turned round and inquired, "Who's there?" A voice replied, "I am the devil, and mean to devour you!" The Baron looked down, and seeing a *cloven hoof* projecting, calmly proceeded to classify the animal: "Ah! divided hoof, herbivorous teeth, ruminating stomach; Class I., Order II., Sub-genus III., Species, *Bos taurus*—you can't eat flesh!" and he kicked the discomfited trickster from his hiding-place!

"For when I see how they do mount on hie,
Waving their outstretched wings with libertie,
Then do I think, how *bird-like* in a cage
My life I leade, and grief can never swage."

—MIRROR FOR MAGISTRATES.

CLASS II.—AVES.

ORDER I.—ACCIPETRES:

647. *Why is the first order of birds called accipetres?*

From the Latin *ad* and *capio* to seize. The name has been applied to this order to denote the *rapacious* character of its members. From the same root we derive *accipitrine*, as the *accipitrine* order of birds, or the *rapacious* order. The name implies *takers by force*.

The accipetres have a hooked bill, the upper mandible near the base being extended on each side beyond the inferior. The genera include the *vulture*, the *falcon* or *hawk*, and the *strix* or *owl*, etc.

648. *Why do birds of prey build their nests upon lofty and barren-rocks?*

Their predatory nature seems to impel them to a species of isolation; they are the banditti of creation; and, like them, they affect the wildest retreats from which to issue, and hunt down their prey.

An elevated situation gives them a *better view of their quarry*; and the barrenness of the soil protects their eggs from the reptiles which would make them their prey.

Cliffs overhanging the sea, deep lakes or rivers, afford to them facilities for *taking fish*, of which the *falcon* tribe in particular are very fond.

649. *Why are the legs and thighs of birds of prey shorter and more robust than those of other species?*

It is by means of these chiefly that they *strike and hold their prey*; the shortness and muscular development of the lower extremities giving greater power to their possessor in the use of the other members.

—“Their proud eyes do not see
The radiance of my helmet there, whose beames had instantly
Thruste backe, and all these ditches filled with *carrion* of their flesh,
If Agamemmon had been kinder.”—CHAPMAN.

650. Those who remember the exhibition a few years since, of a certain dwarf called Hervio Nano—(Harvey Leach)—will have seen, a remarkable illustration of this fact. That strangely formed individual, whose legs were not more than eighteen or twenty inches long, but whose arms, head, and chest, were finely developed, contrived with the greatest ease to scramble—somewhat like a lame fly—along the front of a proscenium and across the ceiling of a theater, by grasping the inequalities of the moulding only. “The Black Dwarf” of Sir Walter Scott was a being thus formed, and was, by the great novelist, admitted to be a mere transcript from the life.

651. *Why are birds of prey generally destitute of the power of song?*

The gift of song would be of no advantage to the accipetres; they generally live in solitary grandeur, or lie concealed under circumstances where *musical notes would prove a detriment*, as serving to warn off their victims.

652. There would appear to be some connection in this respect between the *ruminating animals* and the *song birds*, as distinguished from the *carnivorous mammalia* and *birds of prey*. The voice, if any, of ruminants is gentle, and not unpleasing, like that of song-birds; while that of the predacious tribes of both classes is either disagreeable or terrifying. There is something unamiable, at the very least, about a bird of prey which ill assorts with our ideas of music, and the warblings of the fields and groves. If the gift of melody had been at our disposal we should certainly have decided to withhold it from that species of being, whose career, however necessary in the scale of creation, is one of terror and rapacity. A song from the vulture—whatever might be the extent of its vocal powers—would be the last thing asked for.*

653. *Why are some birds of prey destined to eat carrion only?*

Because in doing this they act as *scavengers* to the countries which they inhabit; clearing the earth of that carrion which, if suffered to remain, might cause infectious diseases among the people of the country.

654. An instance of the manner in which the carrion eaters perform the operation of devouring dead carcases, in obedience to their instincts, is afforded in the following description given by the Naturalist Wilson:—“A horse had dropped down in the street in convulsions, and dying, it was dragged out to Hampstead, near Charleston, and skinned

—“On his bosom sat
Two vultures, digging through his carle of fat
Into his liver, with their crooked beaks.”—CHAPMAN.

The ground for a hundred yards around it was black with *carrion crows*; many sat on the tops of sheds, fences, and houses within sight; sixty or eighty on the opposite side of a small run. I counted at one time two hundred and thirty-seven, but I believe there were more, besides several in the air over my head, and at a distance. I ventured cautiously within thirty yards of the carcase, where three or four dogs and twenty or thirty vultures were busy tearing and devouring. Seeing them take no notice I ventured nearer, till I was within ten yards, and sat down on the bank. Still they paid little attention to me. The dogs, being sometimes accidentally flapped with the wings of the vultures, would growl and snap at them, which would occasion them to spring up for a moment, but they immediately gathered in again. I remarked the vultures frequently attack each other, fighting with their claws or heels, striking like a cock, with open wings, and fixing their claws at each others heads. The females, and I believe the males likewise, made a hissing sound, with open mouth, exactly resembling that produced by thrusting a red-hot poker into water, and frequently, a snuffing like a dog clearing his nostrils, as I suppose they were theirs. On observing that they did not heed me I stole so close that my feet were within one yard of the horse's legs, and again sat down. They all slid aloof a few feet; but, seeing me quiet, they soon returned as before. As they were often disturbed by the dogs, I ordered the latter home; my voice gave no alarm to the vultures. As soon as the dogs departed, the vultures crowded in such numbers, that I counted at one time thirty-seven on and around the carcase, with several within, so that scarcely an inch of it was visible. Sometimes one would come out with a large piece of the entrails, which in a moment was surrounded by several others, who tore it in fragments, and it soon disappeared. They kept up the hissing occasionally. Some of them, having their whole legs and heads covered with blood, presented a most savage aspect. Still, as the dogs advanced, I would order them away, which seemed to gratify the vultures; and one would pursue another to within a foot or two of the spot where I was sitting. Sometimes I observed them stretching their necks along the ground, as if to press the food downwards.”

655. *Why is the vulture a cowardly bird, while the eagle is full of courage?*

Because, while a character of fearlessness and daring are proper and necessary for the *eagle*, whose instinct leads him to attack *live*, and often *large animals*, it is in no way required in the case of the *vulture*, contented as he is to feed upon *carrion*, and seldom attacks his prey, until weakness or death has rendered it unresisting.

656. There is a variety of the vulture tribe to which these remarks do not strictly apply. The bearded vulture (*Gypsetus barbatus*) partakes somewhat of the nature and character of the eagle. Its appearance is less

"Ye dregs of baseness, *vultures* amongst men,
That tyre upon the hearts of generous spirits."

—BEAUMONT AND FLETCHER.

unpleasing than that of the other vultures. It is nicer in its food—only eating offal when it can procure nothing better. It is rather courageous; but is less widely distributed than the common vulture—the scavengers of creation. The bearded vulture is limited to a few countries.

657. *Why are the head and neck of vultures denuded of feathers?*



Because, by this provision these parts are prevented from being rendered foul by the carrion with which they come in contact when the vulture is glutting itself with food. Instinct also guides the vulture to frequently cleanse its plumage.

658. *Why does the vulture, whose food is only met with upon the ground, soar to such a height as to be lost to view?*

The prey of this bird being offal, or carrion, it is of necessity sparsely and widely scattered. The high flight of the vulture, joined with its wondrous powers of scent and vision, enable it to take in a very wide extent of country, and the more readily to obtain the object of its search.

659. It rises higher and higher till its enormous bulk is lost to human view, but though beyond the sphere of man's vision the telescopic eye of the bird is at work. The moment any animal sinks to earth, in death, the distant vulture detects it. When the hunter brings down some large quadruped beyond his powers to remove, and leaves it to obtain assistance, on his return, however speedy, he finds it surrounded with a band of vultures, where not one was to be seen a quarter of an hour before.

660. *Why is the sarcoramphus, or king vulture, so called?*

From the circumstance frequently observed by naturalists, that all other species of vultures defer to it, giving it

"Truth, which itself is light, does darkness shun,
And the true *eaglet* safely dares the sun."—DRYDEN.

the preference; and, in the case where a number of them have alighted upon a carcass, standing quietly by until "his majesty" has gorged himself.

661. This is particularly related by Mr. Edwards in his "Voyage up the Amazon." That traveler accounts for the fact by stating that the king vulture is greatly superior to every other species, both in *strength and courage*. It has a less repulsive appearance, and when caught has been tamed and domesticated.

662. *Why is the eagle denominated the king of birds?*

Because it not only possesses great *size, strength, and courage*, but is in the habit of soaring to a great height in the sky; and of frequenting localities which have a great deal of wild grandeur and sublimity about them.

663. *Why have flying eagles little power of attacking prey that lie immediately under them?*

Because the eagle cannot drop perpendicularly upon its prey, but always does so in an *oblique curve*, by means of which it both delivers its whole impetus upon the prey, and prevents unpleasant collision with the ground.

664. The following description of the white-headed eagle is given by Audubon, the celebrated naturalist:—"The eagle is seen perched, in an erect attitude, on the highest summit of the tallest tree, by the margin of the broad stream; his glistening but stern eye looks over the vast expanse. He listens attentively to every sound that comes to his quick ear from afar, glancing now and then on the earth beneath, lest even the light tread of the fawn should pass unheard; his mate is perched on the opposite side, and should all be tranquil and silent, warns him by a cry to continue patient. At this well-known call the male partly opens his broad wings, inclines his body a little downwards, and answers to her voice in tones not unlike the laugh of a maniac. The next moment he resumes his erect attitude, and again all around is silent. Ducks of many species, the teal, the widgeon, the mallard, and others, are seen passing with great rapidity, and following the course of the current; but the eagle heeds them not; they are at that time beneath his notice. The next moment, however, the wild, trumpet-like sound of a yet distant, but approaching swan is heard. A shriek from the female eagle comes across the stream, for she is as fully alert as her mate. The latter suddenly shakes the whole of his body, and with a few touches of his bill, aided by the action of his cuticular muscles, arranges his plumage in an instant. The snow-white bird is now in sight, her long neck is stretched forward; her eye is on the watch, vigilant as that of her enemy; her large wings seem with difficulty to support the weight of her body, although they flap incessantly. So irksome do her exertions seem, that her very legs are spread beneath her tail to aid her in her flight. She approaches, however. The eagle has marked her for his prey. As the swan is passing the dreaded pair, the male bird starts from his perch,

—“We think the *eagle-winged* pride
Of sky-aspiring and ambitious thoughts,
With rival-hating envy, set you on
To wake our peace.”—SHAKSPERE.

in full preparation for the chase, with an awful scream, that to the swan's ear brings more terror than the report of a large duck-gun.

“Now is the moment to witness the display of the eagle's powers. He glides through the air like a falling star, and, like a flash of lightning, comes upon the timorous quarry, which now, in agony and despair, seeks, by various manœuvres, to elude the grasp of his cruel talons. It mounts, doubles, and would willingly plunge into the stream, were it not prevented by the eagle, which, long possessed of the knowledge that by such a stratagem the swan might escape him, forces it to remain in the air by striking it with his talons from beneath. The hope of escape is soon given up by the swan. It has already become much weakened, and its strength fails at the sight of the courage and swiftness of its antagonist. Its last gasp is about to escape, when the ferocious eagle strikes with his talons the underside of its wing, and with irresistible power forces the bird to fall in a slanting direction upon the nearest shore.

“It is then that the cruel spirit of this dreaded enemy of the feathered race may be seen; whilst exulting over his prey, he for the first time breathes with ease. He presses down his powerful feet, and drives his sharp claws deeper than ever into the heart of the dying swan. He shrieks with delight as he feels the last convulsions of his prey, which has now sunk under his unceasing efforts to render death as painfully felt as it can possibly be. The female has watched every movement of her mate; and if she did not assist him in capturing the swan, it was not from want of will, but merely that she felt full assurance that the power and courage of her lord were quite sufficient for the deed. She now sails to the spot where he eagerly waits her, and, when she has arrived, they together turn the breast of the luckless swan upwards, and fill themselves with gore.”

665. *Why are an eagle and a fish sometimes found dead, and tightly fastened together on the sea-shore?*

Because the bird on these occasions has struck its talons with such force into its prey that it *cannot extricate them*; and the weight of the fish proving too heavy, the eagle is dragged down under the waves of the sea, and thus drowned.

666. *Why are the eyes of eagles furnished with nictating membranes?*

Because *sight* is the chief sense upon which eagles depend for their supply of food; and in order to retain this organ as perfect as possible, nature has accommodated it with this provision, which not only tends to *keep the eyes clean*, but also *shields them from strong light* when in sunny altitudes, and renders them more sensitive of that reflected from below.

"Eye-taught how thou dost me deliver
My endless aid and comfort-giver."—SIR P. SIDNEY.

667. The *nictating membrane*, which has already been repeatedly mentioned, is a most curious apparatus, with which animals of very opposite natures are endowed, but all of which have their eyes liable to certain conditions that render the protection afforded by this curious organ absolutely essential. The organ consists of a thin semi-transparent membrane, which, when at rest, lies in the inner corner of the eye, folded up like a drawn curtain. By the combined action of two muscles, it is capable of being drawn out, so as to cover the whole front of the eye-ball, like a curtain and its own elasticity restores it to the corner in which it previously rested. The action of this beautiful membrane is very instantaneous. Wherever there are zoological gardens, it may be observed with great effect in the eye of the Great South American eagle.

This membrane is also found in the eyes of most *quadrupeds*, *birds*, and *fishes*, but its development and use are beautifully proportioned to the necessities of each animal. It is largely developed, as already stated, in those *birds of prey* which seek sunny altitudes, and are said to "gaze at the sun." When thus apparently gazing upward from their rocky heights, the membrane is probably drawn, to modify the force of the intense rays.

It is found, also, in the *camel* and the *ostrich*, because those animals, being frequenters of the sandy deserts, are liable to have their eyes injured by clouds of sand.

Many animals that obtain their food by pushing their heads among branches of trees, bushes, rushes, and grass, are also provided with it.

It is also found in *fishes*, which, having no eye-lids, because moisture is abundantly supplied to their eyes by the element in which they live, yet need an occasional protection from sea-clouds of sand, and drifting marine vegetation; and also from excess of light, when they approach the surface, quitting the depths where the light is greatly modified.

Man has no such membrane, because he has no occasion to thrust his head into places which *endanger his eye*; and when, in pursuit of sport, he enters the woods and jungles, he is able, by the momentary application of his *hands*, to guard his eyes from injury.

668. Why do eagles drive away their young?

Because, as these birds subsist by prey, they would soon produce a famine among their race did many of them dwell in the same district. Therefore, the old birds drive *away their young* at a certain age from their boundaries.

669. Why are the wings of eagles broad, and hollow in their under surfaces?

Because the eagle, when in search of its prey, floats in the air until its keen eye discovers that of which it is in quest; by this peculiarity of structure, therefore, the wings can take a *more powerful hold on the air*, and the whole body is enabled to float with little labor.

"With *wingy* speed outstrip the eastern wind,
And leave the breezes of the morn behind."—ADDISON.

670. *Why are the wings of the eagle, though powerful, shorter than those of the falcon, both being birds of prey?*

Because falcons catch their prey while on the wing, and therefore have the faculty of rapid and uninterrupted flight; but the eagle strikes its victim to the ground, or the waters, and afterwards rises with it, thus requiring strength in a greater degree than rapidity.

671. *Why, in the eye of the falcon, crane, and other birds of piercing sight, has the flattened optic nerve one of its branches folded into numerous plaits?*

By this arrangement, the extent of surface is considerably augmented, and the powers of vision proportionally increased.

672. *Why are the eyes of birds and animals who seek their prey by night, or in the dark, larger than those of other animals?*

Because the large eye of the nocturnal animal admitting more light, and taking in a wider field of view than a small one, enables the animal to find the object of its search more readily.

673. Animals that depend chiefly upon the eye, and especially if they be feeders in the night, or in places to which little light can come, invariably have the eyes very large. This is the case with *owls*, and other nocturnal birds. The same law is observed even in connection with the inhabitants of the sea. The *surface fishes* usually have the eyes small; and they get gradually larger, till, when we come to those which inhabit the depths, and yet are active, feeding upon other fishes, their eyes are very large—of which we have an example in the *star-gazers*.

674. *Why are the eyes of nocturnal birds placed nearer to each other than the eyes of birds which fly by day?*

Because, with nocturnal birds, the design is that they should have the light concentrated in front of them, in order that they may avoid flying against obstacles, which, under a different arrangement, they would inevitably do in the darkness of the night.

But in birds that fly by day, their range being of greater extent, it is intended to render their vision effective over

"It was the owl that shriek'd, the fatal bellman, which gives the stern'st good night."—SHAKSPERE.

as great an area as possible, that they may command the expanse around them.

675. *Why has the eye of the owl and other nocturnal birds a shining substance deposited at the bottom of the eyeball?*

Because this substance, by reflecting the rays of light, endows the eye with power to distinguish objects in the dark.

676. *Why are owls enabled to turn their heads round in almost a complete circle without moving their bodies?*

The owl has been gifted with this capability in order to compensate for the absence of motion in the eye, the globe of which is immoveably fixed in its socket by a strong elastic hard cartilaginous case, in form of a truncated cone.

677. *Why is the head of the owl so disproportionately large?*

This is partly due to the looseness of the plumage by which it is covered and is further caused by the existence, between the inner and outer tables (or bony layers) of the skull, of a number of large cells, which communicate with the organ of hearing, and render that sense more acute.

678. We find in owls an external ear, or *conch*, which exists in no other birds; this is concealed by the feathers, which are arranged in a sort of hollow cone around it, and, in some species, it is covered with a sort of lid, which the bird has the power of opening or closing at pleasure.

679. *Why do owls possess feeble powers of flight?*

Because they are not intended to obtain their prey by swiftness of pursuit, but by the stealthiness of their approach; and the remarkable powers of other functions are therefore counterbalanced by the comparative incapacity of this particular one.

680. From the nature of their food, which is chiefly the different species of mice and other small and destructive quadrupeds, of which they capture vast numbers, owls may be regarded as the most serviceable of wild birds; and those species which are of the greatest use are so far from timid or retiring in their manner, that they resort to farm-yards, barns, and other places, and perform their services even in spite of the persecutions which they meet with from the thoughtless.

"Ye solemn warblers of the gloomy night,
That rest in lightning—blasted oaks the day,
Thro' the black mantles take your slow-pac'd flight,
Rending the silent wood with shrieking lay."—CHATTERTON.

681. *Why is the plumage of nocturnal birds of prey tapered off to a fine and soft point?*

Because this structure enables them to glide *noiselessly through the air*, and even among the leaves and sprays of the thick forests, without disturbing their prey.

682. *Why are the wings of the serpent-eater, or secretary bird, tipped with hard points?*

Because in attacking serpents, it *covers its breast with one wing* as a shield, to protect itself from the bite of the reptile, and *strikes at his victim* with the other—the two wings thus acting as a *shield and spear*. Then, after breaking the cranium with its beak, the bird devours the serpent. This is the manner in which large and venomous serpents are killed; but the bird frequently swallows non-venomous snakes alive.

683. The secretary bird destroys serpents, rats, and vermin, and is on that account much esteemed in the southern parts of Africa, which abounds with venomous serpents, snakes, scorpions, and noxious reptiles, also with lizards of many descriptions; the land-tortoise, gryllæ, or locusts, in variety, abundance, and depredation equalling their destructive hosts in other countries. Barrow relates a very curious circumstance respecting living serpents in the stomach of one of these birds after death. An English gentleman, who held an official situation at the Cape, being out on a shooting party, killed a secretary bird, which he carried home with the intention of having an accurate drawing made from it. He threw it on the floor of the balcony near the house, when, after it had remained some time, and been examined and tossed about, one of the company observed a large snake pushing open the beak, out of which he speedily crawled in perfect vigor, and free from any injury. In the supposition that others might be in the stomach, the bird was suspended by the legs, and presently a second made its appearance, as large and as lively as the first. The bird was afterwards opened, when the stomach was found to contain seven dead snakes, with a half-digested mass of lizards, scorpions, scolopendræ, centipedes, and beetles.

ORDER II.—INCESSORES.

684. *Why are the incessores so named?*

From their classification as perching birds: the word *incessores* being derived from *insideo*, to lie in ambush; indicating that the proper *habitat* of the order, with its sub-orders, is a bush or tree.

"Better's the place, though homely and obscure,
Where we repose in safety and secure
Than where great birds with lordly talons seize,
Not what they ought, but what their fancies please."—DRAYTON.

685. They are also called *passeres* or passerine birds, from *passer*, "a sparrow," to which bird the greater number of incessores bear a strong resemblance. In all the true incessorial birds, the toes are three before and one behind. The adaptation of the foot to grasping or perching is evident from the situation of the hinder toe, which is invariably placed on the same level with those in front, and by which they are distinguished from the rasores (scrapers) and grillatores (waders). The toes are slender, flexible, and of moderate length; of which the foot of the canary affords a very good example. The incessores are much on the wing; their legs are therefore much less developed than those organs. The male bird surpasses the female in size, plumage, and song; they live in pairs, and construct their nests in bushes, trees, etc., with wonderful art.



The feet of birds present very distinctive marks for observation. In most species the toes are four in number, and in the majority of these three are directed forward, and one turned back. This is the case with the eagle, 1, and falcon, 2; the toes in these and other birds of prey being pointed with long, curved, and sharp talons. The woodpecker has two forward and two backward toes, 3; so also has the parrot. The night-jar has three forward toes, one of which is extended to a considerable length, 4. The swift has all toes forward, 5; it clings with them to walls and cliffs. Larks have the backward claw long and slender, 6. The ostrich has only two toes 7; the co-sowary has three, all in front. Domestic fowls, and others of the same family, have four toes, and a spur.

all in front. Domestic fowls, and others of the same family, have four toes, and a spur.

The order INCESSORES is by many naturalists divided into five sub-orders: 1. *Dentirostres*; 2. *Fissirostres*; 3. *Conirostres*; 4. *Tenuirostres*; 5. *Syndactyli*.

Sub-order 1.—*Dentirostres*.

686. Why is the first sub-order named *dentirostres*?

Dentirostres signifies tooth-billed: from *dens*, a "tooth," and *rostrum*, a "beak;" this tribe of birds being characterized by having a notch and tooth-like process on each side of the margin of the upper mandible. This renders them capable of attacking other birds; and they are ac-

“ ‘Let’s meete,’ quoth Echo *mockingly*:
Which, hearing, he with speed,
(Believed that his shadow was
A nymph, and spake indeed).”—WARNER.

cordingly *predacious*. The *shrike*, or *butcher-bird*, is the most formidable specimen of the sub-order.

687. *Why is the great gray shrike called the sentinel?*

It was thus named by Linneus, from its habit of *sitting like a sentry* in an unconcealed manner near its nest, either watching for its prey or on the alert against danger.

688. The *shrike*, or *butcher bird*, as it is frequently called, is generally dreaded by the lesser birds. They, however, occasionally unite against it, and drive it by clamor and mobbing from a cherished neighborhood. But although a predatory bird, it has good qualities; it is fond of its young, in whose defense it has been known to attack the hawk, and even the eagle.

689. *Why is the shrike called the “butcher-bird”?*

This bird has the singular habit of sticking the remains of its prey, and sometimes the entire prey, upon the twigs of shrubs in the hedges. His *reason for doing so* has given rise to various conjectures, the most probable of which is, that it is for the purpose of attracting other prey; for when the trophies of its previous capture are thus exhibited upon the hedge, the shrike itself may often be observed beating about until some smaller bird comes to peck at the bait; and then the shrike drops down and preys upon the bird thus ensnared.

690. *Why is the mocking-bird so called?*

Because it can *imitate* with the greatest ease and fidelity not only the songs of other birds, but the sounds and cries of animals and the barking of a dog, the mewling of a cat, etc. It even carries its imitative powers to inanimate objects, such as the grating of a grindstone, and the rushing of a torrent of water.

691. The *mocking-bird* loses little of the power and energy of his song by confinement. In his domesticated state, when he commences his career of song, it is impossible to stand by uninterested. He whistles for the dog; Cæsar starts up, wags his tail, and runs to meet his master. He squeaks out like a hurt chicken, and the hen hurries about with hanging wings and bristled feathers, clucking to protect its injured brood. The barking of the dog, the mewling of the cat, the creaking of a passing wheelbarrow, follow with great truth and rapidity. He repeats the tune

"More happy! laid where trees with trees entwined
 In bowery arches tremble to the wind,
 With innocence and shade like Adam blest,
 While a new Eden opens in the breast."—BROOME.

taught him by his master, though of considerable length, fully and faithfully. He runs over the quaverings of the canary, and the clear whistling of the Virginia nightingale or red-bird, with such superior execution and effect, that the mortified songsters feel their own inferiority, and become altogether silent; while he seems to triumph in their defeat by redoubling his exertions.

This excessive fondness for variety, however, in the opinion of some, injures his song. His elevated imitations of the brown thrush are frequently interrupted by the crowing of cocks; and the warblings of the blue-bird, which he exquisitely manages, are mingled with the screaming of swallows or the cackling of hens; amidst the simple melody of the robin we are suddenly surprised by the shrill reiterations of the whip-poor-will; while the notes of the kildeer, the blue jay, martin, baltimore, and twenty others, succeed with such imposing reality, that we look around for the originals, and discover with astonishment that the sole performer in this singular concert is the admirable bird now before us. During this exhibition of his powers he spreads his wings, expands his tail, and throws himself around the cage in all the ecstasy of enthusiasm, seeming not only to sing, but to dance, keeping time to the measure of his own music. Both in his native and domesticated state, during the solemn stillness of night, as soon as the moon rises in silent majesty, he begins his delightful solo; and serenades us the livelong night with a full display of his vocal powers, making the whole neighborhood ring with his inimitable melody.

692. *Why is the bower-bird so called?*

From a singular habit which it has of forming for itself and its immediate associates of the same species a *bower-like structure*, for the purpose of a playing ground, or place of assembly.

693. One of the extraordinary buildings of the bower-bird is thus described by Mr. Gould in his "Birds of Australia":—

"The bower is usually placed under the shelter of the branches of some overhanging tree in the most retired part of the forest; the base consists of an extensive and rather convex platform of sticks firmly interwoven, on the center of which the bower itself is built; this, like the platform on which it is placed, and with which it is interwoven, is formed of sticks and twigs, but of a more tender and flexible description; the tips of the twigs being so arranged as to curve inwards, and nearly meet at the top. In the interior of the bower the materials are so placed that the forks of the twigs are always presented outwards, by which arrangement not the slightest obstruction is offered to the passage of the birds. The bower is used as a place of resort for many individuals of both sexes, which, when there assembled, run through and around it in a sportive and playful manner, and that so frequently that it is seldom entirely deserted."

"Some to the holly hedge
Nestling repair, and to the thicket some;
Some to the rude protection of the thorn
Commit their feeble offspring."—THOMSON.

694. *Why is the cat-bird so named?*

From its voice, which closely resembles at times the *mewing* of a young cat.

695. Wilson the American ornithologist, says:—"In spring and summer, on approaching thickets, or brambles, the first salutation you receive is from the cat-bird; and a stranger unacquainted with its note would instantly conclude that some vagrant orphan kitten had got bewildered among the briars, and wanted assistance; so exactly does the call of the bird resemble the voice of that animal." Other circumstances lend a claim to the title. The cat-bird is more familiar with man than any other of the passerine order: building its nest in gardens, and courting the familiarity of its owner, whom he salutes as he approaches.

696. *Why is the tailor-bird so named?*



From a remarkable habit of *sewing leaves together* with threads or vegetable fibers in the construction of its nest.

697. When the tailor-bird has selected a branch for the site of its nest, it procures a dead leaf, which it sews on to one still pendent and living; thus a pocket or bag is made, within which its nest is arranged. The thread used by the tailor-bird has been sometimes found actually knotted at the end. Colonel Sykes has described the nest of an Indian variety of this bird with great minuteness. He states that the nest thus secured is safe from the depredations of reptiles and monkeys.

698. *Why does the wren make several nests, and then leave them when nearly finished, completing and using only one?*

It has been supposed by some that these are the work of the male bird during the incubation of the female, who labors thus for the sake of occupation.

Other naturalists conjecture that these are *deceptive nests*, calculated to lead to the supposition that the birds have accomplished their task and retired; and, therefore, that further search is useless.

"Among the dwellings framed by birds
 In field or forest with nice care,
 Is none that with the little wren's
 In snugness may compare."—WORDSWORTH.

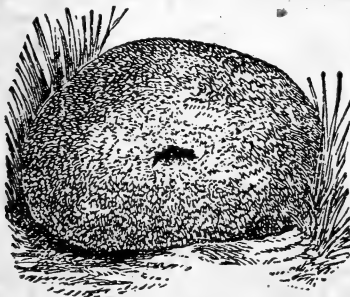
699. Why is the material composing the exterior of the wren's nest varied according to the color of the substance against which the nest is built?



Because by this means the nest is rendered *undistinguishable from the surrounding objects*, and thus best answers the purposes of concealment. If the nest is placed amongst ivy, it is usually constructed of *green moss*; but if erected contiguous to some light-colored branches, it will then be formed of *gray lichens*.

700. Beautiful and elaborate is the structure of this tenement, which is generally placed in the middle of a bush, whose whole contracted stems and branches are covered with tufts of many-colored lichens. To these branches it is not only so assimilated as to seem of natural growth, but is so firmly connected as to render its disengagement impossible, unless by destroying its form and aspect. To obtain it perfect, the branches must be cut away, with the nest undisturbed. Other sites are occasionally chosen, but in every instance the nest is so artfully hidden as to elude a casual glance.

The art of concocting nests so as to protect them from depredation appears to be perfectly well understood by some species of birds. No



British bird conceals its nest more effectually than the water ouzel, a bird common along our trout streams, especially where they wind through rock-girt dales and glens. The nest of this bird may be sometimes discovered in the fissure of a low jutting crag, or block of stone, projecting over the rushing and bubbling current, sometimes in a crevice on the face of a rock, over which tumbles a cascade, the spray throwing a veil around the spot; sometimes between the rude stores of a ruined bridge, or of a tenantless and dilapidated water-mill long since deserted. Wherever it is sit-

uated, the nest blends undistinguishably with the delicate minute ferns, the moss and lichen, which fill up every chink, peep from every fissure, and give a picturesque tone of mingled tints to the humid face of the gray limestone. The nest itself is of a large size, and of a domed figure, with a small aperture on its side. This aperture, from the nature of the materials of which the structure is composed, yields to the

"Half afraid, the *robin* first
Against the window beats; then brisk, alights
On the warm hearth; then hopping o'er the floor,
Eyes all the smiling family askance."—THOMSON.

passage of the bird, and then closes so as to be scarcely discernable. Externally, the nest consists of interwoven mosses and lichens, having an internal lining of dried vegetable fibers. Of a similar character as to details, but differing in its site, is the *nest of the long-tailed titmouse*.

701. *Why is the English redbreast a solitary bird?*

Because, not being migratory, but remaining in the same neighborhoods the whole year round, an instinct teaches it that a sufficient supply of food is *better secured by individual* than by *gregarious search*.

702. The redbreast is very attentive to its mate and rising brood, but in order, it would seem, to enforce the character of separativeness upon its species, lives in a constant state of hostility with its own tribe. The ancient writers were aware of this peculiarity of the redbreast, hence the line—

"A bush contains but one robin."

703. *Why is the English robin the latest bird in retiring in the evening?*

Because it possesses large strong eyes, which *adapt themselves to the weakest rays of light*. This bird lives partly upon worms, and is, therefore, enabled to catch those that venture forth at dusk.

704. *Why are the English robins called autumnal songsters, although they sing throughout all the year?*

Because in the spring and summer, when birds generally warble, *the voice of the robin is drowned in the general chorus*, but in the autumn, when most birds have ceased to sing, the song of the robin becomes *more remarkable*. Besides, many of the robins that sing in the autumn are the male redbreasts of the same year, which increase the number of warblers.*

* White's "Selbourne."

"The thrush
And woodlark, o'er the kind-contending throng
Superior heard, run thro' the sweetest length of notes."

THOMSON.

705. *Why has the wren been associated in nursery literature with the English redbreast?*

The habits of the wren being very *similar to those of the robin*, its anti-migratory character, its familiar bearing towards man, and particularly its practice of paying him an annual winter visit, may have led to this association.

706. The tiny fairy-like form of the wren would also, with children, render it an appropriate consort for the smart vivacious "robin." The loves and woes of the latter in connection with "jenny wren" are, however, too precious a legacy for the mind of childhood for science rudely to interfere with.

707. *Why do wagtails and other birds frequently congregate about the feet of cows when those animals are feeding in moist low pastures?*

They do this for the purpose of availing themselves of the *flies* which settle on the animals' legs, and also to pick up the worms and larvæ that are roused by the *trampling of the cows' feet*.

708. *Why do missel thrushes at times prefer building their nests near houses and in frequented garden walks?*

Because the *magpies* destroy the broods of missel thrushes whenever they can make their way to them, so that the latter build in the neighborhood of frequented places by way of protection. The favorite haunt of the missel thrush is an orchard, and orchards are generally in the neighborhood of human habitations, and of these magpies are shy.

709. *How is the intelligence of the robin manifested by its manner of procuring food?*

When a robin settles upon a lawn moistened with dew or rain, he at first stands motionless, as if undetermined how he shall proceed. Suddenly he bends his head on one side, as if in the act of listening, his beak almost touches the

“Who but the *swallow* triumphs now alone?
 The canopy of heaven is all her own:
 Her youthful offspring to their haunts repair,
 And glide along in glades, and skim in air.”—DRYDEN.

ground, and he draws back his head as if to make a determined peck.

Again he pauses and listens; hops, perhaps, once or twice, scarcely moving his position, and pecks smartly on the sod, then once more stands motionless.

After a moment's pause, appearing to have ascertained that all is right, he pecks away assiduously, and soon draws forth a worm, which his keen sense of *hearing* had informed him was not far off, and which his hops and previous peckings had *driven to the surface* to escape the approach of what the worm apprehended, from the manner of the pecking, was an *under-ground enemy*.

710. *Why have the thrush, the golden-crested wren, and some other birds the front toes fastened by a thin skin in contradistinction, birds which have their toes quite separated from each other?*

Because the birds named rest chiefly upon light bushes, and this union of the two toes gives the foot a stronger foundation for clasping the slender twigs than loose toes could do.

Sub-order II.—Fissirostres.

711. *Why are the fissirostres so designated?*

Because these birds are distinguished by the wideness of their gape, hence they are called gapers; the word is derived from *findo*, to “divide,” and *rostrum*, a “beak.” The *swallow* is the type of the species, hence its name.

712. *Why are swifts, swallows, and martins appointed to their different ranges of elevation when on the wing?*

The intention is, doubtless, to clear the air in some degree of its *over-abundance of living swarms*. Very high in the atmosphere, the fewest flies are to be found: there the rapid *swift is stationed*. The *chimney swallows* take a lower region, and fly more slowly, for in their appointed

"The breezy call of incense breathing morn,
The *swallow* twittering from the straw-built shed,
The cock's shrill clarion, or the echoing horn,
No more shall rouse them from their lowly bed."—GRAY.

track there are *more insects* to be met with. The *house martin*, flying slower still, catches those insects which, except when rain is near, move along at a height of from fifteen to forty feet above the ground. The *sand martin* has his post still lower down, for he usually skims after gnats and other flies just over low flat grounds.

Thus, each bird accomplishing its work at a different altitude, their united efforts *clear the air of insects* which would otherwise be injurious to vegetation, and annoying to animals.

713. *Why do the habits of swallows peculiarly adapt those birds to migration?*



Because their exercise renders long flights endurable; and the capability of sustaining themselves in the air for fourteen or sixteen hours together in search of food, renders these distant journeys *less fatiguing* than they would be to birds of inactive habits.

714. *Why are the holes made by swallows nearly as circular as though they had been planned with a pair of compasses?*

Because, when the swallow is constructing its nest, it perches on the circumference with its claws, and *works with its bill from the center outwards*; a radius is thus formed by a part of the bird's body, which is subject to little variation.

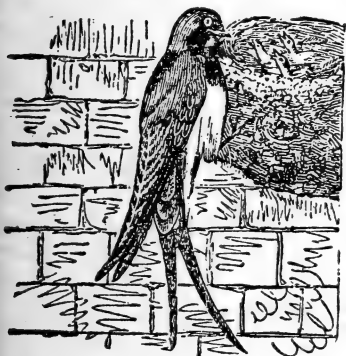
715. *Why do the mandibles of swallows open further back than in most other birds?*

Because, with this bird, the food is *caught when flying*, which requires a peculiar construction of the mouth, pro-

"With these the *martin* readily concurred,
A church begot, and church-believing bird;
Of little body, but of lofty mind,
Round belly'd for a dignity design'd."—DRYDEN.

ducing a large gape, in which the insects are caught, as in a net.

716. *How is a swallow enabled to build its nest on a perpendicular wall where there is no projection underneath?*



The bird partly clings with its claws, and partly supports itself by *strongly inclining its tail against the wall*, making that a fulcrum, and, thus steadied, it works, and plasters the materials into the face of the brick or stone.

717. *Why do martins and swallows prefer to build their nests near to and within the habitations of man?*

These tribes, living almost entirely upon insects, it is most probable that such localities afford them, during their summer residence, *the most abundant supply of food*.

718. Doubtless birds understand who are their friends; the swallows, swifts, and martins have ever been favored by man. Even the savage Indian welcomes them, and provides a receptacle for their nests. The Chectaws and Chicasaws cut off all the top branches from a sapling near their cabins, leaving the prongs a foot or two in length, on each of which they hang a guard or calabosh, properly hollowed out, for their convenience; and the negroes upon the banks of the Mississippi provide similarly for them. The reason why swallows and martins have always been protected by man, is probably because they are inveterate foes to *crows, hawks, and eagles*. Although so small in size, they vigorously attack these depredators, and seldom fail to come off victorious. Of course, the swallow is moved to this degree of combativeness in defense of its nest and brood; but, as a result, he, and his friend the martin, have been from time immemorial recognized as excellent guardians of the poultry yard.

719. *Why is the esculent swallow so called?*

Because both the bird and *its nest form a favorite food* in Java, Japan, and China.

"The *swift* actually performs what has been in these enlightened times disproved of the bird of Paradise; except the small time it takes in sleeping, and what it devotes to incubation, every other action is done on the wing."—PENANT.

720. The edible birds' nest of the extreme east of Asia have given rise to much speculation, and their composition is still a matter of doubt. They are found attached to the sides of cliffs, and the roofs of caverns opening upon the sea-coasts. But whether their substance is derived from the *gastric glands* of the swallows, or collected by the latter from the sea-shore, or elsewhere, it is impossible to say—authorities being equally divided upon the point. In outward appearance, the esculent swallow's nest resembles that of the chimney swallow, being concave, shallow, and lined with feathers; but the crust, or shell, instead of being made of clay is something in appearance like the fine manna of commerce, or isinglass. Fine filaments appear to be cemented together by a transparent viscous matter, not unlike what is left by the sea upon stones alternately covered by the tide, or those gelatinous animal substances found floating upon every coast.*

About twenty-seven thousand pounds weight are annually exported from Java, and about thirty thousand tons of Chinese shipping are engaged in the traffic. The danger attendant upon the collecting of the nests in the awful caverns is described as being imminent in the extreme.

721. *Why does the swift rarely alight on level ground?*

Because, owing to the extreme shortness of the feet, and the disproportionate length of the wings, the bird *cannot rise from a flat surface*, since its body is not sufficiently elevated to admit of the downward stroke of the wings. Whenever the swift does alight, therefore, it is always in such places as present a brink or declivity, from the edge of which it can launch itself.

722. *How do swifts, which seldom alight on the ground, gather the materials for their nests?*

It has been conjectured that swifts gather the materials by raising them as they *glance along the ground*, in the same way that they drink by *skimming over the surface of the water*. Others suppose that these birds *catch the substances in the air* as they are carried up by the wind. Whilst the more common and generally received opinion is, that the materials are purloined from the nests of sparrows and swallows.

723. This latter surmise is corroborated by several circumstances: first, the swift's nest consists of nearly the same substances as the sparrows; secondly, we know that swifts enter sometimes into the nests

* Sir G. Staunton.

"Ah! would thou know'st how much it better were
To 'bide among the simple fisher-swaines;
No shrieking owl, no *night-jar* lodgeth here,
Nor is our simple pleasure mixed with pains."—P. FLETCHER.

of small birds, which we may suppose they do for the sake of pillaging the materials. With regard to the moss which they employ, it is in very small quantity, and they may gather it with their little claws, which are very strong, from trees, on which they can clamber, in the hollows of which they sometimes breed. Of seven nests found under the head of a church porch, fifteen feet from the ground, there were only three which had a regular cup-shape, and of which the materials were more or less interwoven, and with greater order than usual in sparrow's nests; they had also more moss and fewer feathers, and were in general less bulky. The best formed of all weighed two ounces and a half; and the largest, five or six times more than the smallest.

724. *Why is it said, when swallows fly high, fine weather may be expected?*

Because swallows follow *flies and gnats*, and these delight in warm air; and as warm air is lighter, and usually moister than cold air, when the warm strata of air are high, there is less chance of moisture being thrown down from them by the mixture with cold air.

But when the warm and moist air is close to the surface, *the flies and swallows fly low*, and it is almost certain that, as the cold air flows down into it, a deposition of water will take place.

725. *Why is the mouth of the goat-sucker, or night-jar furnished with long bristly hairs?*



These birds pursue their insect prey in the night; for which purpose their eyes are peculiarly adapted. When, however, they have captured an insect, their eyes are of no further avail, and the long bristles then act as *feelers*, enabling the bird

more securely to ensure its prey, and to prevent all possibility of escape.

"His plumes were inky black, of vast extent;
His hooky claws on spoil and *ravine bent*."—HOOLE.

Sub-order III.—*Conirostres*.

726. *Why is the sub-order conirostres so termed?*

From *conus*, a *cone*, and *rostrum*, a *beak*, importing that birds of this sub-order have a bill more or less conical in shape.

727. The *Conirostres* are miscellaneous feeders; but they differ so much in their character and habits, that no one species can be selected as properly descriptive of the whole tribe. The texture of their bills is firm, and capable of bruising hard substances—such as seeds—with tough coats; and also for digging or boring into the ground in quest of earth-insects, or of albuminous roots.

728. *Why are the heads of birds of this sub-order large in proportion to the size of their bodies?*

Because the muscles which move the bill are more powerful, and *consequently larger*, than in the case of birds which feed exclusively upon insects.

729. Many of the *conirostres* are voracious, and somewhat gross in their feeding. They eat all manner of carrion and garbage, thus performing a highly useful service to man; they have no great objection to kill any animal which they can master, especially if they find it in a sick or weakly condition. Some of them occasionally hawk after small birds on the wing, but it is not a general habit with them: they proceed by stealthiness and craft rather than by daring, and in general attack only that which they can take at a disadvantage. They are also plunderers of the nests of other birds.

730. *How is the bill of the raven characterized?*

The structure of its bill is intermediate between those of the *vultures*, which feed chiefly upon carrion, and the *woodpeckers* and analogous species, which obtain their food by digging or thrusting into crevices in the barks of trees and fissures of rocks. It is inlaying and straight, and can inflict a severe wound by thrusting; it is slightly hooked at the tip, so that it can keep a firm hold, while the bird rips and tears by the motions of the neck; and as it is long, the snap of the point is very sharp, from the rapidity of the motion.

"And the hoarse *raven* on the blasted bough,
By croaking from the left presaged the coming flow."—DRYDEN.

731. The raven, though not very numerous in any place, and though dwelling in solitude, pairing for life, and not very prolific, is one of the most generally distributed of birds. Almost every other species has some country which it can claim to a considerable extent as its own; and even though it is migrant, and passes the different seasons in places some thousands of miles asunder, it returns with the season, not only to the same latitude, and to the same land, but often to the very same spot. The raven is no migrant, except in shifting a little with the seasons, as the supply of food varies, but never quitting the same district; and yet there is no country in which the raven is not found native. The margin of the desert, of the jungle, or of the forest, in the hottest climates,—the heights of alternate cliff and copse in temperate climates, or the rocks and heaths, and even the lichen-clad margins of the inhabited regions near the poles, are all equally the abode of the raven. Let the sun blaze, the wind blow, the rain pelt, or the snow drive, with ever so much intensity, his dusky wing, or firmly-set foot, is in its element, and the wreck of nature to others proves to him a season of plenty.

732. *Why is the raven termed the "herald of the year"?*

Because, as early as the latter part of January, if the weather be mild, these birds may be seen on the alert, *looking into the state of their nests*, and making other preparations for the spring.

733. *Why is the raven commonly associated with sickness, misfortune, and other human ills?*

Because his *black plumage*, *discordant croaking cry*, and wild and funeral aspect, favor the superstitious feelings which arise amongst ignorant persons.

734. It is said that the southern aborigines invoke the raven for those who are sick, mimicking his voice; and the natives of Missouri, assuming black as their emblem of war, decorate themselves on those occasions with the plumes of this dark bird. But all the knowledge of the future, or interest in destiny, possessed by the raven, like that of other inhabitants of the air, is bounded by an instinctive feeling of the changes which are about to happen in the atmosphere, and which he has the faculty of announcing by certain cries and actions produced by these external impressions. In the southern provinces of Sweden, as Linneus remarks, when the sky is serene, the raven flies very high, and utters a hollow sound, like the word *clong*, which is heard at a distance. Sometimes he has been seen in the midst of a thunder-storm, amid electric fires which appeared to stream from his bill—a natural, though extraordinary phenomenon, sufficient to terrify the superstitious, and to stamp the harmless subject of it with the imaginary traits and attributes of a demon.

"And the raven never flitting, still is sitting, still is sitting
On the pallid bust of Pallas, just above my chamber door;
And his eyes have all the seeming of a demon's that is dreaming,
And the lamp-light o'er him streaming, throws his shadow on the
floor."—EDGAR POE.

735. *Why are ravens more social than birds of prey?*

Because the food upon which they subsist is of a promiscuous nature, and abundant in quantity, which allows a greater number to subsist together without being urged to the stern necessity of solitude or famine—a condition to which the true rapacious birds are always driven.

736. *Why is it erroneous to suppose that crows destroy grass?*



This error arises out of the following circumstance: In searching for grubs which are concealed in the earth, and which are supported by eating the roots of the grass, the crow pulls at the stem of the grass with its bill, and when the grass comes up, the crow knows that *there are under it*

insects which have destroyed its roots, and in this way detects them; but if the stem of grass is firm, the crow goes to another tuft, and proceeds in the same manner.

737. *Why is the rook the earliest bird stirring in the morning?*

Because its principal food is worms, which feed and crawl upon the humid surface of the ground in the dark, and retire before the light of day; and, roosting higher than other birds, the first rays of the sun as they dart from the horizon, become visible to the rook.

738. *Why is the flight of rooks popularly supposed to portend rough or fine weather?*

Because it is proved by observation that when a gale of wind is blowing, or about to blow, they descend into valleys, and just skim over the tops of the intervening

"*Rooks* unnumbered build their nest—
Deliberate birds, and prudent all;
Their notes, indeed, are harsh and rude,
But they're a social multitude."—CRABBE.

hills and trees; but when the sky is calm and clear, they *pass through the upper air* in regular and easy flight.

739. Sometimes these birds perform an evolution usually called the "shooting of the rooks." When they have risen to an immense height in the air, so that, in appearance, they are scarcely larger than the lark, they suddenly descend to the ground, or to the tops of trees exactly under them. To effect this, they come headlong down, on pinions a little raised, but not expanded, in a zig-zag direction (presenting alternately their back and breast), through the resisting air, with a noise resembling the rushing of the wind; and when we consider the prodigious height of the rooks at the time they begin to descend, we conclude that they cannot effect their arrival at a spot immediately under them by any other process so short and rapid.

740. *Why are rooks seen to busy themselves in autumn about their nests, as though they were going to make immediate use of them, and then desert them for the winter?*

This curious proceeding probably arises from an instinctive feeling that as *the nests will be wanted early in spring*, a few repairs may be requisite to strengthen and prevent their being shattered or blown to pieces by the storms of winter.

741. *Why is it said that a crow can smell gunpowder?*

Because the natural wariness in most seasons of the year of this bird, and the *perpetual persecution* which it has undergone from man, cause it to keep a very sharp look-out; and induces it to take flight at the earliest approach of the gunner.

742. The rook is a bird of great sagacity. It has been known to fly from a man carrying a crutch on his shoulder, and yet to endure the approach of the same man when he walked with a limping gait, with the crutch under his arm. It has also suffered the approach of a sportsman who put his gun under his arm, and pretended to use it as a crutch. We doubt the presumption that rooks can smell gunpowder, although we have seen, in a farm-book of considerable authority, a rag smeared with gunpowder recommended to scare away rooks. The moving rag may have the effect, without the aid of the gunpowder.

743. *In what respects are the bill and stomach of the rook practically adapted to each other?*

The bill is so constructed that it can lay hold of, and rend almost *any kind of food*; and the digestive organs extract nutriment from a *great variety of substances*; the

—“Or in a shady tree
 Nine magpies perch'd lament their alter'd state,
 And what they hear are skilful to repeat.”—MAYNWARING.

stomach being *intermediate* between the membranous, or thinly-muscular kind, peculiar to the *carnivorous* families, and gizzards, or strongly-muscular organs which are possessed by those animals that feed on hard *vegetable substances*.

744. *Why is the wholesale destruction of crows, as generally practiced by farmers, a mistaken policy?*

Because these birds *destroy an amazing number of grubs and injurious insects*, which, to all appearance, have no other enemies; their singular mode of following the course of the plow, both in winter and spring, leaves no doubt of this fact.

745. Crows are persistently destroyed, because it is believed that when they search after insects in newly-sown fields, they devour, also, the grain which they meet with in their track. This may, at least in part, be true; but no positive proof can exist of such being the case. Certain it is, that in particular parts of America, where the crows were completely eradicated or driven away by incessant firing, the numbers of noxious insects increased so prodigiously that the farmers, to their sorrow, found the remedy worse than the disease; the whole district agreeing to suffer the persecuted crows to return, and occupy again their old quarters.

746. *Why does the structure of the magpie adapt it either for a tree or a ground bird?*



Because the *wings are only of moderate length*, which renders them suitable for taking the air at all angles, and also for turning. The tail is also greatly developed, capable of considerable action, and wedge-shaped; the first and second properties, being requisite in the *frequent ascents and descents* of the bird, and the last in avoiding the twigs and other obstacles which the

bird could not have so well avoided, if the tail had been square at the end.

"So doth the *maggie* mischievously steal
Of wealth he knows not—only to conceal."—NEWMAN.

747. *Why have magpies the reputation of being thieving birds?*

These birds possess a strong degree of curiosity in observation, and seem to have an especial perception for *brilliancy of color*. If, for instance, there were two small pieces of potters' ware, of the same size, shape, and consistency, and if one piece were coarse and brown and the other glazed, it is almost certain that the magpie would carry off the glazed piece, but certainly not the other: so also, if a shilling and a halfpenny were left in this bird's way, the shilling would in all probability be carried off and the halfpenny left.

This fondness for bright and shining articles tempts the bird to *steal* articles of plate, etc., hence the incident upon which the popular story is founded of "*The Maid and the Magpie*," and a number of other anecdotes, all illustrative of this thievish propensity; whilst their curious and observant disposition may account for their stealing articles which have no particularly attractive qualities to recommend them.

748. *Why is a magpie, when seen alone, said to foretell bad weather?*

Because magpies generally fly in company, but on the approach of wet or cold one *remains in the nest to take care of the young*, while the other wanders in search of food.

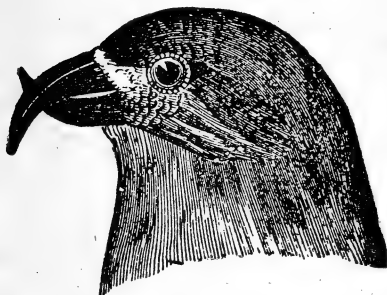
For the same reason, a single magpie is said to be an *unlucky omen* to anglers, while *two* prognosticate fine weather and good sport.

749. *Why is the crossbill furnished with a beak of peculiar structure?*

Because it is a bird inhabiting forests in which *vast pine trees grow*, and living as it does upon *the seeds of the pine*, the beak with which it is furnished is best adapted for assisting it in obtaining supplies of food.

"The *sparrow*, meanest of the feathered race,
His fit companion finds in every place."—COWPER.

750. The seeds of the pines, which, until the cone has been exposed



to the action of the weather for a considerable time after the seeds are ripe, are so firmly enclosed between the ligneous scales as to prevent the bill of an ordinary bird from reaching them. This bill consists of a very powerful pair of levers, by means of which the scales can be wrenched open, and the seeds arrived at in a manner the most effective. When the two sharp points are brought together, they can be inserted into a very small opening, in which, the

instant that they begin to operate, each takes hold like a hook, and tends to draw itself in; thus cutting open in the direction of the face or plane of the scale, while by their action upon each other they press it open by the power of a double wedge; and by the time that the mandibles have crossed to their full extent, the scale is so completely raised that the seed can be taken from under it with the greatest ease. The position into which the oblique action of the bill brings the head enables the bird to see the seed under the scale, and while the mandibles keep the scale open, the tongue of the bird scoops out the seed. The tongue is as curious as the mandibles. It terminates in a horny gouge, supported by a bone, and furnished with muscles, by which it can be raised or depressed so as to act as an independent instrument. The motion of the bill divides a soft and pulpy substance with remarkable facility; and when the birds visit orchards, which they sometimes do in the autumn, they cut the apples asunder, in order to get at the pips, with almost as great a nicety as one would use a knife.

751. *Why are sparrows useful to vegetation?*

Because they devour *myriads of insects* which would otherwise do infinite injury; this is particularly the case when they have young ones, all of which are fed with *insects and caterpillars*.

752. *Why is the sparrow bolder, and less fearful of being caught or killed, than most other birds?*

Because its location in the neighborhood of populous towns and cities renders it *accustomed to man*, who, on his part, being intent on other matters, passes hourly within a few yards of this bird without ever giving it a thought.

"The cleft tree
Offers its kind concealment to a few,
Their food its insects, and its moss their nests."—THOMSON.

753. *Why does the house-sparrow pertinaciously appropriate to its own use the nest of other birds?*



Because sparrows occupy their nests at night throughout the year; and, though they are hardy birds, they require warm shelter during severe frosts, and therefore seize upon any convenience which they can find best adapted to their purpose.

754. *Why is the sparrow comparatively late in awaking in the morning?*

Because it roosts in holes, and under the eaves of ricks, or sheds, where the light does not so soon enter as in open places.

755. *Why is the claw upon the hind toe of the lark of greater length than is to be found generally in other birds?*

Because the lark is a field bird, nestling on the ground, and deriving its food from the earth; and the peculiar conformation of the foot enables the bird to run on thick matted grass, or to rise from it, or alight on it, with much less inconvenience than almost any other bird.

756. Larks are fleet runners, and they stand up for observation, with their heads above the cover; the head, which is generally crested, and has the crest erected, not being easily distinguishable from a clod.

757. *What especial use does the lark make of its disproportionally long claws?*

The lark makes its nest generally in grass fields, where it is liable to be injured, either by cattle grazing over it,

"Ye birds
That singing up to Heav'n's gate ascend,
Bear on your wings, and in your notes, his praise."—MILTON.

or by the mower. In case of alarm from these or other causes, the parent birds *remove their eggs* by means of their *long claws*, to a place of greater security.

758. *Why does the song of the sky-lark, when on the wing, change with its ascent and descent, and possess a uniform key only when the bird is poised in the air?*

Because the windpipe is the musical organ, and birds require this organ less for breathing than other animals having a windpipe and lungs, because of the air-cells and breathing tubes with which all parts of their bodies are furnished.

But those different breathing organs must act with less freedom when the bird is making the greatest efforts in motion, that is, when ascending or descending; and in proportion as these cease to act, the trachea is the more required for the purposes of breathing.

The sky-lark thus converts the atmosphere into a musical instrument of many stops, the song swelling as the bird ascends, sinking with the downward flight, and with each wheel in the air varying the pitch of the song. All birds that sing ascending or descending have similar power, but the sky-lark has it in a degree superior to any other.

759. *Why is the female linnet often mistaken for the male?*

Because, when the male bird has attracted the attention of his intended captor, he *instantly hops into the bush* before his plumage can be carefully noticed; and, if the bush is beaten, the female bird will fly out, and thus get credit for the song of her mate.

760. The deception is further increased by the male ceasing his song and raising his alarm-call as soon as he is seen, and until he disappears in the bush, for he does not generally fly out; but the female does, and wiles away the enemy from the nest by a series of short flights;

"Behold, within the leafy shade,
Those, speckled eggs together laid!
On me the chance-discovered sight
Gleamed like a vision of delight."—WORDSWORTH.

and when the coast is clear, she again flies into the bush, chirping softly the note of safety, and soon after the male resumes his song.

761. *Why do goldfinches build their nests on flexible branches in preference to rigid ones?*



Because the young being thus rocked to and fro in the nest, are made accustomed to the motion which they will afterwards experience when seeking their food on the tops of tall and flexible stems.

762. *Why does the European titmouse suspend its nest over a pond or stream?*

In order to preserve it from the attacks of quadrupeds and reptiles.

763. *What is especially remarkable in the plumage of the canary bird?*

Its light sulphur color, which it has exchanged for the gray or brown hue of its native islands.

764. This little captive songster was introduced to Europe early in the 16th century, and is believed to have spread from the coast of Italy, where a vessel, which was bringing to Leghorn a number of these birds, besides merchandise, was wrecked. The climate being favorable, they increased; but they did not become naturalized, being entrapped by breeders for the purpose of sale.

765. *Why are birds of Paradise so called?*

In earlier ages these birds, which are peculiar in their structure and remarkable for the beauty and gloss of their

"Resplendent wanderer! followed with glad eyes
Where'er her course; mysterious bird,
To whom, by wandering fancy stirred,
Eastern islanders have given
A holy name—the Bird of Heaven."—WORDSWORTH.

plumage, were supposed to whisk about like bright meteors in the equinoctial sun, without the usual attributes of wings or feet; and were also believed to dwell in the air, and live upon the nectar of those flowers which, in the climates where the birds are native, twine in garlands and festoons at the topmost branches of the trees.

766. *Why were the birds of Paradise said by the older naturalists to be without legs, and to remain always suspended in the air?*



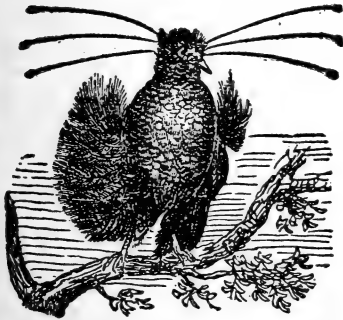
These beautiful creatures frequenting only the neighborhood of the tropics, had, until a comparatively recent date, *never been caught and examined*. The accounts of them, therefore, were like many "travelers' tales," much exaggerated. This is partly excused and accounted for by the extreme beauty of their plumage and motions.

It is certain that the birds of Paradise have legs, and these both large and strong; but their flight is rapid and continuous; they are *the swallows of the tropics*; are seldom seen to alight; and, while pursuing the insects upon which they feed, go through a vast number of the most beautiful evolutions.

767. These birds do not bear much resemblance to an ordinary bird, at least in any part except the bill, head, neck, and shoulders, for the rest of the body is hidden by supplemental feathers issuing from the flanks, the shoulders, or both, which feathers are so loose, light, and

"So on he fares, and to the border comes
Of Eden, where delicious *Paradise*,
Now nearer, crowns with her enclosure green."—MILTON.

airy towards their points that they bear some resemblance to the tails of



comets. Some notion of the general form of this species may be obtained from the annexed figure representing the *golden bird of Paradise*. This beautiful deep black species is a native of New Guinea, and is well named by the French *siflet*, from the six slender feathers, three on each side of the head, which are webs, except at the end where they are without oval. The breast has a rich, gilded, changeable green gorget, which is very brilliant. The female of this species is destitute of the six long shafted feathers and the gorgeous breast of the male; but instead, the

feathers on the neck and side, and under parts of the body, are of a very light brown color, transversely marked with rather wide deep brown bars.

Birds of Paradise, which are allowed to exceed all others in beauty, variety, and the peculiar construction of their plumage, associate in large flocks in the delightful aromatic woods and groves of their native islands; and the inhabitants, sensible of their charms, give them the name of "God's birds."

768. *What remarkable utility is connected with the profuse plumage of birds of Paradise?*

We know too little of the habits of these birds to recognize *all* the specific purposes their singular and beautiful plumage answers; but it appears to be certain *that they are directed to their food by the profusion of their feathers.*

769. This extraordinary fact has been pointed out and enlarged upon in a very able manner in "Partington's Cyclopædia":—

"We know this—the islands in which birds of Paradise are found, are subject to *alternations of rain and drought*. Further, we know that in tropical countries the fervent heat of the rainless period comes at last to have all the effect of a winter, in the suspension of animal and vegetable action. As one part of those countries in which they have their haunts becomes parched, the birds of Paradise must remove to another, and we shall see that the profuse feathers, besides enabling the birds to rise more easily and descend more softly on their shorter excursions, in consequence of the hold which their countless flocculi take of the air,

"Like birds, great nature's happy commoners, that haunt in woods, in meads, and flow'ry gardens, rifle the sweets, and taste the choicest fruits, yet scorn to ask the lordly owner's leave."—ROWE.

assist the birds in finding their way to those other places where there is food for them.

"At those places where the earth and the upper part of the forest are parched, and the ardor of the unclouded sun continues to beat, there is a constant rarefaction of the whole mass of the atmosphere; and in consequence of this the winds from the more humid surfaces must blow towards those parched places with velocities proportional to the differences between the one and the other.

"When the forest which is the haunt of these birds becomes parched, their food lessens, and they are compelled to be more on the wing in search after it. But on which side soever there then happens to be a place more humid, and more abounding in those creatures on which they feed, and which on this account is better suited to them for the time, there is a wind which blows from that side towards the part which is parched and heated; and as the action of that wind upon their flocculent feathers turns them round on their centers of gravity like weather-cocks, their heads are, as they fly, turned to the wind, and against the current. Their feathers thus assist them in finding out the direction of those places where they can obtain food; and though this is more remarkable in the case of birds of Paradise than any other species, it is probable that many of the softer-feathered birds are also assisted in their tropical migrations by the set of the wind."

Sub-order IV.—*Tenuirostres*.

770. *Why is the sub-order Tenuirostres so designated?*

From *tenuis*, long, and *rostrum*, a beak; the birds comprehended within it being characterized by a long and slender bill.

771. They are also by some classed as "bee-eaters," or "honey-suckers," the great majority deriving their subsistence both from insects and the nectar of plants, which they suck up by means of a long and filamentous tongue. The representatives of this sub-order are the *nuthatch*, the *creeper*, the *humming-bird*, the *chough*, and the *hoopoe*. They are clearly distinguishable from the sub-order *syndactyli* by having the toes separated from each other.

772. *Why is it essential that the bodies of humming-birds should be motionless in the air?*

Because the humming-bird seeks its food in the deep cups and tubes which protect the seeds of various plants within the tropics. It would be impossible for them to

"Upon mine honor, Sir, I heard a *humming*,
And that a strange one too, which did awake me."—SHAKSPERE.

obtain a supply, which is only to be found in these places, unless they had some power of suspending their bodies; for if they attempted to rest on the plant, it would yield to their weight, and the insect would escape.

773. *Why are the humming-birds so called?*



From the *sound* produced by the *rapid motion* of their wings, this name is universally applied; the species being in the countries where they most abound, known as *Murmures*, *bourdons*, and *Frou-frous*, names of equivalent meaning.

774. The velocity with which these birds glance through the air is so great as to elude the sight—the motion of their wings appears like a thin cloud of light, and when hovering before a flower they seem to be absolutely suspended in the air.

775. *Why does the humming-bird, when molested, fly at and peck the eyes of its adversary?*

An unerring instinct has taught it that its feebleness can in no better way be protected than by this method of attack?

776. Mr. Bullock says: "They attack the eyes of the larger birds, and their sharp needle-like bill is a truly formidable weapon in this kind of warfare. Nothing can exceed their fierceness when disturbed during the breeding season." An old writer, Ferdinand Ovieds, adds: "When they see a man climb the tree where they have their nests they fly at his face and strike him in the eyes, coming, going, and returning with such swiftness that no man would rightly believe it that had not seen it."

777. *Why is the nest of the humming-bird constructed with a view to great warmth, although within the tropics?*

Because the diminutive size of the bird renders it in-

"One part had their *plumes* all whyt, another hadde them al redde, and the thyردة hadde them of several colours."—HALL.

capable of retaining for any length of time sufficient heat for the purposes of incubation, unless this provision is made.

778. *Why is so small a creature as the humming-bird more gorgeously plumed than any other bird?*

The probable reason is, that this brilliancy serves to attract around the humming-bird the insects upon which it partly feeds, and thus ministers to its means of sustenance: as we see that moths and flies are attracted by a lighted lamp or candle, and rush upon it to their own destruction.

779. "I have seen the humming-bird," says Wilson, "for half-an-hour at a time, darting at those little groups of insects that dance in the air in a fine summer evening, retiring to an adjoining twig to rest, and renewing the attack with a dexterity that sets all other fly-catchers at defiance."

The coloring of the plumage of birds unquestionably depends upon the sun, because they are gay and glossy in proportion as they are exposed to the action of that luminary; but the light of the sun must have a substance upon which it can act; and it appears to act most powerfully upon the firm feather which grows slowly, and, in the first instance, under cover. The coloration is an after process, though an obscure one, and one upon which it does not appear easy to get more information; but it has no apparent connection with the color of the egg; for the *bee-eaters* have, in one or other of the species, all the colors of the rainbow, as brilliant as in the rainbow itself, and yet the eggs are white. Whether the bright colors are *less sentient to the sun* than the more sober hues of the birds of cold climates we are unable to tell; but the smooth surface and metallic luster must reflect the light, as well as decompose it by that refraction which shows the colors; and we find the same kinds of tint and gloss in the day-insects of sunny climes, and in the birds of the same. We may therefore conclude that the resplendent plumage of these birds answers as a sort of *protection against the ardor of the sun*, just in the same manner as the half-furry clothing of the northern owls protects them against the pelting sleet and the driving snow, or as the down upon sea-birds protects them against the action of the water.*

780. *Why are the feet of the creeper very long and powerful?*

Because by their means the bird is enabled to *cling to the perpendicular surface of trees*, and is enabled to use its beak with great effect in the obtaining of its food.

* Partington's "Cyclopædia," Art., "Bee-eater."

"From purple violets and the teile they bring
Their gather'd sweets, and rifle all the spring."—ADDISON.

781. Clinging by their feet, and resting upon the stiff quills of their tails, they will even pass round a horizontal branch with their backs to the ground. This is of importance to the bird, since many of the insects forming its food often seek the under surface of a branch for security.

782. *Why has the nuthatch, whose habits so closely resemble the woodpecker, only a very short tail?*

Unlike the *woodpecker*, the *nuthatch* runs with the head downwards as well as upwards; and, indeed, the former position of the head appears to be the favorite one: it generally alights on a branch with the head in a downward position, and sleeps in that posture. A long tail, therefore, would be *useless* to it, and an *incumbrance*.

783. The *nuthatch*, in procuring its food, sometimes grasps the tree with his powerful feet, and turns its body upon them as upon a pivot, striking with its whole weight, and thus presenting with its body the appearance of the head of a hammer in motion.

784. *Why does the nuthatch make its nest in the decayed trunks of trees?*

In order that the young may subsist upon the insects that inhabit the decayed wood that surrounds the nest.

785. *Why is the rifle-bird so called?*

From the *dark tints of its plumage*—a bottle-green approaching to black—and its habit of creeping upon the boles of trees, after the manner of a sharpshooter.

786. Mr. Gould, the Australian naturalist, considers the *rifle-bird* the most gorgeously-plumed of all the birds of that region. The general color of the male is a rich velvety black, varied with lilac and green. The female is less handsomely furnished. The rifle-bird's powers of flight are very limited, owing to the shortness and truncated form of the wing; but this structure enables it to ascend upright stems of trees precisely after the manner of the *climacteri*, many of whose habits it possesses.

787. *Why is the hoopoe so named?*

From its uttering the song or cry of *hoop, hoop, hoop*, as it sits perched by its nest, or flits along after its insect prey.

"That a *kingfisher* hanged by the bill sheweth in what quarter the wind is by an occult and secret propriety, converting the breast to that point of the horizon from whence the wind doth blow, is a received opinion, and very strange."—BROWN'S VULGAR ERRORS.

Sub-order V.—*Syndactili*.

788. *Why are the birds of this group called syndactili?*

From two Greek words meaning *and toe*, in allusion to their having the external toe nearly as long as the middle one, and united to it, as far as the second joint. *Syndactylic* means *having the toes together*.

789. The bills of syndactalous birds differ considerably in their forms, because their food differs in kind; and this difference probably led Cuvier to name this division after the structure of the *feet*, and not that of the *bills*.

790. *What are the peculiar examples of adaptation in the structure of kingfishers?*

It is furnished with a *long sharp bill*, admirably adapted for transfixing fish, as with a spear; and the plumage is remarkably smooth, and adapted to resist the action of water.

791. When watching for its prey, the kingfisher perches itself upon



some overhanging branch, with its long, dagger-like bill pointed downwards, and its eye intent upon the water beneath. Suddenly, it darts downwards, plunges headlong into the water, and speedily re-appears with a minnow or other small fish between its mandibles. Without loosing its hold, it passes the fish through its bill until it is fairly grasped by the tail, and then destroys the life of its victim by smartly striking its head three or four times against a branch, after which it gulps its prey at one mouthful, except when it is bound away to the nest for the supply of the young.

“For both the boughs doe laughing blossoms beare,
And with fresh colors deck the wanton prime,
And eke at once the heavy trees they *clime*,
Which seeme to labour under their fruite's lode.”—SPENSER.

792. *Why has the kingfisher remarkably small feet?*

Because the habits of the bird are neither those of *wading*, *walking*, nor *standing*; but simply of *perching* upon the points of small twigs that overhang the water. The kingfisher watches patiently, generally from a naked twig, and when it quits that, flies immediately to a similar station.

The feet of the kingfisher, which at first appear very imperfect, and totally unfit for ordinary purposes, are, in fact, excellently adapted to the wants of the bird.

793. *Why are the bee-eaters so called?*

Because *bees* form a considerable part of their food, though they devour also wasps, hornets, and various other insects of comparatively long and rapid flight.

ORDER III.—SCANSORES.

794. *Why is the third order of birds termed scansores?*

The word *scansores* is derived from the Latin *scando*, to climb and implies that these birds live and obtain their food in a scaling position.

795. Their feet are adapted for *clinging to the bark of trees*; and they ascend the stems and branches with great facility. Their food, for the most part, consists of *insects*, which they search for in the crevices and underneath the bark of unsound trees, or in the wood of such as exhibit symptoms of decay. They also occasionally eat *fruit*. The order is very extensive, comprehending the *woodpecker*, the *cuckoo*, the *parrot*, *macaws*, *love birds*, *cockatoos*, *toucans*, *lories*, etc.

796. *Why is the name “zygodactyli” also given by ornithologists to the scansores, or climbers?*

Because of a peculiarity in the feet; two of their toes being *directed forwards*, and *two backwards*.

"Rap, rap, rap, rap, I hear thy knocking bill,
Then thy strange outcry, when the woods are still."—MONTGOMERY.

The word *zygodactyli* is compounded of *zygoo*, "to join," and *daktylos*, a *finger*.

797. *Why are the supposed ravages of woodpeckers beneficial rather than otherwise?*

Because they bore only those trees which insects have previously attacked, and thus diminish very considerably the numbers of such as are injurious to our forests.

798. *Why are the extremities of the feathers in the tail of the woodpecker hard and elastic like whalebone, and with the shaft particularly prominent?*



Because this quality in the bird's tail affords a *prop*, or *fulcrum*, as it rests against a tree; and no other contrivance could enable the bird to maintain its position when throwing back its head to give due force to the bill in hammering at the bark of the tree.

799. *Why is the bill of the parrot so thick and powerful?*

This member, so unlike that of other frugivorous birds, is admirably calculated for the principal offices it has to perform, viz., *breaking the shells and stones of the hardest fruits and seeds*, and as a strong organ of prehension and support when climbing or moving from one position to another.

800. In their native woods, the movements of the parrot tribe are marked by an ease and gracefulness we never see exhibited in a state of confinement. They climb about the branches in every direction, and suspend themselves from them in every possible attitude, in all which movements they are greatly assisted by their hooked bills, which are used, like the foot, as an organ of prehension and support.*

"In painted plumes superbly drest
A native of the gorgeous East,
Poll gains at length the British shore,
Part of the captain's precious store."—COWPER.

801. *Why is a parrot able to move its bill with unusual force, and to peck out and divide its food with extreme nicety?*

Because *both mandibles* of the parrot's beak are *moveable* (most birds being able to move only one), and are endowed with a large amount of muscular power.

802. The *fleshy tongues* of parrots are as peculiar as their bills, and are very useful to the birds in turning a nut, or other food, into a convenient position for the power of the bill to bear upon it. The fleshy tongue is found in all parrots, excepting the Australian group, called the *loniquets*, which birds feed on the honey offlowers, and have tongues *formed with bristles* like a brush, with which they sweep together the honey.

803. *Why has each species of the parrot tribe its own peculiar residence, and a very limited distribution around it?*

This is partly accounted for by the *shortness of the wings*, and the want of power of flight, which prevent their migration; but it is partly due also to the adaptation of each species to a peculiarity of conditions, which would not be met with elsewhere.

804. *Why among the parrot tribes are there marked differences in the forms of their feet?*

Because, as there are *various kinds of trees and plants* upon which they live, so a *different form and development of the climbing organs* is necessary to adapt the bird to its habitation.

805. Those who have examined the tropical forests, mention that there appears to be a *species of parrot adapted for each of the more conspicuous kind of trees* which are to be met with in those forests. Thus, if the tree is a palm, or anything else which has a single stem, and can afford nourishment for a bird only at or near the top of that stem, then the species of parrot set over it to consume the surplus of its fruit is an air bird, capable of flying over the forest in search of such trees; and, when this is the case, the body of the bird is lighter in proportion to its lineal dimensions, and its tail is generally very much produced, which assists it in ascending and descending. On the other hand, the short-flighted parrots, which inhabit trees which are very much branched, and bear fruit in the axillæ of the leaves of the smaller twigs, have the bodies stouter in proportion to the dimensions, the tail

"Words learn'd by rote a parrot may rehearse,
But talking is not always to converse;
Not more distinct from harmony divine,
The constant creaking of a country sign."—COWPER.

shorter, and the feathers more firm and scaly. Parrots of this last description inhabit regions which are more perennially fertile than those inhabited by the former, whose more produced flying feathers and lighter bodies, and, generally speaking, also their more vigorous make, fit them better for ranging into a new locality when food fails them in the old one; and also for making daily excursions of considerable length over the fields in the vicinity of those trees wherein they roost during the night.*

806. *Why are the macaws so named?*

The name is derived from *macro* and *cercus*, the latter having reference to the large naked space on the cheek and around the eye.

807. *Why are parrots, in their natural distribution, limited to tropical climates?*

Because they are almost exclusively vegetable feeders, the kernels of fruits, and the buds and flowers of trees, being the chief sources on which they depend for their nourishment. They are therefore unfitted for a locality where the woods are for several months of the year *fruitless, flowerless, and leafless*.

808. *Why do parrots suffer less from confinement than birds in general?*

Because birds of flight, when brought within the narrow limits of a cage, lose their necessary exercise. But parrots, being *climbing birds*, are able to a great extent to keep up the movements of the natural condition.

809. *Why do parrots gnaw and chip pieces of wood?*

The propensity which the whole of the parrot tribe have for biting wood, and throwing the bits away, suggests that they perform a very useful function in the scheme of nature.

In their distribution they are limited to tropical climates, and in those climates to *localities* where the vegetation is so luxuriant that the forests are impenetrable to man.

* Partington's "Cyclopædia."

"O who would e'er have thought that time could have decay'd
Those *trees* whose bodies seem'd by their so massy weight
To press the solid earth, and with their wondrous height
To climb into the clouds."—DRAYTON.

- It is the office of the parrot tribes to *keep in check* this excessive vegetation, and to prune the trees which they inhabit. A parrot in the woods has harder labor to perform than almost any other bird which lives upon vegetable matter. And it is remarkable that they gnaw and chip wood, not for the purposes of appetite; but because this occupation affords them a great degree of pleasure.

Through this biting propensity, they contribute to the removal of decayed trees, by *enlarging the holes in their trunks*, and exposing the woody fiber to the action of the rain and atmosphere.

810. *What important advantage does the parrot derive from the moveability of its upper mandible?*

The upper mandible being moveable, and not, as in other birds, united to the cranium, *prevents pressure or concussion being communicated to the brain*, while the bird performs the arduous gnawing task assigned to it.

811. *Why are paraquettes so called?*

The term may be considered as a diminutive of *parrot*, and is used to distinguish the smaller birds of the parrot tribes.

812. *Why are paraquettes not abundant in America.*

The Carolina paraquette which was once abundant in North America has been almost exterminated by hunters. It was destructive of fruit to some extent, but its conspicuous colors and ease of approach made it an easy victim to any man with a gun.

813. *Why does the parrot construct no nest?*

The soft dust accumulated at the bottom of the trunks

"The time shall come when chanticleer shall wish
His words unsaid, and hate his boasted bliss:
The *crested* bird shall by experience know,
Jove made him not his master-piece below."—DRYDEN.

of decayed trees suffices for all the purposes of a nest, and precludes the necessity of any artificial contrivance.

814. The instinctive liking for such a bed does not desert it in a state of captivity. Buffon mentions a pair of parrots in France, that for several years successively produced and brought up their young. The place they selected for this purpose was a cask partially filled with sawdust.

815. *Why are cockatoos so called?*



Because of the peculiarly distinct manner in which *they speak the word cockatoo*, though generally they are less capable of articulating sounds than the true parrot. Cockatoos are distinguished from true parrots, and all others, by a *crest*, or tuft of feathers on the head, which they can raise or depress at pleasure.

816. *Why is the toucan tribe so named?*

From the cry *tu-can* which it utters when upon the watch, or when apprehensive of danger.

817. *Why does the toucan toss back its head while eating?*

This habit is rendered necessary by the *length of the bill*, and the *stiffness of the tongue*, which prevent their eating as other birds; they therefore, when the morsel has received its first mastication, throw it into the gullet with a smart jerk.

818. The toucan has a practice of returning his food, some time after he has transmitted it to his crop; and, after masticating it for a second time in the bill, again swallowing it; the whole operation bearing a strong resemblance to the process in ruminating animals.

“The merry *cuckowe*, messenger of spring,
His trumpet shrill has thrice already sounded;
That warns all louvers waite upon their king,
Who now is coming forth with girland crowned.”—SPENCER.

819. *Why has the toucan such an immense bill?*

In order to enable it to procure its food, consisting of small birds and their eggs, found in deep nests, and various hard vegetable substances.

820. The bill of the toucan, although large—in some instances being nearly as long as the body itself—is light and cellular. It serves as a hatchet, and at the same time has all the delicate action of a very neat pair of pliers. The toucan is not a swift or powerful flyer; but its motions, as it hops from branch to branch, are not ungraceful. The bill is, in fact no incumbrance to the bird, however ill its appearance may suit with our ideas of proportion.

821. *Why is it ordained that the cuckoo should deposit its eggs in the nests of other birds?*

Because the cuckoo is the *largest of insectivorous birds*, and requires a great quantity of food, which, like the swallow, it must make constant search for. If cuckoos sat upon their eggs, they would be *unable to obtain this large supply*; and if they left their eggs to search for food, the eggs would become chilled while they were on the wing.

However the American cuckoo is equally large and yet raises its own young honestly, so there is little excuse for the habits of its European cousin.

822. *Why does the cuckoo drop her eggs into the nests of birds smaller than herself?*

Because if she were to drop her eggs into the nest of a bird which produced a large egg, and consequently a large nestling, the young cuckoo would probably find an insurmountable difficulty in *solely possessing the nest*, as its exertions would be unequal to the labor of turning out the young birds.

823. *Why does the female cuckoo deposit her eggs in the nests of the sparrow, the wagtail, etc., which are disproportionately small; and pass by the nests of the black-bird, thrush, etc., which appear to be better adapted for the purpose?*

"Since the *cuckoo* builds not for himself,
Remain in't as thou may'st."—SHAKSPERE.

Because the various *insects and flies* upon which the *sparrow, wagtail*, etc., feed, form the *best kind of food*, upon which the young cuckoos can be reared. Whilst the aliment upon which the blackbird and the thrush usually subsist is not proper, and in some respects would be injurious.



824. When the cuckoo is hatched previously to the offspring of its foster-parent, it throws the unhatched eggs out of the nest by means of its broad and depressed beak. It visits its lay companions with the same treatment; and, admitting no rival, monopolizes all the room and all the food to itself; and such is the voracity of this bird, that the most untiring zeal and labor of the foster-parent are scarcely able to satisfy the cravings of the intruder.

825. *Why does the cuckoo deposit her eggs in the nests of other birds with her bill?*

Because if the cuckoo sat upon the adopted nest while laying the egg, the weight of its body would derange the nest, and cause it to be forsaken; thus defeating one of the ends of Providence.

826. *Why do injuries so frequently occur to the eggs of those birds in whose nests cuckoos lay?*

These accidents are chiefly owing to the sitting bird attempting to accommodate herself to eggs of different sizes.

If comparatively large and small eggs are placed in the same nest, some of the smaller ones are generally thrown out, or rendered addle, by the hen bird endeavoring to arrange them so that she may distribute nearly an equal degree of warmth and pressure to all: but the larger ones, which chiefly sustain her weight, and consequently

"Harsh your *love-notes* thrill,
 To me no pleasure Nature now can yield;
 Alike the barren rock and woody hill,
 The dark-brown blasted heath and fruitful field."—CHATTERTON.

are less liable to be moved usually remain uninjured. When the eggs of birds are exchanged for others of a uniform magnitude, or provided the difference is not so great as to occasion them to be forsaken, no disturbance ensues, whatever their color may be, the change either not being perceived, or totally disregarded.

827. *Why do birds of the cuckoo kind perch upon the backs of oxen while grazing?*

Many of them eat the insects which infest cattle; and the latter are so well aware of the fact, as well as grateful for it, that they frequently lie down, in order that the bird may devour its prey undisturbed.

828. *Why is the bird known as the wry-neck so called?*

Because it has a habit of moving its head in various directions, not unlike a snake; this is especially the case when discovered in its nest, upon which occasions it writhes its head quickly from shoulder to shoulder, with strange and apparently painful contortions.

829. *Why are love-birds so named?*

From the singular degree of attachment to each other which they manifest; sitting closely side by side caressing each other, arranging each other's plumage, and exhibiting various marks of mutual regard.

830. *Why is the oven bird so designated?*

From the singular oven-like form of its nest.

831. It is a native of South America, but is occasionally found in Southern Europe. The nest, whence it takes its name, is placed in the most exposed situations, as the top of a post, a bare rock, or a cactus. It is composed of mud and bits of straw, and has strong, thick walls: in shape it precisely resembles an oven, or a depressed bee-hive. The opening is large and arched, and directly in front. Within the nest there is a partition which reaches nearly to the roof: thus forming a passage, or anti-chamber, to the true nest.

In North America the golden-crowned water thrush is sometimes called the oven-bird, because it builds an enclosed nest of grass and leaves with the entrance at the side,

"Whilst wheeling round in airy wanton flights,
The glossy pigeons chase their sportive loves."—DODSLEY.

ORDER IV.—GYRATORES.

832. *Why is the order gyratores thus designated?*

From the word *gyratio*, a "turning" or "wheeling round." It refers to the ordinary mode of flight displayed by the birds included in the order.

833. *Why has the pigeon tribe a puffed-out appearance about the breast?*

This arises from the presence of its unusually large *crop*; an organ which is capable of some of the uses of the paps in mammalia.

834. *By what remarkable process are the young pigeons and other birds of the dove-kind fed by their parents?*

The parents of the dove kind support their young with the *curd-like contents of their crops*, as the mammalia do with milk in the early stages of the existence of their offspring.

835. This is performed by the faculty which the parent birds possess of throwing up the contents of their crops, which assume the appearance of a granulated white curd. It would appear that the young pigeon is fed for a little time with this curd-like substance only, for about the third day some of the common food is found mingled with it. As the pigeon grows older, the proportion of common food is increased; so that, by the time it is seven, eight, or nine days old, the secretion of the curd ceases in the old bird, and of course no more will be found in the crop of the young. It is a curious fact, that the parent pigeon has, at first, a power to throw up this curd without any mixture of common food, although, afterwards, both are thrown up according to the proportion required for the young ones.

No young birds are in so forlorn a state as young pigeons, if the parents are killed before the young can provide for themselves. Birds of other species, stimulated by the cries of the helpless young which have been deprived of parental aid, can and do assist the little starvelings; but none except an old pigeon, with its crop in a proper state, can save the life of a nestling dove.

836. *Why is the plumage of the rock pigeon very close and compact?*

They are thus furnished to enable them to encounter

"One silent eve I wander'd late,
 And heard the voice of love;
 The turtle thus address'd her mate,
 And soothed the listening dove."—COWPER.

the severe storms which they often experience, at those places where they frequent.

837. It does not appear that there is, generally speaking, much food for them in the close vicinity of the rocks—their natural habitations. But, in order to keep up the powerful and long-continued muscular action which they must exert, they require a high degree of action in the vital system, and consequently a copious and frequent supply of food. In order to obtain this, they must range about in all weathers, and consequently they require to be warmly as well as compactly clothed.

838. *Why is the plumage of the pigeon tribe of a somber hue?*

Their food consist chiefly of grain, acorns, beech-nuts, and other seeds, and occasionally the tender shoots of particular plants. These they gather on the ground, and hence the color of their plumage is so ordered as *not to be readily distinguishable from the vegetation among which they feed.*

839. The structure of the pigeon tribe manifestly displays the unerring provision of Nature. Their bills are slender, though still of average strength, for they have no nuts or fruits to break. Their tails are generally square, and their wings strong and pointed, thus fitting them for long and arduous flights.

840. *Why does the rock pigeon prefer, among artificial pigeon-houses, one that has been whitewashed?*

There may be two reasons for this: first, the whitened pigeon-house is a more conspicuous object than the other; and secondly, a considerable quantity of *carbonate of lime* may be required for the eggs of the female, which, though only two in each batch, are often numerous in the course of the year. This the bird obtains by pecking at the lime.

841. *Why is the rock pigeon, which never feeds upon fish, seen to walk and pick upon the sea-beach?*

Probably for the purpose of taking into its crop *bits of shell and small stones*, as means towards the digestion of its food.

"I have heard her with sweetness unfold
 How that pity was due to a *dove*;
 That it ever attended the bold,
 And she called it the sister of love."—SHENSTONE.

842. *Why does the ringdove feed greedily, and get very fat, in the autumn months?*

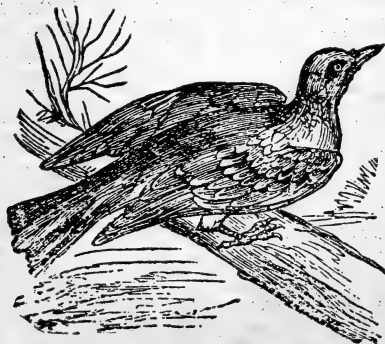
In order to be better prepared for enduring the severer and less abundant months of winter.

843. In autumn the ring pigeons begin to associate in flocks. At first they feed upon the fruits of forest trees, and particularly the beech-mast, which at that time is strewed upon the ground. The grains and seeds left, and small fallen fruits, are their first subsistence; but, as they are ravenous feeders, they, if in great numbers, speedily exhaust these. After this, they migrate farther south, and attack the more succulent green leaves which remain in the fields—such as those of field-greens, turnips, and mangold-wurtzel.

844. *Why does the dove tribe seek the vicinity of man, so as to prefer an artificial pigeon-house to its native haunts in rocks, etc.?*

The feet of the dove, or common pigeon, are *walking feet*, with very little of the perching character. The external and internal front toes are of equal length, the hind toe is short, and the claws are not hooked, as in the decided perchers, but so placed as that the foot may be wholly planted upon the ground. Hence a *regularly formed ground* may have a charm for the pigeon, which its wild rocks cannot supply.

845. *Why are the notes of the wood-pigeon commonly associated with gentleness and love?*



Because the cooings of these birds accord so intimately *with our conception of all that is gentle and innocent*, that one cannot listen to them without being impressed with feelings which no other sounds in nature, save that of the human voice itself, could inspire.

"O, ten times faster than Venus' pigeons fly
To seal love's bonds new made, than they are wont
To keep obliged faith forfeited."—SHAKSPERE.

846. A man, who was once a pirate, declared that several times while at certain wells dug in the burning shelly sands of a well-known bay, the soft and melancholy cry of the wood-pigeons awoke in his breast feelings which had long slumbered, melted his heart to repentance, and caused him to linger at the spot in a state of mind which he only who compares the wretchedness of guilt with the happiness of former innocence can truly feel. He said he never left the place without increased fears of futurity; and so deeply was he moved at length by the notes of this bird, that through their influence he was induced to escape from his vessel, abandon his lawless companions, and return to a family deploring his absence. After paying a parting visit to these wells, and listening once more to the voice of the bird, he poured out his soul in supplications for mercy, and once more became an honest man.

847. *Why is the song of the ringed pigeon heard at intervals only of the spring and autumn?*

Because, except when engaged in constructing its nest, or the process of incubation and the rearing of its young, this bird utters no note: these cares over, it retires to the woods, and is silent until the breeding-time again commences.

848. *Why do pigeons return to the place from which they set out, after having accomplished a long journey?*



Because these birds are conspicuous for their strong attachment to locality or home. And in training them to carry missives, etc., the bird is tried at easy distances, which are gradually extended until twenty or thirty miles are accomplished successfully, and when this distance has been attained,

the pigeon will travel to, and return from, any spot, however remote.

849. The following anecdotes will be found to illustrate the wonderful faculty of the carrier pigeon:—In the year 1819, an experiment was tried between London and Antwerp. Thirty-two pigeons with the word

"Say, mid that grove, in love-lorn state,
While yon poor *ring-dove* mourns her mate,
Is all that meets the shepherd's ear,
Inspired by anguish and despair?"—MASON.

"Antwerp" marked on their wings, and which had been reared in that city, were let loose in London at seven o'clock in the morning, after having their wings counter-marked "London." The same day, towards noon, one arrived at home; a quarter of an hour afterwards, another arrived. The following day twelve others returned, making fourteen in all; of the fate of the rest no tidings were gleaned. In July, 1829, another experiment was made, in consequence of some wagers laid at Maestricht between some merchants there, that pigeons taken to London would, when let loose, return in six hours. Forty-two pigeons were accordingly brought to London, and after being properly marked, were thrown up at twenty-six minutes past eight in the morning. If any one of the number had arrived at Maestricht within six hours, the principal wager, which was for 10,000 guilders, would have been gained; but in consequence, as it was supposed, of a heavy rain, the first did not arrive till six hours and a quarter from the time when it left London, having, nevertheless, traveled at the rate of forty-five miles an hour, assuming that the journey was performed in a straight line. The second arrived in seven hours, the third in seven hours and ten minutes, the fourth in seven hours and a half, and in four days more than twenty had returned. The missing birds are supposed to have met with accidents, which might be reasonably supposed to occur in such a long journey, such as being shot, or to have taken up their abode with wild flocks on their way.

850. *Why does the form of the ring-dove become considerably changed in the evening?*

Because, when they have fed upon turnip-tops and other vegetables during the day, the crop becomes so *distended with food*, as to give to the fore part of the body a very full appearance. The contents of the stomach having been digested during the night the body regains its ordinary proportions.

851. *Why is the flesh of the wild pigeon less delicate and palatable than that of the tamed variety.*

Because the violent and frequently repeated exercise to which they are subjected hardens the muscles of birds in a state of nature.

852. If the birds are brought up from their earliest stage, and kept upon rich pastures where they have occasion to use the wing but little, the tenderness and also the flavor of their flesh are greatly improved.

"The careful hen
Calls all her chirping family around,
Fed and defended by the fearless cock,
Whose breast with ardour flames, as on he walks,
Graceful, and crows defiance."—THOMSON.

ORDER V.—RASORES.

853. *Why is the order rasores so called?*

From *rado*, to *scrape* or *scratch*, the birds of this order comprehending the *gallinaceous* tribe being distinguished by their habit of scraping the earth, to obtain food.

854. They are *omnivorous*; living equally upon seeds, grains, and insects. It is to this order that most of our domestic birds, the feathered tenants of the farmyard, belong; and also most of those unreclaimed by man, celebrated for the excellency of their flesh, as the *grouse*, *partridge*, *quail*, and *pheasant*.

855. *Why do gallinaceous and other birds pick up small stones, bits of shells, etc., and gravel, which are afterwards found embedded in their gizzards?*

The gizzard is a *fleshy stomach*, the substance of which consists of strong muscle; the dark part of the gizzard being the muscle, and the shining part of it the lining of the digestive cavity. Birds pick up small fragments of stone, which pass with the grain to the gizzard, and there become the means of *grinding the food* upon which the birds subsist.

The cavity within this muscle is lined with a dense, rough, insensible coat, and there are always to be found contained in it small stones, generally of quartz, if it be within the reach of the bird.

The grains are mixed with these portions of stone; and if we place our ear close to the bird, we may hear the grinding motions going on as distinctly as the noise of the horse's jaws in a manger.

In fact, this gizzard, is equivalent to the muscles of the jaws, and the pebbles are a fair equivalent to the teeth, with this advantage, that *when they are ground down, the instinct of the bird provides more.**

857. *In what respect do the gallinaceous birds resemble ruminating animals?*

By a peculiar arrangement, the food taken up by the bill of these birds undergoes a tritulating process in the

* Notes to Paley's "Nat. Theology," by Sir Charles Bell.

"The *cock*, that is the trumpet to the morn,
Doth with his lofty and shrill sounding throat
Awake the god of day."—SHAKSPERE.

gizzard, *before passing into the stomach*; thus it submits to a *double digestion*, somewhat analogous to the triple digestive action of the ruminants.

858. The gallinidæ have, generally speaking, *three stomachs*, and their intestines are more lengthened than those of most birds, and furnished with two cæcal appendages, about six inches in length. These three stomachs are: the *craw*, or pouch, into which the food is taken, as into little more than a simple store, where it is sent gradually to the other parts of the digestive apparatus. In this viscus the food undergoes very little change, though it may be partially softened. The *craw* opens laterally from the gullet. The second stomach is a dilatation of the gullet itself, and is furnished with glands which secrete a peculiar fluid; and it is here, also, that the drink of the bird mingles with its food. The third stomach is the gizzard, the texture of which is very strong and muscular, and the inner coat so hard and compact as to have the appearance of firm cartilage. The gizzard can exert a very powerful action, so much so as to grip down glass and metals in a very short time, without appearing to sustain injury.

859. *Why do the gallinaceous birds lay and hatch their eggs in nests upon the ground?*

Because, being *indifferent flyers*, their young after incubation are thus enabled to reach their proper *habitat* without the risk of injury.

860. *Why are the legs of gallinaceous birds developed at a very early stage of their existence?*

Because they are ground birds; feed upon their feet; and pass the greater portion of their lives in *walking and scraping*.

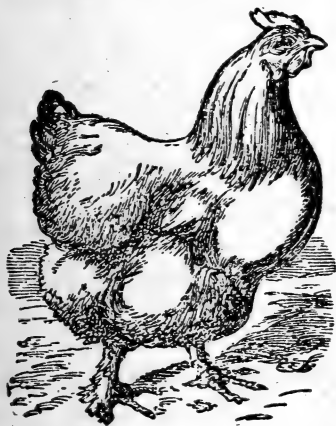
861. The newly-hatched birds require these organs developed very early, being less provided with a formal nest than the young of any of the preceding orders.

862. *Why has the cock a streaming and elegant tail?*

In all probability this appendage, which is useless to him in flying, adds to the dignity and importance of his bearing in the eyes of his mates.

"While the *cock* with lively din,
Scatters the rear of darkness thin,
And to the stack or the barn door,
Stoutly struts his dames before."—MILTON.

863. *Why has the common fowl become thoroughly domesticated?*



Because, being *omnivorous* it delights in that great variety of food which proximity to man affords; while its hardy nature enables it to support great variations of season and temperature.

This rule is not without limitation: the barn-door fowl does not thrive or breed in very cold climates. Every attempt to introduce it to such countries as Siberia has hitherto failed.

864. *Why have common poultry limited powers of flight?*

Because they have little use for wings: only requiring those organs to assist their legs *when alarmed*, or in *reaching the perches* upon which they pass the hours of repose.

865. The chief use of the wings of the *gallinidæ*, besides enabling those which perch during the night to reach their perches, appears to be safety against quadrupedal foes. Their fluttering gets them, perhaps, sooner above the reach of these than if they had a more steady and forward style of flight. From birds of prey they may be said, one and all, to be incapable of escaping on the wing: their safety from these consists in crouching among the clods or lurking among the herbage. Their wings are short, broad, and concave; and also looser in the plumage of their under sides than the wings of almost all other birds. All these qualities enable them to take a firm hold on the air, which assists them in working upwards; though it renders flight more laborious.

866. *Why do fowls prefer to roost in elevated places?*

Because they have an instinctive *dread of vermin* which may molest them on the ground during the hours of dark-

"See from the brake the whirring *pheasant* springs,
And mounts triumphant on exulting wings."—POPE.

ness. Hence poultry, if left to themselves and not housed, will perch the winter through on yew trees and fir trees; and turkeys and guinea fowls, heavy as they are, get up into apple trees around their owner's house for security, let the weather be ever so boisterous.

867. Partridges roost on the ground, not having the faculty of perching; but the same fear prevails with them; for, through apprehension of polecats and stoats, they never trust themselves to coverts, but nestle together in the midst of large fields, far removed from hedges and coppices. As to ducks and geese, their awkward web-feet preclude them from settling on trees; they, therefore, in the hours of darkness and danger, betake themselves to their own element, the water, where, amidst large lakes and pools, like ships riding at anchor, they float the whole night long in peace and security.

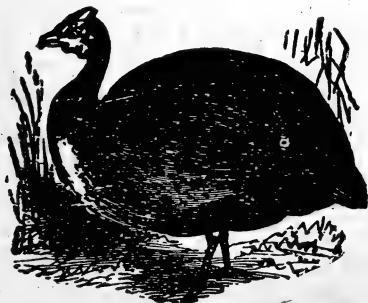
868. *Why does the plumage of the pheasant taper off to a point?*

The haunts of these birds are among shrubs, bushes, and tall herbage, through which they have to make their way *with as little rustling as possible*: this their pointed tails enable them to do most perfectly.

869. *Why do pheasants prefer larch trees to perch upon?*

Because the branches of this tree grow at nearly right angles from the stem; which renders the sitting position of the birds peculiarly easy.

870. *Why have the eggs of guinea fowls so hard a shell?*



Because these birds deposit their eggs on the ground, and were the shells not harder than those of ordinary eggs, they would be broken by many accidental causes. The eggs, though laid on the ground, are usually concealed.

"O'er the wild waste the stupid *ostrich* strays
In devious search to pick her scanty meal,
Whose fierce digestion gnaws the temper'd steel."—MICKIN.

871. *Why do fowls and other birds hustle themselves in the dust?*

Because by this action they rid themselves of the vermin with which they are liable to be troubled.

872. On the same principle, *swine* wallow in the mire, and the *rhinoceros* and the *elephant* roll their bodies in the mud to defend them from the *breeze-fly*.

ORDER VI.—CURSORES.

873. *Why is the order cursores so termed?*

Because the birds comprehended therein are distinguished by possessing great powers of locomotion *afoot*.



874. The word *cursores* is derived from the Latin verb *curro*, "I run." These birds are strictly and exclusively terrestrial: have powerful and even massive legs, moved by voluminous muscles; and wings which are scarcely more than rudimentary, barely enabling the bird to rise above the surface of the earth. The *ostrich*, *dodo*, and *cassowary* are the chief examples of this order.

875. *Why is the ostrich the swiftest of animals?*

Because of the very wide and scanty distribution of its food, and the consequent large area over which it must travel in order to obtain it.

876. *Why does the ostrich possess digestive organs of extraordinary power?*

Because the scanty supply of food which the deserts afford, renders it necessary that the bird should be able

"At both these times they were *motherless* and helpless, concernynge theyro owne strengthes; but were yet cared for of God."—BIBLE NOTES. 1551.

to extract the whole nourishment which that supply is capable of rendering.

877. *Why does the hen ostrich continue to lay eggs, while engaged in incubation?*

Because she thus provides for her young brood a means of subsistence which they would otherwise need. *The eggs laid during incubation are destined to nourish the brood?*

878. Although as large as pullets when first hatched, the young ostriches are then unable to digest the hard and acrid food on which the old ones subsist. The eggs laid for this purpose are not deposited in the nest, but placed *outside* it, which alone would be a proof of the use they are intended to serve.

879. *Why does the hen ostrich sometimes abandon her nest for a long period?*

Because *the absence of moisture in the desert* diminishes the quantity of food which the bird can meet with: and this compels her to take long journeys in order to preserve her life.

880. Under such circumstances, she also actually requires more food; for the amount necessary to the healthy state of an animal increases with the increase of its labor. That this is the only reason why the ostrich should for a while abandon her eggs, is made clear by the fact that where food is more plentiful—*i. e.*, in districts better watered—she takes a narrower range, and is less frequently absent from the nest. Under the tropics, where vegetation abounds, she seldom, if ever, quits it till the eggs are hatched.

881. *Why has the hen ostrich been cited as a type of the neglectful mother?*

Because of an *apparent* inclination to *abandon her eggs to chance*, by leaving them uncovered during some hours of the day.

882. This carelessness is, however, *only apparent*. During the heat of the African day the vertical rays of the sun are sufficient to keep the eggs at a proper temperature, and the mother takes that opportunity to procure food for herself.

During such an excursion she still hovers about her nest, and if surprised, makes a short circuit, and returns to the object of her care.

"I'll make thee eat iron like an *ostrich*, and swallow my sword like a great pin, ere thou and I part."—SHAKSPERE.

The expression in the Book of Job, derogatory to the character of the ostrich, are to be understood as spoken by an individual, not as coming from the lips of inspired wisdom. God has looked upon the creation of his hands and pronounced it "very good." Job (in chap. xxxix.) spoke according to his limited knowledge of the habits of birds, and might pardonably err.*

In the dry desert, where the hen ostrich deposits her eggs, scarcely any dew is formed during the night; and she can without injury to them afford to be absent from the nest during the whole twenty-four hours, if such an absence should be necessary. For the radiation of heat from the sand during the night would be quite sufficient to keep up a stimulus to vitality in the eggs until the direct sun of another day came upon them.

883. *Why does the foot of the ostrich resemble that of a camel?*

Because it *inhabits the same regions*, and is *subject to the same set of circumstances*; with this difference, that as its pace is more swift, the foot of the ostrich is therefore proportionally hard and callous.

884. The resemblance between the ostrich and camel has always been a subject of remark. By the ancient authors it was called the *camel-bird*. Aristotle asserts it to be partly bird and partly quadruped; and Pliny does the same. Its powers of digestion assimilate it to the ruminating animals; it does, in fact, occupy the place among birds which the camel, "the ship of the desert," does among mammalia.

885. *Why has the ostrich small and light wings?*

It is a rule in nature that whenever one species of action is required in a very high degree the organization of an animal is concentrated upon that. *Flight* would have been of *comparatively little use* to a vegetable feeding bird, where its height, standing on foot, is quite sufficient to reach the top of the tallest shrub on its pastures.

886. Wings sufficient to bear up so weighty a bird as the ostrich in swift motion through the air would have demanded a waste of muscular exertion, for the supply of which sufficient food could not have been found in the region inhabited by it.

* See "The Knowledge of the Bible" for many interesting explanations of Scripture texts.

"A giantess she seems; but, look behind,
And then she dwindles to the pigmy kind,
Duck-legg'd, short waisted."—DRYDEN.

ORDER VII.—GRALLATORES.

887. *Why is the order grallatores so termed?*

From the circumstance that the birds comprehended in it are *waders*, distinguished by the *length of their legs*, and generally of their *bills*. The word is formed from *gralloe*, "stilts;" *grallatores*, therefore, means literally "*stilt walkers*."



888. These birds feed upon worms and the smaller species of fish found on the banks, and hold an intermediate place between land and aquatic birds; and though not provided with any apparatus to enable them to swim, the provision thus made, as in the case of the *long-legged plover* seen in the engraving, enables them to wade in the water in search of their prey, and to seize it without any difficulty.

889. *Why have long-legged wading birds generally short tails?*

Because tails of any considerable length would be *inconvenient* to such birds: coming in contact with water, they would be liable to become wet, heavy, and cumbersome. For, although the plumage of water-birds is provided with an oil which repels water, it operates chiefly upon the *closer plumage*, to prevent the water from penetrating to the flesh of the body.

890. Another reason why wading birds have short tails is to be found in the fact that many of them are of *hiding habits*, and fond of concealing themselves in tall vegetation. Birds which have these habits are always small-tailed, or that member is so disposed, as in the pheasant, that it trails the earth, and in no way interferes with their concealment.

891. *Why have wading birds wide-spreading feet?*

Because, in searching after their food, they have frequently to *stand by the slippery edges of the water*, and to

"There's not a better *steerer* in the realm,
I hope, my lord, you'll call him to the helm."—SWIFT.

steady themselves on *sloping banks of wet grass*, neither of which could they effect securely were their feet formed with a narrower base.

892. *Why do short-tailed birds generally throw their legs behind them when flying?*



Because, being destitute of the *steerage power* usually afforded by the tail, they find a substitute in their long legs, which they throw back to occupy its place: thus they get rid of the inconvenience of long legs

while flying, and are compensated for the absence of the tail.

893. *Why have fish-eating birds in general no crop?*

Because all they swallow, however large it may be, *enters at once into the stomach*, and undergoes immediate digestion.

894. *Why has the snipe a long tapering bill?*

Because it derives its food by *penetrating its bill into the moist earth*. This is exactly the instrument which the animal wanted. It did not require strength in its bill, which was inconsistent with the slender form of the animal's neck, as well as unnecessary for the kind of aliment upon which it subsists; but it wanted *length* to reach its object.

895. *Why are the eyes of snipes placed more backward in the head, than in most other birds?*

Because these organs are *not much wanted in the immediate capture of their prey*, and are thus placed so as to *best guard against enemies*. And besides, the eyes being thus situated enables the bill to bore its whole length in the mud, when searching for worms.

"But if I knew when you come next a burding,
I'll have a stronger noose to hold the *woodcock*."

BEAUMONT AND FLETCHER.

996. *Why are birds of the snipe family without the long hind toe of other birds?*

Because in wading in the mud, where the feet must necessarily sink deeply, a long hind toe would be an encumbrance, and tend to throw the bird on to its head in the water.

897. *Why do snipes and woodcocks gradually disappear from cultivated districts?*

Because the three essentials to the tribe are *solitude*, *shelter*, and *humidity*—consequently, population, clearance, and drainage drive them into more sequestered places.

898. The grand resort of woodcocks in summer is understood to be marshy woods to the north of the Baltic; and the farther north, so long as the place is wooded, the better, as the insect food for the birds is not only more plentiful, but the sludge of the marshes is more exclusively the nest of the larvæ.

899. *Why does the flamingo, when feeding, hold its head and beak upside-down in the water?*

The feet of the bird while feeding are moved in a trampling manner, in order to *stir the sand or mud* beneath the water; the food thus disturbed, whether insects, fish, or stones, are continually *falling into their former position*. The flamingo, by placing its head in that peculiar way, *catches in its mouth*, tests upon its tongue, and appropriates to its use whatever is suitable for food.

900. The structure of the flamingo's tongue is admirably adapted to its purpose. The spines with which the upper surface is armed are arranged in an irregular and alternate series, and act with the notches on the edge of the upper mandible, on which they press when the bird feeds with the head reversed. In this reversed position, the weight and size of the tongue supply a very efficient instrument for entrapping the food. The bird muddles and clutters the bill, and dabbles about; and the tongue receives, and holds as a strainer, whatever the water offers for food.*

* Maunder's "Treasury."

"What is this mighty breath, ye sages say
That, in a powerful language, felt, not heard,
Instructs the fowls of heaven?"—THOMSON.

901. *Why does the flamingo make its nest upon mound-like elevations?*



Because the great length of the legs of the flamingo precludes the possibility of its conducting incubation in the ordinary manner. Inhabiting marshy places, the nests are thus raised above the wet soil, to a dry and warm situation, in which the process of hatching can more effectually be accomplished.

902. These elevated nests are constructed by the bird out of loose earth or mud, formed into the shape of a hillock, with a hollow cavity at the top; the eggs are two or three in number, white, and as large as those of a goose, but of a longer figure. The female sits upon her nest during incubation, the attitude being that of a person sitting upon a high stool—the legs resting on marshy ground, and sometimes even in the water. Sometimes, if the female finds a low projecting rock, she makes her nest on the edge thereof, and raises no hillock.

903. *Why has the avocet a bill shaped like a scoop?*

Avocets are fen birds; but, in feeding, they frequent only those parts of the fens which are alternately flooded and left dry by tidal waters. Their bills are *not adapted for taking any kind of food upon land; neither are they fitted for fishing in the waters.* Their food is contained in mud, ooze, or light gravel; and consists of worms, larvæ, and small molluscous and crustaceous animals, which are there found in great plenty. The greater number of these are embedded to a certain depth, and are not seen by birds that feed by sight.

"The machine, which we are inspecting, demonstrates by its construction, contrivance, and design. Contrivance must have had a contriver, design a designer; whether the machine immediately proceeded from another machine or not."—PALEY.

904. In searching for its food among various accumulated matters, the avocet moves along with slow but rather lengthy steps, and scoops ooze or mud in curves, right and left, as it proceeds. In performing this operation, it does not use the bill only, but the whole body. It alights in the middle with its head in the stream, and the one foot a little in advance of the other. It then stretches and depresses the neck, and gives it a twist, so that the extremity of the bill, which is on a level with the ooze, is turned to the other side. The foot farthest in advance is the pivot on which it is to turn, in making the stroke which sweeps one curve. Then it slowly advances the rearmost foot, which

elevates the hinder part of the body, depresses the fore part, and throws the support on the advanced foot, while, supported by that, and moved by the lever power of the other as it is brought forward, the axis of the body is caused to cross the stream obliquely in an opposite direction: by this motion the bill makes another scoop. The head and bill are then elevated for the purpose of conveying to the gullet the food which the bill has thus collected.

905. *Why has the spoon-bill long, flattened mandibles?*

Because these birds inhabit the borders of rivers and sea-coasts, where they feed upon small fish, shrimps, frogs, quails, and aquatic insects; and the form of the bill is admirably adapted for seizing such descriptions of prey. Their beaks consist of long, flat, and broad mandibles, widening and flattening at the end, so as to form a roundish spatula.



"The *stork* assembly meets; for many a day,
Consulting deep, and various, ere they take
Their arduous voyage through the liquid sky."—THOMSON.

906. Paley makes these general and interesting remarks upon the forms of the bills of birds:—"In *birds*, the mouth assumes a new character; new both in substance and in form, but in both wonderfully adapted to the wants and uses of a distinct mode of existence. We have no longer the fleshy lips, the teeth of enamelled bone; but we have, in the place of these two parts, and to perform the office of both, a hard substance, of the same nature with that which composes the nails, claws, and hoofs of quadrupeds, cut into proper shapes, and mechanically suited to the actions which are wanted.

The sharp and tempered point of the *sparrow's* bill picks almost every kind of seed from its concealment in the plant; and not only so, but hulls the grain, breaks and shatters the coats of the seed, in order to get at the kernel. In the same way it breaks the shells of snails, to get at the animal food within.

The hooked beak of the *hawk* tribe separates the flesh from the bones of the animals which it feeds upon, almost with the cleanliness and precision of a dissecting knife.

The *butcher-bird* transfixes its prey upon the spike of a thorn, whilst it picks the bones. In some birds of this class we have the *cross bill*—*i. e.*, both the upper and lower bill hooked, and their tips crossing; and these bills are used for splitting the cones of firs, and other seed-vessels, harder than the ordinary grains and seeds which are dissected by the beak of the sparrow.

The *spoon* bill enables the *goose* to graze, to collect its food from the bottom of pools, or to seek it amidst the soft substances with which it is mixed.

The *long* tapering bill of the *snipe* and *woodcock* penetrates deeply into the bed of the moist earth. But the species of bill which belong to the birds that live by *suction* deserves to be described in relation to that office. They are what naturalists call serrated, or dentated bills; the inside of them towards the edge being thickly set with parallel or concentric rows of short, strong, sharp-pointed prickles. These form a filter. The *duck*, by means of them, strains the mud; examining with great accuracy the puddle, the brake—every mixture which is likely to contain her food.

907. Why is the *stork* an enemy to the *cat* species?

Because probably their *habits and tastes* are too similar for them to reside peaceably together.

The *stork* is fond of small birds; so is the *cat*, who loves young *storks*. The parent *stork* is partial to kittens, as an article of food, and finds them an easy and wholesome prey. Hence the enmity of the two species.

908. Why are birds of the *stork* tribe generally voracious eaters?

Because they are subject to great *vicissitude of season*; at times rejoicing in plenty—at others suffering from scar-

"Who bade the *stork*, Columbus-like, explore
Heavens not his own, and worlds unknown before?
Who calls the council, states the certain day,
Who forms the phalanx, and who points the way."—POPE.

city. Their hearty feeding during favorable seasons enables them to bear a period of abstinence without material injury.

909. *Why has the stork been from the most ancient periods an object of favor and veneration?*

Because its usefulness is great; especially in hot countries, where it acts as a *vigilant scavenger*, removing the causes of disease and death, and eating the most annoying species of reptiles.

910. Its beneficial labors in Egypt doubtless led to the deification of the *ibis*, a bird of similar character and form. In Holland, and the northern parts of Germany, the stork is still protected as a precursor of "good luck."



911. *Why has the jacana toes of extraordinary length?*

Because it inhabits the borders of waters which are frequently over-grown with the broad leaves of aquatic plants. Its spreading toes, coupled with the lightness of its body, enable the bird to walk upon the leaves, whilst it gathers the insects, worms, and small fishes that surround them.

912. *Why has the jacana sharp hard spurs on the corner of each wing?*

Because snakes of various sizes, all rapacious, and to be dreaded, abound in the haunts of the bird. The spurs

"The sitting bird looks up with jetty eye,
And waves her head in terror to and fro,
Speckled and vein'd with various shades of brown."—CLARE.

on the wings are effective weapons against these reptiles, the horny appendages of the beak assisting also in their destruction.

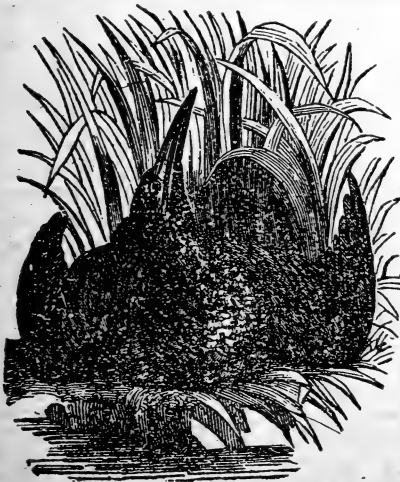
913. *Why are herons furnished with wings which appear to be too cumbersome for their slight bodies?*

Because those vast hollow wings are necessary in *carrying burdens*, such as large fishes and the like, with which they would be dragged to the earth were it not for the resisting force thus provided.

914. *Why is so little known of the habits of the bittern?*

Because it is a bird that *loves seclusion*, and fixes its haunts in wild and desolate places. No temptation will bring it upon cultivated or improved lands as a permanent resident; and when the scarcity of winter forces it from the upland, it comes down reluctantly and stealthily, and seeks those streams and banks which are the rudest and least frequented.

915. Even when not upon the nest, the bittern squats among the



rushes, or other tall stems, during the greater part of the day. The mode of squatting is rather peculiar, and may be understood from the accompanying figure. The neck, when the head is in this posture, is raised, and the point of the bill directed upwards, the body and legs being at the same time in such a position that a violent thrust may be given by the bill, if necessary; and, as the neck is powerful, and, at the same time, readily moveable in such a manner as to secure the whole body from attack, there are few birds of prey that would venture to descend upon the bittern in this position, even if they should see it.

"Shall I, like Curtius, desperate in my zeal,
O'er head and ears plunge for the common weal
Or rob Rome's ancient *geese* of all their glories,
And cackling save the monarchy of tories?"—POPE.

ORDER VIII.—NATATORES.

916. *Why is the eighth order of birds called natatores?*

From *nato*, to swim, this being an equivalent term for swimmers or water-fowl.

917. The head of this order is the *goose*, and by Linneus it was termed *anser*, or the goose family. These birds display decidedly aquatic habits, swim with facility, and are able to pass the greater part of their lives upon the water.



918. *Why are the natatores sometimes called by the name of "palmipedes"?*

From *palma*, the flat front of the hand, and *pes*, a foot—implying that the birds are *palm*, or *web-footed*, the toes of the feet being connected by a web or membrane.

919. *Why has the goose been considered a stupid bird?*

It has occasionally a stupid look; its walk, or rather waddle give it also an absurd and imbecile appearance; but the ready way in which its apprehensions are excited seems to have been the first cause for this imputed character.



920. The number of geese sent from the northern and eastern countries to London for sale annually is immense. They are now conveyed by rail, but formerly used to be driven by gooseherds (*gozzards*). These

"So have I seen, within a pen,
 Young *ducklings* fostered by a hen;
 But, when let out, they run and muddle,
 As instinct leads them, in a puddle."—SWIFT.

were furnished with long sticks, having a piece of red rag fastened at one end as a lash, and a hook at the other. Of this red rag the geese always had an unaccountable dread. The goose *grazes*, and, like the *ox*, is alarmed at a *red color*, probably from the same cause, (*see* 540).

921. *Why was the goose an object of respect to the ancient Roman people?*

On account of a circumstance by which a *flock* of geese saved the capital of Rome from surprise and capture.

The goose, although regarded as an emblem of stupidity, is a very watchful bird, and when anything strange appears, sets up a loud and unmistakable gabbling.

922. The Gauls, under Brennus (year of Rome, 364), were in possession of the greater part of the city. The garrison, however, still held the capitol, and that with such obstinacy that the Gualish general had no hope but to starve it out. One day, Brennus was informed of a secret path by means of which he would be able to enter, and surprise the capitol. Accordingly, a chosen body of his men were ordered by night upon this dangerous service, which they, with great labor and difficulty, almost effected; when suddenly the garrison was awakened to vigilance by the voices of some sacred geese kept in the Temple of Juno. They instantly flew to arms, and the capitol was saved.

923. *Why are aquatic birds enabled to plunge into water and to emerge from it perfectly dry?*

Because their feathers are coated with an *oily matter*, which renders them not only impermeable to water, but repellant of it; so that no perceptible effect is produced by that element.

924. *Why are ducks and other water-birds more assiduous in trimming their feathers than land--birds?*

Because by this means they anoint their feathers with oil, thus preventing them from getting water-soaked.

Because their plumelets being of very close texture, any slight derangement in them is readily felt from the air getting access to the skin through the breach thence occasioned.

925. *Why do geese "waddle" in their walk?*

Because their legs are *placed wide apart*, so that they may act free of the sides in swimming; and the weight of

—“The *swan* with arched neck
Between her white wings mantling proudly, rows
Her state with oaric feet.”—MILTON.

the body in consequence swings from side to side as the bird walks, producing a zigzag motion.

926. *Why do ducks and geese make a gleeful noise upon the approach of rain?*

Because the bills of these birds are very sensitive; when immersed in water, or in mud rendered soft by the admixture of water, the functions of the bill are favored; but when the atmosphere is dry, the sensitive membrane stiffens, and becomes hard; and thus renders the circulation on the delicate tissues interrupted and laborious.

927. *Why is the bill of the duck more sensitive than the same organ usually in other birds?*

Because the whole of the duck tribe find their food more by the sense of touch than by that of sight, and the bill is favorably organized accordingly. It is covered by a sentient membrane, and the edges which come in contact are covered with papillæ, and abundantly furnished with nerves, so that, when a duck dabbles in the water, the feeling of the bill enables it to distinguish eatable substances from the sludge and pebbles with which they are mixed.

928. *Why do swans frequent shallow waters and the sides only of deep lakes?*

The chief reason of this is, that they are vegetable feeders; and although their long necks enable them to reach the bottom at considerable depths, they never dive, and rarely feed upon the land or in any other mode than by floating upon the water.

929. *Why is a blow from the swan's wing powerfully effective?*

The angle or elbow of the wing is the part with which it strikes and the motion is so rapid that the stroke is much

"The *swan* uplifts his chest, and backward flings
His neck, a varying arch, between his towering wings."—WORDSWORTH.

more weighty than would at first be supposed from the mere volume of the striking instrument.

930. When we consider that the effect of a stroke is made up of two elements, the *quantity of matter* and the *velocity*, and that the effect increases only as the quantity of matter, while it does so as to the square of the velocity, we can easily understand how soon rapidity of motion will make up for any inferior weight in the moving instrument. One-fourth the quantity of matter moving with four times the velocity, has an effect in the proportion of sixteen to four, that is, it has an effect *four times as great*.

931. *Why do swans in their migrations fly very high?*

They take a very high flight in order to *avoid the attacks of the eagles and falcons*, against whom their powers of resistance would ill defend them if the latter got "the sky" of them.

932. To everything *above it* in the air, the falcon is comparatively harmless; by taking "the sky" of the falcon, the swan is enabled to perform its migratory trip in safety.

933. *Why are swans in making their migratory flights governed by the state of the wind?*

Because, on account of their bulk and the weight of their closely set feathers, they *cannot make way against the wind*. Hence they almost invariably go *with the wind*; and wait, or even halt on their journey, if the wind is adverse.

934. *Why has the plumage and character of the swan remained for many centuries unchanged?*

Because of its *wild nature*; it is less subject to domestication than almost any kind of bird, pining in captivity, and never breeding, unless allowed to do so within its own haunts.

935. *Why should the alleged "dying song" of the swan be rejected as fabulous?*

That the swan, usually mute, should utter a pleasing musical note at its death is contrary to all experience and

"A *cormorant* flew several times round the ship. As these birds are seldom, if ever, known to fly far out of sight of land, I judged that some was not far distant."—CAPT. COOK.

philosophy. That it should be true, indeed, would be in contradiction to the whole analogy of nature, *the voices of pain in animals, and especially at the hour of death, being without a single exception unpleasant to the ear.*

936. *What peculiarity is there in the structure of the foot of the cormorant?*

The tarsi are stronger and more tendinous than in swimming birds; they are straighter set; the toes collapse more, and thus the birds can walk better, and also stand



firm on the slippery points of rocks. The peculiarity in form is the web continued to the hind toe, and the general position of the web being inwards rather than forwards, as may be seen in the annexed figure of the right foot of the cormorant, with the side

outwards, which is turned towards the center of the bird.

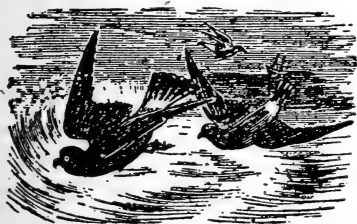
937. If the prey is on the surface, and small, these birds can capture it by a snap of the bill, and ascend again without losing the wing, in the same manner that the skimming birds take the greater part of their food; but if the prey is under the surface, and large, the wing must not only suspend its action, but be partially closed, and the bird must thus enter the water, using its wings as agents in again ascending.

938. *Why are stormy petrels enabled to run upon the surface of the water?*

Because the lightness of their bodies, and the action of the wind upon their wings, enable them with ease to assume this position during a storm. In calm weather they perform the same manœuver, by keeping their wings just so much in action as to prevent their feet from sinking below the surface.

—“Such murmur fill’d
Th’ assembly, as when hollow rocks retain
The sound of blustering winds, which all night long
Had rous’d the sea.”—MILTON.

939. There are few persons who have crossed the Atlantic that have not observed these wanderers of the deep skimming along the surface of the wild and wasteful ocean; flitting past the vessel like swallows, or following in her wake, gleaning their scanty pittance of food from the rough and whirling surges. Habited in mourning, and making their appearance generally in greater numbers previous to, or during a storm, they have long been regarded by the ignorant and superstitious, not only as the foreboding messengers of tempests



and dangers to the hapless mariner, but as wicked agents, connected somehow or other in creating them. “Nobody,” they say, “can tell anything of where they come from, or how they breed, though (as sailors sometimes say) it is supposed that they hatch their eggs under the wings as they sit on the water.” This mysterious uncertainty of their origin, and the circumstances above recited, have doubtless given rise to the opinion so prevalent among seafaring men, that they are in some way or other connected with supernatural powers in the air. In every country where they are known, their names have borne some affinity to this belief. They have been called witches, stormy petrels, the devil’s birds, and Mother Cary’s chickens, probably from some celebrated hag of that name; and their unexpected and numerous appearance has frequently thrown a momentary damp on the mind of the hardiest seaman.

940. *Why are sea-birds enabled to breast the waves in tempestuous weather?*

Because the waves, instead of rolling with the velocity of the wind (as is commonly imagined), roll very little. When we look at them from the shore and with a side wind, they *seem* to roll on, and they always appear to move slower in a fresh breeze. They *heave* and *sink*, the times being as the square roots of their lengths, so that, if a wave four feet broad changes from ridge to trough in four seconds, one of sixteen feet will change in eight seconds. Now, as the apparent forward motion is half the width, the four-foot wave will appear to move at the rate of rather less than a mile and a half in the hour, the sixteen-foot wave at rather less than three-quarters of a mile in the hour, which is very slow motion.

"By them there sat the loving *pelican*,
Whose young ones, poisoned by the serpent's sting,
With her own blood to life again doth bring."—DRAYTON.

941. Thus in the case of single waves, the middle of the slope is a point of rest, on which the sea-bird can sit with little more difficulty than on the calm surface. This will, perhaps, be made plainer by the accompanying diagram, in which two birds are represented as being at rest on the wave:



dotted curve on the points *o o*. The figure 1 represents the ridge, and 3 the hollow, at one end of the vibration; 4 the ridge, and 2 the hollow, as shown by the dotted line at the other. The bird at *b* on the turning-point is not moved either up or down; and as that point is alternately on the windward and the leeward of the wave, the wave keeps the bird from drifting in the first case, and shelters it in the second.

942. Why has the pelican a large pouch attached to its lower mandible?



The pouch answers nearly the same purposes that the *crop* does in birds which possess such an organ. The food is taken into it in much larger quantities than the digestive stomach can receive at once; and is gradually received into the stomach as the process of digestion goes on.

But the pouch serves another and a remarkable purpose. The pelican, though seeking its food in the sea, builds its nest at a distance from it, generally in ruins which have

become dry and waste; and this is the reason why the

"Every copse
 Deep tangled, tree irregular, and bush
 Bending with dewy moisture, o'er the heads
 Of the coy quiristers that lodge within,
 Are prodigal of harmony."—THOMSON.

name of the pelican is so frequently associated in writings with that of the wilderness.

The pouch, therefore, serves as a receptacle, in which the pelican conveys food to its young, in nests which lie remote from the shore. The food designed for the young becomes macerated or softened by the action of the pouch; and when the nest is situated in a very arid district, the old bird uses the pouch to carry water to its young.

MISCELLANEOUS.

943. *Why when birds migrate, do the old ones generally precede the young ones?*

Because the moulting of young birds takes place at a later period than that of old ones; so that they are not sufficiently recovered from the weakness which attends this process, to endure the fatigues of a journey at a time when the old birds are ready to undertake it.

944. *By what circumstances is the migration of birds governed?*

The time at which birds of passage arrive in Britain, or quit it, varies according to the species. Natives of the northern countries of Europe come to us at the end of autumn or the beginning of winter; and in the first fine weather avoid our heat, as they had done excess of cold; they return to lay their eggs in the north.

Other birds, which are born in our own country, and which may be considered as properly belonging to it, quit us in autumn; and after passing the winter in warm climates, they revisit us in the spring, or perhaps, avoiding the moderate warmth of our summer, they emigrate to Arctic

"The bird that hath been limed, with trembling wings misdoubeth every bush."—SHAKSPERE.

regions. Others again, natives of southern climates, come to the north to escape from the ardor of a summer's sun; and arrive in the midst of our own fine weather.

There are also some which never remain in temperate climates, but merely pass through them on their annual migrations. The time of the arrival and departure of these travelers is generally fixed definitely for each species, and in many instances may be calculated upon to a day.

945. Another fact not less curious in the history of birds is the power by which they direct their course in unknown countries, and distinguish at immense distances the immediate vicinity of their nests. *Swallows* furnish a remarkable instance of this. These little birds make very long journeys at the time of migration; and yet, by a singular instinct, they know, in the following spring, how to find again the places where they had formerly established themselves, and always return to them. This fact has been ascertained by attaching to the feet of several swallows small silken threads to establish their identity. They build their first nest near that in which they were born; the *chimney-swallow* makes its nest every year above that of the preceding year, and the house-swallow establishes itself in that which it had quitted the autumn before. Indeed, it has been known for the same couples to repair to their old nests, almost without taking the trouble to repair them, for eighteen years consecutively. Swallows show on other occasions, also, a singular power of directing themselves towards a particular place from which they are at a considerable distance. If a hen that is sitting is carried to a distance, confined in a cage, and liberty afterwards given to her, she first rises to a considerable height, as if to reconnoiter the country, and then flies in a straight line to the spot where she has left her brood.

946. *Why do birds when flying in flocks settle themselves into a triangular body?*

Because the position so assumed is the one best fitted to cut the air with the greatest ease and rapidity.

In this mode of flight, the leading bird, which divides the air in advance of the others, has the most arduous post; and in order to obtain relief, the bird occupying this place goes to the rear after a certain time, and is succeeded by another.

947. *Why do birds which take long flights usually fly high?*

It is supposed that high flight is less fatiguing, owing to a certain density of the atmosphere, which is best suited

“The wanderers of heaven
 Each to his home retire, save those that love
 To take their pastime in the troubled air,
 Or skimming flutter round the dimply pool.”—THOMSON.

to the *weight and action of the wings of birds* and which cannot be found nearer the earth.

Another reason also may be, that the upper regions to which birds thus ascend are exempt from the *momentary gusts and squalls* to which the *lower* atmospheric strata are subject.

948. Eagles are heavy birds, even for their powerful wings, and yet they are high fliers, although their abodes are at great elevations in the mountains. Wild geese and herons take the sky when they set out on long journeys. Rooks may be seen to adjust the height of their daily excursions from the rookeries to the distance at which the pasture upon which they feed lies; and the swallow tribe wheel about far more rapidly and gracefully when they fly high before rain, than when they skim the pools in fine weather. When birds are in long and swift flight, they acquire a momentum in proportion to their velocity, and the difference between their specific gravity and that of the air. In consequence of this momentum, they continue their progressive motion with *much* less effort, which is of itself to explain why they prefer flying high.

949. *Why are birds which winter out of England supplied with a cover of black down under their feathers?*

Because black is a color capable of retaining the *greatest amount of heat*, and in this instance the object is, to keep in the heat arising from the heart and the circulation of the blood.

950. It is likewise remarkable that this provision is not found in larger birds—for which there is also a reason. Small birds are much more exposed to the cold than large ones, forasmuch as they present, in proportion to their bulk, a much larger surface to the air. It is necessary, therefore, that small birds should be more warmly clad than larger ones; and this appears to be the expedient by which that exigency is provided for.

951. *Why are the birds which are brought alive to England from distant regions generally hard-billed?*

Because hard-billed birds *subsist on seeds* which are easily carried on board ship; while the soft-billed birds, which are supported by *worms or insects*, or as a substitute, fresh raw meat, can obtain neither in long voyages.

“Meanwhile the tepid caves, and pens, and shoares,
Their brood as numerous hatch, for the egg that soon
Bursting with kindly rupture forth disclos'd
Their callow young.”—MILTON.

952. *Why have some species of birds extremely soft bills?*

Because the class of birds thus furnished have to seize their prey quickly, as they often catch it while it is on the wing; though they do not fly after it, rapidity of motion both in darting at the food, and in opening and shutting both with firmness and sharpness at the tip, are the requirements of such a bill; and lightness in its general structure is essential to quick motion. These bills are in very many species, so thin and weak that they are not able to break the coat of a vegetable seed.

953. *Why do birds lay eggs?*



Because, to bear their young in any other manner, would encumber the body, and materially interfere with the active movements that are characteristic of the feathered tribes. As soon as an egg becomes large and heavy enough to be cumbersome to the bird, it is removed from the body, and deposited in a nest, which, in some respects, may be re-

garded as an artificial womb.

A shell impervious to air protects the germ of life within, until from two to twenty eggs have accumulated, and then, although laid at different intervals, the incubation commences, and the young birds are hatched at the same time.

954. *Why do the eggs of birds contain two distinct substances, the white and the yolk?*

"The man who can see without pleasure a hen gather her chickens under her wing, or the train of ducklings follow their parent into the pond, is like him who has no music in his soul."—KNOX.

The *white*, or *albumen*, of the egg, supplies *nourishment* to the chick whilst it is in the shell; the *yolk* is *embraced in the body of the chick* when excluded from the shell, and a duct leads from the membrane enclosing this mass of nutriment into the first intestine. Thus the chick is nourished, not only *whilst enclosed* in the shell, but also *during its first feeble existence*.

955. When we hold an egg steadily, and chip it at the upper part, we find the *yolk* close to the shell, and on the upper surface a pale *vesicle*, 3. which contains the *embryo chick*. When the hen sits, the heat of her body develops the action of the living principle in the embryo, and on the second and third day a little *zone of blood-vessels*, 4, 4, 4, appears; these vessels run towards the embryo, and carry nourishment to it; and day by day we may watch its sensible growth. From the delicacy of this action, we may perceive how necessary it is that the embryo at an early period should be close to the breast of the hen, and not at the cold bottom of the nest. We shall now see how it is accomplished.—The yolk is a globe of nutritious matter, and the little vesicle with the embryo is involved in the surrounding membrane, and consequently is at the surface of the globe. If this globe had the axis of its revolution in the center, it would not move



with the change of the position of the egg. But the axis being below the center, it must turn round with every change in the position of the egg, whether the globe be heavier or lighter than the surrounding white: were it heavier, it would revolve so as to bring the embryo to the lower part of the shell—were it lighter, to the upper part of the shell. It is lighter, and the matter stands thus:—The yolk is, as it were, anchored at two points, and the attachments being below the center, and the yolk being lighter than the surrounding white, it revolves like a buoy, and the vesicle containing the embryo is thus kept always uppermost.*

956. *Why has the young chick a hard scaly substance upon its beak?*

This curious provision is designed to assist the young bird in *breaking the shell*, at a time when its bill is too soft for that purpose.

The manner in which the young chick breaks the egg

* Paley's "Natural Theology."

"The *yolke* of the *egge* cannot be without the *whyte* , nor the *whyte* without the *yolke* ; no more maye the *clergy* and the *lordes* be one without another."—FROISSART'S CHRONICLES.

is one of the most wonderful operations of instinct. The instrument which it employs is a small protuberance on its upper mandible, called the *bill-scale* , which has no other use, and accordingly drops off soon after the bird is hatched.

957. This bill-scale is provided with a sharp cutting edge, the use of which is to *cut through the membrane which lines the shell* . Were



it not for this, the shell would *break* , while the membrane would *stretch* , and the chicken would still remain a prisoner.

The *egg-shell* is formed by a solidified deposit from the blood-vessels of the egg-duct of the parent bird; but it is permeable to air, which is necessary to the life of the embryo. The shell is lined by two membranes: the one external and rough, so that it adheres to the shell; the other exceedingly smooth, so that it allows of the rotation of the contained parts. And, at one extremity of the egg, there is a little sack filled with air containing an unusual proportion of oxygen, which is employed in giving vitality to the awakening germ.

958. *Why can a recently hatched bird exist for many hours without food?*

Because a portion of the yolk of the egg yet remains in its *body* , and by that it continues to be nourished.

959. The wisdom of this provision is obvious: had the first-born bird needed immediate food, it must either have been starved, or the mother, whilst providing for it, must have *deserted her other eggs* , and thus destroyed the rest of her family; but, under this arrangement, the mother may, without injury to her first-born, continue to sit on her nest till all her little ones are hatched, which sometimes takes more than a day.

"Some to the rude protection of the thorn
Commit their feeble offspring: the cleft tree
Offers its kind concealment to a few,
Their food its insects, and its moss their nests."—THOMSON.

960. *Why do the number of eggs laid by the different species of birds vary so considerably?*

The number of eggs laid by birds is wisely and beneficently regulated by the difficulty or ease with which the particular kind of food upon which the bird subsists may be obtained. Thus, large birds of prey which live upon flesh, such as eagles, vultures, and falcons, usually lay two eggs, rarely more than three, and frequently only one. Birds that live principally upon seeds and insects, and thus find abundance of food, not only lay a larger number of eggs, but often hatch two and three broods in the year so that these families increase rapidly.

961. *Why do birds select silk, cotton, wool, fur, and down as materials for lining their nests?*

Because these substances are non-conductors of heat; and as it is very essential that the nest should be kept perfectly warm, they could not possibly select more appropriate materials for the purpose.

962. *In what manner do birds build and prepare their nests?*

As the laying season approaches, the bird, conscious of the coming event, occupies herself in the construction of a dwelling, suited by its materials and form to the little beings to which she is about to give life.

Such a structure must fulfill several conditions. In its magnitude and form it must correspond with the magnitude and number of eggs to be laid, and with the body of the mother who is to sit upon them.

It must be so shaped as to keep the eggs securely together, and its materials must be soft, so as not to injure by undue pressure its tender occupants.

To prevent the escape of the warmth imparted by the mother, it must be thickly lined with non-conductors of

"When unobserved
Pluck from the barn a straw, till soft and warm,
Clean and complete their habitation grows."—THOMSON.

heat. All these conditions are fulfilled with the skill of a natural philosopher.

963. The nests of the larger class of birds of hardier nature are of rude construction; but those of the smaller species display, in a



remarkable manner, the qualities here indicated. The parents of the coming offspring, father and mother, co-operate in the construction of the nest, for the external part of which straw and twigs are collected, and woven into a sort of basket-work. This not possessing the requisite durability, and allowing, moreover, the air to penetrate, and the heat to escape, a quantity of fine clay is collected with considerable labor, and worked into a sort of mastic by means of a viscid fluid secreted by glands placed under the tongue of the bird. With this mastic, the parents plaster the interior of the nest,

carefully stopping up every crevice and air-hole. The floor of the nest, however, formed by such plaster is necessarily hard, and would injure the younglings by its pressure. The parents, therefore, fabricate a carpet, which they spread upon the floor of the nest, over which they place a soft mattress, the materials of which consist of wool and hairs taken from the backs of animals and the cottony parts of certain plants. The countless journeys and fatiguing labor necessary to accumulate hair by hair, and filament by filament, may be easily conceived. Sometimes the bird strips its own breast of natural down to form a bed for its young. Thus the eider duck provides for the comfort of its offspring, by taking from its own body part of that down which is sought for and collected at such a cost for the pillow of luxury.

964. *Why do some birds frequently vary the materials of their nests?*

This is doubtlessly done for the purpose of *assimilating the nest in appearance* to surrounding objects, so as to accommodate their habitation to existing circumstances, and to secure it from observation.

965. *Why do some birds make their nests warmer than the nests of other birds?*

"Enjoy the spring of love and youth,
To some good angel leave the rest;
For time will teach thee soon the truth,
There are no birds in last year's nest."—LONGFELLOW.

Because the first-mentioned are those which are necessarily a longer time away from their nests, while the latter birds are those which procure their food more readily.

966. Thus we see the *duck*, and many *aquatic birds*, which have a voracious appetite, and have often to go over a considerable space of ground in search of food, and are consequently a long time absent from their nest, *cover up their eggs with a quantity of down and feathers*, in order to prevent them from being chilled.



In like manner, the *long-tailed titmouse*, who, having from twelve to fifteen young ones to provide for, must necessarily be a long time away from them in search of food, so that she cannot herself impart the necessary warmth to her brood by sitting on them, as most birds do, not only lines her nest with a profusion of the softest feathers and down, but *makes it almost in the shape of a ball*, with a small hole in the side to enter at, so that the young are effectually protected from cold in their snug abode.

The *thrush*, on the contrary, who can so readily procure worms on a lawn, or in a meadow, so that it is not necessary for both the parent birds to be absent in search of food at the same time, lines its nest with clay. The nest of the rook, also, which, in an exposed situation, has but little warmth of lining in it; but then the hen seldom leaves it, and is fed during the period of incubation by the male bird.

967. *Why will birds sometimes hesitate in their flight, when upon carrying building materials to their nest, they are observed?*

Because they are cautious not to *betray the locality of their nests*, the knowledge of which might subject them to future depredations.

968. Mr. Broderip relates the following incident illustrative of this caution:—"As I was one day passing the National Gallery, I saw a sparrow fly down to the neighboring cab-stand and pick up a very long straw, with which it flew with some labor towards the building. The long streaming straw attracted the attention of some

"Oft when returning with her loaded bill,
Th' astonished mother finds a vacant nest,
Robb'd by the hard hand of unrelenting clowns."—THOMSON.

of the pedestrians, who stopped and looked at the loaded little bird, which was directing its flight towards the portico of the Gallery; but finding its motions watched, it turned short round and perched with its straw on one of the window-sills, and the people then passed on. Presently it flew again towards the portico, but the people again stopping and looking, it came back to the window, until the second lot of gazers went their way. The little bird then started again with its straw towards one of the same pillars, and, cutting round it so as to avoid prying eyes as much as possible, bore it to the capital of one of the pilasters and disappeared, straw and all, into the snug nook made by a part of the projecting ornament, which it had chosen as the place for making its nest.

969. *Why do the young birds of some species demand the parents' care for a longer period than others?*

The condition of young birds depends upon the state in which they emerge from the shell. The *partridge* and the *plover* come out of the shell in full activity, and may be said, in part at least, to *find their own food* in the very same hour. Even at this stage they run very rapidly, and have a *clothing of down*, which protects them from change of temperature during the early period of their existence.

The *rook*, on the contrary, comes forth from the shell callow, and in a *helpless state*, so that it would perish if not fed by the parent bird; and if not, in the early stage, sheltered by that bird during the night. Its feathers are not preceded by a downy coat, but first appear in little tufts issuing from those sheathes in which they are produced. The young rook is accordingly fed by its parent for a considerable time, and does not perch apart from the nest; nor does it take flight, or in anyway provide for itself, until it is fully fledged.

970. *Why do male birds evince an affection for their offspring, while on the other hand, in many other species of the animal creation, the male parent neglects, and does not even recognize, its young?*

This exceptional instance of parental affection on the part of the male bird is a beautiful provision of Provi-

"Encourag'd thus, she brought her *younglings* nigh,
Watching the motions of her patron's eye,
And drank a sober draught; the rest amaz'd,
Stood mutely still, and on the stranger gazed."—DRYDEN.

dence in accordance with the necessities and habits of the creature. Amongst birds, food for the young has in most instances to be brought from a distance, and much assiduity is required to collect it in sufficient quantity, the voracity of nestlings being almost insatiable.

Therefore, *the assistance of the male* in this work is in most species almost indispensable. When *the brood* is numerous, it would be extremely difficult, if not impossible, for the female alone to procure the requisite supply.

But in animals which suckle their young, *the assistance of the male parent is not needed.*

971. The affection of both male and female birds for their young has been manifested in a remarkable degree in instances that have fallen under human observation. "When I was a boy," says Smellie, "I carried off a nest of young sparrows, about a mile from my place of residence. After the nest was completely removed, and while I was marching home with them in triumph, I perceived, with some degree of astonishment, both the parents following me at some distance, and observing my motions in perfect silence. A thought then struck me that they might follow me home, and feed the young according to their usual manner. When just entering the door I held up the nest, and made the young ones utter the cry expressive of the desire of food. I immediately put the nest and the young in the corner of a wire cage, and placed it on the outside of a window. I chose a situation in the room where I could perceive all that should happen without being myself seen. The young animals soon cried for food. In a short time both parents, having their bills filled with small caterpillars, came to the cage, and after chatting a little, as we do with a friend through the lattice of a prison, gave a small worm to each. This parental intercourse continued regularly for some time, till the young ones were completely fledged, and had acquired a considerable degree of strength. I then took one of the strongest of them and placed him on the outside of the cage, in order to observe the conduct of the parents after one of their offspring was emancipated. In a few minutes both parents arrived, loaded, as usual, with food. They no sooner perceived that one of their children had escaped from prison, than they fluttered about and made a thousand demonstrations of joy, both with their wings and with their voices. These tumultuous expressions of unexpected happiness at last gave place to a more calm and soothing conversation. By their voices and their movements it was evident that they earnestly entreated him to follow them, and to fly from his present dangerous state. He seemed to be impatient to obey their mandates; but, by his gestures, and the feeble sounds he uttered, he plainly expressed that he was afraid to try an exertion he had never before attempted. They, however, incessantly repeated their solicitations; by flying alternately from the cage to a neighboring chimney-top, they endeavored to show him how easily the journey was to be accomplished. He at last committed himself to the air, and alighted in safety. On his arrival, another scene of clamorous and active joy was exhibited. Next day, I

"You curious chanters of the wood,
That warble forth dame Nature's lays,
Thinking your voices understood."—WOTTON.

repeated the same experiment, by exposing another of the young ones on the top of the cage. I observed the same conduct with the remainder of the brood, which consisted of four. I need hardly add that not one either of the parents or children ever afterwards revisited the execrated cage."

Although sparrows are ordinarily regarded in a very indifferent light, they are, in addition to their utility, birds of a very kindly nature, living in habits of great sociability with each other. Several instances are related of their having been observed feeding the young of other birds which have been in a state of captivity; and there is one well-attested anecdote of a sparrow, which, having been caught by the leg by a piece of worsted, from which it could not extricate itself, was tended and fed by some birds of its own species through a whole winter; and, when it was released, was greeted with evident marks of satisfaction by all its former companions and friends. A farmer's servant placed a nest of young sparrows in a trapcase, and caught forty old birds, all coming with food in their mouths to feed the helpless young. A lady residing in the neighborhood of London hung out a cage near her balcony, in which was a young bird, and it was fed for many weeks by sparrows. Similar instances of kindness and solicitude on the part of these birds might be multiplied to infinity.

972. *Why are small birds, such as those of the sparrow and swallow tribes, so numerous and widely diffused?*

Because they are the chief agents for *keeping insect life within proper limits*. Without them the myriads of minute creatures that would prey upon vegetables would so multiply, that famine would be of frequent occurrence, and industry would meet only with a precarious reward.

973. It appears from the papers, that in New Zealand the country, at particular seasons, is invaded by armies of caterpillars, which clear off the grain crops as completely as if mowed down by a scythe. With the view of counteracting this plague, a novel importation has lately been made. Mr. Brodie shipped, three hundred sparrows, carefully selected from the best hedgerows in England. The food alone put on board for them cost £18. This sparrow question has been a long-standing matter of discussion in Auckland; but the necessity to farmers of small birds to keep down the grubs is admitted on all sides. There is no security in New Zealand against the invasion of myriads of caterpillars, which devastate the crops. Mr. Brodie has already acclimatized the pheasant, which is abundant in the north. The descent from the pheasant to sparrows is somewhat of an anti-climax; but should the latter multiply, the greatest benefit will have been conferred on the country.

974. *Why have the different species of birds distinct voices, or cries?*

This provision has doubtless been made in order that

"The gay troops begin
In gallant thought to plume the painted wing,
And try again the long forgotten strain,
At first faint warbled."—THOMSON.

the members of each species might *make known their wants and dangers*, and otherwise communicate with each other.

That some of the notes of birds are a language designed to convey a meaning is obvious from the very different sound uttered by these creatures at particular periods; the spring voices become changed as summer advances, and the requirements of the early season have ceased: the summer excitements and informations are not needed in autumn, and the notes conveying such intelligence are no longer heard.

The periodical calls of animals, the croaking of frogs, etc., afford the same reason for concluding that the sound of their voices by elevation, depression, or modulation, convey intelligence adapted to their wants and feelings.

975. Rennie relates:—"We recollect having our attention once drawn to the loud scolding of a pair of chaffinches in a copse, a circumstance of very frequent occurrence during summer, but rendered peculiar in the instance in question by the birds darting down almost to the roots of the bushes at some distance from where we stood, from which we concluded their scolding was not directed to us. The loud 'pink, pink' of the chaffinches soon attracted to the spot a crowd of their woodland neighbors, among whom a redbreast took the lead, followed by a green-bird, a song-thrush, and about a dozen of the smaller summer birds, all brought together by curiosity to learn what the chaffinches were scolding about. From all of these clamorous creatures giving vent to the same expression of feeling, we concluded that some common enemy had made his appearance among them; and, upon looking narrowly into the bushes, we perceived a pine-martin stealing along, occasionally throwing a sly, or rather contemptuous look at his vociferous railers, but otherwise continuing a careful prying search into every hole and bush for a nest of eggs or young of which he might make a breakfast."

White, of Selborne, remarks:—"When the hen turkey leads forth her young brood, she keeps a watchful eye, and, if a bird of prey appear, though ever so high in the air, the careful mother announces the enemy with a little inward moan, and watches him with a steady and attentive look; but, if he approach, her note becomes earnest and alarming, and her outcries are redoubled." In the instance of a cock bird expressing fear, or giving an alarm to the hen of the approach of danger near the nest, the tones seem to be varied so as to give her due notice either to keep close and still, or to make her escape with as much caution as she can.

976. *Why is the plumage of female birds generally more somber than that of males?*

This would seem to be a provision made by providence

"She plumes her *feathers*, and lets grow her wings
That in the various bustle of resort
Were all too ruffled, and sometimes impaired."—MILTON.

to favor the personal concealment of female birds, and consequently that of their young, from the depredations of birds of prey. It is remarkable that most birds that are under no apprehension of being attacked, such as eagles, owls, hawks, etc., the females are uniformly covered with plumage as rich as that of the males.

977. *Why is the plumage of young birds somber, and less marked than when they become older?*

Because, if the young had their full plumage the first year, or when they quitted their nest, they would in their then feeble state be *more exposed to be killed by birds of prey* and other enemies. It seems, therefore, a benevolent design that the more humble plumage should remain on them until they are better able to protect themselves.

978. The activity and watchfulness of birds when they have young is most surprising. Dr. Macgillivray records the observations made by a friend on a pair of blue titmice when rearing their young. The parent birds began their labor of love at half-past three o'clock in the morning, and did not leave off till eight o'clock in the evening, after being almost incessantly engaged for nearly seventeen hours. Mr. Weir counted their various returns to the nest, and found them to be 475. Up to four o'clock, as a breakfast, they were fed twelve times; between five and six o'clock, forty times, flying to and from a plantation more than 150 yards from their nest; between nine and ten o'clock they fed their offspring forty-six times; and they continued at their work till the time specified, sometimes bringing in a single large caterpillar, and at other times two or three small ones.

979. *How is a beautiful provision of nature illustrated in the disposition of the feathers upon the body of a bird?*

The feathers are all placed in such a manner that the *action of the wind from before shall tend to smooth them down*. The shoulders and the front edges of the wings are the places, however, on which the beautiful application of the feathers is the most striking, as they are not only most difficult to fit from their greater curvature, but are those which are most exposed during flight. The feathers on these parts are so placed that, let the wind take what direction it may, it can hardly raise or ruffle them.

"'Tis reigning noon; and, vertical, the sun
Darts on the head direct his forceful rays.
O'er heaven and earth, far as the ranging eye
Can sweep, a dazzling deluge reigns."—THOMSON.

980. *How is the varied coloring of the plumage of birds accounted for?*

The variation is supposed to *depend upon the sun*, the color being gay and glossy according as birds are exposed to the action of that luminary. Whether the bright colors of tropical birds are less sentient to the sun than the more sober hues of the birds of cold climates it is difficult to say; but the smooth surface and metallic luster must reflect the light, as well as decompose it by that refraction which shows the colors; we may, therefore, conclude that the variegated plumage of birds answers as a sort of protection against the ardor of the sun in those climates where such protection is most needed.*

981. The brighter colors of *male* birds may be in some degree accounted for upon this hypothesis: the male is more exposed to the sun than the female; his more active life and greater daring, her seasons of retirement and incubation, at once explain this. That light has great influence, not only in illuminating, but in *developing* the colors of bodies, is borne out by the fact that all night-flying birds and insects are of somber hues, while those which are active by day are, with only a few exceptions, more brilliantly arrayed.

Possibly, also, the brighter colored male birds are more successful in getting mates, and thus transmitting this characteristic to their offspring, than are dull-colored males.

982. *Upon what mechanical principles do birds maintain a standing position?*

In standing, a base of sustentation must be given to birds of sufficient magnitude, and in such a position as to *keep the line of direction of the center of gravity within it*, without too fatiguing exertion of the muscles.

983. This is accomplished partly by giving the leg such a structure that the tarsal bones, which extend from the foot to the body, have a sufficient length, and are inclined to the leg bones, so as to direct the foot forwards; while the body, on the other hand, assumes such a position that the spinal column is inclined more or less upwards. The flexibility of the neck, which enables the animal to throw the head more or less backwards, and in bringing the center of gravity into the desired position, as shown in *fig. 1*, which represents the ibis. In the position of the bird here shown, the center of gravity is thrown a little behind

* Partington's "Cyclopædia."

“More certain was the crowing of the cock
To number hours, than is the abbey clock;
And sooner than the matin bell was rung,
He clapp'd his wings upon his roost and sung.”—DRYDEN.

the center of articulation of the wings, and therefore nearer the center of the base of sustentation by the backward position of the head. In the case of birds, such, for example, as the penguin, fig. 2, having a



short and nearly inflexible neck and legs, which are incapable of being advanced, the animal, when it stands, is obliged to assume the vertical position.*

984. *Why do many birds roost upon one leg?*

Because the heavier the body presses upon the bent joint, from the peculiar construction of the foot, the *tighter the claws are pulled round* the branch or perch; and it follows that the weight of the bird must pull more when it falls upon one set of muscles, than when it is divided between the two sets; a firmer and steadier position is by this means achieved.

985. *Why does the formation of the beak of birds indicate the substances they feed upon?*

Because nature has adapted the instrument to its employment with such nicety that the forms of the beak are as various as the qualities of the substances used as food; and so close and invariable is this relation between the mechanical structure of the instrument of prehension and the

"*Sight* is the most perfect and most delightful of all the senses. It fills the mind with the largest variety of ideas, converses with objects at the greatest distance, and continues the longest in action without being satiated."—SPECTATOR.

aliment, that a practical naturalist can infer the one from the other with unerring certainty.

986. Examples of the agreement between the formation of the beak and the food of the bird are furnished as follows:—Sea-birds, which feed



on fish too large to be swallowed at a mouthful, are furnished with a large beak, hooked at the end. But this instrument is much longer, and therefore less powerful, though sufficiently so relatively to their prey. When birds feed on such fishes and reptiles as are small enough to be seized and easily swallowed, the beak is straight, still greater in length and resembling a pair of pincers, as those of the martin pecker, fig. 1. Birds living on insects as the bee-eater, fig. 2, have slender and very long beaks, either straight or very slightly hooked, except when they catch their prey in flight, as do the swallow and the goatsucker, fig. 3, in which the bill is short, broad, deeply cut, so as to enable them to present a large mouth to receive their prey. Birds which live on grain, on the contrary, such as the sparrow, fig. 4, have a short, thick bill, convex above, or conical, and in general straight, the upper mandible not projecting over the lower. A singular modification of this organ of prehension is presented in the case of the pelican, which has a membranous receptacle, consisting of a pouch or pocket, attached to its lower mandible, in which it collects

prey, which it swallows afterwards at leisure. (See 942.)

987. *Why have the eyes of birds a greater facility for discerning near or distant objects than those of other animals?*

Because, in the first place, birds in general procure their food by the aid of their beak; and, the distance between the eye and the point of the beak being small, it becomes necessary that they should have the power of seeing very near objects distinctly.

On the other hand, from being often elevated much above the ground, living in the air, and moving through it

"The eye is not that which sees; it is only the organ by which we see. The ear is not that which hears, but the organ by which we hear; and so on of the rest."—REID.

with great velocity, they require for their safety, as well as for assisting them in descrying their food, a power of seeing *at a great distance*.

988. Two peculiarities are found in the eyes of birds. The one is a bony, yet, in most species, a flexible rim or hoop, surrounding the broadest part of the eye, which, confining the action of the muscles to that part, increases the effect of their lateral pressure upon the orb, by which pressure its axis is elongated for the purpose of looking at very near objects. The other peculiarity is an additional muscle to draw, on occasions, the crystalline lens back, and to fit the same eye for the viewing of very distant objects. By these means, the eyes of birds can pass from one extreme to the other, on a scale of adjustment as convenient as it is remarkable.

989. *Why is the hearing of birds dependent upon the internal structure, rather than the outward development of the organ?*

Because, if the external ear existed as in quadrupeds, it would obstruct the rapid progress of birds through the air, and be inconvenient in other respects. This appendage is therefore withheld, but is amply compensated for by a peculiarity in the internal structure, which enables them to hear with perfect distinctness.

990. *Why do birds perch with their faces to the wind?*

Because, if a bird were to roost with its tail to the wind it would frequently be driven from its perch: the wind would, by turning the feathers, and even getting under the wings, have great power; and the action of that power would unbend the legs, and thereby loosen the feet from the perch. But, by perching with its head to the wind, the latter becomes a means of stability to the bird.

991. The bird keeps its hold on the perch by tendinous elasticity; the flexure of the neck is beyond that position which would be repose in a quadruped, so that the tendons of the extensors are tightened; and any cause which agitates the perching feet, at the same instant brings the neck into action, and extends, elevates, or depresses the head, to the exact extent which the balance requires. Thus, there is, in the very structure of the bird, a means of resisting any casualty that might drive it from its perch, and that without the exercise of any more volition than accompanies the breathing of a human being when asleep.

"The *starling*, distinguishable from the rest of the sparrow tribe, by the glossy green of its feathers, in some lights, and purple in others, breeds in eaves of houses, ruins, hollow trees, cliffs, and high rocks."—GOLDSMITH.

992. *Why are birds enabled to sleep securely when perched on the branches of trees?*

Because the claws of birds are so organized, that the flexor muscles pass over the joints of the knee and heel in such a manner, that, when the latter bend, they necessarily press on the tendons of the muscles, and make them bend the toes; the weight of the body pressing down the thighs and legs, necessarily produces this action; and, as a consequence, the bird grasps, without effort, the branch on which it is perched, and maintains itself in a fixed position without watchfulness.

993. *Why do starlings frequently accompany rooks in their flight?*

Because rooks have a more discerning scent than starlings, and lead them to spots productive of food.

The superior power of finding food is owing to rooks having two large nerves which run down between the eyes into the upper mandible, which invests their beaks with a more delicate sensitiveness than other round-billed birds, and enables them to grope for their food when out of sight.

994. *Why are the necks of birds long, and easily moveable?*

Because the beak is generally the only organ of prehension by which they pick their food from the ground; and the extent of the neck is augmented, in order to admit of the head being brought freely to the ground without incommoding the body.

995. *How is the wisdom of the Creator shown in the structure of the head and neck of birds?*

In the heads of birds teeth are dispensed with, and, as a consequence, along with them, the thick and massive jawbones into which they must have been implanted, and which are replaced by a light strong bill.

"To these, an overgrowne justice of peace,
 With a clarke like a *gizzard* thrust under each arm;
 And warrants for sippets laid in his own grease,
 Set o're a chafing dish to be kept warme."—B. JOHNSON.

Hence mastication is very limited, and the muscles subservient to this function are proportionally small. Everything thus combines to *render the head light*, and consequently a long and slender neck is *sufficient for its support*.

Had it been necessary to sustain a heavier head at the extremity of a long neck, great muscular development in this region would have been required, and the weight so much increased, as to have materially diminished the *powers of flight*. Moreover, the heavy head at the extremity of the lever of the neck would have deranged the center of gravity, and in this way also have interfered with flight.

996. *Why does the breastbone form an important part of the organization of a bird?*

Because it *imparts solidity to the whole of the framework*, and supplies a wide base upon which the muscles of the wings are fastened down and steadied. The breastbone also forms a kind of box, which, during the time the body is stretched out in flight, securely retains and supports the soft interior of the bird.

The more the movements of the wings excite the great muscles which are spread over the inside of the breastbone, the more do those muscles brace and strengthen the frame of the bird. They bear its weight up to the wings, and the wings again, by their long arched form, lay it upon the air. Thus as the bird flies, it is almost insensible of the fact that its body is heavy.

997. The *breast-bone* of a bird secures the whole length of the body, and the great central spire of that bone, called the *keel*, rises from it, so as to give lodgment and attachment to the great muscles of the wings. It will be easily understood that this keel is more largely developed in *birds of passage*, since its greater prominence implies strength of wing for long-continued flight. Under the breast-bone, and between the back-bone, is a considerable space, occupied by air-cells. These cells represent a curious provision for the extension of the body of the bird, independently of weight. The air does not only pass *into* the lungs of birds, but *through* them, so as to fill a series of cells, composed of fine membranes, which are interwoven with all the viscera. The heart is surrounded by such a cell. Two great cells are attached to the liver, and in the same manner all the viscera of the abdomen

"Thy style's the same whatever be thy theme,
As some *digestions* turn all meat to phlegm."—DORSET.

are interspersed with air-cells, and these all communicate. The air thus admitted into the interior of the body extends even into the bones. *By inflating these cells, birds have the power of instantly rendering their bodies specifically lighter, and of rising upon the air with greater ease: when they descend, they exhaust the cells, and alight with greater ease.*

998. *Why is the gizzard such an important organ in the structure of birds?*

Because it *compensates for the absence of teeth*, by triturating or grinding the food, so as to render it fit for digestion. Every particle of food which requires to undergo this operation, is submitted to the action of the two gristly surfaces which form a portion of the organ, and produce a rotatory motion on the food.

999. In order to ascertain the peculiar powers of the gizzard, several experiments have been resorted to, some of which would appear at first sight to be cruel, but which in the end proved to be harmless. "Twelve strong tin needles," says Spallanzani, "were firmly fixed in a ball of lead, the points projecting about a quarter of an inch from the surface. Thus armed, it was covered with a case of paper, and forced down the throat of a turkey. The bird retained it for a day and a half without showing the least symptoms of uneasiness. Why the stomach should have received no injury from so horrid an instrument I cannot explain: the points of the twelve needles were broken off close to the surface of the ball, except two or three, of which the stumps projected a little higher. Two of the points of the needles were found among the food. The other ten I could not discover, either in the stomach or the long track of the intestines; and therefore concluded that they had passed out."

In another experiment, which, without knowing the previous facts, we might justly have deemed still more cruel, Spallanzani tells us he fixed twelve small lancets, very sharp both at the point and edges, in a similar ball of lead. "They were such as I use for the dissection of small animals. The ball was given to a turkey cock, and left eighteen hours in the stomach, at the expiration of which time that organ was opened; but nothing appeared except the naked ball, the twelve lancets having been broken to pieces; I discovered three in the large intestines, pointless and mixed with the other contents; the other nine were missing, and had probably been voided. The stomach was as sound and entire as that which had received the needles.

"Two capons, of which one was subjected to the experiment with the needles and the other with the lancets, sustained them equally well. My next wish was to know how much time elapsed before the beginning of the fractures; and by repeated experiments on turkeys I found that these sharp bodies begin to be broken, and lose their shape, in two hours. This, at least, happened in two individuals of the species: in one, four of the lancets, and in the other, three of the needles, were broken within that space; the others were blunted, but continued fixed in the balls."

"He that has humanity, forewarn'd, will tread aside, and let the *reptile* live."—COWPER.

1000. *Why do birds moult, or change their feathers, periodically?*

The moulting of birds is a process analogous to the *nutrition, expenditure, and decay*, which occurs in *all animal bodies*. When an atom, or it may be an organ, has fulfilled its functions, it dies; and when completely dead, it separates and falls, because a dead substance cannot co-exist with a living.

Moulting is nothing else but this natural *death* of some part of the bird, *in consequence of the development of other interior parts*, which are being matured to carry on the functions of the parts undergoing decay.

1001. We find the germs of leaves, flowers, and fruits, in vegetables, and the hairs, feathers, scales, horns, epidermis, etc., in animals increasing and developing themselves in spring, to flourish in succession, at least for the duration of the summer. But at the approach of the autumnal equinox, plants and animals, being more or less exhausted by the vast expenditure of their vital forces in the great work of reproduction, and also by the increased energy with which those vital forces acted in proportion to the surface, their external functions begin to be enfeebled, and by so much the more as the heat of the sun diminishes. Then these external parts, these vernal productions, cease to receive aliment through the body: they have, besides, arrived at the full term of their augmentation, and can admit of no further nutriment. They dry up, wither, are detached, and fall. Thus is produced, sooner or later, the fall of flowers, leaves, and fruits, and the change of hairs, feathers, horns, epidermis, scales, etc.

CLASS III.—REPTILIA.

ORDER I.—CHELONIA.

1002. *Why is the first order of reptiles called chelonia?*

From a Greek word meaning *a tortoise*; the order including the various species of *tortoise* and *turtle*. They have horny cases, are destitute of teeth, have thick fleshy tongues, well developed eyes, and their limbs differ from an elephantine club foot, to feet divided and webbed.

"A *tortoise*, introduced here (Lambeth Palace) in 1633, lived till the year 1753, and possibly might have continued much longer, had it not been for the carelessness of the gardener."—PENANT.

1003. *Why are reptiles so called?*

The term is derived from a Latin word *repto*, I creep; since the imperfection of the legs and feet in some cases, and the total absence of these members in others, necessarily entail a creeping movement to enable the animal to move along the ground.

1004. *Why are turtles and tortoises covered with hard external shells?*

Because they are destitute of bony skeletons within, and the horny covering is made to answer all the purposes of the usual osseous structure.

But, besides this, they are defenseless animals, except so far as the shell affords a retreat to the head, legs, and tail, which are withdrawn within the shell upon the occurrence of any danger.

1005. It may appear at first sight that there is a great affinity between the armor, or rather box, in which the tortoise is enclosed, and the coat of mail with which many quadrupeds are covered, as, for instance, the *armadillo* (416). But there is this important difference: the coat of mail in the latter quadruped is a simple horny addition to the skin itself, resting upon, and supported by, processes of the skeleton; whereas the osseous shell of the tortoise is part and parcel of the skeleton itself, which is so modified as to protect the internal organs, enclosing them as in a casket, which is covered either with horny plates variously arranged, or with a tough leathery skin.*

1006. *Why do the cheeks of tortoises and turtles appear to be frequently distended?*

Because they swallow air instead of breathing it by the ordinary process. The jaws being firmly closed, the cavity of the mouth is enlarged by the drawing down of the root of the tongue; and into the vacuum thus formed the air rushes through the nostrils. The free part of the tongue is then applied to the posterior openings of the nostrils, so as to stop them; the gullet is also closed, the root of the tongue is elevated, the broad muscles of the

* Knight's "Museum of Animated Nature."

"A lizard's body lean and long,
A fish's head, a serpent's tongue."—MERRICK.

throat contract, and the air is forced down the windpipe into the lungs, which become filled by a repetition of the process.

1007. *Why have tortoises and turtles no teeth?*

Because, for cropping the tender vegetation upon which they live, teeth are *less adapted* than the *serrated horny coverings* with which they are provided, and by which they are enabled to crop and *mince* the vegetable aliment upon upon which they subsist.

ORDER II.—SAURIA.

1008. *Why is the second order of reptiles denominated sauria?*

From a Greek word meaning a *lizard*. The mouths of these animals are always armed with teeth, and the toes are generally furnished with claws. They have all a tail more or less long, and generally very thick at the base.

1009. *Why does the crocodile, which devours birds, beasts, and even human beings, allow one species of bird, the zic-zac, to be on familiar terms with him?*

It is said that when the crocodile comes on shore, he opens his jaws, and this bird enters and swallows the leeches which are found about the animal's jaws and teeth, and which have collected there owing to the creature being for so long a time in the water; the relief afforded by having the leeches withdrawn, induces the crocodile not only to tol-



erate the advances of the bird, but to encourage them.

"An *aligator* stuffed, and other skins of ill-shap'd fishes."

SHAKSPERE.

1010. This is a disputed point in natural history, and is doubted simply on account of its apparent improbability, rather than from any evidence which has been adduced to the contrary. The following anecdote, however, related by Mr. Carzon, goes far to confirm this seemingly incredible account:—"I had always," says Mr. Curzon, "a strong predilection for crocodile shooting, and had destroyed several of these dragons of the water. On one occasion, I saw a long way off a large one, twelve or fifteen feet long, lying asleep under a perpendicular bank, about ten feet high on the margin of the river. I stopped the boat at some distance; and, noting the place as well as I could, I took a circuit inland, and come down cautiously to the top of the bank, whence, with a heavy rifle, I made sure of my game. I had already cut off his head in my imagination, and was considering whether it should be stuffed with its mouth open or shut. I peeped over the bank: there he was within ten feet of the sight of the rifle. I was on the point of firing at his eye, when I observed that he was attended by a bird called the zic-zac. It is of the plover species, of a grayish color, and about the size of a small pigeon." The remainder of the narrative corroborates the fact.

1011. *Why do both jaws of the crocodile move?*

Because its habits of life render it necessary to be able to *seize its prey with great rapidity*—the prey often lying on the surface of the water. The power of moving both jaws facilitates this kind of seizure, by bringing the level of the water surface *instantly and equally within the action of the upper and lower jaws.*

1012. *Why is the alligator so called?*

Either from the Spanish and Portuguese *lagarto*, meaning a lizard, or from the Latin *lacertus*, the arm, in reference to the arm-like appearance of the legs.

1013. *Why are the monitor lizards so called?*

It is said that when the larger reptiles approach them they *utter a cry of alarm*, which gives warning to other creatures of the dangerous approach of the *crocodile* and the *alligator.*

1014. *Why has the chameleon the power of changing its color?*

This faculty has been attributed to the *protective instinct* of the animal, by which it seeks to render itself *less*

"Wak'd by his warming ray, the *reptile* young
Come wing'd abroad; by the light air upborne,
Lighter, and full of soul."—THOMSON.

observable by enemies, by assuming the color of the bed upon which it lies.

1015. The *means* by which this change of color is accomplished is a matter of doubt. There are two distinct colors of pigment present, beneath the transparent skin, and the visible color seems to depend upon which pigment or which combination of the two is extended to view. The *chameleon*, though long an object of interest and study, still presents many remarkable characteristics demanding explanation.

It appears, from the observations of Dr. Weissenborn, who had a chameleon for some time in his possession, that the nervous currents in one-half of the animal may go on independently of those in the other and that the animal has two lateral centers of perception, sensation, and motion, besides the common one in which must reside the faculty of concentration. "Notwithstanding the strictly symmetrical structure of the chameleon, as to its two halves, the eyes move independently of each other, and convey different impressions to their centers of perception. The consequence is, that when the animal is agitated, its movements appear like those of two animals glued together. Each half wishes to move its own way, and there is no concordance of action. The chameleon, therefore, is not able to swim like other animals; it is so frightened if put into water, the faculty of concentration is lost, and it tumbles about as if in a state of intoxication. On the other hand, when the creature is undisturbed, the eye which receives the strongest impression propagates it to the common center, and prevails upon the other eye to follow that impression, and direct itself to the same object. The chameleon, moreover, may be asleep on one side, and awake on the other. When cautiously approaching my specimen at night with a candle, so as not to awaken the whole animal by the shaking of the room, the eye turned towards the flame would open and begin to move, and the corresponding side to change color; whereas the other side would remain for several seconds longer in its torpid and changeable state, with its eye shut."

1016. *Why has the agama the power of inflating its body with air?*



The use of this peculiar endowment is not clearly understood, though it is believed that the animal has the power of *bringing down insects*, by directing upon them a smart current of air. Assuming this to be the case, the function is analogous to that possessed by certain fishes, in the *chætodon* family, of bringing down insects by emitting jets of water.

“Lo! the green *serpent*, from his dark abode,
Which e'en Imagination fears to read,
At noon forth issuing, gathers up his train
In orbs immense.”—THOMSON.

ORDER III.—OPHIDIA.

1017. *Why is the third order of reptiles termed ophidia?*



From the Greek *ophis*, meaning a *serpent* or snake. The order includes all the serpents and snakes, whatever may be their nature or modes of life. They are the only *vertebrated* animals which have the power of infusing a poison into wounds, though many of them are destitute of this power.

1018. *Why are serpents unprovided with feet?*

One reason, at least, may be found for this deprivation in the fact that, as they are adapted for fulfilling certain ends within particular geographical limits, they are *confined to those limits by the absence of locomotive organs?*

If creatures like the boa and the rattle-snake could spread themselves from the hot to the temperate latitudes, and diffuse themselves generally through these, they would prove serious pests, and formidable enemies to a great number of useful races.

1019. *How are serpents enabled to move along the ground without feet or legs?*

Locomotion is effected by the *contractile force of the muscles*, alternately drawing up and extending the body, combined with the adhesion of the tegumentary covering with the ground.

The animal attaching to the ground a point near its head contracts its body, or bends it into an arch, bringing

"Snakes breathe their amorous sighs in hisses.
This dialect no creature misses."—SHERBURNE.

forward the hinder part, some point of which is then attached to the ground liberating at the same time the fore part.

The posterior point of attachment then becoming a fixed point, the animal throws forward its length by the action of its extensor muscles, after which it again attaches a point in the foremost part of its body to the ground, and repeats the same process.

1020. *Why do serpents let themselves fall from trees without sustaining injury?*

Because their peculiar form, and the elasticity of their parts, prevent concussion from such falls. On reaching the ground, the shock they sustain, instead of proving hurtful, impels them forward, and serves as a stimulus to their subsequent movements.

1021. *How does the snake throw its whole body from the ground in a kind of leap?*

This is performed by placing the body upon the ground in form of a *twisted spiral*, the folds of the anterior part forming the center of the figure; then suddenly extending itself in the manner of a spring, it throws itself to a distance.

1022. This movement may sometimes be seen in very hot weather by the banks of the stream, where snakes often lie basking with their bodies coiled in the manner just described, the neck and head being directed from the center to the circumference above the folds. This position seems to be preferred to any other by the snake while reposing; and it is one from which the animal is enabled to perform the most rapid movement upon a sudden surprise; for, in a wood, from this position they will leap by an instantaneous effort into the brushwood, and thus elude our most energetic efforts to secure them, or even to get sight of them; but by the side of a stream this movement may be better seen, for on a sudden approach they will leap from the bank into the midst of the stream, swim to the opposite side, ascend the bank, and secrete themselves.

1023. *Why is the rattlesnake provided with a rattle at the extremity of its tail?*

The use of this curious apparatus is unknown, though so obvious a contrivance cannot be without its specific uses.

"Where at each step the stranger fears to wake
The rattling terrors of the vengeful *snake*."—GOLDSMITH.

It has been alleged that it is a signal of warning to keep away animals that might hear it, from the deadly venom of the snake. *But it is altogether opposed to the economy of nature to endow an animal with means to scare away the prey upon which it must subsist.* It is not unlikely that, as the snake does not climb trees, nor move about with the graceful evolutions of other tribes, but glides along the ground in low and secret places, *the rattle is used as a call to members of its own species.*

1024. *Why have serpents the power of fascination?*

Being *deficient in organs of locomotion*, the power of fascination has probably been bestowed upon them as a compensatory endowment. Otherwise, what chance would there be of a snake bringing down a bird, or pursuing successfully a swift rabbit?

1025. *Why are the Indian snake-catchers enabled to charm snakes?*

It seems to be well-established by observation that certain kinds of serpents are exceedingly *impressible by musical sounds*. A similar fact has been noted with respect to seals, rats, mice, and other animals. But serpents appear to be impressible in a higher degree, and the Indians, who study their habits, learn the exact notes by which the serpents are most affected, and acquire the power of what has been termed "charming them."

ORDER IV.—AMPHIBIA.

1026. *Why is the fourth order of reptiles called amphibibia?*

From two Greek words, meaning *both* and *life*. Amphibials are animals formed to live on land, and to be also capable of living for a long time under water. Their hearts have but one ventricle, their blood is red and cold; and they have such a command of the lungs, as for a considerable time to suspend respiration. *These peculiar-*

"Onely these marishes and myrie bogs,
In which the fearfull ewites do build their bowres,
Yield me an hostry 'mongst the croaking frogs."—SPENSER.

ities, which characterize the amphibia in particular, apply also generally to all the order of reptiles.

1027. Why when the frog is breathing does it keep its mouth firmly shut, and also continually raising and lowering the skin between the bones of the under jaw?



Because, owing to its peculiar structure, it cannot breathe with the mouth open; and if it were forcibly kept open, the animal would die of suffocation.

1028. The explanation of this apparent anomaly is as follows:—The frog receives the air which is to be conveyed to the lungs through the nostrils, but there is no vacuum or cavity formed by the expansion of the thorax, so that the mere pressure of the atmosphere following the expansion, does not, in this instance, inflate the lungs. An effort is required after the air is taken into the body, and that is performed chiefly by the tongue. The depression of the skin of the lower jaw lasts much longer than the elevation, because there is a double operation to be performed—the expulsion of the air already in the lungs, and the re-admission of fresh air into the body. When that skin first descends, there is a contractile action of the abdomen, by which the air in the lungs is driven out; and when that is all expired, the abdomen returns to its natural state; but being without bones it cannot form a vacuum, and thus the lungs could not be inflated but by some other action capable of overcoming the resistance of their cells.

1029. How are the showers of frogs, which are often reported as taking place, accounted for?

The explanation of this apparent phenomenon is as follows: It is generally about the month of August, and often after a season of drought, that these hordes of frogs make their appearance; the animals have been hatched, and quitted their tadpole state, and native pond. Finding the fields hot and parched, they seek the coolest and dampest places, and conceal themselves under clods and stones, where, on account

"I had rather be a *toad*, and live upon the vapour of a dungeon, than keep a corner in the thing I love for others' uses."—SHAKSPERE.

of their dusky color, they escape notice. *When the rain descends*, they come forth in hundreds from their hiding places, and hence are *supposed to have fallen to earth in a shower*.

1030. *How is the bull-frog enabled to make the bel-
lowing noise from which it take its name?*

This sound is produced by certain portions of the larynx of the animal being *convex externally and concave internally*, so that when the entrance to the larynx is closed, they form a dome over the windpipe, which, from its vibratory properties, has been compared to a kettle-drum.

1131. *How is the croaking of the frog produced?*

This peculiar sound, which is supposed to be expressive of pleasure, is produced by means of the air which it forces into the *globular vocal sacs*, which are situated near the corners of the mouth, and causes to vibrate in them. The female being without these organs, produces only a slight noise.

1032. *Why are frogs frequently found dead in dusty roads?*

Because their skin co-operates with their feeble lungs in the *aeration of the blood*. This internal respiration can only take place when the skin is bedewed with moisture. For this purpose the frog is endowed with certain glands that secrete a fluid to moisten the skin. In dusty roads this fluid becomes clogged with dust, and the respiration of the skin being stopped, the animal dies.

1033. *Why are toads useful in greenhouses and other horticultural buildings?*

Because they *destroy ants*; and devour *earwigs, caterpillars, small beetles, slugs*, and all insects which chance to fall in their way.

"Thou cold-blooded slave,
Hast thou not spoke like thunder on my side?
Beene sworne my soldier,
And dost thou now fall over to my foes?"—SHAKSPERE.

1034. *Why are toads enabled to live embeded in rock or stone?*

Because their skins are capable of effecting the necessary changes in the system when the function of the lungs is altogether arrested; and, *requiring an inconceivably small portion of air*, they are enabled to live by the supply which *penetrates the pores of the material in which they are embeded.*

If the many stories to this effect are true, the principal cause must be an ability on the part of these animals to go into a state of almost complete cessation of living activities. As if a clock in good condition, fully wound up to run, should be stopped by holding the pendulum. Life in some organisms seems to be susceptible of almost complete abeyance for a time without losing the power to start up again when conditions becomè favorable.

MISCELLANEOUS.

1035. *Why have most reptiles a kind of moveable lid at the aperture of their nasal organs?*

Reptiles are thus provided, so that when they are under water, *the organ of smell may be exercized or protected as circumstances may require.* The proper vehicle of the impression of smell in reptiles is air; and this they draw through their nasal cavities during inspiration, effecting the operation by depressing their lingual bone, and thus enlarging the cavity of the mouth.

1036. *Why can reptiles abstain for an extraordinary length of time from food and drink?*

Because the languid circulation of their blood, their rare secretions, low temperature, and scaly and impermeable envelope, render their losses by evaporation from the skin very inconsiderable; so that the frequent supplies which are wanted in other animals, to compensate for the incessant waste, are not required for reptiles.

"Forthwith the sounds and seas, each creek and bay,
With frie innumerable swarme, and shoales
Of fish, that with their finnes and shining scales
Glide under the greene wave."—MILTON.

1037. *Why are reptiles termed cold-blooded?*

Because they do not produce enough heat to have a *temperature sensibly higher than that of the surrounding air.*

The whole of their body is heated or cooled at the same time as the surrounding medium; and the changes of temperature which they thus experience have great influence upon all their functions.

A warmth of from 105 deg. to 120 deg. is soon fatal to most of these animals; and cold tends to depress all their natural operations. In winter, most of them could no longer digest the food introduced into their stomach, and do not take nourishment. Their respiration also diminishes in a most remarkable manner. Thus, during the cold season, the action of the air on the skin is sufficient for the maintenance of the life of the frog; and the lungs of one of these animals may be removed without producing asphyxia; whilst in summer they have need not only of the pulmonary respiration, but also of their cutaneous; and death soon occurs when the air does not act on the skin, or is excluded from the lungs.

CLASS IV.—PISCES.

ORDER I.—LEPTOCARDIA.*

1038. *Why is the first order of fishes called leptocardia?*

From two Greek words signifying *small* and *heart*, with reference to the rudimentary formation of the heart, which, indeed, is said to be absent, and to consist entirely of the contractile power of the arteries.

1039. This order includes only a single small fish, which rarely attains a length of two inches, and which presents so many remarkable characters that its position in classification has been much disputed.

* The classification here pursued combines the systems of Cuvier and Agassiz, as blended by Mueller.

"Lie there, Lycaon: let the fish surround
Thy bloated corpse, and suck thy gory wound."—POPE.

This is the *Amphioxus lanceolatus*, a little, slender, transparent creature, found on sandy coasts in various parts of the world. Its body is of the lamprey form, with a narrow membranous border. The vertebral column is represented by a gelatinous cord, which supports the axis of the nervous system; the latter terminates anteriorly by a rounded extremity, without any signs of a brain. The head bears a pair of eyes, which are connected with the end of the nervous axis by short filaments, and there is an apparent rudiment of an olfactory organ. The mouth is at the front of the head, where it forms an oval opening without jaws, but surrounded by a number of cartilaginous points; the oval cavity leads into a large branchial sac. By the action of cilia, with which these cavities are lined, currents are produced in water, the water passing off through numerous slits in its walls into the general cavity of the body, whence it escapes by an opening in the ventral surface.*

ORDER II.—CYCLOSTOMATA.

1040. *Why is the second order of fishes called cyclostomata?*

From two Greek words meaning a *circle* and a *mouth*, in reference to the circular mouth which distinguishes the members of the order.

1041. They are of an elongated, cylindric, and worm-like form; the skin is tough and destitute of scales; the pectoral and ventral fins are wanting; the skeleton is cartilaginous; breathing orifices, little sacs that open exteriorly by separate vents; heart muscular, composed of two chambers.

1042. *Why has the lamprey a circular, cartilaginous mouth?*

Because it *lives by suction*, some species living upon insects and worms: others upon the juices of the larger fishes. One species, the *hag*, contrives to enter the mouths of fishes, and extracts their substance by sucking. Fish that have been hooked on lines, and



allowed to remain in the water for some time afterwards, have been attacked by these creatures, and when drawn up have been found to consist of little more than empty skin.

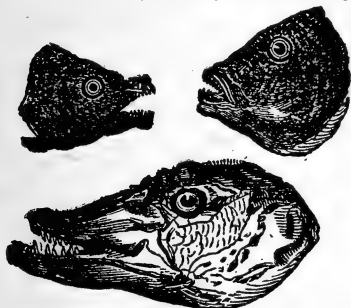
“Let riches never breede a lofty minde,
Let nature’s giftes make no man ouer blinde,
For these are all but *bladders* full of winde.”—TURBERVILLE.

1043. Formerly the *lamprey* was a fish of considerable importance. It was taken in great quantities in the Thames, and sold to the Dutch as bait for *turbot*, *cod*, and other fisheries. Four hundred thousand have been sold in one season for this purpose at the rate of forty shillings a thousand. From five pounds to eight pounds a thousand has been given; but a comparative scarcity of late years, and consequent increase in price, have obliged the line fishermen to adopt other substances for bait.*

ORDER III.—TELEOSTIA.

1044. *Why is the third order of fishes named teleostia?*

From two Greek words signifying *perfect*, and *bones*, in reference to the *perfect bony skeletons* which they possess.



1045. In fishes of this order the skull is always of a very complicated structure, composed of numerous bones; the gills are supported upon free bony arches, and the water passes away from them by a single aperture, protected by bony gill covers. The mouth is always formed by a pair of jaws, and usually armed with teeth.

The ORDER is again divided into six *Sub-orders*: 1. *Physotomata*; 2. *Anacanthina*; 3. *Pharyngognatha*; 4. *Acanthoptera*; 5. *Lopobranchia*; 6. *Plectognatha*.

Sub-order I.—Physotomata.

1046. *Why is the sub-order physotomata so named?*

From the Greek *phuaso*, to *blow*, or *inflate*, in allusion to the possession of an *air-bladder*, connected with the pharynx by a duct, which only occurs in these fishes, of all the teleostia.

1047. The fishes belonging to this group are usually furnished with a complete series of fins, which are always composed entirely of soft

* Yarrell’s “History of British Fishes.”

"Genius, piercing as the *electric* flame,
When waked in one, in others wakes the same."—SCOTT.

rays, with the exception of the first ray in the dorsal, anal, and pectoral fins, which are sometimes spinous. The ventral fins are sometimes wanting; when present, they are always abdominal in position. The skin is sometimes naked, at other times more or less covered with bony plates; in most cases, however, it is thickly clad with scales. The air bladder is connected with the pharynx by a sort of duct. The sub-order includes most of the important fishes that are sought for as food by man, and one species which possesses electrical powers.

1048. *Why has the gymnotus the power of communicating electric shocks?*

For the purpose of *defending itself from enemies*, and also to *benumb its prey*, which is generally swifter in motion than the eel, until the latter can overtake it.

1049. That these are the reasons why this animal is endowed with this wonderful power there can be no doubt, since the *uses* made of the electric force by the eel have been well ascertained.

The electric eel is not only one of the most extraordinary of fishes, but it is one of the most wonderful productions of living nature. And yet it is no more wonderful than the *serpent* which fascinates its prey; than the *bird* which *baits with insects the branches of shrubs*, in order to attract small birds thither, than the *fish* which *emits jets of water to knock down flies*; or the *spider* which *constructs a beautiful snare*, and waits silently and motionless the *entrapment of its victim*.

These various means to the same end, with which different animals are endowed, illustrate the boundless resources of the Creative Wisdom.

The apparatus in which the electric power is lodged is a very singular one, consisting of four organs, which are placed longitudinally in the tail of the fish. The organic part of this singular apparatus consists of a countless assemblage of cells, which have some analogy to the divisions of a galvanic battery.

The nature of the shock transmitted appears to be galvanic or electrical. Nearly the same substances are conductors and non-conductors of the shock, as are conductors and non-conductors of common electricity. The eel may, with perfect impunity, be touched with a glass rod, or the hand wrapped in a dry silk handkerchief; but metals, water, and almost all moist bodies conduct it readily. If the animal is touched with one hand only, that is, if it is touched only in one place, no shock is felt; but if it is touched in two places considerably apart from each other, the shock is very violent.

The manner in which the force is applied is as follows:—The gymnotus approaches as nearly as possible its intended prey; the latter endeavors to escape, when the gymnotus discharges its battery, which has been found to be powerfully effective at a distance of *fifteen feet*. The creature thus benumbed is incapable of any further effort, and the eel swims leisurely towards and devours it.

The degree of force which can be thus exerted is considerable. Horses entering ponds where electric eels abound are frequently knocked

"Barefoot may no neighbour wade
 In thy cool streams, wife nor maid,
 When the *spawns* on stones do lye,
 To wash their hemp, and spoil the fry."

—BEAUMONT AND FLETCHER.

down by its violence; and the Indians of South America, where the *gymnotus* abounds, are frequently drowned while bathing, being stunned by the shock from these animals.

It is remarkable that in tropical lands there are found the choicest fruits, the most beautiful flowers, the grandest plumage, the richest perfumes; and there, too, the rattle-snake has the deadliest poison, and the *gymnotus* its strange electrical power.*

1050. *Why is the herring so called?*

From the German *hoer*, an *army*, with reference to the numbers in which they move from place to place.

1051. *Why do herrings migrate?*

The migrations of the herring are analogous to those of certain birds. Impelled by unfailing instinct, the herring leaves the depths of our surrounding seas *to deposit its spawn in the shallower waters* of the coast, there to be vivified by the genial influence of the sun; and after accomplishing its purpose, it retires to the remoter deeps.

1052. The herring is essentially a northern fish; seldom has it been found so far south as the Bay of Biscay, in Europe, or the coast of Carolina, in America. Like plants that, flourishing in certain climates only, become fewer and more stunted the nearer they approach the limits of their zone, herrings decrease in number and size as they approach their assigned southern boundary—those caught on the southern shores of England being considerably smaller than those which frequent the coast of Norway. Thus it is that about the month of July, the grand array of herrings is found to the northward of the Shetlands, in distinct columns five and six miles long, three and four miles broad. Pressing for the shallows, they drive the sea before them in a continuous ripple. Sometimes they sink down fathoms deep for a few minutes, then again rising to the surface, sparkle in the sun like a prairie strewn with diamonds. Nor even during the calm summer night is the scene less brilliant, from the intense scintillations of phosphoric light exhibited by the countless myriads of moving fish. The quantity of life in these shoals would be completely beyond belief if we did not recollect that 36,000 eggs have been counted in the spawn of one herring.

1053. *Why do herrings swim in shoals?*

Because, like migratory birds and quadrupeds, large numbers of them are *acted upon by the same necessity at the*

"The scaly herd, a numerous throng,
Beneath her silver billows glide along,
Whose still increasing *shoals* supply
The poor man's wants, the great one's luxury."—SOMERVILLE.

same time; they therefore move together by a common impulse, to fulfill an uniform end. Herrings, and all fishes that are known to swim in shoals, are *solitary* except when the necessity for spawning approaches, and then the prevailing need brings them together in enormous numbers.

1054. No adequate conception can be formed of the myriads of herrings and pilchards that move together in what are called *shoals*, which often extend many miles in length and breadth. In some of the lochs, or arms of the sea, on the west coast of Scotland, herrings have often been cast ashore by storms in such numbers that they have been used as manure for land.

Upon one occasion, the bellman of Crail, at the eastern extremity of the peninsula of Fife, was sent round with the bell to announce that any one who chose to go to the shore would get a cart-load of live herrings for a shilling. This passed without much notice; but, by-and-bye, the bellman again went round, proclaiming that any one who chose might go and obtain a cart-load of live herrings for nothing. This announcement, of course, excited some speculation; but it was speedily followed by a third one—that any one who would be kind enough to go to the shore of Crail would get a shilling for taking away a cart-load of herrings. The explanation was, that a storm which was then prevailing continued to drive large shoals of herrings upon the shore; so that, when left by the ebb-tide, they lay in countless thousands for at least a mile and a half or two miles along the coast. The reason for the latter announcement was a fear on the part of the authorities of Crail, that such a quantity of animal matter remaining to putrify on the beach would taint the atmosphere, and cause disease.

1055. *Why are few herrings and pilchards caught in the cold months?*

Because they then resort to deep waters, beyond the reach of nets. They keep to the bottom of the sea, where they feed upon small crustaceous animals and a minute species of shrimp not larger than a flea.

This being their natural food and mode of feeding, it is impossible to take them with a hook, though a rare instance of a pilchard being hooked with a worm is upon record.

Pilchards are, however, frequently found in the stomachs of large voracious fishes, caught during the colder months.

—“Before that, a plump vintner
Kneeling, and offering incense to his deitie,
Which shall be only this, red *sprats* and pilchers.”

—BEAUMONT AND FLETCHER.

1056. *What is the difference between the pilchard and the herring?*

The pilchard is a different species, thicker and smaller than the herring; the scales large, while those of the herring are small. The posterior edge of the dorsal fin is nearly over the center of gravity, so that when a pilchard is held by this fin, the head rises, and the tail droops down, which is the reverse of what happens with the herring.

The pilchard is a more southerly and more local fish than the herring, being found chiefly on the Cornish coasts; and it is rare that one is found beyond Dover, or even in the narrow part of the Channel.

1057. *What are sprats?*

Sprats are a *distinct species of fish*, though of the herring family, of which those usually sold are full grown.

1058. *Why do sprats usually appear soon after herrings have spawned?*

Because sprats approach the shore for the like *purpose of spawning*, their season being a little later than the herrings. The resemblance of the sprat to the herring, and their becoming abundant soon after the herring season, has led to the erroneous supposition that sprats are young herrings.

1059. *What are whitebait?*

They are a *distinct species* * and not, as generally supposed, the fry of a larger kind.

1060. About the end of March, or early in April, whitebait begin to make their appearance in the Thames, and are then small, apparently but just changed from the albuminous state of very young fry. In September, specimens of whitebait, the young fish of the year, may be taken as long as four or five inches but they are even then mixed with

* *Clupea alba*. Yarrel.

“The lusty *salmon*, then, from Neptune’s wat’ry realm,
When as his season serves, stemming my tidedul stream.”—DRAYTON.

others of very small size, as though the roe had continued to be deposited throughout the summer. In their habits they appear to be similar to the young of the herring, always keeping in shoals, and swimming occasionally near the surface of the water, where they often fall a prey to aquatic birds. Whitebait live upon minute crustacea.

1061. *What are anchovies?*

Anchovies are a *genus of soft-finned fishes*,* belonging to the family of herrings, but separated from that genus by certain structural differences of habit and haunt.

1062. The habits of all the herring family are similar: they are migratory, and swim in shoals; and, with the exception of the shad, and those species which frequent the great freshwater lakes and do not migrate to the sea, they all remain in salt water. The anchovies inhabit waters nearer to the equator than the herrings, and may be said to take up the occupation of the sea where the herrings leave it off.

1063. *Why do salmon arrive in some rivers earlier than in others?*

It has been suggested that this depends upon the *varying warmth of the waters*; those highland rivers which arise from large lochs being all early, owing to the warmer temperature and great mass of their sources; while those rivers which are swollen by melting snows in the spring months are later in their fish-producing season.

1064. *Why do female salmon in the spawning season ascend the rivers before the males?*

Because the former are impelled by a necessity which probably operates in a higher degree with them than with the latter: the males, therefore, follow the females, and pair, and attend them during their spawning, and afterwards become, as it were, their escort to the sea.

1065. The sexes of fishes, if we except the sharks and rays, offer no very decided external characters. In the *males*, the respiratory organs

**Engraulis encrasicolus*.

"The *salmon*, (which at spring forsakes Thetis' salt waves,) to look on him,
Upon the water's top doth swim."—SHERBURNE.

occupy more space than in the females; and the abdomen is larger in the females than in the males; the males may be distinguished by their somewhat sharper and more pointed head, the greater length of gill cover, and the body, from the dorsal fin downwards, being not so deep compared with the whole length of the fish.

The organs of reproduction consist of two elongated oval lobes of roe, one on each side of the body, placed between the ribs and the intestinal canal; the lobes in the female called *hard roe*, contain a very large number roundish ova, or eggs, enclosed in a membranous bag. In the male, the lobes of roe are smaller than in the females, and have the appearance of two elongated masses of fat, which are called *soft roe*. In the spawning season, these soft rows become fluid, and are voided during the time of spawning, the ova of the female being impregnated thereby.

1066. *Why do salmon, when either ascending or descending rivers, halt in the brackish water where fresh and salt water mingle?*

By so doing, they accustom themselves gradually to the *change of element* which they have to undergo. And here they obtain a release from numerous *parasitic animals*, those of the salt water being destroyed by contact with fresh, and *vice versa*.

1067. *Why is the flesh of the salmon red?*

It has been assumed by Dr. Knox, that this redness is owing to the *peculiar food* upon which the salmon subsists when at sea—consisting of the eggs of various kinds of small marine animals.

Salmon are known to eat, also, sand-eels, small fishes, and various diminutive marine animals. Mr. Morrison stated before the Highland Society, that he had taken salmon within flood mark, some of which had two, and others three, full-sized herrings in their stomachs.

1068. *What circumstances give rise to the various varieties of trout?*

It is probable that there are not only *varieties*, but that there is more than one *species* of river trout. But when we consider geologically the various strata traversed by rivers in their course, the effect these *variations of soil* must pro-

"Lure
From his dark haunt, beneath the tangled roots
Of pendant trees, the monarch of the brook."—THOMSON.

duce upon the *water* and the influence which the constant operation of the water is likely to have upon the fish that inhabit it; when we reflect also on the great variety of food afforded by different rivers, we shall be able to assign very probable reasons for the variations both in size and color which are found to occur.

1069. Lord Howe remarks, that "There are two considerable streams which take their rise at no great distance from each other, the Whiteadder and the Blackadder, the latter tributary to the former. The Whiteadder from head to foot flowing along a very rocky and gravelly bed, while the Blackadder (Blackwater) rises in the deep mosses near Wedderlea, and the Dorrington laws (high hills), and flows for about half its course through a rich and highly cultivated district. The trout of Whiteadder (Whitewater) are a beautiful silvery fish, but good for nothing; those of the other dark, almost black, with bright orange fins, and their flesh excellent. Nothing can be more various than the appearance of the trout of these two rivers; and surely nothing can be more easier at once to see the cause of this difference."

1070. *Why do young pike frequently appear in ponds where there were none before?*

Because the spawn of the pike is covered with a *sticky viscous fluid*; this adheres to the plumage of water-birds, and is by them *borne into new waters*, causing the unexpected and somewhat unaccountable appearance of pike in new waters.

1071. *Why do smaller fish at certain seasons appear to be familiar with the pike, while at others they avoid his presence?*

Because the pike, which is remarkable for its voracity, nevertheless undergoes *periods of abstinence*. During the summer months their digestive functions are somewhat torpid, and in warm sunny weather they lie basking in a sleepy state for hours together. The smaller fish appear to be aware when this abstinent state of their foe is on him; they are then less alarmed at his presence and may be seen swimming round him with indifference.*

* Blaine's "Rural Sports."

"The goodly well grown trout I with my angle strike,
And with my bearded wire I take the rav'nous pike."—DRAYTON.

1072. *Why does the pike undergo this state of torpidity?*

It is remarkable that this peculiarity in the animal economy of the pike differs materially from the habits of other fishes, which, after the emaciation from the effects of spawning, require an increase of food to repair the exhaustion. But with the pike, the return of appetite appears to be suspended: a wise provision; for, were this fish as voracious as usual, *few of the small fry which are then abundant would escape*, and the stock of fish would be materially reduced.

1073. *Why are "pike" called also "jack"?*

These are verbal distinctions referring to the size and age of the same fish. When the fish does not exceed four or five pound weight, it is called in England "*a jack*"; and when above that weight it is a "*pike*."

1074. *Why is the pike exceedingly voracious at certain seasons?*

Because it is a fish of *rapid growth*, and consequently *vigorous digestion*. The young fry grow rapidly, attaining two pounds weight in the first year; and they gain from two to three pounds weight every subsequent year.

Besides, the *enormous amount of exercise* which the pike takes produces a great expenditure, and creates a corresponding demand for food. There is no more active fish: it sometimes darts through the water with the speed of an arrow.

1075. It has been offered in illustration of the great digestive powers of the pike, that after in part swallowing a fish little smaller than itself, those parts that have entered into the stomach are dissolved with amazing rapidity, while those in the mouth and throat which are yet entire make a constant progress downwards as the process of digestion makes way for them.

The pike has always been remarkable for extraordinary voracity. Eight pike, of about five pounds weight each, consumed nearly *eight hundred gudgeons in three weeks*; "and the appetite of one of these pikes," says Mr. Jesse, "was almost insatiable. One morning I threw to him, one after another, five roaches, each about four inches in length; he

— "The lavish slave
Six thousand pieces for a *barbel* gave;
A sestrice for each pound it weigh'd, as they
Gave out, that hear great things, but greater say."—DUKE.

swallowed four of them, and kept the last in his mouth for about a quarter of an hour, when it also disappeared." Digestion in the pike goes on very rapidly, and they are therefore most expensive fish to maintain. In default of a sufficient quantity of fishes to satisfy them, moorhens, ducks, and indeed any animals of small size, whether alive or dead, are constantly consumed; their boldness and voracity are equally proverbial. Dr. Plot relates, that at Lord Gower's canal, at Trentham, a pike seized the head of a swan as she was feeding under water, and gorged so much of it as killed them both; the servants perceiving the swan with its head under water for a longer time than usual, took the boat, and found both swan and pike dead. Gesner relates that a pike in the Rhone seized on the lips of a mule that was brought to water, and that the beast drew the fish out before it could disengage itself. Walton was assured by his friend Mr. Segrave, who kept tame otters, that he had known a pike in extreme hunger fight with one of his otters for a carp which the otter had caught, and was then bringing out of the water; proving the old adage, that, "it is a hard thing to persuade the belly, because it has no ears." A woman in Poland had her foot seized by a pike as she was washing clothes in a pond; and the same thing is said to have happened at Killingsworth pond, near Coventry. The head keeper of Richmond Park was once washing his hand over the side of a boat in the great pond in that park, when a pike made a dart at it, and he had but just time to withdraw it. Mr. Jesse adds, that "a gentleman now residing at Weybridge, in Surrey, walking one day by the side of the River Wey, near that town, saw a large pike in a shallow creek. He immediately pulled off his coat, tucked up his shirt-sleeves, and went into the water to intercept the return of the fish to the river, and to endeavor to throw it out upon the bank by getting his hands under it. During this attempt, the pike, finding he could not make his escape, seized one of the arms of the gentleman, and lacerated it so much that the marks of the wound are still visible."*

1076. *Why is the barbel so called?*

From the Latin *barbalatus*, meaning *barbs*, or *beards*, in reference to the appendages to its lower jaw.

1077. *Why is the first ray of the dorsal fin of the barbel deeply serrated?*

The serrations arise from certain additions to the ray, which impart a greater degree of strength to it. This increased strength *facilitates the movements of the fish* in the rapid currents and mill streams which it frequents.

* Yarrell's "British Fishes."

"The dainty gudgeon, roache, the minnow, and the *bleak*,
Since they but little are, I little need to speak."—DRAYTON.

1078. *Why has the barbel four wattles, or barbs, on its lower jaw?*

The barbel, as well as devouring small fish, bores in the loose soil for slugs and worms, and these *wattles* serve as *feelers*, in the pursuit of food.

1079. *Why may small fish be seen attending the barbel while it bores in the soil?*

Because they *eat the minute animalcules* thrown up from the soil by the movements of the barbel.

1080. *Why, when angling for roach, is it necessary to try the water at all depths?*

Because, being *miscellaneous feeders*, roach swim at various depths; and, being gregarious, they move in shoals: so that at one level there may be plenty of fish, and at another none at all.

1081. *Why is the *bleak* commonly called the water swallow?*

Because it sometimes occupies one part of a river, then takes its departure to another; the deeps, the shallows, and the surface, are alternately their resort; and they further resemble swallows in *their nimbleness when in pursuit of prey*, and particularly in the catching of flies.

1082. *Why has the roach a very small mouth without teeth?*

The roach lives *principally upon insects and fresh-water mollusca*, which it finds adhering to the weeds; but which it would be unable to obtain were it not for this peculiar structure of the mouth.

1083. *Why does the shanny habitually hide itself behind stones, rocks, etc.*

Being destitute of a swimming-bladder, this fish is *confined to the bottom*, where it takes up its residence on a rock

"Their scaly armour's Tyrian hue,
Through richest purple to the view,
Betray'd a golden gleam."—GRAY.

or stone, from which it rarely wanders far, and beneath which it seeks shelter from ravenous fishes and birds.

1084. When the tide is receding, many of these fishes hide beneath the stones, or in pools, but the larger individuals quit the water, and, by the use of the ventral fins, creep into convenient holes, rarely more than one in each, and there, with the head downward, they wait for a few hours, until the return of the water restores them to liberty. If discovered or alarmed in these chambers, they return by a backward motion to the bottom of the cavity.

1085. *How do gold and silver fish kept in globes subsist upon what appears to us to be water only?*

Because the water abounds in animalcules, which, although invisible to the human eye, are visible to the eyes of fish, and consumed by them as food.

1086. The necessity for frequently changing the water in which gold and silver fish are confined is thus made obvious enough; for if this precaution is neglected, the fish being deprived of their food must eventually die.

1087. *Why do gold fishes kept in vases so frequently come to the surface of the water?*

When the water becomes vitiated, the fishes come to the surface to swallow air; after the air has been changed, they may be observed to reject it again by a kind of eviction, and seek the surface once more for a fresh supply; so that in this way they are enabled to alleviate the evil consequences which result from the unhealthy state of their surrounding medium.

Sub-order II.—*Anacanthina*.

1088. *Why are the fishes of the sub-order anacanthina so called?*

Because they are without the sharp spines which support the fins of other fishes; these organs in the *anacanthina*

“And o’er the ocean’s crystal mirror,
 Taught the unnumber’d scaly throng
 To trace their liquid path along.”—MOORE.

being arranged upon soft rays. The word is derived from *a*, “without,” and *acantha*, a “spine,” or “thorn.”

1089. These fishes also present a difference in the structure of the air-bladder, which, instead of communicating with the throat by a duct, as is the case in the *physostomata*, is here more completely closed, and there is no connection between the interior part of the bladder and the throat.

1090. *Why have the sand-eel and the sand-launce a projecting lower jaw?*

Because it is the habit of these fishes to *bury themselves in the sand*, and by the sharpness and muscular power of the jaw, and the slenderness of their bodies, they are able to bury themselves in wet sand five or six inches deep with great rapidity.

1091. *Why is the cod found in great abundance upon the coast of Newfoundland?*

Because in that region there exist vast submarine mountains upon which crustaceous and molluscosous animals are abundant. These constitute the *natural food of the cod*.

1092. *Why does the skin of a sole act as a clearer for coffee?*

Because it contains a large proportion of *albumen*, which, being driven from the skin by the action of hot water, afterwards *coagulates*, and fixes and precipitates the floating grains of coffee.

1093. *Why are soles and other flat fish destitute of air bladders?*

Because, being bottom fish, and seldom elevating their range in the water, they do not require an apparatus, the purpose of which is to *vary the specific gravity of the moving body*.

1094. *Why do dead fishes usually float?*

It appears to be a creative design that when these in-

"Here's a very fat carp, shall we dress you a brace?
Would you choose any *soles*, or a mullet, or place?"—CAMBRIDGE.

habitants of the deep die in any other manner than as prey to larger species, they shall rise to the surface, and be *presented as food to sea birds, the scavengers of the sea,*

The bodies of fishes are always so near to the specific gravity of water, that the slightest development of gases in their tissues, which would arise from the first stage of decomposition, brings them to the surface.

1095. *Why are bottom, or flat fishes, more commonly found floating than others?*

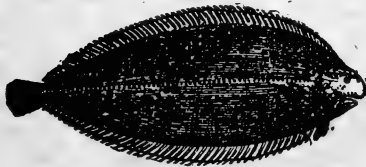
Because, being occupants of the bottom of the sea, their bodies half sunk in the earth, and, concealed by the unity of their color with that of the bed upon which they lie, they are less liable to be preyed upon than other fishes.

The peculiar shape of their bodies is also a great protection to them, since they cannot be swallowed whole, as is the case with many fishes.

Larger numbers of flat fish, therefore, may be supposed to die from natural causes than is common with other species. Hence they are more frequently found floating dead than other kinds of fish.

1096. *Why do soles swim upon their sides?*

Because their eyes are placed upon one side only, by which, being *bottom fish*, they are able to lie upon the ground, and *look upward for their prey*. For a relative reason, too, their *upper sides are dark*, and of the *color of the bed*



which they inhabit, while their undersides are white.

"Of fishes—every size and shape,
Which nature frames of light escape,
Devouring man to shun."—SMART.

Sub-order III.—Pharyngonatha.

1097. *Why is the third sub-order designated pharyngonatha?*

The name is derived from *pharynx*, the pharynx, the muscular fang at the back part of the mouth; and *gnathos*, the jaw, indicating that the pharyngeal bones are united.

1098. This sub-order includes an assemblage of fishes of diverse forms, in which there are both soft and spinous rayed; the pharynxed bones of this sub-order are completely united, so as to form a single bone, which is usually armed with teeth. The air-bladder is always completely closed.*

1099. *Why is the garfish usually called the mackerel guide?*

Because it commonly approaches the shore to spawn, a little prior to mackerel doing so. Hence the popular idea that the garfish guides mackerel to the shore.

1100. *Why is the parrot fish so called?*

Because of the peculiar hooked formation of its mouth, and the brilliancy of its colors.

1101. *Why has the parrot fish rounded jaws and scale-like teeth?*

Because they browse on newly-formed layers of stony corals, digesting the animal matter therein contained, and setting free the carbonate of lime in a chalky state. Their jaws and teeth possess immense strength.

Sub-order IV.—Acanthoptera.

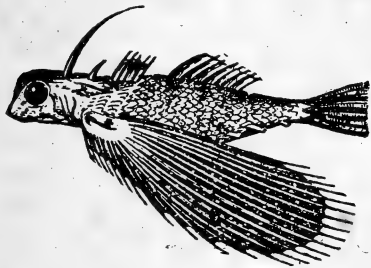
1102. *Why is the fourth sub-order called acanthoptera?*

From *acanthos*, a thorn, and *pterygion*, a fin,—meaning *thorn-finned*. One of the most distinguishing features of these fishes is, that the spinous rays of their fins constitute formidable defensive weapons.

"The west part of the land was high browed, much like the head of a *gurnard*."—HACKLUYT.

1103. The number of fishes belonging to this sub-order is exceedingly great, and they present a considerable diversity of structure.

1104. *Why do the spinous defensive weapons of fishes turn backwards?*

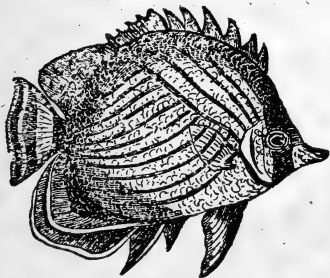


Because their enemies attack them from behind; the direction of the sharp spines is therefore most efficient for their protection.

1105. *Why are the Indian gurnards called "flying fishes"?*

Because, when pursued by the dolphin, or other large creature of prey, they *spring from the sea*, in which action their large pectoral fins support them upon the air, in the manner of a parachute. Their action, however, is not that of flying, but *springing* from the sea.

1106. *Why are the chaetodons remarkable for brilliancy of colors?*



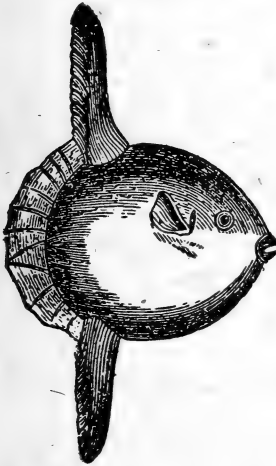
These are tropical fishes, and, like other animals of the tropics, remarkable for their beauty, which may be attributed in this, as in other instances, to the intense *action of the sun*, although the nature of that action cannot be explained.

The chaetodons have been described as occupying a similar place in the tropical seas to those which parrots occupy in tropical forests: they even excel the parrots in brilliancy while living. All the colors have a metallic luster, and though some of them are of one very intense color, as golden, yellow, ultra-marine, or rich

"Thick in yon stream of light, a thousand ways,
Upward and downward, thwarting, and convolv'd,
The quivering nations sport.—THOMSON.

bronze, when the fish is at rest; yet, when it moves, they are iridescent, and sparkle with gem-like luster. The *chaetodon striatus* is sometimes called the zebra, on account of its beautiful stripes.

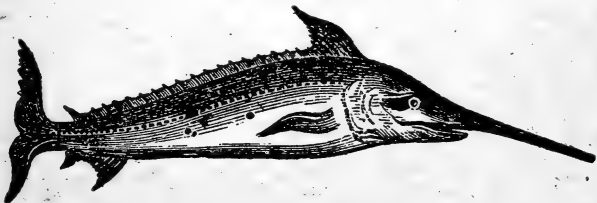
1108. *What peculiarity does the structure and habits of globe fishes present?*



These fishes possess the power of distending themselves into a globular form, by inflating with air a large sac contained in the abdomen. When thus distended, they float along the water with the back downwards, swimming onwards by means of their pectoral fins. They are covered with a series of large spines; which are raised up when the body is thus inflated, so as to form a very efficient means of defense.

1108. *Why is the upper jaw of the sword-fish elongated into a blade-like weapon?*

The sword-fish inhabits seas where the monsters of the



deep, whales, sharks, and threshers abound. Here these monsters battle with each other; and the sword-fish, being

"Straight as above the surface of the flood
They wanton rise, or, urg'd by hunger, leap,
Then fix, with gentle twitch, the barbed hook."—THOMSON.

among the smaller of the races, is armed with a weapon which makes him as formidable as the larger and more powerful kinds.

1109. The sword-fish living at least in part, upon the bodies of fishes larger than itself, uses its formidable weapon to lacerate and divide their substance into convenient morsels.

The prolonged snout forms an excellent *cut-water* when the fish makes its arrow-like darts through the water; and the powerful tail is calculated to drive home the weapon with enormous force.

1110. *Why is the "John Dory" so called?*

This name evidently arises from a corrupt pronunciation of a French term, designating the color of the lighter parts of the fish, which is yellow, with metallic reflections, and, therefore, styled *jaune doree*, or golden yellow.

1111. *Why are some fishes provided with an apparatus resembling a boy's sucker?*

Because, by pressing this organ against any surface they are enabled to retain their hold without using teeth or fins; and by this means retain their position in the water at the same time that they catch their food.

1112. The lump-fish fastens itself by an apparatus on the lower part



of its body, while the sucking-fish has a similar provision on his back, by which it attaches itself to the shark, or to whatever is afloat, or the bottom of ships. In the cuttle-fish there is to be seen a modification of the same kind of apparatus, which can be turned by the animal in any direction, either to fix itself or to drag itself from place to place. There is another fish, called the "Harlequin angler." The appearance of this fish is grotesque and singular; the pectoral fins resemble short

arms, and are palmated at their tips. These fins are converted into feet, and the fish has been known to live three days out of water, and walk about like a dog.*

* Bell on the Hand.

"Cold welle streams, nothing dede,
That swormmen full of smale fishes light,
With finnes red, and scales silver bright."—CHAUCER.

Sub-order V.—Lophobranchia.

1113. *Why is the fifth sub-order named lophobranchia?*
From *lophon*, a crest, and *branchia*, gills—meaning *crest-gilled*.

1114. In the *lophobranchia* the gills are arranged in little tufts, disposed in pairs along the branchial arches. The aperture for the exit of water is very small. The body is elongated in its form, and covered with bony plates. The fins are imperfectly developed. The bones of the face are prolonged, forming a snout. This sub-order includes only a single family, composed of small fishes, of very singular appearance.

1115. *Why has the sea-horse a small pouch-like opening upon its abdomen?*

In the course of the summer, this curious sac is filled with eggs; and at a later period, when the fry are hatched, they continue for a time to seek shelter within this singular cavity.

1116. Mr. Yarrell describes this curious provision nearly as follows: "The male differs from the female in the belly, from the vent to the tail fin, being much broader, and in having, for about two-thirds of its length, two soft flaps, which fold together and form a pouch. They breed in summer, the females depositing their roe in the pouches of the males.

1117. *Why has the sea-horse* a pointed tail, destitute of the usual fin?*



It uses the long tapering tail to support itself by twisting it round the stems of sea-weed and other objects, moving about slowly amongst sea-weed, by a series of undulations, feeding upon minute crustacea, worms, mollusca, etc. As the creature cannot pursue its prey, a caudal fin would be of no utility; the tail is therefore converted into a kind of fulcrum, from which the animal strikes its prey.

* Hippocampus.

"And over all with scales was arm'd,
Like *plated cote* of steele, so couched neare
That nought mote percee."—SPENSER.

Sub-order VI.—Plectognatha.

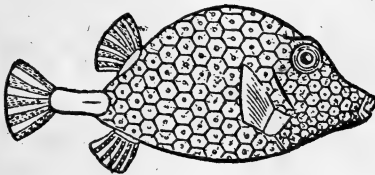
1118. *Why is the sixth sub-order termed plectognatha?*

From *plecto*, to connect, and *gnathos*, a jaw—signifying that the bones of the upper jaw and palate are connected with those of the cranium.

1119. The head is large, the mouth small, and the gills so covered with skin and muscles that only a small aperture is left for the exit of water employed in respiration. The body is usually short and stout, and covered with a thick rough skin, or sometimes with bony plates.

1120. *Why is the trunk-fish covered with a complete suit of bony plates?*

These plates furnish to the trunk-fish a *coat of armor*



analogous to that worn by the *armadillo*, and doubtless for similar purposes. The body is covered with plates, so as to form a perfect coat of armor, leaving only the tail, fins,

mouth, and a small portion of the gill-opening, capable of motion, all of which moveable parts pass through openings of the armadillo-like coat of mail, the joints being protected and rendered flexible by a leathery substance.

ORDER IV.—GANOIDEA.

1121. *Why is the fourth order of fishes named ganoidea?*

From *ganos*, splendor, and *edios*, appearance. Of the remarkable fishes belonging to this order, very few exist at present in our waters. But their fossil remains occur in abundance in almost all the fossiliferous strata of the earth. They are divided into *two sub-orders*:—

Sub-order I.—Holostea.

1122. *Why is the first sub-order of the ganoidea called holostea?*

"From that clear space, where, in the cheerful ray
Of the warm sun, the *scaly* people play."—CRABBE.

From *olos*, the whole, and *osteon*, a bone, in reference to the fact of their being covered with a suit of scales or bone.

Sub-order II.—Chondrostea.

1123. *Why is the second sub-order of ganoidea called chondrostea?*

From *chondros*, a cartilage, and *ostean*, a bone, signifying the gristly nature of the fish.

ORDER V.—SELACHIA.

1124. *Why is the fifth order of fishes called selachia?*

From *selachos*, a Greek common noun, signifying a gristly, or cartilaginous fish.

The skeleton in the *selachia* is entirely of a cartilaginous nature. The skull consists of a cartilaginous capsule, composed of a single piece without any indications of suture. The structure of the jaws varies considerably. They are divided into two sub-orders:

Sub-order I.—Holocephala.

1125. *Why is the first sub-order of selachia called holocephala?*

From *olos*, whole, and *cephale*, head, meaning that the head is one entire piece or skull.

1126. The holocephala are all oviparous, and their eggs, like those of the sharks and rays, are enclosed in a strong, horny capsule.

Sub-order II.—Plagiostomata.

1127. *Why is the second sub-order of selachia called plagiostomata?*

From *plagios*, transverse or oblique, and *stoma*, mouth, in reference to the oblique form of the mouth, which is always arched, and contains numerous rows of teeth. The mouth is also wide, and placed on the lower surface of the body at some distance from the extremity of the snout.

1129. *Why are sharks said to follow in the wake of ships on board which there may be sick people?*

"Increasing still the terrors of these storms,
His jaws horrific arm'd with threefold fate,
Here dwells the direful *shark*. Lured by the scent
Of steaming crowds, of rank disease, and death."—THOMSON.

Sharks instinctively follow ships, with the object of *picking up refuse matters which are constantly being thrown overboard*.

The well-known voracity of the shark—the manner in which it seizes upon the body of man alive or dead—gives it an ominous aspect when following in the wake of a ship having a sick crew. And hence has arisen the popular error, that sharks follow ships, waiting for dead bodies to be thrown overboard.



1130. *Why have the eggs of sharks and rays long filamentous processes attached to them?*

For the purpose of *attaching the eggs to sea-weeds*, so that they may not be damaged by being beaten on the shores, nor preyed upon by crustaceous animals. Each egg consists of a horny case, filled with a nutritious fluid. The empty cases are frequently found by the sea-side, and are commonly called *mermaid's purses*.

1131. *Why have the rays, and kindred fishes, long tails armed with spines?*

These organs, as well as being used for propulsion, are employed as *weapons of defense*, and from the muscular strength of the fish, are very formidable when seized or terrified; its habit is to *twist its long and flexible tail round the object of attack*, and, with the serrated spine, *tear the surface*, lacerating it in an effective manner.



"Had I like fish, with fins and *gills* been made,
Then might I in your element have played;
With ease have dived beneath yon azure tide."—FAWKES.

MISCELLANEOUS.

1132. *How is the breathing of fishes conducted?*

The breathing of fishes takes place by *gills*. The water, which is impregnated by atmospheric air, is taken in by the mouth, and forced out again by the apertures on each side of the neck. It is thus made to *pass between the gills*, which form a set of comb-like vascular fringes, supported upon a system of bones termed the branchial arches, and during this passage the air is absorbed by the blood of the fish.

These fringes are generally four in number on each side, and are attached by one extremity to an intermediate chain of bones situated opposite the middle of the neck, behind the hyoid bone, while by their opposite extremity they are joined by ligaments to the under surface of the skull.

1133. *Why is the flesh of fishes white?*

Because after death the oxidized blood is chiefly confined to a few internal organs, as the heart, liver, kidneys, lungs, and gills; the flesh is consequently white and apparently bloodless.

1134. *Why do fishes swallow their food hastily, and without mastication?*

Because they are obliged unceasingly to open and close the jaws for the *purpose of respiration*, and cannot long retain food in the mouth when quite shut.

1135. *Why are the teeth of fishes slightly curved inwards?*

Because this form is best adapted for taking a *firm hold of prey*, which is frequently alive, and which without

"See how she gasps, and struggles hard for life."—LLOYD.

such a provision would, in its struggles, easily escape from the mouth of the captor.

1136. *Why are certain species of fish constituted to live for a long period out of water?*

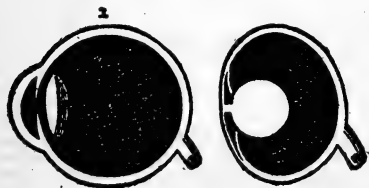
Because they inhabit ponds and streams in warm countries, where, in many situations, there is an ample supply both of food and water for fish during the rainy season; but a complete deficiency of both when this is succeeded by a periodical drought. Such receptacles can only be tenanted by fish which are furnished with the peculiar apparatus for *keeping the gill moist*; since, when one pond or stream is dried up, they can migrate in search of another. In the course of these journeys, they climb up steep banks, and even trees; and, by a remarkable instinct, they seem always to travel to the nearest water.

1137. *Why is that part of the fish's eyes known as the crystalline lens, much rounder than in the eyes of the terrestrial animals?*

Because the rays of light, in passing from water into the eye, require to be refracted by a more convex surface than when it passes out of air into the eye.

1138. As an illustration of the instances adduced here, of the adaptation of the fish's eye to the medium in which it lives, we may observe that the power in the human eye, for example, of drawing the pencil of rays to a focus, and producing an accurate image upon the retina in the

bottom of the eye, depends principally upon two circumstances—the form of the cornea and the convexity of the lens. That the cornea may produce this effect, it is not only necessary that it should be convex, as in fig. 1, but that the rays should enter it from a rarer medium. As this cannot be effected in the water, the lens or crystalline humor, which is much denser



than water, is brought into operation. In the eye of an animal living in the atmosphere, the lens is removed backwards, and resembles the

"The sounds and seas, with all their finny drove,
Now to the moon in wavering morrice move."—MILTON.

optician's double convex lens; but in the fish it is a sphere, and being brought in contact with the transparent cornea, it not only has the power to concentrate the rays of light coming through the water, but by its altered position it increases greatly the sphere of vision (fig. 2). It may be added that it is not exactly the cornea that is deficient in the fish, but the aqueous humor behind it. An aqueous fluid being thus both behind and before the cornea, and that membrane being in a very slight degree thicker in the center than in the margin, this part of the organ which is so efficient in the atmosphere is rendered useless in water. A man diving, for example, sees imperfectly, somewhat in the condition of an aged person who requires spectacles.

1139. *Why does a fish lie with its head against the stream?*

Because when a fish is situated with his head down the stream, he is compelled to travel more rapidly than the waters, or the latter will *find its way into the gills*, and, by becoming stationary, suffocate him.

1140. A trout may be seen lying for hours stationary, while the stream is running past him; and it sometimes appears to remain so for whole days and nights. In salmon-fishing the fly is played upon the broken water in the midst of a torrent, and there the fish shows himself, rising from a part of the river where men could not preserve their footing, though assisted by poles, or locking their arms together.

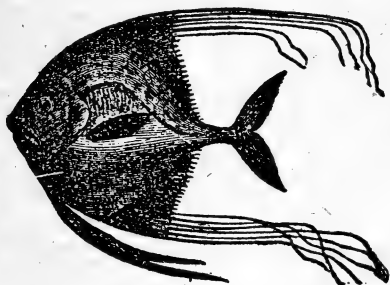
1141. *Why do the jack and stickleback keep up a continual motion of the fins nearest their gills?*

Because they frequent *still shallows*, and require the water to be perpetually *brought to their gills*. In this case, the water does not come of itself, and, therefore, the fish moves his pectoral fins continually to create a perpetual change in the water, propelling that which has already passed through the gills, bringing fresh in its place, and thus keeping up a constant current.

1142. Neither to the jack nor the stickleback does the motion appear to cause any exertion; it seems natural to them, and a distinct function apart from the motion of the fins for swimming purposes. It is, in fact, somewhat analogous to the perpetual motion of the heart, lungs, and internal viscera in the human body.

"A man may fish with the worm that hath eat of a king, and eat of the fish that hath fed of that worm."—SHAKSPERE.

1143. *Why do fishes which swim vertically inhabit near the surface, while those which swim horizontally keep to the bottom?*



The fish which swims on edge has the tail much more effectively formed as a swimming organ, and the fins much firmer, as well as more produced; they are, therefore, rapid swimmers, and rather discursive in their motion.

From a opposite development, fishes swimming on the flat of their bodies can only progress slowly, and do not, on that account, range far.

1144. *Why will a fish which has broken away with a hook, frequently take another hook immediately afterwards?*

Because the mouths of fishes are usually cartilaginous, and furnished (at least in the part where the hook strikes) with few nerves, or they are altogether absent. In such a case the fish experiences little inconvenience from the presence of a hook, and boldly strikes at a fresh bait.

1145. Sir Humphrey Davy says:—"I have caught pike with four or five hooks in their mouths, and tackle which they had broken away with only a few minutes before; and the hooks seemed to have had no other effect than that of serving as a *sauce piquante*, urging them to seize another morsal of the same kind."*

1146. *Why do wounds in fish heal rapidly, and why do they appear to be generally exempt from disease?*

Because fish have a strong resistance to disease-producing bacteria, and because the temperature of the water, being cooler, as a rule, than that of the air, hinders the development of bacteria. The heat of the warm-blooded animals hastens bacterial development. However even fish suffer certain diseases.

* "Salmonia."

“Being moody, give him line and scope; till that his passions, like a whale on ground, confound themselves with working.”—SHAKSPERE.

1147. *Why may a fish be “drowned” when being “played” by an angler?*

Because fishes breathe by passing water, which always holds common air in solution, through their gills, by the use of a series of muscles connected with them.

When a fish is hooked in the upper part of the mouth, it is scarcely possible for him to set the muscles in action which move the gills, while the rod is applied as a lever to the line, so that no aerated water can be respired.

1148. A fish, hooked in a part of the mouth where the force of the rod will render his efforts to respire unavailing, is much in the same state as that of a deer caught round the neck by the lasso of a South American peon, who gallops forwards dragging his victim after him, which is killed by strangulation in a very short time. When fishes are hooked foul—that is, on the outside of the body, as in the fins or tail—they will often fight for many hours, and in such cases very large salmon are seldom caught, as they retain their powers of breathing unimpaired; and if they do not exhaust themselves by violent muscular efforts, they may bid defiance to the temper and the skill of the fisherman.*

1149. *Why is the migration of fishes of great importance to mankind?*

It is by these migrations that the blessings of fish diet are periodically bestowed upon the inhabitants of shores remote from each other. If such fishes were constant residents in any one locality, we might feed on them to satiety; but, by a temporary privation, we learn to estimate the value of the treat, and to hope for the periodical return.

1150. *Why do fishes generally spawn in shallow waters?*

Because a certain degree of solar heat and light is necessary for quickening the eggs into life; and also because the young fry are thereby protected from large fish.

1151. *Why does the sea sometimes exhibit a luminous appearance?*

Because of the great numbers of *medusæ*, or jelly animalculæ, which, being congregated in one part, under certain conditions emit a phosphorescent light.

"Order is Heaven's first law; and, this confess'd,
Some are, and must be, greater than the rest."—POPE.

1152. *Why does the sea contain a certain proportion of saline matter?*

These saline matters have the effect of raising the freezing point, and diminishing the tendency to give off vapors; and, also, because it renders the water more buoyant, and thus makes it better fitted to support the animals which it contains.

[The Author finds himself reluctantly compelled to omit the various Orders comprising the Division MOLLUSCA. The Entomological series alone would supply matter for a highly interesting volume; and in the hope that he may be soon able to present such a work to his readers, the Author will close his present labors, with a few questions of leading application.]

1153. *Why has every race of animals its appointed enemy, or enemies?*

Because *birth, life, and death, constitute the order of nature* appointed by a Divine Being. This order established, it may be accepted that the Infinite Wisdom whose works exhibit such marvelous adaptation and perfection, *has chosen the best means to a necessary end.* The death of an animal, as the prey of an appointed superior, is *doubtless a more rapid and painless process than we, with a dread of death, conceive.*

1154. Paley reasons upon this proposition in a conclusive manner:—"Perhaps there is no species of terrestrial animals whatever, which would not overrun the earth if it were permitted to multiply in perfect safety; or of a fish which would not fill the ocean: at least, if any single species were left to their natural increase without disturbance or restraint, the food of other species would be exhausted by their maintenance.

"It is necessary, therefore, that the effects of such prolific faculties be curtailed. In conjunction with other checks and limits, all subservient to the same purpose, are the thinning which take place among animals by their action upon one another. In some instances, we ourselves experience, very directly, the use of these hostilities. One species of insects rids us of another species, or reduces their ranks; a third species, perhaps, keeps the second within bounds; and birds or lizards are a fence against the inordinate increase by which even these might infest us."

"Cease, then, nor order imperfection name:
Our proper bliss depends on what we blame."—POPE.

To this may be added, that MAN *alone* appears to be without a natural enemy, gifted with a *special instinct* and an *organization* intended to effect his conquest. The *web of the spider* is a beautiful contrivance, evidently designed to ensnare flies. The *scent* by which the stoat pursues the rabbit; the *teeth* with which the former perforates the neck of its victim, and the *instinct* which guides it to attack the neck, are three special means bestowed for a given end. The *gaping mouths* of swallows and night-jars are manifestly conceived for the purpose of capturing insects in the most certain manner. Although man is born the most defenseless of all creatures, there is not a single animal gifted with an instinct to pursue him, and armed with weapons adapted to give effect to that instinct. The elephant, the lion, and the tiger, although endowed with strength by which they could immediately crush him, all retire from and avoid his presence, unless he trespasses upon their haunts, or they are driven to extremities of rage or hunger by restraints which he imposes upon them. Regarded as enemies to man, their armatures are too formidable: the tusks of the elephant, and the talons or teeth of the lion and tiger, might be dispensed with, and they would still be immensely his superiors in the balance of natural powers. Even the vermin that sometimes surround and annoy man, are the enemies of his negligence and vices, and not of himself. On the contrary, the whole of the animal creation, in some form or other, are friends of man, and contributors to his need.

1155. TABLE OF THE FECUNDITY OF VARIOUS ANIMALS.

<i>Mammalia.</i>	<i>Young at a birth.</i>	Swallow -----	5 or 6
Bear -----	2	Wren -----	10 to 16
Elephant -----	1	<i>Fish</i>	<i>Eggs at a spawning.</i>
Hippopotamus -----	1	Carp -----	205,000
Leopard -----	2 to 4	Codfish -----	3,686,000
Lion -----	2 to 4	Flounders -----	1,357,000
Rhinoceros -----	1	Herring -----	36,000
<i>Birds</i>	<i>Eggs at a sitting.</i>	Perch -----	28,000
Eagle -----	2 to 3	Mackeral -----	546,000
Falcon -----	2 to 4	Pike -----	49,000
Fowl (domestic) -----	6 to 20	Roach -----	81,000
Hawk -----	2 to 4	Smelt -----	38,000
Owl -----	2 to 6	Sole -----	100,000
Partridge -----	14 to 20	Tench -----	383,000
Pheasant -----	10 to 20	<i>Insects.</i>	<i>Eggs in a season.</i>
Sparrow -----	4 to 6	Bee -----	10,000
Sparrow-hawk -----	2 to 5	Gnat -----	2,000
Stork -----	2 or 3	House-fly -----	20,000,000

In five generations one *aphis* may produce 5,000,000,000, and there are 20 generations in a year. The numbers are beyond calculation.

1156. *Why does the duration of life of different tribes greatly vary?*

The longevity of animal races appears to be in the inverse ratio of their fecundity. The wisdom of this arrangement is apparent: if mosquitoes and locusts prolific as they are, were appointed to live from a quarter to half a century, in spite of all existing natural checks, they would

"No more the paths of misty doubt I trod:
My reason saw, my soul confessed, a God!"

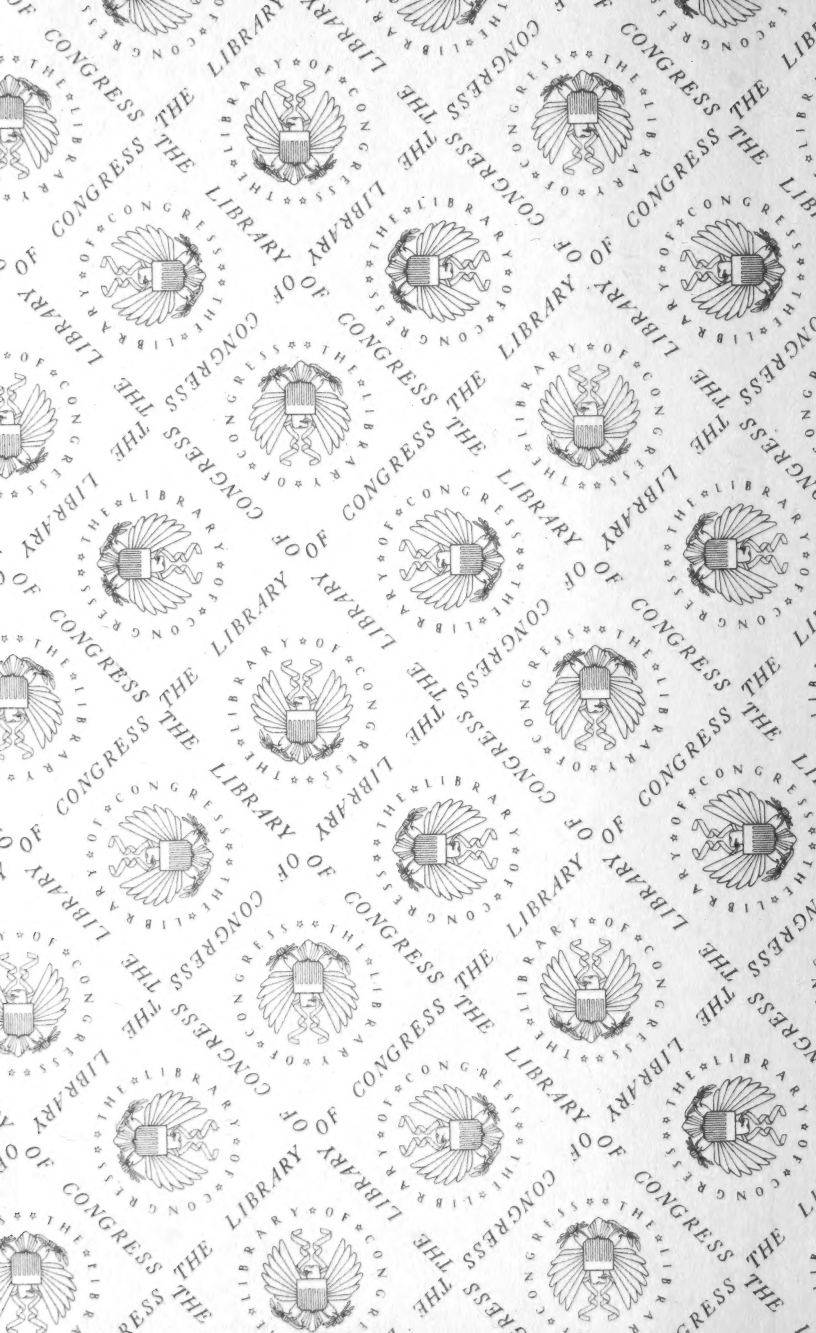
render every other form of existence impossible. If lions and tigers, living for half a century, and possessed of enormous powers, were to multiply as rapidly as insects, they would overrun creation, unless, indeed, they destroyed each other.

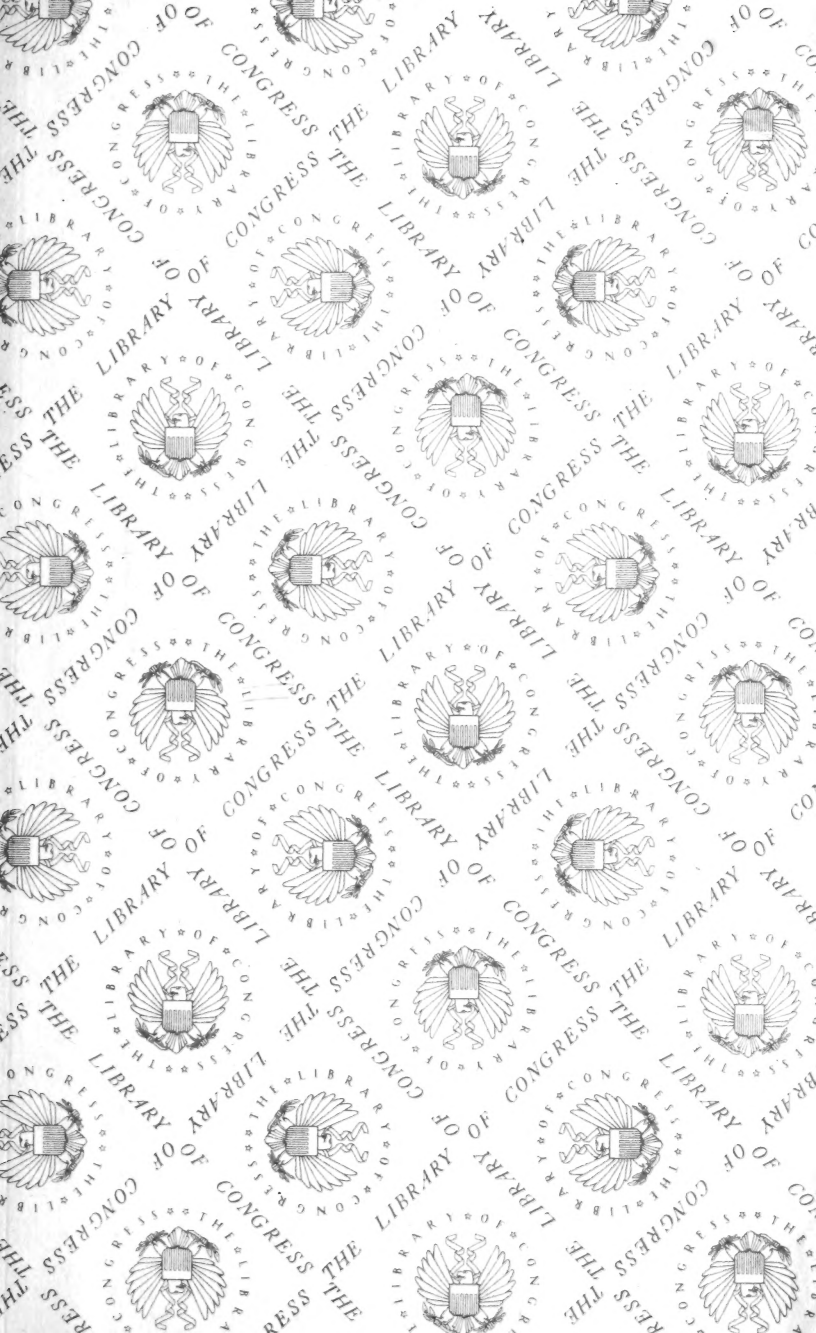
1157. TABLE OF THE LIFE PERIODS OF VARIOUS ANIMALS.

	Years.		Years.
Ass, from	25 to 50	Linnet	14 to 23
Antelope	16 to 18	Lion	60
Bee (female)	4	Llama	15
Bear	20	Lynx	16
Beaver	50	Mantis	10
Beetle	1 to 4	Margay	16 to 17
Blackbird	10 to 12	Monkey	16 to 18
Blackcap	15	Nightingale	16 to 18
Bream	10	Ocelot	16 to 18
Bull	30	Ox employed in agriculture	19
Camel, from	50 to 60	Parrots	100
Canary, if it does not couple	24	Peacock	24
Carp, from	100 to 150	Pelican	40 to 50
Cat	18	Pheasant and Partridge	15
Chaffinch	20 to 24	Pigeon	20
Chamois	25	Pike, sometimes more than	100
Civet cat	12 to 14	Porpoise	30
Cod	14 to 17	Rabbit, from	8 to 9
Cow, sometimes more than	20	Racoon	12
Crane	24	Raven	100
Cray-fish	20	Reindeer	16
Crocodile	100	Rhinoceros	20
Crows	100	Redbreast	10 to 12
Deer	20	Salmon	10
Dolphin	30	Scorpion	1
Dog, from	23 to 28	Serval	16 to 18
Eel	10	Sheep	10
Eagle	100	Skylark	10 to 30
Ephemera (from egg to imago)	3	Sparrow-hawk	40
Ephemera (as a perfect fly)		Spider	1
days	2 or 3	Squirrel	7
Ephemera (other kinds) hours	2 or 3	Stag, under	50
Elephant	150 to 200	Starling	10 to 12
Fox	15	Swan	100
Fowl, common	10	Tench	10
Goat	10	Thrush	8 to 10
Goldfinch	10 to 16	Tiger and Leopard	25
Goose	50	Tiger cat	16 to 18
Hare	7 to 8	Titlark	5 to 6
Heron	60	Toad	20 to 30
Hog	20	Tortoise	100
Horse	25 to 30	Viper	6 to 7
Hyenas	25 to 30	Wheatear	2
Jaguar	25	Wolf	20
Lark	16 to 18	Wren	2 to 3

THE END.

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