MEDICAL

AND

PHYSICAL RESEARCHES.

MEDICAL

AND

PHYSICAL RESEARCHES:

OR

ORIGINAL MEMOIRS

IN

MEDICINE, SURGERY, PHYSIOLOGY, GEOLOGY, ZOOLOGY, AND COMPARATIVE ANATOMY.

ILLUSTRATED WITH PLATES, CONTAINING 160 FIGURES.

By R. HARLAN, M.D., F.L.S. Lond.,

CORRESPONDING MEMBER OF THE ROYAL MUSEUM OF NATURAL HISTORY OF PARIS; OF THE ROYAL ACADEMY OF MEDICINE OF SWEDEN; OF THE WERNERIAN NATURAL HISTORY SOCIETY OF EDINBURGH; OF THE GEOLOGICAL SOCIETY OF FRANCE; OF THE BOSTON NATURAL HISTORY SOCIETY: HONORARY MEMBER OF THE ASIATIC SOCIETY OF BENGAL; OF THE MEDICAL SOCIETY OF KENT, ENGLAND; OF THE NEW HAMPSHIRE STATE MEDICAL SOCIETY: MEMBER OF THE NEW YORK LYCEUM OF NATURAL HISTORY; OF THE AMERICAN PHILOSOPHICAL SOCIETY; OF THE ACADEMY OF NATURAL SCIENCES OF PHILADELPHIA. SURGEON TO THE PHILADELPHIA ALMS HOUSE HOSPITAL; PROFESSOR OF COMPARATIVE ANATOMY, ETC.

"Whilst professional knowledge should undoubtedly be the first object of the Physician's studies, general science should not be neglected, and is so far from being incompatible with that primary object, that it cannot fail to enlarge your views and give efficiency to your professional researches. So intimate is the connexion between every object of useful and scientific inquiry, that there is hardly one branch of knowledge which does not in some measure throw light and illustration upon others."—*Sir A. Cooper.—Lect. on Surgery.*

PHILADELPHIA:
PRINTED BY LYDIA R. BAILEY,
No. 26 NORTH FIFTH STREET.
1835.

TO

WILLIAM MACLURE, ESQ.,

PRESIDENT OF THE ACADEMY OF NATURAL SCIENCES OF PHILADELPHIA; MEMBER OF NUMEROUS LEARNED SOCIETIES AT HOME AND ABROAD.

Dear Sir,

Admiration of your intellectual endowments—esteem for your private virtues—and grateful recollection of your munificent donations to public institutions devoted to Science, have induced me to inscribe these sheets to you, as a most sincere, although feeble, expression of the value I attach to the friendship of one whose brilliant efforts in the department of science which forms, in part, the subject of the following pages, have so greatly contributed to advance its interests.

I have the honour to be,

Yours, most respectfully,

Richard Harlan.

TO

PHILIP SYNG PHYSICK, M. D.,

MANY YEARS PROFESSOR OF ANATOMY AND SURGERY IN THE UNIVERSITY OF PENNSYLVANIA, ETC.,

Whose successful exertions in the relief of suffering humanity have secured to him the admiration and lasting gratitude of his fellow-citizens—whose success as a teacher of the most important departments of medical science in the school of which he was long the ornament, so ably contributed to its just renown—and whose professional pre-eminence is only equalled by the urbanity and alacrity with which he is ever ready to communicate the results of his vast experience to his junior confrères, the Medical portion of these pages is respectfully dedicated,

By his much obliged friend,

THE AUTHOR.

TABLE OF CONTENTS.

B

INTRODUCTION.

ON THE AFFILIATION OF THE NATURAL SCIENCES.

"Between the physical sciences and the arts of life there subsists a constant mutual interchange of good offices, and no considerable progress can be made in the one without of necessity giving rise to corresponding steps in the other."
Herschel's Discourse on the Study of Natural Philosophy.

It is not the design of this introduction, to insist on the necessity, much less on the *utility* of the study of the natural sciences: —such an effort would be derogatory to the understandings of a highly civilized community.

Since our existence evidently depends on the constitution of the elements of the universe which surround us, we enter the world with an instinctive partiality for this kind of knowledge; the earliest operations of the mind lead us to become acquainted with the nature and properties of material creation; the earliest and most pleasing recollections of our infancy are associated with this effort; the propensity is developed with our ripening years:—arrived at maturity, in all our aspirations after perfection, in all our criticisms as to the true merits of every production in science, and in art, our constant appeal is to nature;

"To *Heaven's* institute of laws eternal,"

whose ordinances are equally revealed to us, "in the slightest atom which fluctuates in the meridian ray, or in the mighty confluence of worlds." *Nature!* is still the theme of every one; but whilst nothing is so common as the word, how rare is the correct apprehension of the term!

To the closet of the metaphysician we would willingly consign the fruitless inquiry into the nature of final causes, and confine our researches to the study of accessible laws. But, "nature dis-

c

dains a *cabinet* courtship; to be wooed with success, she must be interrogated in the free and majestic scenery of her works. The earth,—the air,—the ocean,—the heavens!—Thither, she calls the genius and the powers of her favourite votary; to him, toil in the pursuit of truth, is luxury and pleasure."

In fine, it must be conceded, that the end and aim of natural science, is the gratification of an instinct deeply implanted in the mind of man, impelling him to search into the secret of his own existence; or at least, to detect its connexion with that of the rest of nature, and to discover those general laws by the agency of which the internal and external world are regulated. However short we may fall of attaining this great object, yet is there no reason to doubt, that in every path of science, the certainty and celerity with which we attain a familiar acquaintance with truth, will be proportioned to the degree in which we avoid the influence of the imagination, and adhere to pure experience collected with philosophic circumspection.

Ever since the restoration of letters in Europe, the learned of every profession have occupied themselves with the study of natural science, which is recommended to us not only by its reference to intellectual objects, but as it exerts a beneficial and important influence on the moral dispositions; the tranquil occupation which it supplies to the mind is a salutary contrast to the restless agitations of avarice and ambition; its innocent pleasures are well calculated to detach us from the frivolous and destructive pursuits of dissipation and folly, and lead us to estimate justly, the ordinary objects of human exertion.

It is in a state of the highest polish and refinement, that the mind turns with the most intense longing from the feverish agitations of which it is *weary*, to the contemplation of man, happy in the pursuit of natural knowledge.

"Whilst there are qualities in the products of nature yet undiscovered, and combinations of art yet untried; it is the duty of every man to endeavour that something may be added by his industry to the hereditary aggregate of knowledge and happiness."

In offering a general view of the several subjects embraced in an inquiry like the present, I shall be excused for dwelling on that which is so intimately connected with the study of Medicine—and which will, at the same time, aid us in demonstrating the affiliation, and intimate association of the Physical Sciences.

The study of *Comparative Anatomy* has indeed been strangely overlooked in this country—for whether we consider it in its extensive relation to other branches of science, its general utility, or its peculiar attractions, I shall endeavour to prove that there is no scientific pursuit possessing stronger claims to the attention of the Physician, the Naturalist, or the general Student.

Coeval with the earliest records of human history, we learn from the sacred historian that *names* were attached to the various parts of the animal structure; hence we infer the great antiquity of the study of *Comparative Anatomy*:—this term was originally employed to designate the structure of *animals* compared with that of *man* as a standard,—it is now used in a more extensive sense, and implies the anatomy of all living animals compared with each other.

Zoology, or the history of living beings, takes its origin as a science from Comparative Anatomy:—our *first* step in the study of life, is to examine its material instruments:—the various organs which enter into the structure of animals, must therefore be examined under every possible modification of simplicity or of combination, in order that we may obtain any satisfactory knowledge of general structure; and no one can fully comprehend the philosophy of Anatomy, who limits his views to the study of a single species; the same remarks apply with equal force to *Physiology*, or the study of the phenomena of life;—the functions must be observed and compared in all the links in the great chain of beings to whom any modification of vitality has been imparted.

The number and complication of the organs in the higher order of animals, oppose insuperable obstacles to our knowledge of the precise importance of each. Comparative Anatomy, by unfolding organic structure as it exists in the various classes, illustrates the precise operation of each part; and as we descend the animal scale, the organs are found successively to disappear, until we arrive at the most simple structure, in which any share of vitality has been manifested: thus, fish are destitute of external ears, and the lowest orders are without brain or any definite nervous system.*—&c. &c.

*Until very recently, we are taught by all writers on Natural History, that insects are destitute of a true vascular circulation; for affirmative proofs of this phenomenon we are indebted to Professor Carus, who, in 1824, was the first to discover and demonstrate this circulation in the *Agrion puella*.

This mixed circulation, partly diffused and partly vascular, is beautifully illustrated also in the *Ephemera Marginata*, vid. Entomol. Magaz. 1, 239, pl. 2.

By thus extending our views over the whole animal creation, we rectify our notions, and avoid many absurd blunders, and erroneous conclusions, which are the unavoidable consequences of confining our notions to the more complicated animals. Whilst a slight injury of the brain is sufficient to destroy the life of man, a tortoise has been known to survive the removal of the whole cranial contents, for six months! The precarious tenure of life in the mammalia is most strikingly contrasted with the powerful vitality of the *Hair-worm*, and other animalcules, which after remaining for years in a dried state, resume life and motion on being moistened.*

A contrast equally curious is observable in the power of *reproduction*, or of restoring parts that have been mutilated, or entirely destroyed, which is displayed in a wonderful degree in the more simple animals. The *Aquatic Hydra*, so celebrated by the curious experiments of Trembley, may be divided almost infinitely, and each portion forms a perfect Hydra; the head is reproduced as often as decapitated, thus realizing the fable of Hercules. Such phenomena, when viewed in connexion with the system of nutrition, forms one of those decisive and grand characters which distinguish, at first view, the works of God from the most ingenious and boasted productions of human skill. The latter possess no power of self-preservation, which forms, under various modifications, so imposing a character of the *animal* kingdom. It is beyond the contrivance of man to construct an automaton, "capable, by the operation of an internal force, of sustaining itself in the air, in opposition to gravity, for even a few minutes; and far less of performing in that element the evolutions which we daily witness even in the lowest of the insect tribes."—(Vid. Roget, Animal and Vegetable Physiology, vol. 1, p. 344.) The entire eye, limbs, and tail of the salamander,—the claws of the lobster,—the arms of the cuttle-fish, &c., when mutilated, can be completely restored. Some of the worms may be divided into as many parts as there are rings of their bodies, and each part will become a perfect worm.

Reflecting on these curious phenomena, developed in the study

* The *Gordius Aquaticus*, or Hair-worm; The *Rotifer Redivivus*, or *Wheel-animalcule;* The *Vibrio tritici*, or Eel-like animalcule infesting diseased wheat; The *Filaria*, or parasitic worm, infesting the aqueous humour of the Eye of the Horse, as described by Blainville, Ann. dis. Sc. Nat., are among those in which this astonishing revivification has been experimentally tested.

of Comparative Anatomy, the great Haller was convinced that "Physiology had been more illustrated by the dissection of animals, than by human anatomy." There is nothing more worthy of admiration to a philosophic eye, than the various *structures* of animals, by which they are qualified to support existence in the elements or climates to which they are appropriated; and of all natural bodies, it must be generally confessed, that they exhibit the strongest evidences of infinite wisdom, bear the most indisputable testimony to the Supreme Reason, and excite in the mind new raptures of gratitude, and new incentives to piety.

It may be adopted as a principle, than which there is none more important in the animal economy, that the organization is universally in relation to the mode of life; and in consequence of their reciprocal influence, all the various parts of an animal are so closely connected with each other, that this relation can be traced even in the most minute particular.

Cuvier, in his "Researches on the fossil bones of Quadrupeds," points out this mutual relation of the organs, and the laws of *Coexistence* to which their combinations are subjected; wherein he has shown that "the form of the tooth determines the form of the condyle, or hinge of the lower jaw; the form of the scapula, (shoulder-blade,) that of the nails, either of which indicates the structure of the stomach and the nature of the animal's food, just as the equation of a curve indicates *all* its properties, as in taking each property separately for the basis of a particular equation, we might arrive not only at the ordinary equation, but at all the other properties whatsoever; so the nails, the scapula, the maxillary condyle, the femur, and all the other bones taken *separately*, would indicate each other *reciprocally;* and beginning with *either* separately, we might, according to the rational laws of the animal economy, construct the whole animal."

Further,—"When we observe the track of a cloven-footed animal in the mud or sand, we may conclude that the animal which left it there was a *ruminating* quadruped, and this conclusion would be as certain as any other in physics or morals:—thus then, the track alone, would enable the observer to infer the form of the teeth,—the form of the jaws, of the vertebræ, of the legs, shoulder, &c., of the animal which had passed. It is a mark much more certain than those of *Zadig*."—(Dis. pl. p. 58.)

Such being the importance of Comparative Anatomy to the

Physiologist, who draws from it the facts, on which his knowledge of the functions of animals is grounded; to the *Naturalist*, who finds in it a clue to guide his steps through, what appears at first sight, the inextricable labyrinth of animated nature; to the *Physician* and *Surgeon*, whose pathological reasonings can only be relied on, when built on the broad foundation of *General Physiology*; to the *Natural Theologian*, who discovers in the modification of structure, according to situation and circumstance, and its constant relation to the wants, habits, and powers of animals, the strongest evidence of *final* purposes, and therefore the strongest proofs of an *intelligent first-cause;* we shall not wonder that this subject has powerfully attracted the attention at all times, and been prosecuted by some of the most eminent men. The oldest of these whose works we possess, is *Aristotle*,—the patronage of whose royal pupil, Alexander the Great, enabled him to draw from all quarters, the animals he described in his immortal work; he not only knew and dissected a great number of species, but studied and described them on a vast and luminous plan, to which none of his successors has approached; ranging the facts not according to species, but to the organs and functions, the only means of arriving at comparative results. The modern works of Blumenbach, Cuvier, Fife, Carus, Lawrence, &c., are constructed on the same principle.

Whilst the Romans held the reins of empire, facilities for improving this science existed, which may never again occur; the rarest animals from all parts of the empire were exhibited in the triumphs and public games to amuse the inhabitants, and they became familiar with species which have seldom since been brought alive to Europe.

The Baconian maxim,—"*Knowledge* is power," is fully supported by our retrospect of the past and anticipations of the future.—What a practical commentary does it not offer on those who are active in the pursuit of the pompous nothings of the day, when we reflect that of all the monuments erected to the pride and ambition of *Alexander the Great*, not one is left to the conqueror of the world, not one has withstood the shock of twenty centuries, save the published works of *Aristotle*, his humble preceptor!—these have already survived a period more than sufficient to revolutionize the whole political fabric of the world, and yet it is the privilege of any one to retire to his library, and peruse with pleasure and profit, the *works* of Alexander's great master—these being a faithful register of facts, and containing descriptions true to *nature*, must maintain an existence commensurate with the march of mind; so true it is, that, in human affairs, every thing is permanent in proportion as it is connected with intellect; and whilst the common events of life weary by repetition, and the memory of them perishes, the productions of the mind preserve their lustre, and even continue to shine more brightly.

"The lion engraved on the tomb of the Theban patriots who fell at Chæronia, together with the empty splendour of the mausoleum, have long been lost in oblivion; but the spirits of departed glory will live for ever in the glowing *eloquence* of Pericles in praise of his countrymen."

In the first half of the seventeenth century, discoveries were made on animals which illustrated equally the *human* structure and functions, and ultimately revolutionized the whole system of Physiology and Pathology. The discovery of the circulation of the blood, by Harvey; of the *Lacteals* by Asellius; of the *Thoracic duct* by Pecquet; and of the *Lymphatics* by Rudbeck; are some of the results for which we are indebted to the researches in *Comparative Anatomy*, prosecuted during that period.

About this time, the invention of the *Microscope* opened a new world to the cultivators of science; Malphigi, Swammerdam, Lewenhoeck, Hook, and Baker, were among the first of those who most successfully illustrated, by dissections, experiments, and observations, many parts of Physiology and Comparative Anatomy.

To enter into a minute detail of the *works* of those authors who have laboured in the cause of this truly interesting and important branch of science, would in itself almost complete a volume—the enumeration of the *names*, however, of some of the most distinguished, will convey some idea of the high estimation in which this science is held in Europe.

In Germany, we have Blumenbach, Soemmering, Shneider, Keilmeyer, Rudolphi, Albers, Reil, Tidyman, Meckel, Carus, &c. In Italy, Camparetti, Poli, Malacaine, Mangili, Penada, Moreschi, Rossi, Spallanzani, Configliachi, Rusconi, &c. In France, Perault, Duverney, Philip de la Hire, Buffon, Daubenton, Cuvier, Dumeril, Geoffroy, Blainville, &c. In England, Monro, Hunter, Townsend, Home, Abernethy, Fife, Carlisle, Lawrence, Prichard, Grant, Yarrel, &c. But, it is above all, to Cuvier, the *French*

Aristotle, to whom we are indebted, for having elevated this pursuit to the first rank in the legions of science. The improvements and discoveries which have constantly followed in his illustrious path could scarcely have been anticipated from the labours of a single individual, however extended his views or comprehensive his mind.

"Engaged," says this author, "in an Antiquarian research of a new kind, (alluding to fossil Zoology,) I have been obliged to learn the art of *decyphering* and *restoring* these monuments, of recognising and replacing in their primitive arrangement, the scattered and mutilated fragments of which they consist; of reconstructing those ancient beings to whom they belonged; of exhibiting their proportions and characters; and lastly, of comparing them to those which are found at this moment on the surface of the globe. An art hitherto almost unknown; and presupposing the existence of a science, hitherto almost untouched—I mean the laws of *Co-existence* which regulate the forms of the various parts of organized beings. I could only prepare myself for these researches on *existing* animals. It was necessary to review almost the whole of the *present* creation, in order to give the force of demonstration to my conclusions respecting this *extinct* creation. This review produced numerous rules and relations of a character not less demonstrative; and I thus discovered new laws applicable to the whole animal kingdom."—(Discours preliminaire.)

He has thus succeeded in distinguishing the fossil remains of seventy or eighty species of quadrupeds; forty-nine *unknown* to naturalists of the present time, eleven resembling closely known species, sixteen or eighteen remaining doubtful.

The *death* of this *High Priest of Nature* has been too recently announced, to render it necessary for me to remind you of a catastrophe universally deplored. Seldom have the votaries of science been called to regret the loss of one so eminent; and, though it must be acknowledged that within the few last years, *death* has made fearful havock in the ranks of the renowned, for a *greater* than *He*, the *Lethal Shaft* hath sought in vain. Inasmuch as we are assured that "God created man after his own image," that image must be shadowed forth in the mental manifestations alone. In this sense, he only merits the title of *great*, who has essentially contributed to enlarge the boundaries of knowledge, or advanced farthest in human perfectibility.

The vivifying influence of this bright luminary was felt throughout the intellectual horizon. He not only investigated every department of physical science, but was *eminent* in all,—endowed by nature with the most enviable faculties—surrounded by circumstances most favourable to their development—his mind, fortified by severe study and disciplined by deep reflection, was happily directed, about thirty years ago, towards the fossil relics of those lost animals of former creations, with which the rocks in his immediate vicinity abound. He gave to the admiring world a new science, as interesting in its details, as it is magnificent in results!

By the most persevering zeal and unwearied research, extended throughout every quarter of the globe, he was enabled to snatch from the oblivion of their stony sepulchres, wherein they had been for countless centuries "quietly inurned," and to amass together, whole catacombs of "*dry bones;*"—he breathed over these the breath of *science*,—they lived! and "stood upon their feet an exceeding great army,"—the least element of which bears indisputable evidence of the various epochs and condition of pre-existing worlds, and the geological revolutions by which they were destroyed.

The intelligence which could thus penetrate the night of time,—give new wonders to the beam of day,—unveil the mysteries of creation,—give life to the inanimate,—establish new principles,—*create* a science, and render *that* immortal! *Cuvier!* now is numbered with the illustrious dead.

Of him it may be truly said, "though dead, yet doth he live." Though stript of this "mortal coil," yet doth he exist in every thing endowed with living existence; his spirit is identified with that living nature which he has so lucidly and so faithfully depicted; his *ever enduring* works have formed for him a *Pyramid of fame*, far less perishable than the boasted monuments of Egypt.

"*Thrones,—princedoms,—powers,—dominions*," shall fade away, whilst his *memory* will stand, a rock unshaken amidst the waste of ages!—

"Ingenio stat sine morte decus."

It was in reference to such characters, that Dr. Johnson remarks—

"*Rank* may be conferred by princes and tyrants, *Wealth*, bequeathed by misers and robbers, but the honours of a lasting

D

name, and the veneration of distant ages, the sons of learning can alone command."

Thus the same objects, which when viewed in an isolated manner, and superficially examined, had given rise to the belief in the former existence of giants and monsters, afforded in the hands of a philosopher who contemplated them with all the auxiliary lights of modern science, the means of dissipating many absurd fables, and of establishing a conclusion, not only the most important hitherto made, concerning the construction of the globe which we inhabit; but equally valuable as an instrument of criticism in estimating the hypotheses of Geology, and in weighing the probability of the traditions that relate to the early history and past condition of our earth. The latter subject, which is the ultimate term of all these researches, is one of the most curious that can oocupy our attention. If we feel an interest in following, through the infancy of our species, the almost effaced traces of so many extinct nations; we shall be at least equally gratified, in exploring amid the darkness that involves the early ages of the earth, the remains of revolutions *anterior* to the existence of *all nations*.

That Geology should have derived its most important accession from *Comparative Anatomy;* that the history of the *Globe* should have been elucidated by the examination of some fragments of *bone*, is a striking illustration of the connexion between the different sciences, and of the aid which they are capable of affording each other; it shows us that little can be expected from the exclusive prosecution of *one;* and that he who wishes to succeed signally in any department of knowledge, should have his mind fortified by the possession of many branches.

"It is to organic remains," remarks an accomplished writer, "that the Geologist must turn for information of a most interesting nature; they teach us that man is a comparatively recent creature on the face of the globe; that creation has succeeded creation on its surface; that life has existed on it from remote geological epochs; that climates have varied over the same areas; and that there has been no stability in the modifications of animal and vegetable life, since it was first called into existence on the surface of this planet."

Having thus briefly noticed the extensive relations, and magnitude of the subject; the great attention bestowed on this department of knowledge by foreign nations; I return to my own country, and look in vain for her public establishments and institutions for teaching natural science; where even in *Universities* which claim to be the most enlightened and liberal of this hemisphere, we find Comparative Anatomy, and General Physiology, with all their collateral pursuits, as entirely overlooked, as if they formed no part of *Universal* Knowledge! Where these opulent mines of useful lore,—these unexhaustible stores of imperishable truth, lie totally neglected and unknown!*

It is not unusual to hear physicians of reputation regret their want of time to study the natural sciences; forgetting that there are some departments indispensable to a liberal knowledge of their own profession, as is shown by the attention paid to *Comparative Anatomy* by Blumenbach, Tydiman, Meckel, Carus, Muller, De Serres, Magendie, Monroe, Hunter, Home, Prichard, Good, Lawrence, &c. all eminent physicians, and experienced practitioners.

In fine, it must be conceded, that the study of Natural Science, is, at least, as indispensable to the accomplished physician, as a knowledge of the dead languages is, to the perfect understanding of our vernacular tongue.

If *Haller* had not been a great Naturalist;—if *Darwin* had not fortified his mind with the truths of Physical Science, the "*Ele-*

* The day cannot be far distant when our Medical Schools must embrace a more liberal scheme of instruction, and join the current of progressive improvement of the age in which we live—or retrograde and give precedence to the more aspiring ambition of the rising generation, who are fully alive to the necessities of the case. Some recent demonstrations on the part of the enlightened Trustees of the oldest Institution, for Medical instruction, in this country, afford us the cheering assurance that they are not unmindful of the best interests of the liberal profession of which they are the common guardians. But much remains to be accomplished, to place our most favoured schools on an equality with even the less renowned of the old world. A Medical School without a chair of *Comparative Anatomy*, and its inseparable associate *Physiology*, is an anomaly, unknown at the present day by our transatlantic contemporaries. In some of their Schools the students are obligated to attend from ten to sixteen distinct branches, each course extending from seven to ten months, thus furnishing a humiliating comparison with our own institutions. Will it be conceded that the sons of Republicans are less intelligent, or that the genius which presides over our institutions is less liberal? An increase in the number of Professional Chairs—an extension of the course of instruction, with a diminution in the cost of each branch, could not fail to contribute to the immediate interest of the student, and by enhancing the reputation of the School, must finally redound to the honour and profit of the Professors themselves.

menta Physiologia" and the "*Zoonomia*," would not now be studied and admired by every philosophic physician.*

When we take into consideration, the comparative infancy of our country; the spirit of internal improvement, and increasing reliance on our own domestic resources; the more general diffusion of knowledge, and thirst for literary excellence, so strongly characteristic of the rising generation, notwithstanding the great disadvantages under which we labour in the absence of national cabinets, we may indulge the rational hope, that America will soon also assert her claims in this. What may not be expected in a country like our own? where the monstrous forms of superstition and authority, which tend to make ignorance *perpetual*, by setting bounds to the progress of the mind in its inquiry after physical truths, no longer bar the avenues of science; and where the liberal hand of nature has spread around us in rich profusion, the objects of our research.

* It has even been maintained by some that a Physician of general science is not qualified to practice the minute details of his profession: no view is so narrow, I ought to say, so pusillanimous, so adverse to history, so opposed to experience, so contrary to truth; and can only be viewed as one of those dogmatical assertions under which ignorance and indolence seek a convenient shelter.—A mind meanly endowed could alone be contented to drudge along in the monotony of routine practice, in the enjoyment of a public confidence, but too frequently surreptitiously obtained. Ours is a Profession, in the prosecution of which, *hesitation* implies danger, *mistake* involves death! In extraordinary or desperate cases of disease, demanding the exertions of the highest intellectual resources, that man cannot assuredly be held guiltless who occupies a post for which his education and genius have not thoroughly prepared him, and which he holds to the exclusion of more efficient aid. In the oracular language of the immortal Rush, "*false principles in Medicine* have slain their thousands and tens of thousands; the great evil consists in the servile adherence to one particular system." It was doubtless in allusion to licensed empyrics, that Sir Anthony Carlisle, an eminent British Surgeon, facetiously defined Medicine "*an art founded in conjecture and improved by murder!*" In truth, the practice of an unqualified physician is very little better than legalized murder; thouands of unsuspecting victims are annually hurried to the oblivious tomb, sacrificed to stupid pride or nefarious avarice; not to mention the millions whose constitutions are irretrievably ruined by tampering with active remedies, or by neglecting the critical moment for the establishment of health.

That day has long since departed, when the intellectual worth of a practitioner of Medicine can be fairly estimated by his popularity alone; "He who is not known beyond his personal acquaintances will seldom be fairly estimated; he will either be liable to extravagant praise, or the jealousy and envy of those persons will discolour all his qualities. The world at large is too wide a field to be so poisoned. Little people govern in a small circle by intrigue, craft, and falsehood; while greatness has too wide a swing to show his strength in the same limits."

It is time that we should cease to look to foreigners for masters and teachers.

I have hitherto endeavoured to excite attention to this Science, by showing that men of the most powerful minds, and of great acquirements, have found it an interesting and instructive field of inquiry. The perusals of their published works are most eminently calculated to afford knowledge and gratification.

It must be admitted by all, that Comparative Anatomy is as essential to the practice of *Veterinary Medicine*, as a knowledge of the structure of the human body is, to the cure of the diseases and accidents incident to mankind. The evils to which our domestic animals are subjected, and the consequent loss which society sustains, by unmerited neglect in this respect, are too obvious to need illustration.

In Europe, Colleges have been established, and Professorships endowed for the express purpose of teaching the history and cure of the diseases which affect our domestic animals.

The *gradations* of organization; and the final purposes contemplated by nature in the construction of her living machines; two interesting and much agitated subjects in the philosophy of natural history, receive their only clear illustration, and incontrovertible evidence, from the science to which I would wish to urge attention.

In the *doctrine of final causes,* which has so often excited the disputations of Theologians and Philosophers, this science is calculated to lend essential aid; the naturalist, by its light, discovers at every step, striking peculiarities in the economy of animals, founded on corresponding arrangements of organization; there is throughout nature, to be observed, such wonderful adaptation of means to ends, so constant a relation between peculiarities of structure, as must strike the most sceptical mind with the conviction, that the whole is a work, which prescient Omnipotence was alone adequate to conceive;—the hand of creative wisdom to execute!

Without the aid of Comparative Anatomy, the physical construction of our globe would be enveloped in a mantle of impenetrable obscurity; the most inviting and essential circumstances connected with the study of Geology, consisting in those rocks and earthy strata containing *organic remains.*

" It has been discovered, that mountains and districts are sometimes composed entirely of such remains. It is the business of Naturalists to compare those of a former world, with corresponding objects in the present order of things; to determine their resemblances or differences, whether they are the same or of different species or genera: to compare the productions of the different strata with each other, and to distinguish those which have belonged to fresh, from those of salt water animals, and lastly to ascertain whether the organic fossils of each country, are like the living animals of the same, or of distinct and remote regions and climates."

Such investigations require extensive and accurate observation; an acquaintance both with the great outlines and minute details of nature; and belong, therefore, to an advanced stage of science.

That Comparative Anatomy exerts a most important influence in the study of Medicine, none but the ignorant can possibly doubt; it is, in fine, through it alone that we can become adequately acquainted with the history of that vast and complicated fabric —*Man*,—whose health, interest, or comfort, constitute a centre to which all useful knowledge tends.*

The *physical* history of our own species, in the most comprehensive sense, constitutes a subject of immense extent, and of almost endless variety; or rather includes *several* very important branches of science, if we attempt to describe both the individual and the species. To write such a history, would demand a familiar acquaintance with nearly the whole circle of human knowledge. This labour, beyond *individual* capacity, is therefore divided into several departments; it is the business of the Anatomist and Physiologist, to unfold the construction and uses of the corporeal mechanism; of the Surgeon and Physician, to describe its diseases; while the Metaphysician and Moralist employ themselves with those functions which constitute the mind, and with the *moral sentiments*. Considered in the latter point of view, the sub-

* So intimate indeed, with our own race, are the analogies in structure, function, and disease, of the whole class of Mammalia, "that we must ever feel a deep interest in the accurate investigation of their comparative anatomy and physiology; and it has been found, accordingly, that the progress which has of late years been made in this branch of science, has materially enlarged our knowledge of the structure, the functions, and the physical history of Man; subjects with which our welfare has obviously the closest and most multiform relations."—*Roget, An. & Veg. Physiology*, vol. i. p. 478.

ject forms a vast and inexhaustible field for speculative philosophy.

To *Phrenology*, or the history of the cerebral functions alone, those eminent votaries of science, Gall and Spurzheim, devoted more than thirty years of their existence. Their labours have been followed by highly important results.

But of all the grand and imposing operations of nature, none are more pregnant with results of high importance, or furnish greater interest, than the study of the characteristic signs of those striking events and mighty revolutions to which our earth has been subjected; we observe with pleasure that among the ancients, not only the cultivators of science, but historians, and even great poets, refer with eagerness and astonishment to those important occurrences. The marine productions discovered upon the summits of the highest mountains, or imbedded in the bowels of the earth, furnished them with the clearest evidence, as they then thought, that the "Old Ocean," or as they ingeniously termed it, the "Father of all things," had occasionally deluged the whole globe.

Homer, Virgil, Ovid, and Lucretius, among the poets;—Plato, Plutarch, Diodorus, Strabo, Pausanius, and Atheneus, among the philosophers and historians, are some of those who always speak with the most profound interest and elevated sentiments of these curious phenomena.

As a subject of Comparative Anatomy, we have only to treat of *Man* as the head of the *Animal* kingdom; to distinguish between the different races of mankind;—for example, "is there one species of men only, or are there many distinct species? what particulars of external form and internal structure characterize the several *races?* what relation is observed between the differences of structure, and those of moral feeling, mental powers, &c., &c., &c.? how is man affected by the external influence of climate, food, mode of life? are these, operating on beings originally alike, sufficient to account for all the diversities hitherto observed?"

It has been the subject of serious investigation, whether *all* animals, man himself included, have not sprung from one simple point of organization. The very existence of *species* as a law of nature, has been called into question. Precise and correct notions on this subject are absolutely indispensable in order that the labours of the Oryctologist may be duly appreciated, and the inferences of the Geologist fairly tested; not to mention the direct interests of man himself, involved in this question.

The idea of the *successive* formation of organized beings, by means of *progressive* improvement, has been a favourite notion of some authors.*

"But, the Author of Nature has not given laws to the *universe*, which, like the institutions of men, carry in themselves the elements of their own destruction; he has not permitted in his works any symptoms of infancy or old age, or any sign by which we may estimate with precision either their future or past duration." —(*Playfair's Illustrations of Hut. Theory.*)

In comparing the animals, most minutely described by Aristotle, more than two thousand years ago, with the descriptions of the same, of the present day, not the slightest difference is observable.

We are indebted to the skill and diligence of the French naturalists who accompanied the army of Egypt, for many interesting facts relative to the permanence of species: M. Geoffroy and his associates examined diligently, and sent home great numbers of embalmed bodies of consecrated animals, such as the bull, the dog, the cat, the ape, the ichneumon, the crocodile, and the ibis.

The evidence derived from the Egyptian monuments was not confined to the animal kingdom;—the fruits, living seeds, and other portions, of twenty different plants, were faithfully preserved with the mummies; among these were the common wheat and onion:—no difference could be detected between any of these species as they existed three thousand years ago, and those of similar species inhabiting the same country at present. Indeed, when we contrast the *permanency* of species with the *transitory* nature of individual existence, the reflection cannot but prove mortifying to human pride. In a state more or less perfect, every individual of a species proceeds from the same permanent mould. Among men, some are destined to enlighten the world by the brilliancy of their conceptions, or to astonish by their magnitude of genius; whilst others are consigned to perpetual slavery, or are the victims of sensuality, terminating with each day the uses of their existence. All, without reserve, submit to the law of transmutation;

* Vide Essay on the "Successive formations of organized beings," at p. 232 of this volume.

and men the most celebrated for intellectual pre-eminence, the wise—the heroic—and the great, are hourly hurried into the oblivion of the tomb, with the slave, the vagrant, and the demoniac; and, on the part of nature, with the same apparent indifference.

From this law, even the productions of his ingenuity and power, claim no exemption; and all the boasted monuments of art, which appear to have been formed for posterity, "feel the tooth of time, and experience the rasure of oblivion!"—Persepolis and Palmyra, with their splendid porticoes, majestic temples, and gorgeous palaces, have long ceased to be;—and "the land of Priam lives only in song:"—the serpent and the bramble creep over the sanctuary of kings;—in vain

> "The sculptor's art exhausts the pomp of wo,
> And storied urns record the dust below."

Time is the genius of transmutation, into whose magic circle are continually passing all created things; he waves his ebon sceptre, and mountains of adamant are as "the dust in the balance"—he nods his hoary head, and the self-reputed lord of the creation, like the "clod of the valley," is without perception, sense, or motion,—he spreads his sable pinions, and our fondest recollections are shrouded in oblivion:—the colossian statue, the sculptured bust, and the marble monument, crumble into the dust, in commemoration of which they were constructed. "All that gives motion to the active, and elevation to the eminent;—all that sparkles in the eye of hope, and pants in the bosom of ambition, at once becomes without weight, and without regard."

> "The deep foundations that we lay,
> *Time* ploughs them up, and not a trace remains;
> We build with what we deem *eternal* rock;
> A distant age asks where the structure stood!"

Such being the march of nature, where shall we look for the proofs of the common origin, or successive and uninterrupted formation of organic beings?

In our survey of the *animal*, man, such are the inquiries which claim attention: they can never be answered except by those who are thoroughly acquainted with the anatomy and physiology of our frame; with Comparative Anatomy, and its concomitant principles of *general* physiology; and the analogies derivable from the whole extent of living nature.

Much might be said of the connexion of Comparative Anatomy with the arts of sculpture and drawing, did our limits admit of this latitude. The proportionable developments, the expression and attitudes, as well as the ravages of age, in the animal frame, can be correctly represented only by the anatomical artist.

From Geology proper, will be learned, that there have been endless vicissitudes in the shape and structure of organic beings in former ages;—that the approach to the present system of things has been gradual;—that there has been a progressive development of organization, subservient to the purposes of life, from the most simple to the most complex state;—that a series of physical revolutions can be traced in the *inorganic* world, coeval and co-extensive with those of *organic* nature;—and finally, that the appearance of *Man* is the last phenomenon in a long succession of events!

The crust of the earth thus marvellously constituted, bears within itself inherent evidence of its vast antiquity. Millions and millions of years have been consumed in establishing the present order of creation; countless myriads of animated beings had appeared and disappeared from the diversified scene, ere yet the wonder, *Man*, was accomplished; and here the question naturally presents itself—is the *present* order the *ne plus ultra* of perfection? Has the mandate gone forth, "*thus far* shalt thou go?" Is man indeed the *last* link in the great chain of creation, connecting earth to heaven?

It is most probable, that if the motion of this planet, together with the seasons and order of time, should be subjected to a change, it would follow as a natural sequence, that the course of existence, the structure even, and the mode of combination of the organic elements, would undergo a corresponding change. But however this may be, the experience of the fluctuating past teaches us that Truth alone is permanent; and nothing is unchangeable save the Eternal!

Not less interesting or important, in geological associations, are the curious phenomena developed in our study of the *Antediluvian Flora.* The forms, structures, and *habitat*, of the various genera and species of extinct plants, together with the peculiar distribution of the earth's temperature, at these early periods, are well calculated to attract due regard by the student of *Fossil Botany.* The scale of vegetation, from the oak of temperate climates, to the palms and tree ferns of the tropics, including the mosses which exist at the heights of perpetual snow, in both hemispheres, constitute *gradations*, the forms of which are proper to each climate, but very different, however, among themselves. From this consideration is naturally derived the idea, that at different periods, when other mixtures and other combinations of soil must have taken place, such change ought necessarily to have resulted in the production of different vegetables. Fossil vegetables, like fossil animals, display a progressive formation from the most simple to the more complex structures; thus, the acotyledonous class appearing first, or in the lowermost strata, followed by the monocotyledonous, and dycotyledonous, in a pretty regular series:—the confervæ, algæ, fuci, mosses, ferns, grasses, canes, reeds, palms, pines, &c., of which they consist, being for the most part extinct species of tropical plants, are found *fossil* in the northern climates of both hemispheres, generally associated with fossil coal, or the subjacent strata.

It has been further observed, that the upper and more recent strata display fossil plants, more closely allied to those of the same country of the present day.

It was during the resuscitation of letters, about the sixteenth century, that ligneous fossils, dispersed throughout the various formations, began *first* to fix the attention of observers; but they were then generally considered rather as objects of simple discussion, than of accurate research.

Philosophers were divided in opinion as to the origin of *these* fossils, as they were on those of *animal* remains; though to the vegetable kingdom perhaps belongs the honour of dissipating those vague and ridiculous notions, which attributed all such relics of the ancient worlds, to the "sport of nature," or to plastic force.

Agricola, Gesner, Imperati, and others, already maintained that they were the remains of trees destroyed by the deluge; but nearly a century elapsed before any work was specially devoted to this subject. It was only in the commencement of the eighteenth century, that the labours of *La Hire*, *Lister*, *Luid*, and *Scheuchzer*, directed the attention of naturalists, to a subject so intimately connected with the history of the formation of the globe.

The present century opened a new career, in the various special publications which have appeared in order to throw light on a subject sufficiently abstruse. To analyze, or even to indicate all these is not permitted at present; Parkinson, Steinhauer, Faujas, Rhodes, Young and Bird, Noggerath, Agardh, Nilson, Mantelle, Artis, Lyelle, Granger, Nau, Martius, are among those who have most conduced to elucidate this branch of science. To Sternberg, Brongniart, and Lindley and Hutton, we are indebted for a systematic classification of them; together with the discovery of numerous species.

"In regard to those laws of *co-existence*, in conformity with which the *animal* frame is constructed, they are found to exist only to a limited extent in the anatomy of the vegetable kingdom.

"The organs of plants are divided into two great classes;—those of vegetation, and those of fructification.

"*Nutrient vessels* forming the basis for determining the relations of position, and often even the form of organs, are evidently more important than the parenchyma, or cellular matter, which surrounds and unites them: the mode of distribution of these vessels may develope the true affinities of vegetables; consequently, *their* disposition is the principal thing to be observed in every organ. When we are able to detect the interior structure of the stalk, this disposition demands close inspection: but when we cannot examine this, the mode of growth of the stalk being constantly associated with this interior structure, and the external form of the stalk depending on its mode of growth, the *form* of the stalk is sufficient to determine, with considerable accuracy, its *internal* structure.

"The next most important character of the stalk, is the mode in which the *leaf* is inserted at its base; a character depending necessarily on the *structure* of the *stalk*, and not of the leaf, as it is the former which produces and developes the latter: the same may be observed of the *vessels* which run from the stalk to the petiole."—(Sternberg.)

Such are the modifications of structure which require our particular attention in the present investigation, as they enable us to determine the analogies which unite the fossil with recent vegetables.

In the *leaf* the disposition of the *nervures* will enable us to determine the families to which they belong. In these researches, the characters of the *flowers*, are comparatively unimportant; this part being seldom or never met with in a fossil state.

The fruit presents us with a variety of structure; and the adherence, or non-adherence of the calix; the number of compartments, and their mode of opening; the number and mode of insertion of the seeds; furnish good distinctive characters when such fossil parts are so preserved as to admit of the examination of their internal structure.

An extensive view is opened to reflection, in the study of the geographical distribution of the living plants of a family, compared with the geographical distribution of the fossil plants of the same family, which furnish interesting results, attended with important consequences; and appear to indicate, either a change in the earth's ecliptic, or that the temperature and light of antediluvian climates depended on other sources than the sun.*—For the last named agent we know of no substitute.

Topography and *Physical Geography*, are intimately connected; the former bearing the same relation to the latter, as Mineralogy does to Geology. What an endless field for observation they open to our view! How interesting to follow the distinguished investigators in their various researches! where continents and islands,—mountains and plains,—hills and vales,—crystal lakes and majestic streams, rolling their never-failing tributes to the boundless ocean, are successively offered to our regard.—With the volcano—the earthquake, and the deluge for agents, scarcely a limit can be assigned to the slow but certain changes to which the surface of the earth is subjected. Properly to estimate such changes, induced by the destroying and transporting power of *water* only, would require a volume.

Among these effects, may be enumerated, the detrition of river-banks, destroying, in some instances, whole forests; the immense rocks, and other heavy matter, removed by torrents and floods; the effects of *ice* in removing rocks, and grinding to atoms heavy masses; erosion of chasms through rocks; the excavation by rivers of their basaltic beds, in certain volcanic countries; desertion of old channels, and formation of islands and lakes; the phenomena of land-slips, and bursting of lakes, with their devastating effects; the formation of immense deltas at the mouths of rivers, &c., caused by the disintegration of land; (such deltas may contain the remains of both sea and land animals and vegetables,)—the subsidence of the bottom of the sea, in some places, and its elevation in others; fossil marine shells have thus been

* Very interesting memoirs on "The Climates of the Globe," have been published by Mr. Crichton, in the Annals of Philosophy for 1825.

elevated to immense heights above the level of the ocean; Col. Gerard observed petrifactions of this nature 16,000 feet above the level of the ocean, on the Himalay mountains, and Baron Humboldt, 15,000 feet on the Andes. So recently as the year 1822, an area of 100,000 square miles was considerably elevated by a single shock of an earthquake; this change of level extended one hundred miles along the coast of Chili. In 1775, a single volcanic eruption gave rise to a mountain 1700 feet high, on the Mexican plateau. In 1750, the shock of an earthquake, at Pinco, on the coast of Chili, elevated the coast about twenty-five feet. In 1692, the harbour of Port Royal, in Jamaica, was sunk at once, by a similar cause, fifty feet.—(*Lyle.* v. 2. pp. 161, 67.)—No inconsiderable compensation for the slow detrition of the land !*

On the discovery, in 1750, of the remains of the temple of *Jupiter Serapis*, situate on the bay of Baiæ near Puzzuoli, it was observed that this celebrated monument of antiquity, alone afforded unequivocal evidence that the relative level of land and sea, had changed twice, at this point, since the Christian era; each movement of elevation and subsidence exceeding twenty feet. Of the forty-six noble columns which originally supported the roof, three only maintain an erect position—these are forty-two feet in height; it has been unequivocally demonstrated, that these columns must have continued for a long time immersed in salt water; and that after remaining for many years submerged, they must have been upraised to the height of twenty-three feet above the level of the sea.

The strata in the vicinity vary from a foot to a foot and a half in thickness, and one of them contains abundantly, remains of works of art—tiles, squares of mosaic pavement of different colours, and small sculptured ornaments, perfectly uninjured, intermixed with remains of domestic animals: strata containing marine shells are found both above and below these fragments of art, which are now more than twenty feet above the ocean's level.

Proofs of a similar change of level have been more recently obtained from Captain Elliot, of the U. S. Navy, who, in 1827, brought home with him specimens of human bones, imbedded in

* It is right here to remark, that the accounts relative to the elevation of a district of Chili, 100,000 miles in area, during the earthquake of 1822, have recently been doubted by the President of the Lon. Geol. Soc.—G. B. Grenough, Esqr.—*Vid. Jameson's New Ed. Philos. Jour.* 1834, *p.* 205.

solid calcareous tufa, which he cut out of a rock with an axe, on the coast of Brazil, about two degrees west of Rio de Janeiro. The stratum, which contained hundreds, or "whole acres," as Captain Elliot expressed it, of human bones and skulls, on some of which recent marine shells are found adhering, is now elevated fifteen or twenty feet above the level of the ocean, at the foot of a plain about three miles distant from the mountains.

There can be little doubt but that these bones are derived from an ancient Indian cemetery, which has been subjected to alternate subsidence and elevation, during some of those volcanic convulsions to which this whole coast is known to have been repeatedly subjected. These interesting remains have been described by Dr. Meigs, in a recent volume of the Transactions of the American Philosophical Society.

To the changing causes already enumerated, we may add, those immense masses of lava, ejected from incalculable depths, from a chain of volcanoes, which have acted for ages. In 1783, *Skaptar Jokul*, a volcano in Iceland, vomited forth a burning liquid mass, which extended from forty to fifty miles in length, from seven to fifteen miles in breadth, and from one to six hundred feet in depth; filling in its course, rivers, lakes, and valleys, destroying ten thousand persons, besides innumerable herds of cattle.—It is thus proved to demonstration, that the surface of our globe is constantly subjected to extensive changes.

It has been aptly remarked by an admirable historian of these phenomena, that the poets of old selected the *rock* as the emblem of firmness,—the *sea* as the image of inconstancy; not so the prince of modern poets, who, in a more philosophical spirit, saw in the latter the "image of eternity," and has finely contrasted the fleeting existence of the successive empires, which have flourished and fallen on the borders of the ocean, with its own unchanged stability.—

"————Their decay,
Has dried up realms to deserts; not so thou—
Unchangeable save in thy wild waves' play:
Time writes no wrinkle on thine azure brow;
Such as creation's dawn beheld, thou rollest now."

Ch. Har. Can. iv.

The powers of springs, impregnated with mineral, calcareous, and saline ingredients, though not very extensive, exert, nevertheless, a very important influence in modifying the physical features of a country. To these must be added, the destroying, transporting, and reproductive effects of tides and currents.

To *chemical analysis*, we are indebted for our knowledge of the intimate structure of rocks and minerals; as well as the various composition of soils, so necessary to practical agriculture. Not less instructive and important to the geologist, is a knowledge of the power of chemical agents, in the great laboratory of nature, in modifying the surface of the earth. The form of vegetables is determined by the chemical combinations of the constituent parts of the soil, by the surrounding atmosphere, and by the relations which these bear to light and heat.

At first sight there might appear but the most distant connexion between *Geology* and *Meteorology;* but a more philosophical view of the subject will convince us of the truth of Blackstone's remark, "that the sciences are of a sociable disposition, and flourish best in the neighbourhood of each other." "Any accession to our knowledge of nature is sure, sooner or later, to make itself felt in some practical application; and a benefit conferred on science by the casual observation, or shrewd remark, of even an unscientific or illiterate person, infallibly repays itself with interest, though often in a way that could not have been at first contemplated.

"It is to such an observation, reflected upon, however, and matured into a scientific form, by a mind deeply imbued with the best principles of sound philosophy, that we owe the practice of vaccination; a practice that has effectually subdued, in every country where it has been sufficiently introduced, one of the most frightful scourges of the human race, and in some extirpated it altogether."—*Sir J. W. Herschel's Study of Natural Philosophy.*

Not to mention the mechanical power of the wind,—the active chemical agents which compose the atmosphere, together with the hygrometrical moisture always combined with it, exert a very sensible influence in the decomposition of the hardest rocks, and modify in no slight degree the Geological outline. Not a less important agency is attributable to rains, dews, and vapours.

Atmospheric Stones of considerable magnitude have occasionally fallen from the heavens; the theory of the formation and origin of these, belongs as much to the meteorologist, as the examination of their structure and composition, does to the mineralogist and chemist. It has already been demonstrated that such meteoric phenomena are not limited to any particular epoch, time or place, that these stones, wherever they fall, resemble each other, and that they are unlike any of those which the earth produces naturally. Men of science are undecided as to their origin,—*Chladny* considered them species of little planets floating through space! *De la Place* and *Poisson* have demonstrated mathematically the possibility of their being ejected by volcanoes of the Moon! (vide Lithologie Atmospheric de M. Isarn.) *Vauquelin* remarks, that though part of the elements of such stones might be suspended in the atmosphere, it is scarcely conceivable how masses of such magnitude could be formed in the air before falling.

Concerning the origin of springs and rivers, *Hydrology* leaves us nothing to desire on this hand; it having been long shown that rains and aqueous vapours are the sole causes. The snow that caps the Alps and the Andes is derived from the surface of the ocean.

From *Mineralogy*, as connected with mining, much useful information may be expected. The mineral and metallic riches of our vast country, remain as yet, in a great measure, unexplored; no subject of paramount importance has been so injuriously neglected.

Metallurgy, or the many curious methods devised by art, in order to separate the various metals from the ores or matrices which contain them, constitutes a very important branch of general science, and serves to unite mineralogy, geology, and chemistry.

Wonderful in structure and magnificent in design, as is the small portion of this planet, hitherto subjected to the eye of observation, yet, considered as a part of the whole system of creation, the globe itself is but as the grain of sand, driven by the winds of the trackless desert! A general view of the extent and form of the superficies of our own planet; the unalterable laws which regulate its complex motions; its true position in the planetary system; how far the structure of other planets may be conjectured by analogical deductions; together with many other points of philosophical inquiry; may enter with propriety into the astronomical view to be taken of geology.

A variety of magnificent speculations have been offered respecting the original formation and primitive state of the earth, and other planets, which, in a course of philosophical inquiry, must not be permitted to pass unnoticed.

Des Cartes seems to have supposed stars to have preceded planets in the order of creation: and that this earth was at first a star, and continued so till rendered opaque by having its bright surface incrusted with grosser and untransparent matter, and drawn into the vortex of the solar system. This conjecture was adopted by *Leibnitz*. *Whiston* considered it to have been originally a comet, the rude materials of which constituted the *chaos* of the earth; to which, Buffon added a portion of the sun's exterior limb or edge, carried off by such comet, in consequence of its having given the sun an oblique stroke in the course of its orbit; the chaos of the earth being thus formed by the vapoury substance of the impinging comet uniting with a portion of the sun's igneous mass; and in this manner he endeavoured to account for the production of every other planet of the solar system. *Dr. Herschel* supposed the existence of an immense mass of opaque but igneous matter, seated in the centre of universal nature; that the sun, and every other star, were originally portions of the common substance; that it is volcanic in its structure, and subject to eruptions of inconceivable violence; that the sun and other luminaries were thrown forth from it at different times; that these possessing, in a great degree, the qualities of the parent body, threw forth afterwards at different times, by means of similar volcanoes, portions of their own substance, each of which, by the common laws of projectiles, assumed an orbicular motion, constituted a distinct planet, and became the chaos of a rising world. Hence, according to this hypothesis, the existing universe has acquired its birth; new systems of worlds are perpetually rising into being, and new planets added to systems already created! But, alas! for these comprehensive efforts of the imagination, within the last half century! her airy castles have vanished before the great truths of geology; and like " the baseless fabric of a vision, leave not a wreck behind." Besides, modern astronomers appear to agree, that there is abundant proof that the planets disturb the comets, but that the converse is not known; thus the comet of 1454 eclipsed the moon, while that of 1770, not only came near the earth, but passed through the midst of the satellites of Jupiter, without producing any sensible effects.—(vide Ed. Philos. Journal, Ap. 1826.) A most extraordinary fact, however, has been sufficiently demonstrated by Herschel, that, within the period of the last century, not less than thirteen stars, in different constellations, none of them below the sixth magnitude, seem totally to have perished; forty to have changed their magnitude, by becoming either much larger or much smaller; and ten new stars to have supplied the place of those that are lost.—(Philos. Trans. vol. 73.) Some of these changes may perhaps be accounted for, by supposing a change in the proper motions of sidereal or solar systems; but this explanation will by no means apply to all of them; and in many instances it is unquestionable, that the stars themselves, the supposed habitations of other kinds of intelligent beings, together with the different planets, by which, it is probable, they were surrounded, have utterly vanished, and the spots which they occupied have become blanks!

MEDICAL AND PHYSICAL RESEARCHES.

Description of a new Species of Orang, from the north-eastern province of British East India, lately the kingdom of Assam.

SIMIA, Linn.—HILOBATES, Illig.

S. Hoolock. Colour of the skin and hair, deep black; canine teeth very long; a band of whitish grey hairs over each eye.

Dimensions. Total length about two feet six inches. Humerus eight inches nine-tenths; radius nine inches; hand, from the beginning of the wrist to the end of the fingers, six inches; inferior extremities about thirteen inches; the foot six inches.

Habitat. Garrow-Hills, Assam, and probably extending into China between latitudes twenty-five and twenty-seven degrees north. *Cab. of A. N. S. Philadelphia.*

THE present specimen is an adult male; and forms one of three individuals which lived some time in possession of Dr. M. Burrough, who has lately returned from India, with a magnificent collection of rare and valuable skins of birds and quadrupeds, selected principally from the plains of the Burrampooter river. Dr. Burrough informs me, that there is not much exterior difference between the adult male and female. The young, we shall have occasion to notice, possesses several characteristic marks. They were all taken on the Garrow-Hills, in the vicinity of Goalpara, in the latitude of twenty-six degrees north; they very soon became tamed, especially the young one; they were docile, affectionate, and rather inclined to melancholy.

According to the accounts of the natives, these animals are not found south of the regions specified. There cannot be the least doubt but that this species is the same mentioned cursorily in Latreille's Buffon, Vol. XXXV. p. 140. The observations relative to the habits of this species contained in this account, corresponding in so many respects with the specimens introduced by Dr. Burrough, induces us to make the following translation. "Mr. Gordon has sent me the drawing of an Orang, which the King of Assam had made a present to Mr. Harwood, president of the provincial council of Dinagipal. The brother of Mr. Harwood brought it to the Cape of Good Hope and presented it to Mr. Gordon, with whom it unfortunately lived only one day. It had been attacked with scurvy on ship-board, and on arriving at the Cape was so feeble as to die at the end of twenty-four hours; thus Mr. Gordon had only time to make a drawing of it; and not being able to make any observations on its habits, has communicated the information he obtained from Mr. Harwood, as follows. This orang-outang, named Voulock [Hoolock] in its native country, was a female, and regularly menstruated, but the discharge was interrupted after the attack of scurvy. She was of a very gentle disposition, only monkeys displeased her, whose presence she could not endure. She always walked in the upright attitude, and could even run very fast: when walking on a table, or among china-ware, she was very careful not to break any thing; when climbing she used only her hands; her knees resembled those of man. Her cry was sharp and deafening, pronouncing often and frequently repeating the syllables yaa-hoo! yaa-hoo! yaa-hoo!—with the emphasis on the last syllable, particularly on the terminal sound: when she heard any noise resembling this, she commenced crying also. When contented, she emitted a low guttural sound. When sick she whined like a child, and was fond of being nursed. Her food consisted principally of vegetables and milk; she would never touch a dead animal, or eat meat, and refused even to eat from a plate which had contained meat" [in this respect she differed from those individuals in the possession of Dr. Burrough, these latter would eat meat occasionally.] "When thirsty, she plunged her fingers into the water and licked them: she voluntarily covered herself with pieces of sailcloth, but would not endure clothes. She would come when called by name. She was commonly melancholy and pensive. When answering to the calls of nature on board of ship, she would hold on to a rope and evacuate into the sea.

"The length of her body was two feet five inches and a half—the circumference of the chest was one foot two inches—that of the thinnest part of the body was ten inches and a half: when in health she was fatter, and had calves to the legs.

"The drawing had been taken during illness, or after death, when the subject was greatly emaciated: there were nails on all the fingers."

Notwithstanding the high northern latitude of the country in which this species is native, it would appear that they are less able than even other *Gibbons* to endure the hardships of captivity and change of climate. All those belonging to Dr. B. died, either on their passage down the river from Goalpara, or on board vessel before they arrived at the Cape of Good Hope.

The Gibbons, or long armed apes, in many particulars, all bear a very close resemblance to each other. Thus the *S. lar*, *leucisca*, *agilis*, *syndactylus*, and *concolor*, which includes all the species hitherto described, differ from each other only in some particulars of size, colour, proportions and markings. The present specimen is as strongly characterized, as distinct, as any of the others. In some of its habits, particularly in its mode of drinking, it resembles the Siamang of Sir Stamford Raffles, or S.

syndactylus; but differs widely in other respects. In form, size, and proportion, it is most closely allied to the females of the S. agilis of F. Cuv., but it is very different in colours and markings, especially the young individuals of the two species, which differ totally in these respects; the male and female resemble each other in the present species, but the sexes are different in size and colour in the S. agilis; the two species differ also in their habits; both differ also from the S. lar, Linn.

The skin of the present species is of a deep black colour, which, on the hands at least, is not confined to the rete mucosum, as the *cutis vera* of the palms remains black after maceration, so as to destroy the epidermis.

The hair, which is *universally* black, with the exception of the grey band across the forehead of the adult, covers the back of the hand to the ends of the fingers, and on the palm descends as low as half the length of the metacarpal bones. In both old and young the hair on the fore-arm is reversed.

In the young individual, which is about half the size of the adult, besides the difference of colour, a remarkable peculiarity was noticed in the relative proportions of the arm and fore-arm, as will be observed in the following measurements. Total length, two feet six or eight inches; humerus, eight inches nine-tenths; ulna, ten inches three-tenths; femur, eight inches; tibia seven inches; length of the head from the vertex to the chin, four inches five-tenths—breadth, two inches five-tenths.

In the young animal the fore-arm is *shorter* than the arm, a fact at variance with the proportions of those parts, not only in the Orangs, but in all the race of adult Simiæ.* In the adult of this species the arm and fore-arm are within one inch two-tenths of being equal in length.

In the *S. concolor*, (Harl. Journ. A. N. S. Vol. V. p. 229, pl. ix.) the fore-arm is two inches and a half longer

* The measurements here alluded to refer to the bones of the arm and fore-arm.

than the arm.* If M. F. Cuvier's account of the dimensions of the *S. agilis* be correct, there is six inches difference between the length of the arm and fore-arm; but if the author has improperly included the hand and fingers in the term "fore-arm," the proportions of these parts are nearly similar in the S. agilis, and S. Hoolock.

The colour of the young of the present species is blackish-brown—back of the hands and feet sprinkled with grey—buttocks greyish: a tuft of greyish hairs grows from the point of the chin, and a line of the same colour extends along the middle of the front of the body: the band of grey over the eyes of the adult is generally interrupted in the middle of the forehead by a line of black hairs—which is absent in the young one; the band is broader in the latter, in the proportion of seven-tenths to four-tenths.

Buffon, speaking of the habitat of the Gibbon (Vol. XXXV. p. 200,) remarks, "it appears to inhabit the more northern countries, and that the ape of the province of Gannaure, on the frontiers of China, ought to be referred to the Gibbon; which some travellers have indicated under the name of Féfé."

The following extract is quoted by Buffon; "in the kingdom of Gannaure, frontier of China, there exists an animal very rare, which they call *Féfé;* it has almost the human form; the arms very long; the body black and hairy; walks lightly and very fast." (Recueil des Voyages, &c. Rouen, 1716, Tome III. p. 168.)

It is this Féfé, which the traveller Nieuhoff describes as carnivorous and anthropophagous; a character attributable to the extreme length of the canine teeth. It is highly probable that Féfé is the Chinese name for the Assamese "Hoolock." The dentition of this species

* In the Bull. des. Sc. Univers. 1830, M. Lesson remarks that the S. concolor is probably a variety of the *S. lar*, notwithstanding the former animal has *two dorsal vertebræ* and *two ribs* more than the former, not to mention other distinctive characters.

bears close analogy to that of the S. agilis or Wou-wou, so accurately detailed by F. Cuv. (Dent des Mammiféres, &c.): the only difference is the greater length of the canines of the *Hoolock*, and the obsolete appearance of the longitudinal grooves, especially that on the posterior face of this tooth.

In all particulars not mentioned this species resembles the other Gibbons. A drawing of the adult male and young female, also the cranium of the adult male, accompanies the description.

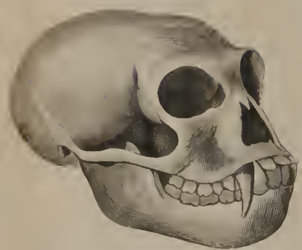
For the details concerning the habits of the specimens which form the subjects of the present description, we refer to the observations contained in the annexed letter from Dr. Burrough.

To Richard Harlan, M. D.

"The specimens of Ourang Outang, or Gibbons, furnished you, were obtained by me during my late excursion into the interior of Bengal. They were presented to me by Captain Alexander Davidson of the honourable East India Company, stationed at Goalpara, situate on the Burrampooter river in *Assam*. This district of country was formerly attached to the Burmese empire; but at present is in possession of the East India Company, and constitutes the north-eastern limits of their territory in this quarter.

"The Ourang, of which I am now to speak, called by the Assamese '*Hoolock*,' is to be met with on the Garrow-Hills in the vicinity of Goalpara, between latitudes twenty-five and twenty-eight degrees north, and the specimens brought to this country by me were taken within a few miles of the town of Goalpara. The full-grown one, which at this time you have prepared, was in my possession, alive, from the month of January to May, when it died from a blow it received across the lumbar region, inadvertently inflicted with a small stick by one of my ser-

One Fifth size of Nature



One Half size of Nature

One Fourth size of Nature

SIMIA HOOLOCK.

vants at Calcutta. They inhabit more particularly the *lower* hills, not being able to endure the cold of those ranges of the Garrows of more than four or five hundred feet elevation. Their food in the wild state consists, for the most part, of fruits common only to the jungle in this district of country, and they are particularly fond of the seeds and fruits of that sacred tree of India, called the Peepul-tree, and which on the Garrow-Hills attains a very large size. They likewise take of some species of grass, and also the tender twigs and leaves of the Peepul and other trees, which they chew, swallow the juice thereof, and reject the indigestible part. They are easily tamed, and when first taken show no disposition to bite unless provoked to anger, and even then manifest a reluctance to defend themselves, preferring to retreat into some corner rather than attack their enemy; they walk erect, and, when placed upon a floor or in an open field, balance themselves very prettily, by raising their hands over their head and slightly bending the arm at the wrist and elbow, and then run tolerably fast, rocking from side to side; and if urged to greater speed, they let fall their hands to the ground, and assist themselves forward, rather jumping than running; still keeping the body however nearly erect—if they succeed in making their way to a grove of trees, they then swing with such astonishing rapidity from branch to branch, and from tree to tree, that they are soon lost in the jungle or forest.

"The individual in question became so tame and manageable in less than a month, that he would take hold of my hand and walk with me, helping himself along at the same time with the other hand applied to the ground as described above. He would come at my call and seat himself in a chair by my side at the breakfast table, and help himself to an egg, or the wing of a chicken from my plate, without endangering any of my table furniture—he would partake of coffee, chocolate, milk, tea, &c., and although his usual mode of taking liquids was by dipping his knuckles into the cup and licking his fingers, still, when apparently more thirsty, he would take up the vessel from which I fed him with both hands, and drink like a man from a spring; his principal food consisted of boiled rice, boiled bread and milk with sugar, plantains, bananas, oranges, &c., all of which he ate, but seemed best pleased with bananas; he was fond of insects, would search in the crevices of my house for spiders, and if a fly chanced to come in his reach he would dexterously catch him in one hand, generally using his right hand. Like many of the different religious castes of this country, he seemed to entertain an antipathy to an indiscriminate use of animal food, and would not eat of either the flesh of the cow or hog, would sometimes taste a little piece of beef, but never eat of it; I have seen him take fried fish, which he seemed to relish better than almost any other description of animal food with the exception of chicken, and even this he would eat but very sparingly of, preferring his common diet, bread and milk, and milk with sugar, fruit, &c. In temper he was remarkably pacific, and seemed, as I thought, often glad to have an opportunity of testifying his affection and attachment for me. When I visited him in the morning, he would commence a loud and shrill Whoo-whoo-whoo-whoo, which he would keep up often from five to ten minutes, with an occasional intermission for the purpose of taking a full respiration; until finally, apparently quite exhausted, he would lie down and allow me to comb his head, and brush the long hair on his arms, and seemed delighted with the tickling sensation produced by the brush on his belly and legs; he would turn from side to side, first hold out one arm and then the other, and when I attempted to go away he would catch hold of my arm or coat tail, and pull me back again to renew my little attentions to him, daily bestowed; if I called to him from a distance and he could recognise my voice, he would at once set up his usual cry, which he sometimes gradually brought down to a kind of moan, but generally resumed his louder tone when I approached him. This animal was a male, but showed no particular marks of the sex, and by a casual glance might readily, if not examined more closely, have passed for a female. I have no idea of his age, but judging from the size and length of his canine teeth, suppose him to have been advanced in life.

"The other large '*Hoolock*,' of which you have the cranium, was also a male and full grown; he was likewise obtained from the Garrow-Hills in Assam, presented to me by my friend Captain A. Davidson of Goalpara. He came into my possession in the month of April, and died at sea in July, just before getting up with the Cape of Good Hope, of a catarrhal affection: his death probably might have been hastened from the want of proper food, such as is not procurable on long voyages. This animal was similar in habit and general characters to the one already described, and may have been eight or ten years of age or perhaps older, as I am informed by the natives of Assam they live to the age of twenty-five or thirty years.

"The young specimen was also alive in my possession —this is a female, and was brought to me by a Garrow Indian at the same time the first was received, but died on the way from Goalpara to Calcutta of a pulmonary disease following catarrh. This poor little creature when first taken sick suffered great pain and oppression at the chest, for which I prescribed a cathartic of castor oil and calomel, and a warm bath, which seemed to afford it some temporary relief, but she died after ten days illness. The animal appeared delighted with the bath, and when I removed her from the vessel she would run back again to the water, and lie down again until again removed; she was, like the others I had in my possession, gentle and pacific in disposition, very timid and shy of strangers, but in less than a week from the time she was taken, would, if put down in an open place, quickly run to me, jump in my arms and hug me round the neck. I supposed her to have been from nine months to a year old. I fed her on boiled milk, goat's milk diluted with water and sweetened with sugar candy; she also would sometimes partake of a little bread and milk with the older one; she soon learned to suck the milk from a small bottle, through a quill covered with a piece of rag.

"M. BURROUGH."

"*Nov.* 19*th*, 1830."

Description of an Hermaphrodite Orang Outang, lately living in Philadelphia.

Simia.

S.—With black, thick, woolly, and frizzled hair, covering all parts of the body, with the exception of the palms, the face, and the ears. Skin black. Nails on all the fingers. Orbits of the eyes prominent. Arms very long. No cheek pouches: no tail: no guttural sac: a rudiment only of callous buttocks. Nose more prominent, and facial angle more elevated, than in the Simia *satyrus* of Linnæus.*

Dimensions.—Total length, from the vertex to the heel, 2 feet 2 inches: superior extremities, 1 foot 6 inches: arms, 6 inches 6 tenths: fore-arm, 9 inches 1 tenth: hand and fingers, 5 inches 5 tenths: lower extremities, 11 inches: thighs, 5 inches 4 tenths: legs, 6 inches 2 tenths: foot, 4 inches 6 tenths: body, 10 inches 5 tenths: head and neck, 11 inches 3 tenths: length of the bare face, 3 inches: circumference of the thorax, 11 inches 3 tenths: circumference of the head, 10 inches.

Observations.—This interesting animal was imported into New York, from the island of Borneo, in the month of May, 1826; and at its death, was said to be rather less than two years of age. Each jaw contained twelve teeth; three molars, one canine, and two incisors, on each side.

When standing erect, the fingers of the fore-hand nearly touched the ground; advancing on a plane surface, he voluntarily assumed the erect attitude; balancing himself with his long arms, on the slack rope, and climbing with the greatest agility; when he retired to sleep, assuming a recumbent posture; displaying great fondness for fruits of all descriptions, but particularly for grapes; possessing all the docility and intelligence characteristic

* Corpore pilis nigris obtecto; facie, palmis, et auriculis nudis; cute nigro; palmis pentunguibus; brachiis longissimis; cauda, et sacculis buccarum et gutturis omnino carentibus; natibus leviter callosis; naso prominentiore, et angulo faciali plus elevato quam in Simia Satyro Linnæi.

of the orangs. He died of a diarrhœa, from excessive indulgence in fruits.

Distinctive characters of the species.

The Orang genus has already been increased from one to six species. The present specimen differs from all the others hitherto described; it evidently pertains to the *Gibbon* family, or the Long-armed Orangs, the type of which is the *Simia lar* (Linn.) to which are added, 1st, the Little Gibbon, or *Orang varie* of Cuvier. 2nd, the Siamang, or S. *syndactylus* of Raffles; and 3d, the Active Gibbon, or *Wou-wou* of Duvaucel and F. Cuvier. From all these our specimen differs, in being of a universal black colour, in the facial line being less inclined, in the absence of the circle of grey hairs around the face, in the rudimentary state of the ischiatic callosities, and, with the exception of the Active Gibbon, in the absence of the guttural sacs.

Should I be right in supposing the above details offer *specific* differences, the animal may be properly named Simia *concolor*.*

Habitat.—Island of Borneo; climbing trees, feeding on fruit and insects. The present specimen, caught and devoured all the flies within his reach.

Dissection.—General adhesions of the peritoneum, omentum and intestines; glands of the mesentery very much enlarged; white eruptions, or rather ulcerated tubercles on the peritoneum, such as are observed occasionally in scrophulous subjects, and inflammation of the mucous coat of the stomach and intestinum rectum.

Orangs have been occasionally dissected, and minute and laboured descriptions of their anatomy are published. The present individual displayed remarkable peculiarities: the ligamentum rotundum very strong; liver resembling the human, having the same number of lobes, &c. Ap-

* Vide Note at p. 13.

pendicula vermiformis very large; contents of the thorax displaying close analogy to the human; ventricles of Morgagni rather large, though not communicating with a sac in the throat, as in the Simia satyrus and some monkeys; sternum composed of only two pieces, like that bone in man, in which it differs from the Simiæ with tails. Twenty-five rings to the trachea, fourteen ribs on each side, fourteen dorsal vertebræ, seven cervical, five lumbar, five sacral, and five coccygeal: but the most remarkable peculiarity remains to be noticed; the subject proved to be a complete *Hermaphrodite.*

Hermaphrodism, that is to say, individuals uniting in themselves the means of reproduction, without the concurrence of other individuals of their own species, appears to be, in some sort, a vegetable attribute; as among plants, the class Dioëcia (Linn.) is the only one not hermaphrodite. The nearer the animal approaches the vegetable kingdom, the more frequent and complete are the instances of hermaphrodism. This is of two distinct kinds: in the one, it is absolute, the animal possessing within itself the powers of reproduction, as is instanced in the Bivalve shells, as the Oyster, in some of the Multivalves, as the Chiton, and in Zoophytes, Holothuria, &c.; whilst in Univalve shells, on the contrary, such as the Helix, Limnea, Planorbis, &c. although they unite the two sexes, yet the union of two individuals is necessary to fecundation. The common garden snail, is a familiar example: animals of this description are properly termed "Androgynous." The disposition, then, to hermaphrodism, is more rare as we advance in the scale of perfection, or rather to a more complex organization. Those cases said to have occurred in the higher orders of animals, may, with few exceptions, be attributed to mal-conformation of the genital organs, and to a mixture of the two sexes; which, according to the observations of Sir E. Home,*

* Philosoph. Trans. 1799.

and Mr. John Hunter,* are of more frequent occurrence in the bull, than in any other of the mammifera: but in no instance have these authors found the assemblage of the organs of both sexes complete; some or other of the organs being absent, or existing in a rudimentary state.

The case which most nearly approaches in perfection the subject of the present description, is that detailed by Mascagni in the "Bulletin de la faculté de Medecine for 1811, p. 176," where he describes a bull with all the male organs, and with ovaries, uterus, and vagina; but in place of a vulva, the vagina had its orifice in the urethra. There is also another case, somewhat similar, described in the "Med. Repository, No. XLV," of a human individual in Lisbon, uniting both sexes in apparently great perfection. The subject was 21 years of age, was twice pregnant, and aborted at the third and fifth months. It is true, that though the penis and testicles existed, the latter, with their excretory ducts, were not examined anatomically. For a more detailed account of this individual, vide Dictionnaire des Sciences Medicales, art. "*Cas rares.*"

The above observations will at least demonstrate the possibility of the occurrence of complete hermaphrodites, even in the highest class of animals. The specimen which forms the subject of the present description, will furnish us, perhaps, with the nearest approach to a complete union of the sexes in the same individual, which has been detailed; and is the only instance, as far as we have observed, of a circumstance of this kind occurring in the monkey race.

In the present instance, the penis was about one inch in length, subject to erections: terminating as usual in a glans, but imperforate; a deep groove on the inferior surface, serving as a rudimentary urethra: this groove extended about two-thirds of the length of the penis, the

* Obs. on certain parts of the animal economy, Lond. 1792.

remaining portion being covered with a thin, cuticular, diaphanous membrane, which also closed the external orifice of the vagina, being extended across the vulva. The vagina rather large, and displaying transverse striæ; remains of the nymphæ, and labia externa, visible; the meatus urinarius opening beneath the pubis into the vagina, the urine must have been directed along the groove of the penis, by the membrane obstructing the orifice of the vagina: the os tincæ was surrounded by small globular glands, the orifice and cervix admitting a large probe into the cavity of the uterus, which organ appeared perfect, with all its appendages; the round and broad ligaments, together with well-pronounced ovaries, all in situ.* The scrotum was divided, consisting of a sac on each side of the labia externa, at the base of the penis, covered with hair; the testicles lay beneath the skin of the groin, about two inches from the symphysis pubis, obliquely outwards and upwards; they appeared to be perfectly formed, with the epidydimis, &c. The most accurate examination could not discover vesiculæ seminales; but an opening into the vagina, above the meatus urinarius, appeared to be the orifice of the vas deferens. The testicles were unfortunately separated from the body, during the process of skinning. Admitting what in reality appeared to be the fact, that all the essential organs of both sexes were perfect in this individual, had the subject lived to adult age, most interesting results might have been elicited. Could not the animal have been impregnated by the male individual, by rupturing the membrane closing the vulva? or by masturbation, might not the animal have impregnated itself? by this means exciting the testicles to discharge their seminal liquor into its own vagina. The imperfection of the urethra, most probably, would have pre-

* The male and female organs of generation, were in this animal, as completely perfected as could have been anticipated in so young an individual, and resembled those of other individuals of a similar age: minute ova were visible in the ovaries.

vented the animal from ejecting the semen into the vagina of another individual. The subject, whilst living, always passed for a male. Had an instance of a like nature occurred in the human subject, it might have occasioned great difficulties, viewed in the light of a case of Legal Medicine.

Dr. Charles Pickering and others, assisted at this dissection. The accurate drawings of the anatomical parts, in a recent state, of the natural size, by Dr. Morton, and the figure of the animal, by Dr. R. M. Bird, have largely contributed to the value of this paper.

SIMIA CONCOLOR, Harlan.

Fig. 1

Fig. 2

EXPLANATION OF THE PLATES.

No. 1.—From a drawing of the animal, taken after death.
No. 2. fig. 1st.—External organs of generation.

A. Orifice from the vagina and urethra.
b. Membrane covering the vulva.
c. Prepuce.
d. Raphé of the perineum.
e. Penis with a groove on its inferior surface.
f. Ischiatic nudities.
g. Anus.

Fig. 2nd.—Internal organs of generation, viewed from behind; the uterus turned up, with its ligamentum latum, to show the ovaries, &c.

A. Bladder.
b. b. Ovaries.
c. Uterus.
d. d. Fallopian tubes.
e. Rectum.
f. f. Broad ligaments.

Description of the Vespertilio Auduboni, a new species of Bat.

Of the numerous creatures which attract our admiration, or excite our fears, the greater part display their appetites, or develope their instincts, during the day time only; especially—with few exceptions—all those remarkable for beauty of plumage, and vocal melody. Predacious animals are chiefly distinguished for their nocturnal habits; and ideas of rapine, terror, and blood, are ever associated with the tiger, the hyena, and the wolf. Among the feathered tribes, the *owl* and the *bat,* also companions of darkness, are shunned by many, as horrible objects, and full of ill-omen. Haunted castles, ruined battlements, and noisome caverns, are the chosen abodes of these nocturnal marauders, and it is to such associations that these animals are indebted for the unamiable character they have obtained. The prejudices conceived against that portion of these animals, with which we are familiar, are founded entirely upon these their habits; for small quadrupeds, reptiles, and fish, constitute the food of the first, whilst insects and fruit suffice for the other. It is at the close of the day, when the hum of nature is beginning to subside, that the patient *bat* steals from his dark retreat, and spreads his leathery wings in search of his food.

The new species of this little flying quadruped, which we are now about to notice, belongs to a very large and respectable family. In the days of Linnæus, they all—from their appearance at twilight—went by the family name of *Vespertilio.* They further belong to the order

Carnivora, their teeth being constructed for masticating flesh; though some—and in this they resemble ourselves —are also fond of fruit. In one important point, the whole race has a common character, in their organ of flight. The bones of the fingers are extremely elongated, and united by a membrane, which is continued down the side of the body; and extending on the leg as far as the tarsus, also unites the legs and tail. Agreeing so universally in this particular, they form a very natural family, under the appropriate term, Cheiroptera, constructed from two Greek words, signifying *hand* and *wing*.

The Vespertilio are again divided into GENERA and *Species*,—divisions which are grounded on certain peculiarities of dental structure, and various developements of the brachial, digital, and interfemoral appendages, with other modifications of the organs of progression. These genera include species which are discovered in every habitable part of the globe, of various magnitudes, from the size of a half-grown cat, to that of a half-grown mouse.

Of this numerous family only three genera, of modern authors, inhabit the United States, viz. RHINOPOMA, VESPERTILIO, and TAPHOZOUS. Seven species, exclusive of the present, are all that have been hitherto discovered in North America.

The following concise notice of the species, at present known to inhabit the United States, is offered by way of comparison:

Genus.—RHINOPOMA.—Superior incisors, separate from each other; nose, long, surmounted by a membrane; tail, long, enveloped at base.

Species 1st. *R. Caroliniensis*, (Geoffroy, or Vespertilio of Linnæus.)

Is recognised by its brown pelage, and long and thick tail; it is two inches in length, of which the tail occupies more than one inch; the inferior half of the tail, free of the interfemoral membrane.—Inhabits South Carolina, according to Geoffroy.

Genus.—Vespertilio—(Linn. Cuv. Geoff.)—Dental formula, various; superior incisors generally separated into pairs; nose and lower lip, simple; wing membranes, extensive.

Species 2d. *V. Caroliniensis.*—Geoff. Ann. du Mus. d'Hist. Nat. tom. 8, pl. 47.

This species is of a chesnut-brown colour above, and yellowish beneath—the ears are simple, oblong, and of the size of the head, with their exterior surface sparsely hairy; auriculum cordiform; extreme point of the tail free. Inhabits the vicinity of Charleston, S. C.

Species 3d. *V. Noveboracensis.*—Penn. Synop. p. 367, Linn. Vulgo, *New York Bat.*

Characterized by its short and rounded ears.—Nose short and pointed; pelage, brown above, pale beneath; a white spot at the base of the wings; tail, wholly enveloped in the interfemoral membrane; total length, tail inclusive, two inches five tenths; spread of the wings, ten inches. Inhabit New York and neighbouring states. A living specimen lately presented to us, taken near Camden, New Jersey.

Species 4th. *V. Pruinosus,* Say.—Vide Long's Exp. to the Rocky Mountains, Vol 1, p. 167.

Mr. T. Say, who noticed this species, when on the exploring expedition under Lieut. Col. (then Major) S. H. Long, has thus distinguished it:—ears broad, not so long as the head, hairy on their external side, more than half their length; auriculum, obtuse at tip, and arcuated; pelage, hairy above, ferruginous about the sacrum, dull yellowish white on the throat; interfemoral membrane covered with fur; length, nearly four inches and a half. Inhabits the western states, and western Pennsylvania.

Species 5th. *V. Arquatus*, Say.—Long's Exp. ut supra.

Head, large; ears, rather shorter, with the posterior edge obtusely emarginated; auriculum arcuated; interfemoral membrane naked, including the tail to one half the penultimate joint; total length, five inches; expansion of wings, thirteen inches. Inhabits the western states.

Species 6th. *V. Subulatus*, Say.—Long's Exp. Vol. 2, p. 65.

This species is the nearest allied to the Vespertilio Caroliniensis, of Geoffroy, from which, however, it differs in colour, form of the auriculum, and in other particulars. Mr. Say observed it in the distant territories. A specimen was subsequently presented to the Academy of Natural Science, from the White mountains, New Hampshire.

Genus.—Taphozous—(Geoff.)—Without incisor teeth in the upper jaw. Nose, simple; upper lip, very thick; ears, moderate.

Species 7th. *T. Rufus*. Figured in Wilson's Ornithology, Vol. vi. *Red Bat of Pennsylvania.*

With this little animal we are all familiar. The city and its vicinity abound in them. The body is of a reddish cream colour; membranes of a dusky red; auricule slender, rounded at the extremity, and situated internally. Total length, four inches; spread of the wings, twelve inches.

Like other Vespertilio, they enjoy the crepusculum, and are fond of insects, which they seize on the wing. The female has been known to manifest the strongest maternal affection; a young lad having caught two young bats of this species, was in the act of bearing them off to the Philadelphia Museum, at mid-day;—being watched by the mother, she followed him through the streets, fluttering round him, and eventually settled on his bosom, preferring captivity, to freedom with the loss of her progeny.

Species 8th. VESPERTILIO *Auduboni*.—Pl.

We propose to dedicate this new species to our valuable friend, the justly celebrated naturalist, J. J. AUDUBON, as a small tribute of respect to his eminent talents, and the highly important services he has rendered science. The drawing which accompanies this paper is from his inimitable pencil.

This species was first observed during the summer of 1829, when an individual female flew into the apartment of the late Dr. Hammersly, then one of the resident physicians of the Pennsylvania hospital: on the subsequent evening a male individual, of the same species, was also taken in the same manner. In August, 1830, a very fine specimen was brought to the Academy of Natural Sciences, and Mr. Audubon informs me that the species has very recently been observed in New York.

Natural characters of the species.—General colour black, sprinkled with grey above and beneath; ears black and naked; auriculum, short and broad, or obtusely triangular; interfemoral membrane, sparsely hairy; last joint of the tail free: two incisors, with notched crowns, on each side of the canine teeth of the upper jaw, with a broad intervening space without teeth.

Dimensions.—Total length, 3 inches 7 tenths; tail 1.7; length of ear, 0.5; breadth of ear, 0.4; length of leg, 1.7; spread of wings, 10.7. Inhabit Pennsylvania and New York, and probably the southern states.—Cab. of Acad. Nat. Sc. Philad.

VESPERTILIO AUDUBONI.

Lehman & Duval Lithrs

Description of Chlamyphorus truncatus, a new Genus of Mammiferous Quadrupeds, of the Order Edentata.

On the 18th December, 1824, Mr. William Colesberry of Philadelphia, presented to the Philadelphia Museum of Natural History the interesting animal which forms the subject of the following pages. Mr. C. gave the following statement to Mr. Franklin Peale:—"The animal is a native of *Mendoza*, and in the Indian language is named 'Pichiciago.' Mendoza is situate on the east of the Cordilleras, in lat. 33° 25′, and long. 69° 47′, in the province of Cuyo. It had been obtained on the spot, in a living state, but it continued to live in confinement only a few days. Its habits resemble those of the mole, living for the most part under ground; and is reputed to carry its young beneath the scaly cloak with which it is covered; and that the tail possessed little or no motion."

It is to be regretted that the viscera and the greater portion of the skeleton of this animal had been removed before it came into my possession; and the gentleman who presented the same, having left the city, precludes the possibility of receiving, at present, any further particulars relative to its habits; but the observations which I have been able to make from the examination of its exterior, together with the skull and teeth, all of which are in nearly a perfect state of preservation, establish the characters of the animal on the most solid foundation.

Cuvier, that justly celebrated naturalist, remarks: "In zoology, when the teeth and jaws of an animal are given, the remaining structure may be readily determined; at least as far as relates to essential characters. The form of the tooth, determines that of the condyle; the form of the scapula, that of the nails; just as the equation of a curve indicates all its properties; as in taking each property separately, for the basis of a particular equation, we might arrive, not only at the *ordinary* equation, but at all the other properties: so the nail, the scapula, the maxillary condyle, the femur, and all the other bones, taken separately, would indicate each other reciprocally; and beginning with either separately, we might, according to the rational laws of the organic economy, construct the whole animal."

It is thus, by a perfect knowledge of the laws of co-existence, to which the combinations of animals are subjected, the skull alone of the animal under consideration would have enabled us to determine that it belonged to a new, and nondescript genus.

The varied, magnificent, and multiplied collection of natural objects, in the Philadelphia Museum, drawn from every department of nature, displays in the strongest light the wonderful results to be obtained by the talent, industry, perseverance, and zeal, of an individual. The venerable octogenarian *founder* still lives, to contemplate with sentiments of pride and delight the colossal monument which has risen at his command; which will perpetuate the fame, and hand down the name of *Charles Wilson Peale* to the latest posterity.*

On the present occasion, as on many others, I have been indebted to the Philadelphia Museum for the opportunity of making the necessary comparisons with the subject of investigation.

The order EDENTATA includes quadrupeds destitute of incisor teeth, forming the last order of Cuvier's clawed animals. Although united only by a negative character, there exist some positive relations between them, particularly the large nails which embrace the extremity of the fingers, and resemble more or less the nature of hoofs.

* Since the above paragraph was penned, this venerable benefactor to science has paid the debt of nature, dying on the 22nd of February, 1827.

Chlamyphorus truncatus.

Corpore, supra testâ coriacea, postice truncata, squamis rhomboideis, lineis transversis dispositis, conflata, subtus capillis albis, sericeis, obtecto; capite supra squamis testa dorsali continuis, adoperto; palmis, plantisque pentadactylis; unguibus anterioribus longissimis, compressis.

DIMENSIONS.

	Inch.
Total length - - - - - -	5.2
Length of the head - - - - -	1.6
Breadth between the eyes - - - -	.8
Depth of the posterior truncated portion of the shell	1.3
Greatest breadth of the same - - -	1.8
Girth posterior to the shoulders - - -	4.
Length of the sole of the foot, including the nails	1.2
Breadth of the foot - - - - -	.3
Length of the nails - - - - -	.2
Length of the hand - - - - -	1.4
Breadth of ditto - - - - - -	.4
Length of the longest nail - - - -	.7½
Length of that portion of the tail which is free, and curved beneath the body - - -	1.2

The shell which covers the body, is of a consistence somewhat more dense and inflexible than sole leather of equal thickness. It is composed of a series of plates of a square, rhomboidal, or cubical form; each row separated by an epidermal or membranous production,* which is reflected above and beneath, over the plates; the rows include from fifteen to twenty-two plates; the shell being broadest at its posterior half, extending about one half round the body; this covering is loose throughout, excepting along the spine of the back and top of the head; being

* The rows of plates were probably separated by distension in the preparation.

attached to the back immediately above the spine, by a loose cuticular production, and by two remarkable bony processes (to be described hereafter) on the top of the os frontis, by means of two large plates, which are nearly incorporated with the bone beneath; but for this attachment, and the tail being firmly curved beneath the belly, the covering would be very easily detached. The number of rows of plates on the back, counting from the vertex, (where they commence) is twenty-four; at the twenty-fourth the shell curves suddenly downwards, so as to form a right angle with the body; this truncated surface is composed of plates nearly similar to those of the back; they are disposed in semicircular rows, five in number: the lower margin, somewhat elliptical, presents a notch in its centre, in which is attached the free portion of tail, which makes an abrupt curvature, and runs beneath the belly parallel to the axis of the body; the free portion of tail consists of fourteen caudal vertebræ, surrounded by as many plates, similar to those of the body; the extremity of the tail being depressed, so as to form a paddle; the rest of the tail compressed. The caudal vertebræ extend up to the top of the back, beneath the truncated surface, where the sacrum is bent to meet the tail. The superior semicircular margin of the truncated surface, together with the lateral margins of the shell, are beautifully fringed with silky hair.

Head: posterior half, broad, anterior half, before the eyes, tapering; the occiput is covered by the five first rows of the *back plates*, with which they are continuous; the occiput not distinguishable externally. The anterior half of the top of the head, is covered, first, by a row of large plates, five in number, which are firmly attached to the bone beneath; particularly the two outer;—secondly, by a smaller row, six in number, anterior to which, that is to say, the top of the snout, is covered with smaller plates irregularly disposed.

External ear, consists of a circular, somewhat patulous opening, directly posterior to the eye, surrounded with an elevated margin; and communicating with a bony canal, to be more fully described hereafter. *Eye*, minute, totally black; and, like the ear, nearly hidden by long silky hair. *Mouth*, the rictus small. *Nose*, the extremity of the snout is furnished with an enlarged cartilage, as in the hog; the anterior nares opening downwards, at the inferior border.

The whole surface of the body covered with fine silk-like hair, longer and finer than that of the mole, but not so thick set. The anterior of the chest is large, full, and strong; the anterior extremities, short, clumsy, and powerful; the hair is continued for some distance on the palm—the phalanges of the hand united; five powerful nails rising gradually one above the other; the external shortest and broadest; the whole so arranged as to form a sharp cutting instrument, somewhat scooped; very convenient for progression under ground; and such as must very much impede motion on the surface. Hind legs weak and short—feet, long and narrow; the sole resembles considerably the human foot, having a well defined heel, which rests flat upon the ground, and being arched in the middle; toes separate, nails flattened horizontally.

Skull. At first view, the bones of the cranium and face would appear to constitute one solid case, the remnants of sutures are indistinctly visible in some parts only. The cavity of the cranium is capacious; the greatest breadth, which is from ear to ear, is one inch; greatest depth five tenths; length of the cavity, seven tenths. One of the most remarkable peculiarities of this skull, consists in the two processes of bone, above alluded to, which project obliquely, forward, upward, and outward; from the os frontis, anterior to the cavity of the cranium, and directly above the malar bone; giving to the front of the skull an aspect totally unique; these prominences are hollow, communicating with the frontal sinuses, and must contribute in a great measure to enlarge the organ of smell; there exists a considerable concavity between them, which, in the recent state, was filled with an adipose, gristly mass, which served to unite the skull to the plates above. The snout commences anteriorly to these processes, and is rapidly attenuated and depressed. The ossa nasi are broad and strong, slightly arched transversely, extending anteriorly beyond the os incisivum, as does likewise the osseous septum narium. The zygomatic processes are laterally arched; a small pointed process, descending near the malar bone, (somewhat like that in the sloth); the zygomatic fossæ are large.

The labyrinth is protuberant, and occupies the usual situation at the base of the skull; joined to which is the tympanum;—to the last is attached a bony cylinder, stretching first upwards behind the zygomatic process of the temporal bone, around which it makes a sudden curve, and runs forward and upwards to terminate at the external ear. This structure, which I believe is peculiar to the animal before us, will be better understood by referring to the plate.

Lower jaw. Anterior portion shaped like that of the elephant, much elongated; the general form and proportion resembles very closely the lower jaw of the sheep, the base being considerably arched, and the curve at the posterior part, forming with the base nearly a right angle, projecting obliquely outwards: the base is marked by eight slightly elevated protuberances, occasioned by the roots of the teeth; the condyloid process is longer than the coronoid; in the sheep, this is reversed: the articulation at the glenoid cavity is such as to admit a great freedom of motion. Length of the base of the lower jaw one inch; length of the angle five tenths; greatest width two and a half tenths; width of the angle three tenths.

Teeth. Incisors, none in either jaw; molars, eight in number, on either side of the upper and lower jaws, all approximate; disposed in separate alveoli; the crowns of the two first only, approach to a point, and thus much resemble canine teeth; the six remaining are all nearly flat on the crowns; their structure is simple; a cylinder of enamel, of equal thickness throughout, surrounds a central pillar of bone, there being no division into body and root; the lower half is hollow, the cavity representing an elongated cone. In the lower jaw, the teeth penetrate its whole depth;—length of the teeth, about three tenths of an inch: two tenths of which are buried in the sockets—diameter, about one tenth. They are somewhat flattened on the sides, and in a slight degree curved externally, to be adapted to the shape of the jaw. The teeth of the inferior maxilla are directed forwards and upwards; those of the superior maxilla are directly reversed in their direction, so that the crowns meet each other obliquely; and the posterior margin of the lower teeth, and the anterior margin of the upper, present their angles to the object of mastication. (This structure is exemplified in fig. 7.)

The remainder of the skeleton, with the viscera, having been removed previous to my obtaining a view of the animal, I am unable to give any further detail of the internal organization. It is fortunate that I have been enabled to make so complete a preparation of the skull; this, with the external organization, which is well preserved, will enable me to establish its generic characters on the firmest foundation. To such as have made comparative anatomy the subject of their investigation, the above minute detail of this very extraordinary individual will enable them in some measure to anticipate the observations which follow; they will perceive, at first view, that the animal before us unites in its external configuration traits peculiar to the genera *Dasypus*, *Talpa*, and *Bradypus;* yet a very superficial observation will unfold characters generically distinct from either. It will be observed, that though this singular being is clothed with a coat (or rather cloak) of mail, in a slight degree resembling the armadillo, yet it differs remarkably in its texture, form, situation, arrangement, and mode of attachment to the body. In the armadillo, the body is covered with a hard, scaly shell, and consists,—1st. In a plate upon the forehead. 2d. A vast shield, situate upon the shoulders, and formed of small rectangular compartments, disposed in transverse bands. 3d. In bands of similar plates, but moveable, and varying in number, from three to twelve, more or less, according to the species. 4th. In a shield upon the rump, very similar to that on the shoulders. 5th. In rings more or less numerous on the tail; five toes behind; before sometimes five, at others four; hairs sparse. The whole shell is covered by a thin, transparent epidermis, *which is joined to the skin of the belly*, which gives to the shell a shining aspect, as if it were varnished; the extremities are entirely covered with strong scales. The armadillo burrows in the earth; is sufficiently quick in its motions; is capable of rolling its body into the form of a ball; and is omnivorous. The external ear is sometimes large, and always very apparent.

From this statement, we are convinced that there exists only the most distant analogy in the external covering of the *Dasypus* with that of the *new genus;* other analogies, which are found in the comparison of the skulls, will be referred to hereafter.

The lower portions of our animal, as well as that beneath the scales, will bear a pretty close comparison with the same parts of the mole, (*Talpa Europea*, (Lin.) white variety.) The hair is finer and longer than in the mole, and at a distance resembles long staple cotton in appearance. The eye is small; the neck, breast, and shoulders, are very powerful; the posterior extremities are short and weak; the anterior, short and strong, and furnished with large claws, as in the mole; but in the form of the head, in the structure and form of the claws, in the external ear, which is apparent when the hair is separated, our animal is totally dissimilar to the mole. The claws bear some analogy to those of the sloth, (*Bradypus*, Lin.) but are articulated to the last phalanx, as in the mole. Like the last named animal, the organs of generation must have opened anterior to the pubis, and at a great distance from the sacrum, viz. before the inferior margin of the truncated portion of the shell, near the middle of the caudal vertebræ, which, as I have remarked above, are continued, within the truncated plate, to near the top of the back. Thus far, like the mole, our animal is eminently constructed for subterranean progression; and here, in all probability, any strict analogy with that animal ceases.

In the examination of the skull, we are struck with its many peculiarities, and great dissimilarity to that of the mole, to which it is so nearly allied in its subterranean habits. The skull of the latter animal is long and narrow, flattened vertically; the jaws are furnished with four large canine teeth, separated from each other; having between them six incisors above and eight below, seven molars on each side of the upper jaw, six on each side below, the crowns of which are furnished with sharp points; in all of which our animal differs entirely. Like the mole, the extremity of the snout is furnished with a sort of button, but of much firmer consistence; in the form of the snout, and posterior part of the skull, as well as in the effaced appearance of the sutures, some slight resemblance is visible. The palm of the hand is directed rather inwards, in our new genus; whereas in the mole it is directed outwards, and the nails are destitute of the cutting edge, so remarkable in the former. On comparing the skull of our animal with that of the armadillo, (*Dasypus sexcinctus*, Lin.) a few traits of similarity of typification are visible: both these animals being equally destitute of incisor and canine teeth in either jaw; in both, a considerable space intervenes between the anterior margin of the os intermaxillare and the commencement of the teeth; and in both the number of molar teeth is the same, viz. eight on each side of both jaws—thirty-two in all. Here all further analogy with the *Dasypus* is at an end.

In the last named animal, the crowns of the teeth terminate in two points, and, together with the bodies, are completely enveloped in enamel; they are so far separated from each other, that when the jaws are closed, those of the lower jaw pass between those of the upper; furthermore, the teeth are proportionally much shorter, neither sinking so deep into the jaw, nor rising so high above the alveoli. The whole form of the head, and of the jaws, particularly the inferior, will admit of no comparison in the two animals; lateral motion being almost entirely forbidden in the armadillo, and the greatest freedom in this respect existing in the *new genus:* in which, the *condyloid* extends above the *coronoid* process.

The teeth in structure are most nearly allied to those of the sloth, (*Bradypus tridactylus*, Lin.) that is to say, they consist of a simple cylinder of bone, surrounded with enamel, except the crowns, which are destitute of enamel in the centre; the roots, (or rather that portion buried in the jaw,) of both these animals, are hollow. In these particulars, together with the short process descending from the zygomatic arch, which has been alluded to before, as well as in the form of the fore-claws, there is considerable analogy; but in all other points of organization, these two genera are most widely separated.

For additional particulars relative to other portions of the skeleton of the Chlamyphorus, which were wanting in our specimen, we are indebted to the observations of Mr. Yarrell, on a specimen in the museum of the Zoological Society of London.—Vide Zool. Journ. Vol. 3, p. 544.

"The cervical vertebræ seven, the first large, the articulating surfaces broad; the 2nd, 3rd, and 4th, very firmly ossified together, pierced with foramina for the passage of the cervical vessels; the 5th united to the 4th on the under surface only; the 6th and 7th slender and separate, allowing the head great freedom of motion upwards: the whole of the last six grooved on the under surface, in the line of the passage of the œsophagus. Dorsal vertebræ eleven, the spinous process of the first slender, three-eighths of an inch long, the others diminish gradually in length, but increase in size; all directed backwards. The first rib is very broad, and from the 2nd to the 8th, the ribs of the *Chlamyphorus,* like those of birds, are firmly united to the sternum without the intervention of an elongated cartilage; and, again like those of birds, are also supplied with a false joint, at the distance of about two-thirds of their length from the spine to the sternum. The 9th, 10th, and 11th, being false ribs, are united in the usual way to each other, and to the 8th, by elongations of cartilage from their extremities. The portions of ribs intervening between the false joints and the sternum are in the 6th, 7th, and 8th ribs, consolidated, broad, flattened portions of bone, which form the boundary of the anterior and lateral parietes of the thorax. The first bone of the sternum is broad and flat, the superior surface regularly concave, the inferior irregularly convex. Upon the anterior edge of the sternum are two prominences to which are attached the extremities of each clavicle. From each of these articulations a slightly elevated ridge proceeds backwards along the inferior surface of the sternum, converging towards the centre, where they become united and form a prominent crest. The lateral edges of this first bone of the sternum are articulated at its anterior extremity to the first and broadest rib; from this part the bone suddenly becomes narrowed posteriorly, and terminates in a concave articular surface to which the second bone of the sternum is attached. Judging from the imperfect remains of the second bone, of which the upper part only was distinguishable, it would appear that its form was oblong, the superior surface concave. The remaining portion of the sternum was too much mutilated to admit further description.

"Lumbar vertebræ three, the spinous processes short and flattened; the two last dorsal vertebræ, as well as the lumbar, furnished with long oblique processes directed forwards, upwards, and outwards; the transverse processes of the first two lumbar vertebræ considerably elongated, the last possessing a rudiment only.

"The whole of the sacrum and innominata is so peculiar and unique in character, that I should despair of giving any correct idea of this part, without the assistance of accurate representations. The superior part of the ilium is flattened, the upper part bent to form an arched plate of bone, the concavity of which faces downwards and outwards; the crista of great length from before backwards. The inferior portion of the ilium is much stronger, inclining outwards, from its junction with the sacrum to the acetabulum.

"The transverse and spinous processes of the sacrum are represented by three slender plates of bone, which, approximating as they pass backwards, are united to form a septum, extending down the median line of the sacrum to the tail. A channel is formed on each side of this septum by a thin flat plate of bone, which, arising from the posterior and superior part of the ischium on each side, is bent over the back part of the sacrum, and fixed to an arched and prominent plate of bone, which is extended from this septum outwards, to form a junction with it. The channels thus produced are bounded below by the sacrum, on the inner sides by the septum, on the outer sides by the ascending plates of bone just described, and above by the junction of both. From this union a short osseous stem issues horizontally on each side, and expands into a flattened circular plate of bone, to the rough surface of which, as well as to the tuberosity of the ischium below, portions of the truncated exterior of the animal are firmly attached.

"The under surface of the sacrum is broad and flattened, and marked by an indistinct central ridge, as shown in figure 7. The pelvis is open in front, the ossa pubis on each side do not incline inwards, but descend at right angles from the horizontal surface of the sacrum. In the circumstance of the pelvis being open, there is a second resemblance to the bony structure in birds.

"The caudal vertebræ are fourteen in number; the transverse processes of the last four are elongated, to support the thin dilated lateral edges of the paddle or spatular extremity of the tail. Large muscles are imbedded in the two cavities formed on the upper surface of the sacrum by its septum and the two lateral elevated portions of the ischium before described; and there are antagonist muscles of equal size on the under surface. The tendons of these muscles were inserted into the superior and inferior spinous processes of the caudal vertebræ, giving great power to the tail, which is probably exercised in removing backwards the loose earth accumulated under the belly of this burrowing animal by the action of the fore legs, and for which purpose the expanded and flattened extremity seems well calculated.

"The scapula has its superior margin straight, ending in a notch of great size; the base rounded; the inferior margin concave, and the posterior inferior angle considerably elongated; the coracoid process but little produced, the spine elevated, the acromion very long, passing forwards, downwards, and inwards, over the head of the humerus, to be articulated to a long and slender, but perfect clavicle. There is a second spine of smaller size parallel to, but beneath, the true spine. The humerus is three-fourths of an inch in length, large and broad; the deltoid crest prominent; between which and the external condyle a deep groove is formed for the lodgment of muscles, &c.; both condyles very much elongated transversely; the inner condyle perforated above; the edge rising from the external condyle acute. The radius small, and seven-sixteenths of an inch in length; the ulna flattened, concave upwards, the olecranon nearly as long as the ulna, horizontally flattened also, and presenting a superior concave surface, ending in a curve pointing downwards. The feet furnished with sesamoid bones for the insertion of the tendons of the flexor muscles.

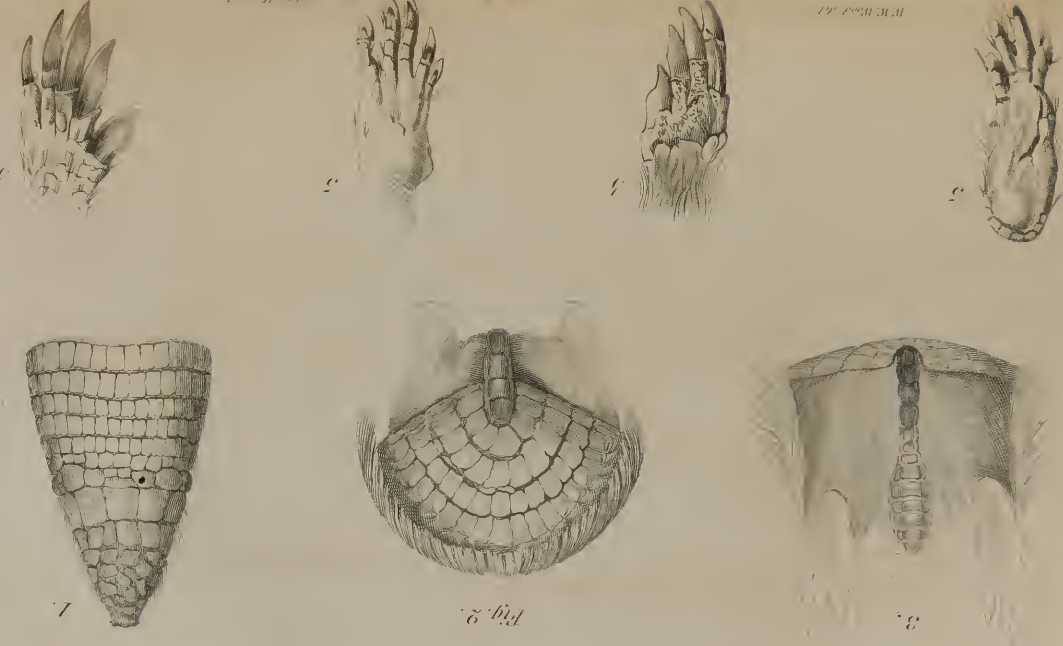
"The femur thirteen-sixteenths of an inch long, large and strong; the length of the neck considerable; the great trochanter elongated backwards beyond the line of the articulation of the head of the femur with the acetabulum, and ending in a tuberosity; the lesser trochanter directed downwards; a third trochanter projecting from the outer side of the shaft of the femur somewhat above the middle; the condyles moderately elongated transversely, the outer having a crest directed backwards. The tibia and fibula fifteen-sixteenths of an inch, flattened, concave inwards, firmly anchylosed at each extremity, and arched in opposite directions, giving an appearance of great size and strength to the leg. The os calcis elongated backwards, flat, and ending in a curve slightly inclined upwards. Hind feet plantigrade."

As far as the nature of the subject will admit, I have now gone through with the detail of the organization of this most singular quadruped. During the investigation, I have had frequent occasion to admire those laws of coexistence which regulate the structure of organized beings; Nature, true to herself in this as in all other instances, has pursued an undeviating course. We have been presented in the subject before us with a *new form:* an animal combining in its external configuration a mechanical arrangement of parts which characterizes, respectively, the armadillo, the sloth, and the mole; constituting in themselves, individually and separately, of all other quadrupeds, those which offer the most remarkable anatomical characters. Pursuing the investigation step by step, with the skeletons of the above-named animals before me, it was not until after I had completely finished every point of observation, that I perceived in the skull alone, of the new animal, a reunion, more or less complete, of all those remarkable traits that an external view of the animal had offered for contemplation; which, taken collectively, furnishes us with an example of *organic structure,* if not unparalleled, at least not surpassed in the history of animals.

The most peculiar and unique characters consist—First, In the general contour of the animal. Second, In the form, texture, and disposition of its scaly cloak, which would very much confine the power of flexion and extension of the body, and nearly altogether impede lateral motion; the greatest freedom of motion would consist in the extension of the head on the body. Thirdly, In the position of the organs of generation. Fourthly, In the form, structure, position, and use of the tail. Fifthly, In the peculiar and complicated structure of the feet and claws. Sixthly, In the structure of the organ of hearing. Seventh, In the bony protuberances on the os frontis. Eighth, In the disposition of the teeth; and Ninth, In the form of the lower jaw, which separates the animal, in this respect, from the order *Edentata,* and approximates it to the Ruminantia and Pachydermata.

EXPLANATION OF THE PLATES.

No. 1. Profile view of the Chlamyphorus, of the size of nature.
No. 2. fig. 1. A view of the back of the head.
fig. 2. Posterior truncated portion.
fig. 3. Anterior view of the inferior portion of the body.
fig. 4. Anterior and posterior view of the fore foot.
fig. 5. Do. do. of the hind foot.
No. 3. fig. 1. Profile view of the cranium, magnified.
fig. 2. Posterior view of the cranium, magnified.
fig. 3. Anterior do. do. magnified.
fig. 4. Several views of a tooth, magnified.
fig. 5. Enlarged view of the organ of hearing, magnified.
fig. 6. Anterior and inferior view of the end of the snout, magnified.
fig. 7. Relative position of the teeth.
fig. 8. Lower jaw, natural size.
No. 4. Skeleton of the Chlamyphorus.



CHLAMYPHORUS TRUNCATUS.

Peter Maverick sc.


Fig. 1.

Skeleton of the Chlamyphorus truncatus.

Description of the Arvicola palustris—a new Species of Campagnol.

Arvicola palustris, (nobis.)
Marsh campagnol.
Arvicola riparius, Ord. Journal of the Phil. Acad. of Nat. Sciences, vol. iv.

Char. Body above dark grayish-brown; pale plumbeous beneath; snout rather elongated, reddish-brown at its extremity; ears moderately long, sparsely bordered with hair.

Tail short, sparsely hairy.

Dimensions. Total length, from the tip of the nose to the base of the tail, very nearly six inches; length of the tail two inches and three tenths.

Description. Body elongated, thickest behind, covered above with soft fur, plumbeous at base, and tipped with gray and brown, from whence results the general colour, dark grayish-brown above, lighter on the flanks and sides, becoming reddish-brown on the end of the snout, and beneath the tail, between the hind legs; belly, inside of the legs, and throat, of a pale plumbeous colour, occasioned by the hairs being plumbeous at base, and white at the extremity; head long and narrow; snout rather elongated; facial line straight: ears situate far back, moderately long, internal border lined with sparse hair, posterior surface nearly naked; whiskers fine long hairs, white and black; inferior incisors very long, distinct, gently recurved at top, laterally compressed, very sharp and pointed, yellow on the anterior surface, and convex; upper incisors much shorter and cuneiform.

Molar teeth unusually long at the crowns, and so deeply grooved laterally, that when viewed in this direction, these animals appear to possess six or eight, in place of three molars on each side, the usual number; eyes large, situate sixth-tenths of an inch from the extremity of the snout.

Legs small, terminated by five clawed toes behind, four before. The fore feet brown above; middle toe the longest, then the next on each side, the outer one small, all furnished with hooked nails; the thumb tubercle very small, and furnished with a scarcely visible nail.

The three middle toes on the hind feet nearly equal; the two remaining toes very small, particularly the interior; all furnished with nails similar to those on the fore toes.

Tail small and short, sparsely covered with brownish hair.

Habit. Living in marshes on the shores of rivers; they dive well, and swim with facility; their habits in many respects resemble those of the *Arvicola amphibius;* they bring forth six or eight young at a birth; feeding principally on the wild rice, (*Zizania aquatica.*)

Inhabit the swamps along the shores of the Delaware. (Specimens in the Philadelphia Museum.)

Description of the Arvicola hortensis—a new Species.

Arvicola hortensis, (nobis.)

Char. Body ferruginous-brown above; plumbeous, intermixed with yellow beneath; hairs coarse, standing more or less obliquely from the body, giving the animal a shaggy appearance; ears broad, oval; head globular; snout contracted, conical; tail more than one-half the total length.

Dimensions.—Total length, from the tip of the nose to the origin of the tail, five inches and five-tenths; length of the tail two inches and seven-tenths.

Description.—Body covered with rather long, coarse hair, of a dark plumbeous colour for the greater portion of its length next the skin, but reddish or dusky brown, sometimes grayish at the extremity, standing more or less obliquely from the body, which occasions the plumbeous colour of the inferior portion to show through in some places, giving the animal a motley, shaggy appearance; beneath the throat of a dirty yellowish-white; belly ochreous-yellow, intermixed with plumbeous; tail rather thickly invested with blackish-brown hair, lighter beneath; head rather broad; snout contracted, conical; facial line arched; ears six-tenths of an inch broad, the same in height, hairy within, sparsely hairy without; coarse, stiff hairs lining the anterior borders; whiskers, numerous, fine, long hairs, both black and white.

Molar teeth rather oblong, deeply grooved at their crowns, and marked by several transverse curved lines of enamel; the grooves extending nearly one-half the length of the sides of the bodies; the lower incisors rather shorter, the upper rather longer than in the preceding species.

Feet small, brown above; the number of toes and nails, their form and situation, do not materially differ from the same parts in the preceding species.

Habit.—Mr. Ord discovered these animals in Florida in the year 1817 or 1818, and presented specimens to the Philadelphia Museum, where they have remained ever since, undescribed. He states that they frequent the ruined gardens of deserted plantations; feed on seeds, grain, &c.; they are very abundant also on the borders of marshes, and constitute the principal food of the Marsh-Hawk, as we are informed by Mr. T. Peale.*

Note.—The molar teeth of this species present some differences from those of the common *Arvicola*, and re-

* *Some weeks after the above description had been drawn up, and read before the Philadelphia Academy of Natural Sciences*, Messrs. Say and Ord thought it necessary to describe the same animal, and to construct from it a new genus, which they name "*Sigmodon*." For this distinction they have no other foundation than a slight and unimportant variation in the form and direction of the plates of enamel, which traverse the crowns of the molars, and the partial division of the root into rudimentary radicles. On similar distinctions, F. Cuvier has founded his *divisions* of the genus *Arvicola*, which "differ from each other in the number of parts of which the teeth are composed."

It could be shown, if necessary, in a number of instances, that greater differences are observable in the different teeth of the same individual, than have served those gentlemen, in the present instance, to construct a new genus; who, in their description of the animal, have entirely neglected to point out any generic distinctions in the *external characters*, (which, in reality, correspond with the genus *Arvicola*.) This neglect is the more extraordinary, as in their former descriptions they have dwelt upon the *external* characters of animals, and, in some cases, to the exclusion of any observations on the structure of the teeth, as was instanced in the "*Mus floridanus*." The slight variations in the teeth noticed above, provided they be accompanied with well marked differences in the external characters of the animal, may form good grounds for *specific* distinctions, but surely cannot be received as sufficient reason for the construction of a new genus, according to the established laws which regulate naturalists in similar instances; particularly as nature acknowledges no such distinction, inasmuch as the food, the manners, the habits, and we may add, the external characters of this animal, correspond with those of other species of the genus *Arvicola*.

Note.—The description of the present species is drawn from one of the three individuals presented to the Museum by Mr. Ord.

semble somewhat those of the genus *Lemmus;* but the following, among other characters of this latter genus, "*ears very short,*" and "*tail very short,*" &c. will not apply to the present species; in all other respects it resembles the *Arvicola* much more closely than any other genus; it must consequently be referred to the former, or establish a new genus; the latter alternative would be as unwarrantable as to make distinct genera of the two existing species of Elephants.

EXPLANATION OF THE PLATE.

Fig. 5.—Profile, magnified view, of the jaws of the Arvicola hortensis.

Fig. 6.—Lower jaw, natural size, left side, with the alveoles removed.

Fig. 7.—Molars of the upper jaw, left side, magnified.

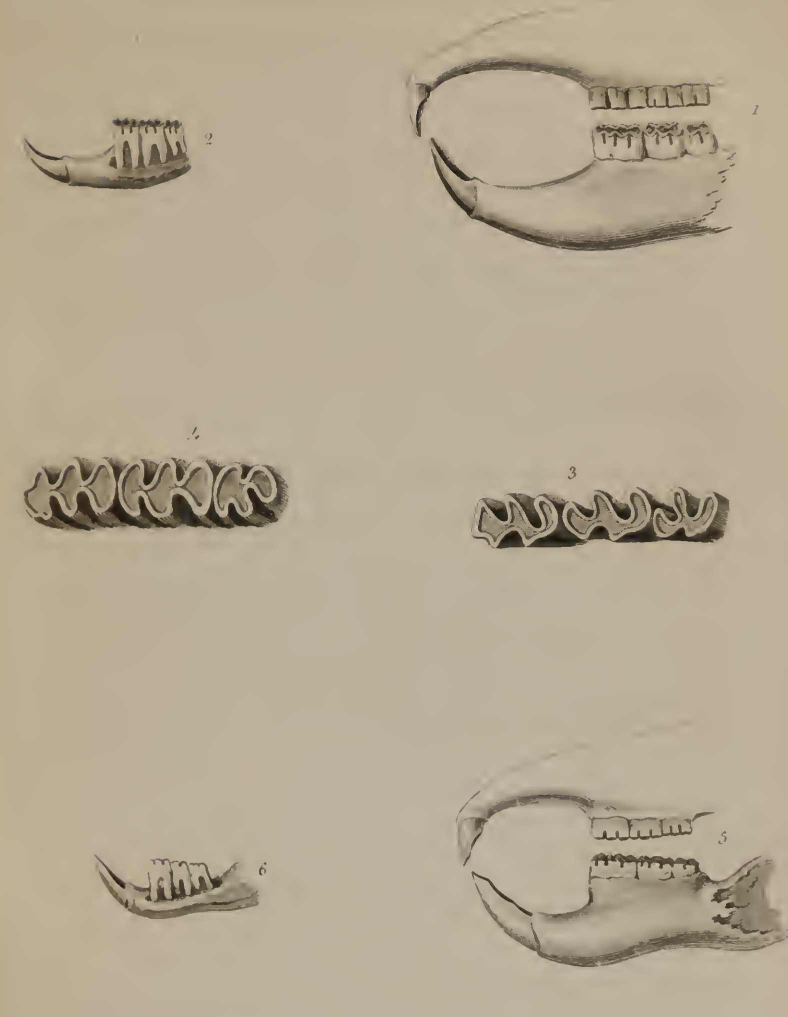
Fig. 8.—Idem, of the lower jaw.

Fig. 1.—Profile, magnified view, of the jaws of the Florida rat—Arvicola floridana.

Fig. 2.—Lower jaw, left side, natural size.

Fig. 3.—Molars of the upper jaw, left side, magnified.

Fig. 4.—Idem, of lower jaw.



2
1
3
5
6

Description of the Arvicola Floridanus.

Arvicola floridanus. Harl. Fauna Americana.

Mus floridanus, Ord, Nouv. bull. de la Soc. Philomat. Decem. 1818. *Mus floridanus,* Say, Long's Exped. to the Rocky Mountains, vol. 1. p. 54.

Char. Body robust, black plumbeous; sides, rump, and origin of the tail, ferruginous-yellow; fur plumbeous near its base; all beneath white.

Dimensions.—Total length including the tail, nearly sixteen inches; tail, seven inches; ear, nine-tenths; greatest breadth, one inch.

Description.—Head gradually attenuated to the nose, plumbeous, intermixed with gray; ears large, prominent, patulous, obtusely rounded, naked or furnished with sparse hairs behind, and on the margin within; eyes moderate, prominent; whiskers, some white, some black bristles, the longest surpassing the tip of the ears, arranged in six longitudinal series; tail hairy, as long as the body, above brown; legs subequal, robust; feet white; toes annulate beneath; thumb minute; palm with five tuberculous prominences; nails concealed by the hairs; sole with six tubercles; the three posterior ones distant from each other. (Say.)

Habit.—Feeding on vegetables, such as the green bark of trees, and the young shoots of plants; their nests are large, and composed of a great quantity of brush. This species is well known in some districts under the name of large hairy tailed rat, and is by no means rare in Florida; it is as large as the ordinary stature of the Norway rat, and equally troublesome; infesting houses, but gives place to the Norway rat.

Inhabit Florida and the borders of Mississippi river. Two prepared specimens in Philadelphia Museum; one from Florida, presented by Mr. Ord, the other from Mississippi, presented by Maj. Long's exploring party.

A beautiful figure accompanies Mr. Ord's description of this animal, in vol. 4 of the Journal of the Philadelphia Academy of Natural Sciences.*

* Since this work first went to press, we have received No. 11 of the Journal of the Academy of Natural Sciences, in time to follow up the eventful history of this animal. In vol. 4, p. 345, of the work above quoted, there is an essay entitled "A New Genus of *Mammalia*, &c. proposed by T. Say, and G. Ord; read March 8, 1825." The name of the proposed genus is "*Neotoma*." There appears to have been some mistake relative to the date, wherein it is stated that the new genus "*Neotoma*" was proposed; at any rate, it is very certain that on the evening of the 8th of March, the identical animal on which this new genus is founded, was described by those gentlemen as an "*Arvicola*," and this after an attentive examination of the teeth. It was not until this description of the "*Arvicola floridanus*" had passed through the press, that it was recalled by the authors, and the new name substituted. In order to avoid confusion, it will be necessary for naturalists to remember that the animal under notice, is at present described as pertaining to three or four distinct genera. The first notice of this animal, is an imperfect description by Mr. Ord, in the Bull. de la Soc. Philom. 1818, who named it "*Mus floridanus*," (its identity with the genus *Mus*, was doubted from the first, by the French naturalists.) A more complete description occurs in Maj. Long's exped. to the Rocky Mountains, vol. 1, p. 54, 1819—20, where Mr. Say has adopted in an unqualified manner the name given by Mr. Ord. Thus it remained until the attention of these gentlemen was particularly directed to the dentition of this animal, by the observations of M. Desmarest, in his "*Mammalogie*." They now described the animal as an *Arvicola*, (to which, in reality, it belongs.) Finally, observing that the molar teeth of the animal were furnished with "*roots*," they have constructed the new genus "*Neotoma*." (The *division* is sufficiently *novel*, it must be confessed, and if adopted, would destroy the whole fabric of classification.)

F. Cuvier has not mentioned the *roots* of the molar teeth of those species from which he has drawn the characters of the genus *Arvicola;* a circumstance so apt to vary even in the teeth of the same animal, this able naturalist considered as beneath his notice in a work which has for its object *a description of the teeth considered as zoological characters.* ("Dents des mammiféres considerées comme charactères zoologiques.") Notwithstanding this, Messrs. Say and Ord consider the "roots" of the teeth as of sufficient importance to establish generic distinctions. In the present instance, at least, they admit, that in the softness of the fur, and in the tail being clothed with hair, the "*Neotoma*" resembles the *Arvicola;* to which I would add, that in all other external characters, this species resembles the *Arvicola*, as closely as the different species of that genus resemble each other.

The description which Messrs. Say and Ord have given of the *teeth* of the "*Neotoma*," (always excepting the roots,) so exactly corresponds with M. Cuvier's description of the teeth of the genus Arvicola, that we are tempted to believe the former to be a literal translation. (Vid. Dents des mammiféres, &c. F. Cuvier; first division, page 155.)

Description of the Arvicola Nuttalli—a new Species.

Arvicola *Nuttalli.*—Fawn-coloured above, whitish beneath; ears long and hairy; toes sparsely hairy; tail nearly the length of the body.

Dimensions.—Length of the body, three inches; of the tail, two and a half inches,

Habitat.—Southern States.

Description.—Crowns of the molars similar in the arrangement of the enamel to those of the type of the genus, as represented by F. Cuvier—"Dentes des mammiféres;" but the roots are mostly cleft into four prongs: the inner surface of the inferior incisors, grooved longitudinally: ears very large, hairy within and without; legs small and weak, sparsely hairy; fore feet with four toes, armed with hooked nails; thumb rudimentary, with a flat nail; hind feet with five toes, armed with hooked nails, all with sparse hairs extending to the roots of the nails; a callous tubercle at the inferior base of each finger, and two others on the wrist; tail long, cylindrical, and sparsely hairy; eyes, large, black, and prominent. General colour of the body above, plumbeous, each hair being tipped with brownish yellow, presenting a fawn-coloured surface; beneath white. Whiskers composed of very long, fine, black and white hairs.

Like the musk-rat, (Ondatra, Lacep. or Fiber, Cuv.) this quadruped differs from the arvicola principally in the possession of roots to the molar teeth: but for the existence of these roots, in the former, M. F. Cuvier remarks, that he would consider the genus as merely forming a third division of arvicola: we doubt if the existence of a single character of this nature, should indicate even a specific distinction.

The specimen under consideration is a young male, just full grown; in colour it displays a striking resemblance to the GERBILLUS *canadensis;* it was recently taken in Virginia, by Mr. Nuttall, (the eminent botanist,) in the vicinity of Norfolk, near the river shore, and was one of several he discovered under the bark of a hollow tree, where they had built a fine nest. Vid. Pl.

ARVICOLA NUTTALLI.

Lehman & Duval Lith.rs

Description of the Arvicola Ferrugineus—a new Species.

Arvicola Ferrugineus. (nob.)

Vulgo.—*White-bellied Cotton Rat.*

Char.—Body large, ferruginous, brown above, whitish beneath; fore legs very short and slender; tail more than half the length of the body.

Dimensions.—Total length from the snout to the root of the tail, 7 inches; length of the tail, 4 inches.

Description.—Head long; snout tapering; whiskers white, fine, and sparse, some long, others short; ears rather large, broader than long, sparsely hairy within, naked without, anterior borders covered with long hairs—the teeth do not differ essentially from those of the *A. hortensis,* (nob.) the upper molars are rather more compressed in their antero-posterior diameter, and the curved lines of enamel on the crowns of the inferior assume, in some instances, the form of the Greek epsilon. Body massive, tapering towards the root of the tail in the same manner, though not to the same degree, as in the Norway rat; covered with fine long hairs of a dark plumbeous colour, tipped with brown, and intermixed with black. Inferior parts of the body plumbeous white, the hairs being plumbeous, tipped with white; tail slender, tapering, covered with hair, brown above, whitish beneath; feet greyish, white anteriorly, in form and structure resembling those of the *A. palustris,* (nob.), but in proportion are exceedingly small and slender, being very little larger than those of the common mouse—in an animal 7 inches in length of body, and nearly 6 inches in girth, the fore legs measure less than one inch and a half to the extremity of the nails; the latter are black, compressed, sharp, and hooked as in the squirrel.

Habit. According to Mr. J. J. Audubon, (to whom I am indebted for this specimen,) this animal never burrows, but conceals itself in hollow trees, generally forming a hole in the side, somewhat after the manner of the woodpecker, where they retreat in case of emergency. They inhabit the cotton fields exclusively; carry their young on their back, and, with their family thus secured, climb dead trees as nimbly as the squirrel.

Inhabit the borders of the Mississippi—the present specimen from Beech woods, near Natchez.

On the whole, the present species bears a near resemblance to the *Arvicola hortensis*, but is sufficiently distinguished by the extreme proportional minuteness of the fore legs and feet, by the colour of the fur, as also in size and in the tapering form of the body at the root of the tail, the manners of the animal, &c.

Description of the Mustela Lutreocephala, a new Species of Weasel.

Mustela Lutreocephala. (Nob.)

Under this name I wish to make known an animal hitherto confounded with the *M. lutreola*, (Pallas, spicil. Zoolog. 14. pl. 31. *Lutra minor*, Erxleb. mem. de Stock. 1739, tab. 11.) or with the *M. vison*. Lin. Gmel.

It resembles most nearly the "*lutreola*," yet is characteristically distinguished by its form, colour, size, and markings; it was indeed noticed as specifically different from the "*lutreola*" by Warden, (descrip. des Etats Unis, Vol. v. p. 613.) who, speaking of the American *Mink*, says, "We do not think this Martin (*Mink*) similar to the *M. lutreola*, (Pall.) which is a Swedish animal; although many naturalists have confounded the two, we have reason to believe them different, though both have a common name, and there exists much resemblance in their natural habits."

The specimen here described, was obtained and prepared by Mr. C. W. Peale, many years ago, in Maryland.

Char.—General colour, brownish white, lightest beneath; tail, ferruginous brown; length of the animal nearly double that of the "*lutreola.*"

Dimensions.—Total length, one foot eight inches; length of the tail, about nine inches.

Description.—In form, the head and ears resemble those of the otter; the hair, the tail, and general proportion of the body, are more analogous to those of the weasel; body long: feet short; toes united to the middle, of equal length, slightly palmated, and furnished with very small sharp nails, nearly covered with hair.

Habit.—According to Warden, this animal resides in the ground near to streams, in which it pursues its prey, consisting of fish, aquatic birds, rats, mice, insects, moles, and eggs of tortoises; during the night, entering the farm yards and destroying poultry; when famished it demonstrates astonishing boldness.

Inhabits the United States.

Note.—*Mustela lutreola,* Sab. append. to Franklin's Exped. p. 649, was described by Foster, (Philos. Trans.) as the same with the European.

Description of the Condylura Macroura, a new Species of Mole.

Condylura macroura, Nob.

Char.—Nose surrounded with a circular fringed membrane, asteriform; tail nearly the length of the body, cylindrical and appearing strangulated at base, becoming suddenly enlarged, slightly compressed and tapering.

Dimensions.—Total length, five inches four lines; length of the hands, seven lines; length of the hind feet, one inch; longest nail of the hand, two-eighths. (Extremity of the tail lost.)

Characters.

$$\text{Dental formula.—Teeth 40.}\begin{cases}\text{superior 20.} & \begin{cases}\text{Incisor 4.}\\ \text{Canine 8.}\\ \text{Molar 8.}\end{cases}\\ \text{inferior 20.} & \begin{cases}\text{Incisor 4.}\\ \text{Canine 10.}\\ \text{Molar 6.}\end{cases}\end{cases}$$

Note.—There is no rule by which to determine in this genus, the distinction of the various kinds of teeth. Thus Desmarest gives them incis. $\frac{6}{4}$, and allows six false molars above, and eight molars proper; whilst F. Cuvier gives as characteristic of his genus *Condylura*, two incis. two canine, ten false molars, and six true molars, to the upper jaw, but the total number of teeth is similar in all; the differences exist only in the names by which the teeth have been designated.*

* According to the observations of Dr. Dekay, the total number of teeth in this genus is 44; but 2 of the upper incisors are mere rudiments. His dental formula stands thus:

$$44.\begin{cases}\left.\begin{array}{r}\text{Above 4 incisor.}\\ \text{2 canine.}\\ \text{16 molar.}\end{array}\right\}\begin{array}{l}8.\\ —\\ 8.\end{array}\\ \left.\begin{array}{r}\text{Below 6 incisor.}\\ \text{6 canine.}\\ \text{14 molar.}\end{array}\right\}\begin{array}{l}8.\\ —\\ 6.\end{array}\end{cases}$$

Description.—Snout very much elongated, a longitudinal wrinkle on the upper surface, and on each side; cartilaginous points on the nose twenty in number; hands short and broad, naked, except at the upper border, which is lined with hair; nails strong, short, and flat, with cutting borders, not curved or arched at the extremity, nor pointed as in the *C. cristata;* tail more than one half the length of the body, thick, compressed, and tapering, furnished with coarse scales, clothed throughout with sparse, short, thick hairs; colour of the back, blackish-gray; the snout, fawn colour, darker on the sides. A specimen in the Philadelphia Museum, No. 866, from Pennsylvania.

Lehman & Duval Lith[rs]

CAPRA MONTANA. Harlan.

Rocky Mountain Goat

Description of the Capra Montana, or Rocky Mountain Goat.

Genus.

Capra, Linn. Pallas, Erxleb. Cuv. Geoff.
Goat.

Characters.

$$\text{Dental formula.—Teeth 32.}\left\{\begin{array}{l}\text{superior 12.}\left\{\begin{array}{l}\text{Incisor 0.}\\ \text{Canine 0.}\\ \text{Molar 12.}\end{array}\right.\\ \text{inferior 20.}\left\{\begin{array}{l}\text{Incisor 8.}\\ \text{Canine 0.}\\ \text{Molar 12.}\end{array}\right.\end{array}\right.$$

Incisors of nearly equal dimensions, regularly arranged and touching at their borders.

Horns directed upwards and outwards, compressed and wrinkled transversely; facial line straight or even, or somewhat concave; no muzzle; interval of the nostrils naked; no lachrymal depressions or suborbitar grooves; ears pointed, straight, and moveable; tongue smooth; body rather slender; legs rather robust; tail short; no inguinal pores; no tufts on the wrists; two mammæ.

Coat composed of two sorts of hair; the interior very fine and soft,* more or less abundant; the exterior long, or very long and smooth; chin most frequently furnished with a beard; sometimes two cuticular appendages, or sorts of glands, hang from beneath the neck.

Testicles contained in a very voluminous scrotum.

* It is this which in some of the Asiatic races, furnishes the material for Cashmere shawls, &c.

Habit. In the savage state the goats seek the most elevated and inaccessible places, and unite in troops more or less extensive, under the protection of an old male; these animals of all the ruminants display the most vivacity and intelligence; their vision is good; they hear at a distance, and their sense of smell is remarkably acute; they feed on herbs and shrubs; they bring forth two young at a birth.

Inhabit the Granitic chains of Europe and Asia, also the Rocky Mountains of North America.

Capra montana.—Vid. Plate.

Ovis montana, Ord, Jour. Philad. Acad. Nat. Sciences, vol. i. part 1. p. 8. 1816. *Rupicapra americana,* Blain. *Antilope americana,* Ejus. Nouv. Bull. Soc. Phil. 1816. p. 80. *Mazama sericea,* Rafin. Amer. Mon. Mag. 1817. p. 44. *Mazama dorsata,* idem. *Antilope lanigera,* C. H. Smith, Trans. Linn. Soc. p. 38. Tab. 4. vol. xiii. 1822. *Rocky Mountain Goat—Capra montana,* Harlan's Fauna Americana, p. 253.

We have here an animal, described for the first time in 1816, which has already been classed under four distinct genera, with nearly as many specific appellations. This can only be accounted for from the remoteness of the regions inhabited by these animals, and their consequent scarcity; one specimen only of the prepared skin having reached any cabinet in the world, which is that at present in the Museum of the Linnæan Society of London, from which the plate is taken accompanying Mr. Smith's description of this animal. Concerning this figure, we must here remark, that though the drawing from which it has been engraved, appears to have been very spirited, nevertheless, we are assured that the direction of the tail is not natural, and further, the transverse wrinkles on the bases of the horns are much too deep. In the horns of this animal formerly attached to the skin in the Philadelphia Museum, (which appear to have belonged to an animal in the second year of its age,) there exists no transverse wrinkles, only three or four slight undulations on the anterior base of the horns; they are nearly four inches in length, slightly recurved, perfectly black, and obsoletely striated longitudinally, hollow to the point; the base of the cavity measures one inch in diameter. This individual, though young, is by no means destitute of long hairs, which almost exclusively occupy the back, from the shoulders to the tail.

The reasons which have induced us to range this animal under the genus *Capra*, will be found detailed below; the *specific* name under which Mr. Ord has noticed it, although equally applicable to all the species of the genus, having the right of priority, must be retained.

Char. Horns short, conical, slightly curved backwards, black, and slightly annulated in the old animal; the colour of the animal entirely white, furnished with long silky hairs, and a fine wool beneath the hair; no mane.

Dimensions. In bulk it exceeds the sheep.

Description. Body elongated, but little elevated on the legs; facial line straight; ears rather long and pointed, covered on the inside with long hairs; the neck short; the tail stumpy and directed upwards; the whole structure of the animal robust; the colour is entirely white; the bulk of the animal is considerably increased by a thick coat of long straight hair, of a yellowish tinge; side of the lower jaw, and beneath the throat, furnished with a long beard; beneath the long hair, the skin is covered with a close downy wool, of a clear white colour, and in young animals feeling like unspun cotton; on the face and legs the hair is short and close, similar to that of the sheep and goat; the eye-lashes are white; the horns are about five inches long, above an inch in diameter at base, bending slightly backwards, having two or three annuli, and terminating in a point not always obtuse: the legs exceed

9

in thickness those of a calf; the fetlocks are short and perpendicular, and the hoofs are of a jet black, high, broad, and with deep grooves in the soles.

Remarks.—Like the goat, the facial line is nearly straight in the *C. montana*, this line being more or less arched in the sheep and antelope. Like the goat, the *C. montana* is furnished with a long beard; the sheep and the antelopes being destitute of this appendage.

In the form and size of the hoofs; in the direction of the tail; in the form of the snout; in the strength and proportion of the limbs in particular, and of the body in general, our animal resembles the goat, and is unlike the sheep and antelopes; the latter animals have furthermore, never been known to possess a covering consisting of fine long hair, and wool of exceedingly delicate texture, whilst, in this respect, our animal bears a striking analogy to the *Cashmere goat.* Though the horns are at best uncertain characters, varying as they do in form, in similar species, yet, even in this respect, our animal offers stronger analogy to the goat than to the nearest allied congenera.

The horns of the young male goat are very similar to those of the *Capra montana.*

Habit and Country.—For the following information concerning this highly interesting animal, we are under many obligations to Major S. H. Long, being chiefly the copy of a letter addressed by him to the Philadelphia Agricultural Society.

"The information I am able to furnish, was obtained on the late expedition to the sources of St. Peter's river, &c. and was procured principally from Donald M'Kinzie, Esq. (of the family of Sir Alexander M'Kinzie,) stationed at the junction of the Assiniboin and Red rivers, in the capacity of chief factor for the Hon. H. B. Company on that station; the intelligence furnished by this gentleman was from personal observation.

"The Rocky Mountain sheep inhabit the elevated region comprised in that portion of the mountain range from which its name is derived, situate between the forty-eighth and sixtieth parallels of north latitude.* They are found in great numbers near the head waters of the north fork of Columbia river, where their flesh constitutes the principal food of the natives. The country at the sources of Muddy river, (Marais river of Lewis and Clark,) Saskatchawin and Athabaska rivers are also inhabited by them; but they are said to be less numerous on the eastern slope of the Rocky Mountains than upon the western; they are seldom or never seen at a distance from the mountains, the climate and productions of which appear best adapted to their nature and mode of life. In summer they resort to the peaks and ridges in quest of pasture, but retire to the valleys in winter. The size of the animal is nearly the same of the common sheep; their fleece is white, interspersed with long hair, protruding beyond the wool, and standing erect on the surface of the body, which gives them a shaggy appearance; their horns are short, merely projecting beyond the wool of the head, and slightly arcuated backwards; these, together with their hoofs, are black, while the other parts of their bodies are uniformly white; their flesh has a musky flavour, and is, at best, unsavoury.

"They are of easy access to the hunter, who seldom pursues them unless compelled by hunger. Their fleece is esteemed of little value by the traders, and are used only as a covering to the feet during winter; their skin is of a remarkably thick and spongy texture. It has been asserted by good judges, that the silky fineness of the wool is not surpassed by that of the Cashmere goat."

* Lewis and Clark observed this animal as low as forty-five degrees of north latitude. Vid. Exped. up the Missouri, vol. ii. pp. 35, 49.

Description of a new Species of Manatus, or Sea Cow, inhabiting the coast of East Florida.

MANATUS *latirostris,* (Nob.)

THE Lamantins are but imperfectly known. Gmelin and Shaw admit only one species, (TRICHECUS *Manatus;*) and yet confound the animal of Steller (Lamantin du nord) with the true Lamantin. Buffon distinguishes five species; but two of these are purely nominal, as M. Cuvier has demonstrated, who only acknowledges the Lamantin of America, and the Lamantin of Senegal. According to him the Lamantins of the East Indies are nothing more than Dugongs; and the Lamantin of Kamtschatka ought to be referred to the Rytina (Illig.) These animals inhabit the shores of the sea, and principally about the mouths of rivers; they are confined to the torrid zone, and, as far as is known, to the Atlantic ocean only.

The MANATUS *Americanus* (Cuvier) has hitherto been described as existing only on the shores of South America and the West Indies. The species I am about to describe, is on the most accurate comparison found to possess all the characters by which Cuvier has distinguished the Senegal from the American Lamantin; the differences which Buffon thought he had remarked as separating the former from the latter do not exist.

But Cuvier has observed others more important in the form of the head, which part alone, he has been able to compare in these two animals. That of the American Lamantin is more elongated, but less elevated in proportion to its breadth, which is due principally to the snout and nares; the nasal fossæ are much wider and shorter in the African, than in the American species. This last has the orbits less separated, the temporal fossæ less wide and longer; the zygomatic apophyses of the temporal bone less ventricose. The inferior part or base of the lower jaw is curved in the African species; in the American it is straight.

The specimens of this animal from which I have drawn its characters, consist of two skulls, two ribs, and a strip of *skin*, seven feet six inches in length, half an inch thick; one of the heads wants the lower jaw, and is nearly perfect, with the exception of the zygomatic arch: the other is less perfect, but has the lower jaw. The former has four perfect teeth and four empty sockets on each side, making eight teeth on both sides when complete; the crown of the last tooth does not project above the alveola; the latter specimen presents the same number and appearance; the socket of the anterior tooth is nearly obliterated, whilst the crown of the last tooth had not yet protruded through the gum; which corresponds with the idea of Cuvier respecting the dentition of this animal, who says, he has reason to believe, that independently of the milk teeth, one or two of the anterior molares fall, as in many other herbivorous animals, in proportion as the posterior are developed.

The number of teeth of the Lamantin is not correctly ascertained; Cuvier estimates them at thirty-six; nine on each side; in both of my specimens they do not exceed thirty-two, eight on each side.

I am indebted for these specimens to Dr. Burrows, who collected them, together with several skulls of the alligator, (Crocodilus *lucius*, Cuv.*) on the coast of East Florida, in the year 1822.†

* Which likewise differs from the Crocodilus *acutus* of the West Indies, and from the South American alligators. (C. *palpebrosus* and *sclerops*.)

† Dr. Burrows obtained from the natives the following account of these animals.

The following table will afford a comparative estimate of the three heads.

Comparative dimensions of the three heads.

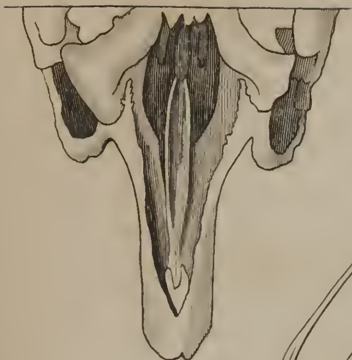
	American Head.	Senegal Head.	Head from Florida.
	Inches.	Inches.	Inches.
Total length - - - - - -	14.6	12.6	13.5
Length from the occipital crest to the superior border of the nares - - -	5.4	5.4	5.5
Length of opening of the anterior nares -	6.5	4.2	6.3
Width of the same - - - - - -	2.	2.4	4.3
Length from the inferior border of the nares to the end of the snout - - -	2.2	2.	2.6
Breadth of the occiput - - - - -	6.7	7.2	7.4
Smallest distance between the temporal crests (which is across the parietal bone)	1.3	1.3	1.5
Distance of the post obitar apophysis from the frontal - - - - - -	5.1	5.1	5.6
Distance from the anterior tooth to the end of the snout - - - - - -	7.2	4.8	5.
Distance from the top of the head to the crown of the teeth - - - - -	4.4	4.8	5.

It is not necessary to describe particularly the lower jaw of this animal, we have only to refer to fig. 1st, to be convinced of its exact resemblance to the MANATUS *Senegalensis;* and figures 2nd and 3rd compared with figures 4th and 5th of the cranium of this animal, (in Cuvier Anim. foss. vol. 4th,) afford the same results; another difference distinguishing this animal as well as the

"They are found in considerable numbers about the mouths of rivers, near the capes of East Florida, lat. 25°. The Indians kill them with the harpoon, during the summer months. One Indian has been enabled to capture ten or twelve during a season. They measure from eight to ten feet, and are about the weight of a large ox."

We have reason to believe this species inhabits the West Indies, and is probably the same animal mentioned by Capt. Henderson, in his account of the British settlement of Honduras, (1809.)

Fig. 5.



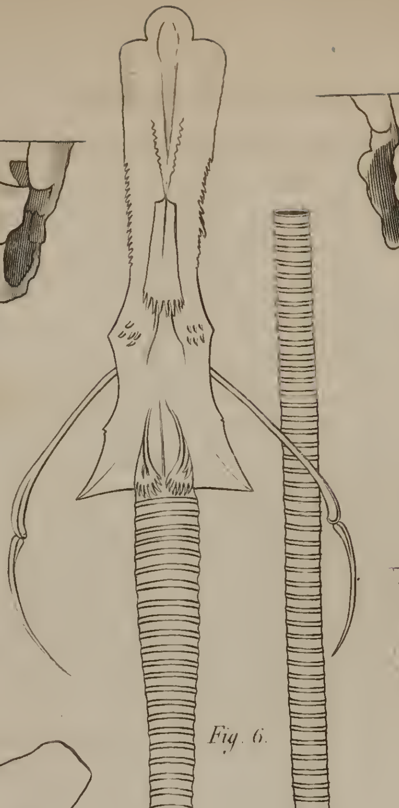


Fig. 6.

Fig. 4.

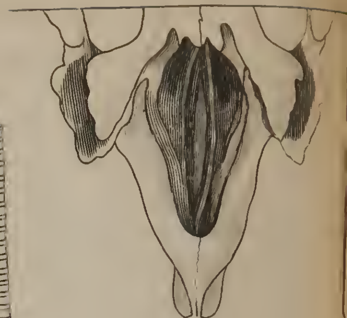


Fig. 3.

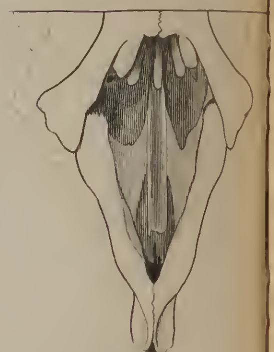


Fig. 2.

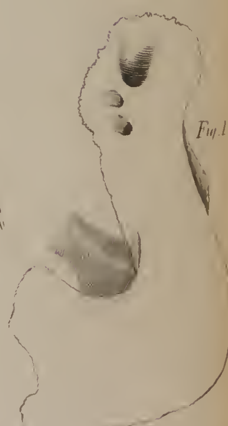


Fig. 1

T R Peale

Senegalensis, is a greater depth of the nasal process of the intermaxillary bone, fig. 2nd. (a.)

From this comparison it results that the characters detailed by Cuvier as separating the African from the American Lamantin, do not apply to those of North America; and we are made acquainted with the interesting fact, of the existence of two species of MANATI on the coast of North and South America. However, should further investigation and examination of the living animal from Florida, prove it possessed of some *external* characters sufficient to render it specifically distinct from the "*Senegalensis*," then this species will require to be designated by an appropriate name, in order to distinguish it from the other Lamantins hitherto described; and as the snout of the former appears to be wider below the eyes, than in both the latter, we propose that it shall be denominated MANATUS *latirostris*, which distinction, though useful to naturalists in general, would be particularly so to the oryctologist.

EXPLANATION OF THE PLATE.

Fig. 1. Lateral view of the Florida head.
2. Lower jaw.
3. Opening of the anterior nares.
4. Same of the Senegal.
5. Do. South American.

Description of the Delphinus intermedius—a new Species of Grampus, inhabiting the Coast of New England.

Delphinus *intermedius.* (Nob.)

Char.—Above, shining black; side of the abdomen and neck marked with the continuation of the white colour of the abdomen and throat; beneath, varied with white; tail, compressed, terminating in a deep constriction just before the caudal fins.

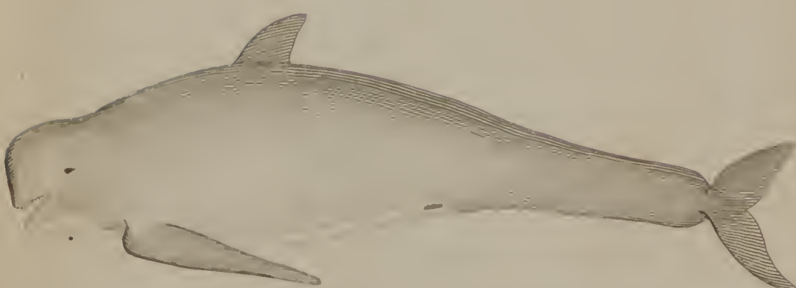
Dimensions.—Length, sixteen and a half feet; girth of the largest part, ten feet; length of the pectoral fins three feet eleven inches; rictus of the mouth, nine inches; pectoral fins, one fourth, dorsal fin one-thirteenth of the total length. Inhabits the coast of New England.

Description.—Colour uniformly black above, with a white patch beneath the throat, becoming a narrow longitudinal strip on the breast between the fins, and a broad longitudinal band on the abdomen; teeth about twenty in each jaw, small, prismatic, slightly reflected, and projecting half an inch above the gums; head blunt, cylindrical, and anteriorly sub-globose; body slightly compressed, tail strongly compressed, almost carinated, and much constricted just before the caudal fins.

This individual, a female, was harpooned in the harbour of Salem, (Massachusetts) in the month of Sept. 1823. The preceding facts, together with a drawing taken from the recent animal, are due principally to our zealous friend, Dr. Charles Pickering, late of Salem, Mass.

Fig 1

Rana dorsalis



Delphinus Intermedius

Distinctive characters.—The animal at first view, evidently belongs to the sub-genus *Phocæna*, (Cuv.) or such Dolphins as have the snout short and ventricose, without a beak, numerous teeth in both jaws, and a dorsal fin.

Our species bears the closest resemblance, in some respects, to the Delphinus *grampus*,* and Delphinus *globiceps*,† but is distinguished from both by the caudal constriction, as well as in its form, proportions, and markings; the dorsal fin is also proportionably much smaller than in either; the head of the globiceps is more ventricose, and the latter species is chiefly found on the coast of Europe. We have accordingly placed our species in the systems between the two, and named it *Intermedius*.

* *D. grampus*, Hunter, Cuvier, Desm., &c. Figured by Bonnaterre, Cetologie, p. xxii. No. 4. pl. 12. fig. 1., and Duhamel, Peches, pl. ix. fig. 1.—*D. Grampus*, Harlan, Fauna Americana, p. 287.

† *D. globiceps*, Cuv. Rapport sur les cétacès échouès a Paimpol, An. du Mus., tom. 19, pl. 1, fig. 2 & 3. Idem, Animaux fossiles, Ed. 2. vol. v. p. 285.—*Delphinus melas*, Traill. Nicholson's Journal, vol. xxii. p. 81.—*Delphinus deductor*, Scoresby. —*Dauphin à tête ronde.* Desm. sp. 777. p. 519.

Notice of certain prepared specimens of Quadrupeds of the United States and Territories—lately exhibited in Philadelphia.

1. RACCOON, perfectly white, and of the usual dimensions, from the trans-Mississippi country; also one of very large dimensions. Total length three feet six inches, height one foot.

2. Felis *fasciatus?* perhaps a *variety* of the Striped Lynx, a species hitherto imperfectly described.

Char.—Above grayish-brown; *beneath* whitish; *legs* spotted with black, externally of the same colour with the back, internally of the colour of the abdomen; sides of the face and snout fasciated longitudinally: *tail* short, black at the extremity: long retreating hairs on the cheeks: *ears* moderately pencilled with hairs.

Dimensions.—Length of the body seventeen inches; of the head and neck six inches; tail four inches; height at the withers one foot.

3. MINK, from Missouri, a strong marked variety (if not a distinct species) of the MUSTELA LUTREOCEPHALA, (Nob.) vid. Fauna Americana, page 63.

Description.—Nose black; tail black and exceedingly bushy: above blackish-brown; beneath, blackish: legs entirely black: a transverse black band on the upper and back part of the root of the neck anterior to the scapulæ: ears hairy, small and oval, blackish without, whitish within: three small molars above, four below; large molars two in each jaw on either side; incisors six in each jaw; canines large and strong.

Dimensions.—Length of the body ten inches; head and neck six inches; tail fourteen inches; height at withers nine inches.

4. A Fox, from the N. W. Territory, if not a distinct species, at least a strongly marked variety of the *Canis cinereo argenteus*.

Description.—Above blackish-gray; beneath silvery-white, and blackish along the middle of the abdomen; legs entirely black; ears blackish without, whitish within, hairy: cheeks furnished with long and silvery hairs: nose and whiskers black; tail very bushy and black, except at the root, which is surrounded with gray.

Dimensions.—Length of the body fifteen inches; head and neck eight inches; tail eighteen inches; height thirteen inches.

Observations on a large Skeleton recently disinterred from the mouth of the Mississippi River.

These bones have excited much curiosity in this country, and have even been noticed in some European publications: they have been referred, by different individuals, to the fossil remains of some extinct animals, and it has been proposed by the late Dr. Godman to construct upon them a new fossil genus, to be designated "Megistosaurus." (Greatest of all lizards.)

In a verbal communication, which I had occasion to make to the Academy of Natural Sciences, some months since, before I had an opportunity of examining these remnants, I offered it as my opinion, (judging from the descriptions which I had received concerning this subject, from persons unacquainted with natural history,) that they were the remains of some large Cetaceous animal.

On a late visit to Baltimore, I enjoyed the opportunity of a particular examination of these specimens, and was gratified to learn, that the opinions which I had previously formed were correct.

On the first view, it was very easy to perceive that the bones were not *fossil*, but that they were portions of the skeleton of the recent spermaceti whale, "*Physeter macroeephalus.*" Indeed the situation, or geological relations of these bones would preclude the possibility of their being fossil.

The remains of three different individuals were distinguishable, and the following parts were noticed.—The largest portion consists of the superior maxillary bone of the left side—the total length of which, measured in the direction of its curvature exteriorly, is seventeen feet three inches, the greatest breadth thirteen inches; there are belonging to the same animal seven dorsal vertebræ, six lumbar, and five caudal, with two ribs, all in a perfect state of preservation.

The os humeri, radius and ulna, have belonged to another whale of much smaller dimensions. A cervical vertebra and the lower jaw of a very young whale-calf were also observed. The teeth, several in number, from the lower jaw of the large individual, were detached and slightly broken at their bases; the largest measures six inches in length and six and a half in circumference.

The long process of bone, or "*horn*" as it has been called by several observers, is a mutilated portion of some of the facial bones, erroneously attached to a process on the upper and outer side of the large bone.

On comparing the large bone, with the same portion in the specimen of the head of a similar animal in the cabinet of the Acad. of Nat. Sc. Philadelphia, known to have been thirty feet in length, (and to have yielded eighteen or twenty barrels of oil,)—and on taking the comparative measurements, the animal whose remains we are discussing, is demonstrated to have been about fifty three feet in length.

The average size of the common spermaceti whale is from forty to sixty feet; they inhabit the polar regions principally, but are sometimes found in the temperate regions. The *Physeter trumpo* (Desm.) which according to Linnæus and Cuvier, is only a variety of the *P. macrocephalus,* is an inhabitant of the coast of Bermuda and of North America.

The skeleton of the head of the P. macrocephalus is figured by Baron Cuvier, Oss. foss. vol. 5. pt. 1. pl. 34.

*Revised Catalogue of the Mammiferous Animals of North America.**

Order *PRIMATES.*

Genus Homo.

H. *sapiens.*

The most approved writers on the physical history of our species, admit but five principal varieties, viz. Caucasian—Mongolian—American—Negro, and Malay.

Order *CARNIVORA.*

Family CHEIROPTERA.

Genus Rhinopoma.

R. *caroliniensis.*

Genus Vespertilio.

V. *caroliniensis.*
V. *noveboracensis.*
V. *pruinosus.*
V. *arquatus.*
V. *subulatus.*
V. *auduboni.*

Genus Taphozous.

T. *rufus.*

Family INSECTIVORA.

Genus Sorex.

S. *minutissimus.*
S. *brevicaudatus.*

Genus Scalops.

S. *canadensis.*
S. *pennsylvanica.*

Genus Condylura.

C. *cristata.*
C. *macroura.*
C. *longicaudata?*

* Vid. Harlan's Fauna Americana.

Family CARNIVORA.

First Tribe PLANTIGRADA.

Genus URSUS.

U. *arctos.*

U. *cinereus.*

U. *americanus.*

U. *maritimus.*

Genus PROCYON.

P. *lotor.*

Genus MELES.

M. *labradoria.*

Genus GULO.

G. *arcticus.*

Second Tribe DIGITIGRADA.

Genus MUSTELA.

M. *vulgaris.*

M. *erminia.*

M. *lutreocephala.*

M. *vison.*

M. *canadensis.*

M. *martes.*

Genus MEPHITIS.

M. *americana.*

Genus LUTRA.

L. *brasiliensis.*

L. *marina.*

Genus CANIS.

C. *familiaris.*

C. *lupus.*

C. *lycaon.*

C. *latrans.*

C. *nubilus.*

C. *vulpes.*

C. *argentatus.*

C. *virginianus.*

C. *fulvus.*

C. *cinereo-argenteus.*

C. *velox.*

C. *lagopus.*

Genus FELIS.
F. *concolor.*
F. *onca.*
F. *pardalis.*
F. *canadensis.*
F. *rufa.*
F. *fasciata?*
F. *aurea?*
F. *montana.*

Third Tribe PINNIPEDIA.

Genus PHOCA.
P. *cristata.*
P. *vitulina.*
P. *groenlandica.*
P. *fetida.*
P. *barbata.*

Genus OTARIA.
O. *ursina.*

Genus TRICHECHUS.
T. *Rosmarus.*

Genus MANATUS.
M. *latirostris.*

Family MARSUPIALIA.

Genus DIDELPHIS.
D. *virginiana.*

Order *RODENTIA.*

First Section—*Furnished with Clavicles.*

Genus CASTOR.
C. *fiber.*

Genus FIBER.
F. *zibethicus.*

Genus ARVICOLA.
A. *amphibius.*
A. *xanthognatus.*
A. *palustris.*
A. *hortensis.*
A. *floridanus.*
A. *pennsylvanica.*
A. *nuttalli.*
A. *ferrugineus.*

Genus Lemmus.

L. *hudsonius.*

Genus Mus.

M. *rattus.*

M. *musculus.*

M. *sylvaticus.*

Genus Geomys.

G. *bursarius.*

Genus Gerbillus.

G. *canadensis.*

G. *labradorius.*

Genus Arctomys.

A. *monax.*

A. *empetra.*

A. *ludoviciana.*

A. *tridecemlineata.*

A *franklinii.*

A. *richardsonii.*

A. *parryii.*

Genus Sciurus.

S. *cinereus.*

S. *capistratus.*

S. *rufiventer?*

S. *niger.*

S. *magnicaudatus.*

S. *quadrivittatus.*

S. *lateralis.*

S. *grammurus.*

S. *hudsonius.*

Genus Spermophillus.

S. *striatus.*

Genus Pteromys.

P. *volucella.*

P. *hudsonius?*

Second Section—*Destitute of true Clavicles.*

Genus Hystrix.

H. *dorsata.*

Genus Lepus.
L. *americanus.*
L. *glacialis.*
L. *virginianus.*

Order *PACHYDERMATA.*

Genus Sus.
S. *scrofa.*

Genus Dicotyles.
D. *torquatus.*

Order *RUMINANTIA.*

First Tribe—Horns osseous and deciduous.

Genus Cervus.
C. *alces.*
C. *tarandus.*
C. *canadensis.*
C. *virginianus.*
C. *macrotis.*

Second Tribe—Horns with a sheath surrounding an osseous core.

Genus Antilope.
A. *americana.*

Genus Capra.
C. *montana.*

Genus Ovis.
O. *ammon.*

Genus Ovibos.
O. *moschatus.*

Genus Bos.
B. *americanus.*

Order *CETACEA.*

First Family—SIRENIA, or HERBIVOROUS WHALES.

Genus Manatus.
M. *latirostris.*

Genus Stellerus.
S. *borealis.*

Second Family—or WHALES PROPER.

Genus Delphinus.
D. *coronatus.*
D. *canadensis.*
D. *phocæna.*
D. *gladiator.*
D. *grampus.*
D. *leucas.*
D. *anarnachus.*
D. *intermedius.*

Genus Monodon.
M. *monoceros.*
M. *microcephalus.*

Genus Physeter.
P. *macrocephalus.*
P. *trumpo.*

Genus Balæna.
B. *mysticetus.*
B. *glacialis.*

Genera of North American REPTILIA, *and a Synopsis of the Species.*

THERE are few departments of natural science which, to American naturalists, have given rise to more investigation, than the history of the REPTILES of our widely-extended country. Within a very few years, most important facts have been elicited, and many new and interesting species have been added to a list, formerly extensive. The great obscurity and confusion peculiarly prevalent in the descriptions of authors who have written on this subject, though gradually dissipating, are by no means sufficiently cleared. To the student of *Herpetology*, whether general or local, a systematic arrangement of all the N. A. genera, with scientific descriptions of their species, cannot but be a desirable object.

Brongniart's division of the reptiles into four orders, viz: CHELONIA, SAURIA, OPHIDIA, and BATRACHIA, is universally acknowledged, and justly esteemed. As all systems are arbitrary, we shall take the liberty of deviating from the numerical arrangement of this author, and commence with that ORDER which best comports with our present convenience.

BATRACHIA.*

Characters of the ORDER.—Heart with a single auricle and ventricle; the latter destitute of fleshy columns, and discharging the blood by one opening: skin naked, usually lubricated by a mucous secretion: no external organs of generation in the male: fecundation external: the eggs

* From βατραχος—animals resembling frogs.

are deposited in the water: the young are hatched in that element, and at first possess branchiæ, which, in some genera, are persistent; in others, are absorbed when the lungs have acquired the proper degree of development: all destitute of true ribs, and possessing the faculty, more or less extensive, of changing their colours at will.

1st Division.

Branchial fenestræ* persistent: skull composed of a solid piece.

1st Genus. AMPHIUMA. Garden. Linn. Harlan.

Characters of the Genus.—Teeth in both jaws; legs, four, slender and jointless: toes before and behind, jointless, clawless.

The genus consists of two species.

Amphiuma *means.* Garden.

Synonyma. *Amphiuma means*, Garden. Smith's correspondence of Linnæus.
Amphiuma means, Harlan. Journal of Philad. A. N. Sc. Vol. 3—and Annals of the N. Y. Lyceum of Nat. Hist. Vol. 1. p. 269, pl. xxii.
Sireni simili, Linn. Smith's correspondence of Linnæus.
Chrysodonta larvæformis, Mitchell, Med. Recorder, No. 19. Vulgo, *Congo snake*.

Char.—*Colour,* dark brown; or slaty, with a bluish tinge on the sides, and the belly rather lighter: *head,* long, tapering, depressed: *mouth* extending half the length of the jaws: *teeth,* two rows above, and one below, with their points somewhat flattened and reflected: *legs,* small, distant, with rudiments only of bones concealed in the flesh, and with two clawless toes, the external the longest: mi-

* In common with several authors, we have hitherto used the term "Opercula," (coverings,) to express the idea intended by *branchial fenestræ*, (Gill openings.) The term "Spiracula," (breathing holes,) which is occasionally used as synonymous, is equally objectionable, as it conveys an erroneous idea.

nute rudiments of ribs attached to the transverse processes of the five or six dorsal vertebræ.

Habit.—Burrowing in the mud, in swamps, or in the vicinity of streams, where it searches its food, and hybernates; occasionally visiting the dry land.

Growing to the length of three feet.

Inhabits the southern Atlantic states, from South Carolina to Mexico. Specimens are common of late, in most of our museums. The species was for a long time neglected or unknown.*

AMPHIUMA *tridactylum.*

A. *tridactylum.* Cuv. Mem. lu à l'Acad. des Sc. le 13 Nov. 1826. Avec pl.

"The description of the Amphiuma *means* will apply in almost all respects to the species with three toes. Its general form is the same; its length is twenty times its diameter; the length of its head is nearly one-fourteenth of the body; the tail constitutes exactly one-fourth. In a word, in order to distinguish them it is necessary to confine our attention to the extremities; when we observe that the hands and feet are divided each into three toes perfectly distinct, which constitutes the only visible external character."

A specimen in the Cab. of the Americ. Philos. Soc. from the Arkansaw, and in the Baltimore Museum, from the vicinity of Fort St. Philip, found several feet beneath the recent alluvial deposit, under a decayed trunk of a tree.

* June, 1829, received from Mr. F. Nesbit, of Alabama, thirty-four specimens of A. MEANS, from one-half foot, up to three feet in length.

Small fish and beetles were found in their stomachs. The size of the legs did not increase in proportion to the size of the animal. The largest measured six inches round the head.

2nd Genus. MENOPOMA. Harlan.

Characters of the Genus.—Destitute of branchiæ at all periods of its existence: four strong legs: toes clawless: one or more rows of teeth in both jaws.

As yet only a single species of the genus is known.

Menopoma *alleghaniensis.*

Synonyma. *Salamandra alleghaniensis*, Michaux.
Salamandra gigantea, and *S. horrida*, Barton.
Protonopsis horrida, Barton.*
Salamandre des monts alleganiens, Sonnini and Latreille.
Abranchus alleghaniensis, Harlan. Annals of Lyceum, Vol. 1, p. 233. pl. 17.
Menopoma alleghaniensis, Harlan. Annals of Lyc. N. Y. Vol. 1. p. 271.
Triton alleghaniensis, Daudin.
Molge gigantea, Merrim.
Vulgo, *Hell-bender*, *Mud-devil*, *Ground-puppy*, *Young alligator*,—and *Tweeg*, by the North American Indians.
Confounded with the *Proteus of the Lakes*, by Dr. Mitchell. Vide Silliman's Journal, Vol. IV. and VII. Also by Baron Cuvier, Animaux fossiles, 2d. edit. Vol. V. p. 417. Indicated as the young of the *Triton lateralis*, or "Proteus of the Lakes," by Say; vid. Journ. of A. N. S. Vol. 1.

Char.—*Lower jaw* furnished with a single row of teeth: *upper jaw* with two concentric rows: four strong legs: five toes behind, four before: the outer edge of the feet fimbriated: two outer toes of the hind feet palmated, clawless. Vid. Annals of the N. Y. Lyceum of Nat. Hist. Vol. 1. p. 222.

Inhabits the Ohio river and its tributaries.

2d Division.

With persistent branchiæ: skull composed of separate pieces.

3d. Genus. SIREN. Linn.

Characters of the Genus.—Body anguilliform; two anterior legs, toes small and clawless.

At present this genus consists of three species, the type of which is the

* A name proposed without a description, is not adopted by Zoologists.

SIRENA *lacertina*, Linn.

SYNONYMA. *Murœna siren*, Gm. Linn.
Murœna siren, Turt. Linn. and Stewart's Elements.
Mud iguana, Ellis. Amer. Philosoph. trans. Vol. VI. p. 189.
Siren lacertina, Barton.
S. lacertina, M. P. de Beauvois.—Fig. passim.

Char.—*Toes* four, clawless; long in the following order, commencing at the interior, 2, 1, 3, 4: *teeth*, two very minute rows surrounding the lower jaw: the anterior portion of the palate furnished with two oblong eminences arranged obliquely, as respects each other, and studded with minute teeth: a few teeth scattered over the middle of the anterior palate: *body* black above, dusky beneath, sometimes speckled: three branchial appendages, the lowermost the longest, all with lateral fringes: three gill-openings, or branchial fenestræ, the interior edges serrate, as in the gills of fishes: *tail* compressed, with narrow rayless fins, above and below.

Habit.—The Siren conceals itself in the mud, occasionally visiting both land and water.

Inhabits the southern states, from South Carolina to Florida: common in the vicinity of Camden, S. C. Specimens common in public and private collections.

SIREN *striata*, Le Conte.

SYNONYMA. *Siren striata*, Le Conte, Annals of the Lyceum, N. Y., Vol. I. pl. 4.
Pseudo-branchus, Gray. Vulgo, *guana*.

Char.—*Legs* feeble; three clawless toes: *branchiæ* three on each side, with a fleshy trilobate covering; the lobes entire and naked: *colour* dusky, with a broad brown stripe on each side: length nine inches: teeth?

Habit.—Frequents mud-swamps, but does not burrow in the ground.

Inhabits South Carolina.

SIREN *intermedia*, Le Conte.*

Char.—*Colour* resembling that of the *Lacertina;* branchiæ resembling those of the *Striata*. Length about one foot.

Inhabits the southern states—specimens in the cabinet of the Lyceum, and in the cabinet of the A. N. S.

4th GENUS. MENOBRANCHUS. Harlan.

Characters of the Genus.—Persistent branchiæ: four footed, toes clawless: jaws armed with teeth. The genus consists of two or three species, the type of which is found in the

MENOBRANCHUS *lateralis.*

SYNONYMA. *Salamandra alleghaniensis*, (young,) Say. Journ. A. N. S., Vol. I.
Triton lateralis, Say, Long's Exped. to the Rocky Mountains, Vol. I. p. 5.
Proteus of the Lakes, Mitchill, Silliman's Journal, Vol. VII. p. 63.
Menobranchus lateralis, Harlan, Annals of the Lyceum, Vol. I. pl. 16.

Char.—A black vitta from the nostrils passing through the eyes, and dilated on the sides, becoming obsolete on the tail. *Feet* four; four toes to each foot, clawless: *teeth*, two rows in the upper, one in the lower jaw; conic, obtuse and small: *body* brown, spotted with black: *tail* ancipital. Length from one to two feet.

Habit.—Aquatic, carnivorous, gluttonous.

Inhabits the Lakes and the Ohio, with its tributaries. Specimens in the cabinet of the A. N. S.

Variety, A.—"*Proteus of the Lakes*" of Professor Mitchill.

Char.—Destitute of the lateral line: colours lighter; blackish spots more numerous.

Cabinet of the A. N. S.

* Manuscript notes.

MENOBRANCHUS *tetradactylus*.

SYNONYMA. *Proteus tetradactylus*, Lacepède. Ann. du Mus. Vol. X. p. 230. figured.

Char —Teeth two rows in each jaw; a duplicature of skin forming a collar, partially surrounding the superior part of the neck, anterior to the branchiæ: four toes to each foot, clawless. Length 6-4 inches, French.

Observations.—We have lately examined some fine specimens of the *Mexican Axolotl*, or Siren *pisciformis* of Shaw, contained in the cabinet of the Lyceum. The animal being furnished with teeth, and the branchiæ having every appearance of being persistent, we have little hesitation in considering it a perfect animal, and not a larva. It will very naturally arrange itself as a species of the present genus, along side of the Menobranchus *lateralis:* it has one toe more on the hind foot, which circumstance indicates the transition of this genus to the Salamandra.

In concluding our observations on this genus, we regret to remark that some authors have very unadvisedly, we think, confounded it with the genus PROTEUS of Laurenti.

In a recent number of the American Journal of Science and Arts,* we observe an error of this description: the author gravely quotes twenty "particulars," in which he thinks the two genera "resemble each other," when nearly one half the genera included in the whole order resemble each other in the same "particulars;" and which, taken collectively, will characterize no particular genus. In order to obviate the possibility of a similar error in future, we offer to the students of herpetology the following *generic* characters afforded by the type of the genus under consideration. They differ from each other widely in their general form and anatomical details, but more par-

* Vol. XI. No. 2. p. 227. Oct. 1816.

ticularly in osseous structure. The Proteus has thirty vertebræ, exclusive of the caudal, and seven false ribs on each side: the Menobranchus is furnished with nineteen vertebræ, and eighteen false ribs;* the Proteus has three toes before, and two behind: the Menobranchus, four toes to each foot: the pelvis of the former is attached to the 26th vertebra, the pelvis of the latter to the 19th. Lastly, the habits and geographical distribution of the two genera are altogether at variance. Differences, which, taken collectively, are more than sufficient to establish a generic distinction.

Compared with the other genera of this order, the Proteus of Laurenti, and the Menobranchus, will be found to be precisely those which are the most widely separated from each other; in most of its internal anatomical characters, the latter genus is much nearer related to the Salamandra than to the Proteus.

3d Division.

Breathing with lungs only in an adult state; branchiæ and their fenestræ deciduous.

Tail persistent, teeth in both jaws.

5th Genus. SALAMANDRA. Brongniart.

Lacerta Salamandra, Linn.

Characters of the Genus.—Body elongated, lacertine: tail long: feet four: toes, four before, five behind: ears concealed beneath the skin: no tympanum: jaws armed with numerous small teeth, and with two longitudinal palatine rows: tongue adhering at its sides, reflected at the

* "Les animaux de même genre ont ordinairement des nombres des côtes et de vèrtébres à peu près semblable."—*Cuv. Anim. foss.* V. 5. *pt.* 1. *p.* 81.

extremity:* no sternum: numerous false-ribs: branchiæ in the larva state: membranaceous opercula covering the branchial fenestræ: breathing with vesicular lungs in the adult state, at which period the rudiments of the cartilaginous arches of the branchiæ remain attached to the os hyoides: anterior extremities developing before the posterior. The "modus copulandi" is peculiar to the genus; the sexes unite their bodies anteriorly, and separate them below, forming an angle more or less acute; the male ejects a quantity of white, thick liquor on the female organs of generation; these organs are much swollen in both sexes, during the season of their amours. The seminal liquor vivifying only those ova which are situated near the orifice of the vulva: the whole of the eggs not being vivified at the same time, they require frequent reiterations of the act: the union of the sexes continues for twenty or thirty days, and is repeated several times in an hour: the wonderful faculty of reproduction observed in this genus is generally known. For important and interesting particulars connected with the history of the Salamanders, vide "Histoire naturelle des Salamandres de France, by P. A. Latreille," who has furnished us with the best figures of these animals. Laurenti reserving the name Salamandra to the S. *terrestris*, has described under the two generic names, *Triton* and *Proteus*, several aquatic Salamanders.

This genus is naturally divided into the terrestrial, or such as are furnished with tails more or less compressed, sometimes cylindrical, and seek their food on the land, and into the aquatic, or such as are furnished with compressed tails, and seek their food in the water. Like most animals of this order, the Salamandræ prey on living game only, which they seize leaping.

* Latreille erroneously states, as a natural character of the Salamandra, "Langue fixée dans toute sa longueur." Vid. Lat. Hist. Nat. des Salamandres de France.

Land Salamanders.

Tail more or less compressed, sometimes cylindrical, tapering.

The type of which in American species, is the

Salamandra *subviolacea.*

Lacerta punctata, Gmel.
Synonyma. *Lacerta venenosa.* Barton, Am. Phil. trans. fig. 1. Vol. VI.
S. *subviolacea*, Idem.
Lézard aquatique. C. S. Rafinesque.
Stelio.? Catesby, Carol. pl. X, fig. 10. *Le ponctuée*, Laccpède.
La Salamandre à points blanc, Sonnini.

Char.—Body black above, rather lighter beneath, with two longitudinal rows of yellow or whitish spots on the back, which become single on the lower half of the tail: *throat* with a strong cuticular fold: *tail* compressed at the end, cylindrical at the base, and about the length of the body; a few spots on the legs.

Length about seven inches.

Inhabits Pennsylvania. Cab. of A. N. S.

Note.—This species differs from the S. *terrestris* of Europe, principally in the form of the tail, and form and arrangement of the blotches.

A variety of this species is found in South Carolina, differing principally in being of a larger size, and in the arrangement of the blotches.

Salamandra *tigrina.*

S. *tigrina*, Green. Journ. Acad. Nat. Sc. Vol. VI. p. 116.

Char.—Tail rather longer than the body; tapering, compressed, and rounded at tip; *beneath* granulated, immaculate: *above* blackish, with numerous, large, irregular spots of pale ochre: *beneath* cinereous, irregularly marked with patches of an ochraceous colour: *throat* pale ochre. Length?

Inhabits New Jersey.

SALAMANDRA *cylindracea.*

S. *cylindracea*, Harlan. Journ. Acad. Nat. Sc. Vol. V. p. 156.

Char.—General colour blackish, clouded with confluent white blotches on the sides: *head* thick and oval: *tail* cylindrical, longer than the body: all the toes fissile: total length about five inches.

Inhabits South Carolina. Cab. of A. N. S.

May prove a variety of S. glutinosa.

SALAMANDRA *fasciata.*

S. *fasciata*, Green. Journ. Acad. Nat. Sc. Vol. 1. p. 350.

Char.—*Tail* about as long as the body, oval, tapering, and pointed: *back* brown marked with transverse, irregular blue bands, which extend over the upper part of the tail: *beneath* ash colour, or dark brown in the young animal.

Length five inches.

Inhabits New Jersey. A specimen was found hybernating beneath the moist leaves, in the woods: sometimes visits the water. Cab. of A. N. S.

SALAMANDRA *sinciput albida.*

S. *sinciput albida*, Green. Journ. Acad. Nat. Sc. Vol. 1. p. 352.

Char.—*Nose* white: *tail* shorter than the body, thick, tapering, and pointed: *above* dirty ferruginous: *beneath* yellowish.

Length three inches.

Inhabits New Jersey. Placed provisionally with the land salamanders, from the form of its tail.

SALAMANDRA *erythronota.*

S. *erythronota*, Raf. Green. Journ. Acad. Nat. Sc. Vol. 1. p. 356.

Char.—Tail rather shorter than the body, cylindrical, tapering, and pointed: *above* red, mixed with brown; the colours forming a stripe, from the snout to the end of the tail: *beneath* cinereous: *throat* whitish. The young have no brown mixed with the red.

Length four inches.

Inhabits New Jersey, Massachusetts, &c., under stones, &c., in high places.

SALAMANDRA *cinerea.*

S. *cinerea*, Green. Journ. Acad. Nat. Sc. Vol. 1. p. 356.

Char.—Tail longer than the body, cylindrical, tapering, and pointed: *back* dark brown, sprinkled with white dots: *beneath*, black and white, mixed: *throat* whitish. Toes very minute; four before, five behind.

Length four inches.

Inhabits New Jersey. Specimens in the cabinet of the Acad. from South Carolina. Perhaps a variety of erythronota.

SALAMANDRA *variolata.*

S. *glutinosa*, Green. Journ. Acad. Nat. Sc. Vol. I. p. 357.
S. *variolata*, Gilliams. J. A. N. S. Vol. I. p. 460.

Char.—Tail nearly twice the length of the body, slightly compressed near the end: *above* blackish, marked with white spots: *beneath* black.

Length six inches.

Inhabits New Jersey.

Salamandra *fusca.*

S. *fusca*, Green. Journ. Acad. Nat. Sc. Vol. I. p. 357.

Char.—*Tail* the length of the body, tapering, slightly compressed: *above* uniformly yellowish-brown: *beneath* white, with a line on each side of black spots: *throat* spotted with black.

Length three inches.

Inhabits New Jersey.

Water Salamanders.

Tail always vertically compressed, sometimes fringed; passing most of their time in or near the water.

Salamandra *maculata.*

S. *maculata*, Green. Journ. Acad. Nat. Sc. Vol. I. p. 350.

Char.—*Tail* about as long as the body, slightly compressed: *above* whitish, sprinkled with irregular, reddish-brown spots: *beneath* white.

Length, five inches.

Inhabits New Jersey, Massachusets, &c. Cab. of the A. N. S.

Salamandra *subfusca.*

S. *subfusca*, Green. Journ. Acad. Nat. Sc. Vol. I. p. 351.

Char.—*Tail* rather shorter than the body: *above* of an olive-brown, marked with dark spots: *beneath* yellowish, and spotted.

Length six inches.

Inhabits New Jersey. Perhaps a variety of S. maculata.

Salamandra *longicaudata.*

S. *longicauda*, Green. Journ. Acad. Nat. Sc. Vol. I. p. 531.

Char.—*Tail* nearly twice the length of the body, compressed and pointed: *above* yellowish-brown, spotted with black dots, assuming the form of transverse bands on the tail: *beneath* whitish.

Length six inches.

Inhabits the swamps of New Jersey. Specimens in the Cabinet of the Academy.

SALAMANDRA *nigra.*

S. *nigra*, Green. Journ. Acad. Nat. Sc. Vol. I. p. 352.

Char.—*Tail* the length of the body, oval and pointed: *above* blackish, sides sprinkled with white: *beneath* whitish.

Length four inches.

Inhabits Pennsylvania. Specimens in the cabinet of the Academy.

SALAMANDRA *flavissima.*

S. *bis-lineata*, Green. Journ. Acad. Nat. Sc. Vol. I. p. 325.
S. *flavissima*. H. Silliman's Journal, 1825.

Char.—*Tail* longer than the body, compressed: *above* cinereous, with two, sometimes three dark lines; if three the middle one broadest near the head, and about the length of the body: *beneath* whitish or yellowish.

Length three inches.

Inhabits New Jersey, Pennsylvania, and New England.

SALAMANDRA *rubriventris.*

SYNONYMA. S. *rubriventris*, Green. Journ. Acad. Nat. Sc. Vol. I. p. 353.
Perhaps a variety of S. maculata.

Char.—*Tail* shorter than the body, compressed: *above* blackish, with brown spots: *sides* red: *beneath* red.

Length seven inches.

Inhabits New Jersey. Cab. of the A. N. S.

SALAMANDRA *picta*.

S. *picta*, Harlan. Journ. Acad. Nat. Sc. Vol. V. p. 136.
S. *intermixta*, Green. Maclurian Lyceum, No. 1.

Char.—*Above* blackish or slate colour: *beneath* yellowish, or light orange colour: *skin* beneath the neck, folded: *head* large: *tail* nearly the length of the body, compressed at the end.

Length four inches.

Inhabits Pennsylvania. Specimens in the Cab. of the Acad.

SALAMANDRA *symmetrica*.

SYNONYMA. *Stelio*, Say, Silliman's Journal, Vol. I. p. 264.
S. *symmetrica*, Harlan. Journ. Acad. Nat. Sc. Vol. V. p. 158.

Char.—*Above* dusky brown or fuscous: *beneath* orange-yellow: a row of deep orange-coloured spots on each side of the spine, symmetrically arranged: *tail* compressed, longer than the body.

Length three inches.

Inhabits South Carolina and New England—sometimes under the bark of dead trees. Specimens in the Cab. of Acad.

SALAMANDRA *porphyritica*.

S. *porphyritica*, Green. Maclurian Lyceum for January, 1827. p. 3. pl. I.

Specific Characters.—"Cauda mediocri—corpore supra fusco, maculis albidis—subtus albido."

Length, between five and six inches: *tail* the length of the body, tapering, much compressed, and slightly carinated on the lower half of its upper and lower edges.

Habitat.—Pennsylvania. Cab. of Lyceum.

SALAMANDRA *Jeffersoniani*.

S. *Jeffersoniani*, Green. Maclurian Lyceum, ut supra.

Specific Characters.—"Cauda mediocri—corpore supra fusco, maculis cœrulis—subtus fusco."

Blue spotted Salamander.—*Length*, seven inches: *tail* as long as the body, slightly compressed: *skin* a light brown colour, rather darker above than beneath, with azure-blue points scattered irregularly over the whole surface.

Habitat.—Pennsylvania. Cab. of Lyceum.

Salamandra *cirrigera.*

S. *cirrigera*, Green. Journ. A. N. S. Phila. Vol. VI. p. 253.

Specific Characters.—"Cauda longiuscula corpore supra fusco—nigroque variato—lineis duabus distinctus—sincipite cirrigera—subtus albida."

Length three inches: *tail* rather longer than the body, slender and rounded: *snout* obtuse, with two short thick fleshy *cirri* projecting between the nostrils and the upper lip: *back* yellowish, speckled with white, a black line on each side edged with white: *beneath* whitish: femal e more robust, and destitute of cirri.

Habitat.—Louisiana, near New Orleans.

Salamandra *dorsalis.*

S. *dorsalis*, Harlan. Journ. A. N. S. Phila. Vol. VI. p. 101.

Specific Characters.—*Above* fuscous: *beneath* yellowish white: *tail* longer than the body, strongly compressed, ancipital: a whitish dorsal line extending from the occiput over the tail; a row of whitish-coloured oblong spots on each side of the dorsal line: *beneath* freckled with black dots.

Length three inches and eight-tenths; body, one inch and five-tenths; tail, one inch eight-tenths.

Inhabits South Carolina. Cab. A. N. S.

6th Genus. RANA. Linnæus.

The Linnæan genus Rana, includes the modern genera, Rana, Hyla, Bufo, and Pipa.

All the modern genera possess the following characters in common: four legs, with four toes before, five behind; sometimes the rudiment of a sixth: head flat, snout rounded: throat very large: tongue attached at the borders of the jaw, and reflected at the extremity: teeth, palatine: jaws serrated: skeleton destitute of ribs and sternum: eyes furnished with a third lid: inspire by means of the muscles of the throat; expire by the agency of the abdominal muscles: no tail in the adult state. Larvæ or Tadpoles, furnished with large fleshy tails, and small corneous beaks: branchiæ beneath the skin, attached to four cartilaginous arches. Feeding principally on insects, which they search for on dry land.

July 1827.—A Tadpole, detained in a glass jar, underwent its metamorphosis, or obtained all its limbs, in five weeks from the commencement; about which period it appeared to breathe with both branchiæ, and approached the top of the water to use its nostrils, also using its feet more and tail less in proportion as the limbs were completed—towards the middle of the sixth week, affects the surface of the water, and breathes through its nostrils—tail appears to become lighter and thinner daily.

Frogs, properly so called.

Genus. RANA. Of modern authors.

Characters of the Genus.—*Body* slender: hind feet very long, strong, and palmated: skin for the most part smooth: upper jaw serrated: palate armed with one or more transverse rows of teeth, or serrated eminences. The larvæ possess, mostly, but one branchial fenestra, and that always on the left side.

Rana *pipiens*.

Synonyma. *Bullfrog*, Bartram, Catesby, Brown, Kalm.
Rana maxima, Catesby, Nat. Hist. Carol. Vol. II. p. 72. pl.
Rana catesbiana, Shaw, Gen. Zool. Vol. II. part 1. p. 106. pl. 33.
Rana pipiens, Linn.

Char.—*Above* brown-cinereous: *beneath* whitish: *arms* and *legs* striped with black: *head* and fore part of the body more or less green.

Length of the body, from 6 to 10 inches; of the hind legs, from 8 to 12 inches.

Inhabits the middle states; common in the vicinity of Philadelphia. We have recently observed this species in Canada. Cab. of Acad.

Rana *clamata*. Clamitans. Bosc. Dict. d'Hist. Nat.

Synonyma. *Rana clamata*, Daud.
Le criard, Idem. Vulgo, *the bawling frog*.

Char.—*Above* dusky cinereous: *beneath* whitish: *snout* more or less green: *throat* yellow: *legs* white within, obsoletely banded without, or spotted with black.

Length of the body, about 3 inches; of the hind legs, 4 inches.

Inhabits the middle states; the most common of all our frogs. Cab. of Acad.

Rana *ocellata?*

Synonyma. *Rana maxima virginiana*, Seba.
Rana pentadactyla, Linn. Gmel.
Rana ocellata, Linn.
Argus frog, Shaw, Gen. Zool. Vol. III. pt. 1. p. 108. pl. 34.
Grunting frog, Bartram's Travels through North and South Carolina, &c. p. 276.
Rana grunniens? Daudin.

Char.—In form and size resembling the "Pipiens:" *above* brownish, or greenish, with irregular deeper coloured spots: *beneath* whitish, granulated under the belly and thighs; round brownish spots, surrounded with a clear teint upon the flanks, buttocks and thighs.

Inhabits Florida and Mexico. We have never seen this species.

Rana *melanota?*

Rana melanota, Rafinesque. Vulgo, *Black-frog.*

Char.—Back olivaceous-black: a yellow streak on the sides of the head: *chin, throat,* and inside of the *legs* whitish, with black spots: *belly* white, immaculate.

Total length $2\frac{1}{2}$ inches.

Inhabits Lake Champlain and Lake George.*

Rana *halecina.*

Synonyma. *Rana pipiens*, Schneider, Schreber, Shaw.
Rana aquatica, Catesby, Carolina, p. 70. Vol. II.
Rana ocellata? Kalm, Trav. in North America, Vol. II.
Shad frog, Bartram, Trav. p. 278.
R. halecina, Daud.

Char.—Above light cinereous: *beneath* white: marked above with irregularly disposed blotches: *body* and *limbs* elongated.

Length of the body $3\frac{1}{2}$ inches; of the hind legs $5\frac{1}{2}$ inches.

Inhabits Pennsylvania, and the southern states. Cab. of Acad.

Rana *utricularius.*

Rana utricularius, Harlan. American Journal of Science and Arts, by B. Silliman, M. D. Vol. X. p. 60, 1825.

Char.—Above dark olivaceous-green: *beneath* white: *back* with sub-oval blackish spots: a vocal vesicle on each side of the neck: *legs* with a few blackish bands; tym-

* After lying for months in a dormant state, most frogs become of a dark colour; we have seen them, quite black on their first appearance, regain their colours on exposure to the light.

panum small, the cuticular fold on each side of the back, prominent.

Length of the body about 3 inches; of the hind legs more than 4 inches.

Inhabits Pennsylvania and New Jersey. Cab. of the Acad.

Rana *scapularis.*

Rana scapularis, Harlan. Silliman's Journal, ut supra.

Char.—*Above* dark olive-brown: *snout* green: *throat* yellow: *abdomen* white: a golden coloured line above the scapulæ.

Length of the body 3 inches; of the hind legs 4 inches.

Inhabits Pennsylvania. This may possibly prove to be the young of the *R. pipiens.*

Rana *flaviviridis.*

Synonyma. *Rana flaviviridis*, Harlan. Silliman's Journal, ut supra.
Rana fontinalis? Le Conte, Ann. of Lyceum, Vol. I. p. 282.
Yellow throated green frog.
Spring frog? Bartram, manuscript notes, penes me.

Char.—*Above* clear lively green: *beneath* white: *throat* yellow: *buttocks* mottled with black spots: *body* rather clumsy: *abdomen* large: *snout* rather obtuse.

Length of the body 3 inches; of the hind legs more than 4 inches: breadth of the head 1 inch.

Inhabits the middle states—also New England.

Rana *sylvatica.*

Synonyma. *Rana sylvatica*, Le Conte. Ann. of the Lyc. of New York, Vol. I. p. 232.
Rana pennsylvanica, Harlan. Silliman's Journal, ut supra. Vulgo, *Wood-frog.*

Char.—*Above* olive-brown, or drab coloured: *beneath* white: a black vitta, commencing on the side of the snout, passes backwards, dilating and involving the eye and tympanum: *posterior extremities* obsoletely fasciated.

Length rather smaller, and more slender than the *clamata*.

Inhabits the middle states and Massachusetts. Cab. of the Academy.

Rana *palustris*.

Synonyma. *Rana palustris*, Le Conte, Ann. of the Lyceum, Vol. I. p. 282.
Rana pardalis, Harlan. Silliman's Journal, ut supra.
Vulgo, *Leopard*, *Zebra*, or *Tiger-frog*.*
La G. *Pit-Pit*. Pl. 4. fig. 3. of Bonneterre, Tab. Encyclopedeque et Methodique, who confounds it with R. halecina.

Char.—*Above* dark-cinereous: *beneath* white, lighter on the flanks, snout and extremities: interior surface of the limbs yellowish: a row of dark green spots on each side of the spine, extending the whole length of the back: two longitudinal rows on the flanks: posterior extremities striped with broad, transverse, greenish lines or bands.

Length of the body three inches; of the hind legs four inches three-tenths.

Inhabits Pennsylvania. Cabinet of the Academy.

Rana *pumila*.

Rana pumila, Le Conte. Ann. of Lyceum, Vol. I. p. 282.

Char.—*Body* pale green: *back* with a decurved line on each side, bounded with dusky: *head* with a triangular spot between the eyes: legs barred with dusky.

Length ?——

Rana *gryllus*.

Synonyma. *Rana gryllus*, Le Conte. Ann. of the Lyc. Vol. I. p. 282. *Savannah cricket*, Bartram's Travels, p. 278. Erroneously supposed by Daudin to be the young of the Hyla *lateralis*.

Char.—*Above* warty, colour various: a dark triangular spot on the top of the head between the eyes: a pale line

* A beautiful variety, with the back of a golden green colour, observed on the head of Lake Champlain. June, 1832.

extending from the apex of this spot to the vent: hind part of the thighs yellowish or white, with one or two lines of dusky or brown.

Length about one inch and a half.

Inhabits the southern and middle states: frequents the grass, and verges of ponds. Cab. of the Acad.

Rana *dorsalis.*

Rana dorsalis, Harlan. Journal and Cab. A. N. S. Vol. VI.

Char.—*Above* fuscous, smooth, with a broad, green or reddish, longitudinal vertebral band, bifurcating anteriorly, and extending over each eye: *snout* above, pale or whitish: *beneath* white, *throat* and inner part of the thighs freckled: *buttocks* white with two brownish transverse lines: a white line on the side of the neck, extending from the eye to the scapula.

Length of the body $\frac{8}{10}$ of an inch: of the legs $1\frac{1}{2}$ inches. This measurement being taken from the largest of seven specimens.

Inhabits Florida, Carolina, and New Jersey. May prove a variety of R. gryllus. Specimens in the Cabinet of the A. N. S. Figured at p. 72 of this volume.

Rana *nigrita.*

Rana nigrita, Le Conte. Annals of the Lyceum, ut supra.

Char.—*Above* black, speckled with white warts: middle of the back cinereous, with an interrupted stripe of black: *upper lip* with a white line: *beneath* granulated, whitish: *legs* barred with whitish: hind part of the thighs brown; hind legs very long.

Length?

Rana *Holbrookii.*

This new species, first figured and described by Dr. Holbrook, (vide his valuable work on North American

14

Reptilia,) possesses very peculiar characters, displaying, in its external configuration, a strange mixture of the toad and frog. It has the contracted form of the first, with small tympanum, and rudimentary supertympanal warts, without visible pores, and small warts disseminated over the back of the head: possessing palatine teeth, and serrated maxillæ, like the frogs, and like the Rana cultripes of Cuv., is remarkable in possessing a rudiment of the sixth finger, covered by a sharp horny plate, which must materially aid the animal in climbing steep and slippery ascents.

Habits are said to be peculiar; about the size of the Esculent frog.

Inhabits South Carolina. Cab. of A. N. S.

Sub-Genus. ENGYSTOMA. *Fitzing.*

Char.—Body oval; *head* and *mouth* very small; *feet* slightly palmated; destitute of tympanum and parotids.

Engystoma *Carolinensis.*

Synonyma. *Breviceps*, Merr.
Engystoma Carolinensis, Holbrook.

One fourth the size of common esculent frog, olivaceous above, speckled with white beneath.

Found in South Carolina, first described by Dr. Holbrook, and figured by the same author.

Habit.—Seldom appearing above ground except after a hard rain. Specimens in the Cab. of A. N. S. *

7th Genus. HYLA. Roesel, Daudin, Cuvier.

Characters of the Genus.—Living chiefly on trees during the summer, and temperate weather; preying on insects; changing the colour of the skin, so as to resemble

* The species hitherto known, are natives of India, Africa, and South America.

the substances on which they rest; hybernating in the mud, and generating like the frog; hind toes semipalmate; with the extremity of each toe surrounded with a mucous tubercle: skin more or less granulated: colour changeable.

Hyla *lateralis.*

Synonyma. *Rana arborea, varietas* B. Linn. Gmel.
Hyla viridis, Laurenti, Catesby.
Calamita carolinensis, Pennant.
Calamita cinerea, Schneider.
La raine flanc-rayée, Daudin.
La calamite cendrée, Schneider.

Char.—Body smooth above, lively green: *beneath* whitish, or pale green, granulated: a straight, narrow line, of a yellow or silvery colour, bordering the superior lip, prolonged on the flanks, and posterior extremities: *iris* golden.

Length one and a half inches.

Inhabits the southern states and Surinam: frequents water plants, according to Le Conte. Cab. of the A. N. S.

Hyla *femoralis.*

Synonyma. *La raine. La raine femorale*, Daudin, Hist. Nat. des Reptiles par Latreille, planche enluminée.

Char—Above dark cinereous, marked with a few confluent spots of dusky, largest between the eyes: *beneath* whitish, granulated: *head* rather obtuse: *thighs,* exterior spotted with yellow: *legs* bordered with dusky.

Length one and a half, to one and three quarters of an inch. Colours various: a variety with the back chiefly occupied with a large irregular blotch: *legs* barred.

Inhabits the southern states. Cabinet of the A. N. S.

Hyla *squirella.*

Synonyma. *La raine squirelle*, Daudin.
Hyla ocularis, *var.* Le Conte.

Char.—Above brown-cinereous: *beneath* whitish, granulated: a dusky, or various coloured band, extending from the nostrils to the eyes, and a narrow white stripe extending from near the nostrils along the upper lip, reaching to near the fore-leg: *thighs* yellow on the exterior: *legs* barred.

Length more than one inch.

Coloured by Daudin, from a specimen in spirits.

"Var. A. *Above* cinereous, with a bar between the eyes: back with a few spots of dusky, sometimes confluent, sometimes uniting into a lateral line.

"Var. B. *Above* cinereous, irregularly spotted with darker: line between the eyes broken.

"Var. C. *Above* brown, immaculate: exterior of the thighs not yellow." (Le Conte.)

Inhabits the southern states. According to Bosc, the young resemble the common frog of Europe. Cabinet of the A. N. S.

Hyla *delitescens.*

Hyla delitescens, Le Conte. Ann. of Lyc. Vol. I. p. 281.

Char.—Above cinereous, spotted with darker: *beneath* whitish, granulated: *head* rather obtuse: *lips* whitish: *chin* speckled with brown: exterior of the thighs, and inner surface of arms and legs, yellow.

Length about two inches.

Inhabits Georgia, under the bark of trees.

Hyla *versicolor.*

Hyla versicolor, Le Conte, ut supra.

Char.—Above verrucose, colour varying with the will of the animal from pale brown to cinereous and green: *back* more or less marked with an acute angled cross: *beneath* white, granulated: *head* small: hind part of the abdomen, and hind legs, beneath, yellow.

Length two inches.

Inhabits the northern and middle states; has more the resemblance of a toad than the other species. Cabinet of the A. N. S.*

8th Genus. BUFO. Daudin, Cuvier, &c.

Characters of the Genus.—Body thick, contracted, and for the most part warty above, and granulated beneath: tongue short and thick: fore feet four-toed, fissile: hind feet five-toed, mostly palmated: destitute of teeth, but having the upper jaw grooved, the lower jaw closing within the channel of the upper: a gland behind each eye in most instances.

Bufo *musicus.*

Synonyma. *Rana musica*, Lin. Gmel.
Bufo clamosa, Schneider.
Le criard, Daub. Lacépède, Bosc, &c.
Land-toad, Catesby.
Land-frog, Bartram.

Char.—*Above* deep brown, verrucose, with irregularly disposed fuscous, or blackish spots, edged with white: *beneath* dirty white granulated: *sides* pale, spotted: *legs* barred: large oblong warts behind the eyes: a large blackish spot posterior to the tympanum: *head* above canaliculate: two tubercles on the heel of each foot: a longitudinal, vertebral, shallow groove.

Length of the body about three inches.

Inhabits the southern and middle states. Mostly leaps, seldom crawls; preying on living insects only. Cabinet of the A. N. S.

Bufo *cognatus.*

Bufo cognatus, Say. Long's Exp. to the Rocky Mountains, Vol. II. p. 190.

Char.—*Body* above dark brownish, verrucose; papillæ and their disks black: *beneath* whitish, granulated: *head*

* A specimen was dug up from the root of an apple tree in Bartram's botanic garden, in the winter of 1828, several feet beneath the surface.

with a short groove: *sides* and *legs* with irregular cinereous lines: *verrucæ* behind the eyes moderate: a cinereous vitta extending along the vertebræ, with three oblique lateral lines.

Length about four inches.

Inhabits the plains of Missouri A specimen in the Philadelphia Museum.

Var. A. The reddish-brown, or brick-coloured toad of Bartram; very large, weighing near one pound when full grown: legs and thighs marked with blotches and ringlets. Inhabits the southern states. The red toad of Pennsylvania is but little larger than the B. *musicus*.

ORDER. OPHIDIA,* or *Serpents*.

Characters of the Order.—Body long, more or less cylindrical, covered with scales or plates, sometimes annulated, tuberculated, or granulated: casting their exuviæ for the most part twice annually: destitute of feet: tail sometimes long, at others short: jaws armed with short teeth; also, perforated fangs in the poisonous species: tongue long, extensible, and bifurcated, with few exceptions: top of the head covered with plates, or with scales; in some instances, with both plates and scales; in others, smooth:† heart with two auricles and two ventricles.‡

1st GENUS. OPHISAURUS. Daudin.

Characters of the Genus.—Body rather thick, oblong,

* From Οφις—Serpent.

† Any attempt to draw *specific* characters from a difference in the *number* of abdominal plates, or subcaudal scales, as first proposed by Lacépède, is altogether nugatory, an immense difference existing in this respect in the same species: nor has the enumeration of the teeth for a similar purpose, proposed by M. P. de Beauvois, proved more successful.

‡ Extract from manuscript notes on the dissection of the *Python Javanica*, March 23d, 1825.—"The heart has two auricles and two ventricles, forming a complete double heart, without any direct communication, (as represented by Cuv. 'Leçon. d'Anat. comp.') but the great systemic vessels communicate with each other, as in the alligator."

cylindrical; on each side a longitudinal fold: tail long, cylindrical, tapering: smooth plates on the head: furnished with eye-lids: ears visible externally: tongue extensible, notched at the extremity: scales square, symmetrically arranged, so as to appear longitudinal or transverse: anus simple, transverse: minute sharp teeth to each jaw; destitute of poisonous fangs.

Ophisaurus *ventralis.*

Synonyma. *Anguis ventralis*, Linn., Gmel., Schneider.
Chamasaura ventralis, Schneider, Gray, Phil. Trans.
Cæcilia maculata, Catesby, Hist. Caral. pl. LIX.
Glass-snake, Bartram's Travels in North and South Carolina.
Le jaune et brun, Daubenton, Encyc. Meth. Idem, Lacépède.
L'Anguis jaune et brun, Latreille.
Anguis ventral; anguis lamproie, Bosc, Dict. d'Hist. Nat. édit. de Deterville.
Ophisaurus ventralis, Daudin. Hist. Nat. des Rept. pl. 88.

Char.—Above with fourteen longitudinal ranges of nearly square scales: *abdomen* with twelve longitudinal ranges of smooth scales, and forming about 120 transverse ranges, similar to rings: *beneath* the tail similar to the abdomen: *colour* above brownish, with the sides of the head and neck spotted with black: abdomen and back separated by a longitudinal fold or groove, which terminates at the anus. Length between two and three feet.

Inhabits the southern states and Arkansa. Cabinet of A. N. S.

2d Genus. COLUBER. Linn.

Characters of the Genus.—Body long, cylindrical and tapering: head oblong, covered above with smooth polygonal plates: above covered with rhomboidal scales, imbricate, reticulated or carinated, or smooth: abdomen with transverse plates: beneath the tail with double plates: anus transverse, simple: jaws furnished with sharp teeth: without poisonous fangs. Some species oviparous, others ovo-viviparous.

Coluber *obsoletus.*

C. obsoletus, Say. Long's Exp. to the Rocky Mountains, Vol. I. p. 140.

Char.—Above black: *beneath* whitish, with large subquadrate black spots, which are confluent and pale-bluish towards the tail: *throat* and *neck* pure white: *sides* between the scales with red marks.

Length about five feet; tail about one fifth.

Abdominal plates, from 223 to 228: caudal scales from 67 to 84.

Inhabits Missouri. A specimen in the Philadelphia Museum.

Coluber *constrictor.*

Synonyma. *Coluber constrictor*, Linn. Gmel. Kalm; Trav. in N. America, Vol. III. p. 136.

Black-snake, Catesby's Carolina, Vol. II. pl. XLVIII.

Le serpent lien, Daub. Enc. Method. Idem, Lacépède.

La couleuvre lien, Latreille, Daudin.

Coluber ovivorus, Linn. Syst. Nat.

La couleuvre ovivore, Latreille, Lacépède, Daudin.

Chicken snake, of Bartram. Vulgo, *Racer* or *Black-snake.*

Char.—Above blackish blue: *beneath* slate-colour: *throat* and *lips* white: *head* above covered with plates: scales of the back, rhomboidal or hexagonal, slightly carinated in some instances. Length from three to six feet; tail about two sevenths.

Abdominal plates from 176 to 186: caudal scales from 88 to 98.

Inhabits North America; very common in the middle states: feeding on small animals; climbing trees in search of birds nests: suffocating its prey in its folds, like the Boa Constrictor. Cab. of the A. N. S.*

* A new allied species has recently been discovered in the Alleghany mountains. Vid. Holbrook's Reptilia, now in press, Nov. 1835.

Coluber *testaceus.*

C. *testaceus*, Say. Long's Exp. to the Rocky Mountains, Vol. II. p. 48.

Char.—Above pale sanguineous, or testaceous: *beneath* sanguineous, immaculate: scales large: size of the black-snake (C. *constrictor.*) Abdominal plates 198: caudal scales 80. Inhabits Missouri. A specimen in the Philadelphia Museum.

Coluber *ordinatus.*

Synonyma. *Coluber ordinatus*, Linn. Gmel., and Gronovius.
Coluber cœrulescens, Boddaert.
Little green snake, Catesby, Carol. Vol. II. pl. LIII.
Blue spotted snake, Shaw.
L'ibibe, Daubenton, Lacépède, Latreille, Daudin.
C. biponctuée, Latreille.
Garter snake, Say, Long's Exp. to the Rocky Mountains, Vol. I. p. 375. This popular name is applied indiscriminately to several very distinct species.

Char.—Colour bluish, marked with black and cloudy spots, with a row of black dots under the flanks, and a green line on the back. (According to Catesby, the colour is spotted green above.) *Head* covered with plates.

Total length two feet; tail four inches. Abdominal plates 138: caudal scales from 65 to 74.

Inhabits South Carolina, and as far north as Salem, Massachusetts. Varieties from New Jersey.

Coluber *parietalis.*

C. *parietalis*, Say. Long's Expedition to the Rocky Mountains, Vol. I. p. 186.

Char.—Above blackish, with three yellow fillits, and about eighty red concealed spots: *beneath* bluish; a series of black dots on each side.

Total length one foot; tail four inches.

Abdominal plates 165: caudal scales 88.

Inhabits Missouri. Specimens in the Philadelphia Museum.

Coluber *filiformis.*

Synonyma. *Coluber filiformis*, Linn. Gmel.
Anguis flagelliformis, Catesby, Carol. pl. LIV.
Natrix filiformis, Laurenti.
Le fil, Daub. Lacépède.
La couleuvre filiforme, Latreille. Vulgo, *Coach-whip snake.*

Char.—*Above* entirely brown, or obscure livid: *beneath* whitish, with a black vitta near each eye, prolonged on the side of the neck.

Length from four to six feet, very slender and tapering. Abdominal plates 165; caudal scales 158.

Inhabits Carolina.

Coluber *flagelliformis.*

Synonyma. *Coluber mycterizans*, Linn. Gmel. and Gronovius.
Natrix colore magis virescente, Gmel. syst. Nat. p. 1119.
Anguis viridis, Catesby, Carol. Vol. 2. pl. LVII.
La fouet de cocher, Daudin. *Coach-whip snake* of the Anglo-Americans.
C. *flagelliformis*. Idem.*

Char.—*Above* entirely grass-green: *beneath* whitish, with a longitudinal pale line on each flank.

Length between two and three feet; tail one third. Abdominal plates 187; caudal scales 147.

Inhabits South Carolina, on trees.

Coluber *sipedon.*

Synonyma. *Coluber sipedon*, Linn. Gmel.
Le sipede, Daub. Lacépède, Latreille. Vulgo, *Brown water-snake*

Char.—*Above* dusky brown: *beneath* whitish, or yellowish-brown, speckled with black.

Total length four feet four inches: tail fourteen inches. Abdominal plates one hundred and thirty-six; caudal scales fifty-four.

* Dryanus mycterizans—Merrem; Syst. Amph. p. 136, who attributes Abdom. Scut. 191—192. Sub. Caud. Sc. 167—173.

Inhabits middle states, also Massachusetts. Specimens in the Cabinet of the A. N. S.

This species, the most common in the vicinity of Philadelphia; first discovered by Kalm, and named by Linnæus, has never been correctly *described* by succeeding naturalists.

Description.—Body thick and long: tail short and abruptly tapering: head thick and short: scales oblong, hexagonal, notched at the lower end, strongly carinated: colour above, unvaried dirty brown, or of a dusky, dead-leaf appearance: sides reddish-brown: abdomen whitish or yellowish-brown, freckled with black, particularly beneath the tail; in some instances the flanks or sides obsoletely banded with black: posterior occipital plates large, oblong, and rounded posteriorly, arranged as follow: postoccular eight, interoccular three, antoccular twelve, labial eighteen. Living chiefly in or near the water, feeding principally on live frogs; hybernating in the mud: sometimes attains to five feet in length. The young possesses some resemblance to the C. *eximius,* though the transverse bands are not confluent beneath, and the scales are carinated as in the adult animal.

Coluber *saurita.*

Synonyma. *Coluber saurita*, Linn. Gmel.
Riband snake, Catesby, Carol. Vol. 2. pl. L.
Le Saurite, Daub. Lacépède, Latreille, Daudin.

Char.—*Above* deep brown, with three longitudinal stripes of a whitish or light green colour: *beneath* light green: *head* small, oblong, covered with plates: *scales* similar to those of the C. *sipedon.*

Length about two feet; tail one-third, long and tapering. Abdominal plates from 154 to 159; caudal scales from 117 to 122.

Inhabits southern and middle states. Specimens in the Cab of A. N. S.

Coluber *sirtalis.*

Synonyma. *Coluber sirtalis*, Linn. Gmel.
Le sirtale, Daub., Lacépède, Latreille, Daud. Vulgo, *Garter-snake*, in Pennsylvania.

Char.—Above brown, marked with a longitudinal vertebral line, and one on each side, of a yellowish green colour: *back* spotted with black dots; scales oblong, strongly carinated, largest on the sides: *beneath* yellowish-green, lighter on the throat and lips: abdominal plates with two black spots; one at the union with the lateral scales, the other a little distant.

Total length two feet three inches; of the tail five and a half inches. Abdominal plates one hundred and fifty; caudal scales sixty.

Inhabits Pennsylvania. Specimens in the Cab. of A. N. S. Hitherto not accurately described.

Coluber *proximus.*

C. *proximus*, Say. Long's Exp. to the Rocky Mountains, Vol. 1. p. 187.

Char.—Above black, trilineate; vertebral line ochraceous; lateral line yellowish; a double white spot on the parietal plates: *beneath* tinged with greenish blue.

Total length two feet; tail seven inches. Abdominal plates one hundred and seventy-eight: caudal scales eighty-six.

Inhabits Missouri. Specimens in the Philadelphia Museum.

"This species differs from the *Saurita* in the numerical proportion which its sub-caudal scales bear to its plates; from the *Ordinatus*,* by being destitute of the two series of black points beneath; it is a much more slender serpent than the *parietalis*, and the tail is proportionably longer." (Say.)

* Coluber *sirtalis*, Linn.

Coluber *flaviventris.*

C. *flaviventris*, Say. Long's Exp. to the Rocky Mountains, Vol. 1. p. 185.

Char.—*Above* olivaceous: *beneath* yellow: *lower jaw* beneath white: scales destitute of carina.

Total length three feet eleven inches; tail eleven inches. Abdominal plates one hundred and seventy-six: caudal scales eighty-four.

Inhabits Missouri.

Coluber *striatulus.*

Synonyma. *Coluber striatulus*, Linn. Gmel. Bosc.
Le strié, Daub., Lacépède.
Le couleuvre striatulée, Latreille, Daudin, &c.

Char.—*Above* of a clear brown colour, with rhomboidal, stongly carinated scales: *beneath* whitish-gray: *head* oval, covered with nine plates.

Length nine inches; tail two inches. Abdominal plates from one hundred and twenty-six to one hundred and thirty-two: caudal scales from twenty-five to forty-five.

Inhabits South Carolina; frequents woody places. Specimens in the Cab. of the A. N. S.

Coluber *punctatus.*

Synonyma. *Coluber punctatus*, Linn. and Gmel.
Le ponctuée, Daub., Lacépède, Latreille, and Daudin.

Char.—*Above* plumbeous, finely pointed with gray: *beneath* reddish-yellow, with three longitudinal and parallel rows of plumbeous and sub-triangular points; beneath the tail immaculate: *head* rather oval, flattened, with a white spot or band disposed across the occiput.

Total length nine inches; tail two-ninths. Abdominal plates one hundred and thirty-six to one hundred and forty: caudal scales forty-three to forty-eight.

Inhabits South Carolina, under the bark of trees. A specimen in the Cab. of A. N. S.

Coluber *amœnus.*

C. *amœnus*, Say. Journ. of the A. N. S. Vol. IV. p. 237.

Char.—Above brown or blackish, in different lights reflecting a hyacinthine blue: *beneath* bright red or rosaceous: *tail* short, with an abrupt solid conic tip: *scales* smooth pantagonal: *head* small and vermiform.

Length from four to ten inches; tail one-tenth of total length. Abdominal plates from one hundred and eighteen to one hundred and thirty-four: caudal scales thirty-two to thirty-eight.

Inhabits Pennsylvania; found beneath stones and logs: not very common. Specimens in the Cab. of A. N. S. C. Amœmes var. from New Jersey.

Coluber *rigidus.*

C. *rigidus*, Say. Journal of the A. N. S. Vol. IV. p. 239.

Char.—Above dark fuscous or blackish: *beneath* yellow, with two black lines.

Total length twenty inches; of the tail four inches. abdominal plates one hundred and thirty-three: caudal scales fifty-one.

Inhabits the southern states. A specimen in the Cab. of A. N. S.

Coluber *septemvittatus.*

C. *septemvittatus*, Say. Journ. of the A. N. S. Vol. IV. p. 240.

Char.—Above brownish, with three blackish lines: *beneath* yellow, with four blackish lines.

Total length nine inches nine-tenths; of the tail two and a half inches. Abdominal plates one hundred and forty-three: caudal scales seventy.

Inhabits Pennsylvania. Specimens in the Cab. of the A. N. S. From Michigan Territory.

Coluber *porcatus.*

Perhaps *sipedon*, Linn.
Synonyma. *Coluber porcatus*, Bosc. Manuscript notes.
La couleuvre à stries, Latreille.
Copper-belly snake, Catesby, Carolin. Vol. 2. pl. XLVI.
Coluber aquaticus? Shaw.
La couleuvre sillonnée, Daudin.

Char.—Above brown, sprinkled with darker; with obsolete reddish bands on the flanks: *beneath* whitish, spotted with red; each plate at its base marked with two subtriangular spots: colours on the tail less distinct.

Total length two feet; tail seven and a half inches. Abdominal plates one hundred and twenty-eight: caudal scales sixty-eight.

Inhabits South Carolina. Cab. A. N. S.

Coluber *coccineus.*

Synonyma. *Coluber coccineus*, Linn. Gmel.
Couleuvre écarlate, Latreille; Daudin. Hist. Nat. des Reptiles, pl. 83. Vulgo, *Scarlet-snake.*

Char.—Above of a lively blood-red colour, with twenty-one or twenty-two transverse yellowish bands, bordered with black; the first band being situated on the posterior part of the head: *beneath* whitish, immaculate.

Total length two feet; tail one-seventh. Abdominal plates from one hundred and sixty-one to one hundred and seventy-five: caudal scales thirty-five to forty-three.

Inhabits South Carolina: feeding on grasshoppers and other insects. Received a specimen from Mr. B. Say, New Jersey, September, 1827.

Genus. HETERODON. Latreille, Cuv.

Coluber *heterodon.*

Synonyma. *Couleuvre hétérodon*, Daudin; fig.
Heterodon platirhinos, Latreille.
Coluber simus, Linn. Gmel.
Le camus, Daub., Lacépède, Latreille.
Boa contortrix? Linn. Vulgo, *Hog-nose snake.*

Char.—Above blackish, sometimes marked with oblique and bifid bands of a pale reddish-gray colour: *beneath* whitish, immaculate: *head* short and triangular: *nose* flattened, pointed, slightly reversed, and carinated above.

Total length from one to three feet. Abdominal plates from one hundred and nineteen to one hundred and fifty: caudal scales thirty-eight to forty.

Inhabits New Jersey; bold, but innoxious. A specimen in the Cab. of A. N. S. From Michigan.

Coluber *thraso.* Harl.

Vulgo, *Blowing-viper*, or *Blustering Coluber.*

Char.—Above black; *beneath* bluish-white; *scales* mostly sub-imbricate, sub-carinated, first lateral row imbricate, and smooth; *head* small, body thick and chunky; head covered with plates; when at rest oval; *nose* flat, triangular, and reversed, keel-shaped above; *tail* small and tapering, terminating in a horny point; iris gray, pupil circular; length of body two feet, tail five inches.*

Abdominal plates one hundred and forty-five; subcaudal scales forty.

Inhabits Pennsylvania.

Presenting a most venomous aspect; flattening the

* Numerous small black worms were observed adhering to the interior of the throat.

head and neck extensively, and hissing loudly when irritated; innoxious.

Present specimen from Broad river emptying into the Delaware at its origin. Description from life.

Coluber *æstivus.*

Synonyma. *Coluber æstivus*, Linn. Gmel.
Le verdatre. Daub., Lacépède, Latreille.
La couleuvre verte d'été, Daudin.
Green-snake, Catesby, Carol. pl. 47, and Bartram, Trav. in North and South Carolina, Vol. II. p. 16.

Char.—Above brilliant green: *beneath* nearly white: *body* slightly compressed at the sides: *tail* long and pointed: *scales* very slightly carinated.

Length about two feet; tail two-fifths of total length. Abdominal plates from one hundred and fifty-five to one hundred and fifty-nine: caudal scales from one hundred and twenty-eight to one hundred and forty-four.

Inhabits South Carolina. Specimens in the Cab. of A. N. S. This snake is found in New Jersey.

Coluber *fasciatus.*

Synonyma. *Coluber fasciatus*, Linn. Gmel.
Le vampum, Daub., Lacépède, Latreille, Daudin.
Wampum snake, Catesby, Carol. pl. 58.

Char.—Above bluish-black, with more than thirty yellowish marks, alternately disposed on each flank, and a few transverse yellowish lines on the back, bifurcated on the flanks: *head* blackish, covered with plates: *inferior lip* yellowish.

Length four or five feet; tail one-fifth. Abdominal plates from one hundred and twenty-eight to one hundred and thirty-eight: caudal scales sixty-six or sixty-seven.

Inhabits the southern states. Specimens in the Cab. of A. N. S.

Coluber *getulus*.

Synonyma. *Coluber getulus*, Linn. Gmel.
La chaine, Daub. Lacépède, Latreille, Daudin.
Chain snake, Catesby, Carol. Vol. II. pl. 52.

Char.—Above bluish-black, with thirty or more yellowish and transverse stripes; these lines uniting on the flank to a longitudinal or zig-zag line, which at each inferior angle unites to a white spot, prolonged on the abdomen: *beneath* yellowish-white, spotted with bluish-black: *lips* bordered with white: plates of the head black, spotted with white.

Length four or five feet; tail one-eighth. Abdominal plates from two hundred and ten to two hundred and fifteen: caudal scales forty-three to forty-six.

Inhabits South Carolina. Cab. of A. N. S.

Coluber *calligaster*.

C. *calligaster*, Say.

Char.—Above fuscous, with three rows of black blotches; the vertebral row transversely oblong, and large; a longitudinal row of smaller black blotches on each side: *beneath* reddish-yellow: *tail* corneous at tip.

Length about four feet. Abdominal plates 213: caudal scales 52.

Inhabits Missouri. Specimens in the Philadelphia Museum; one of which has eight sub-caudal entire plates next the vent. The present description is taken from the prepared specimens in the Philadelphia Museum. Perhaps a variety of C. *eximius,* described below.

Coluber *melanoleucus*.

Synonyma. C. *melanoleucus*, Daudin.
Le couleuvre noire et blanche, Idem.
Pine snake and *Bull snake*, Bartram's Trav. Vol. II. p. 18. Vulgo, *Horned snake*.

Char.—Above black and white; black colour prevailing on the anterior half of the body: *beneath* yellowish-white, very sparsely spotted with black: *tail* corneous at tip: scales on the back sub-carinated.

Length from four to six feet. Abdominal plates 246: caudal scales 66.

Inhabits the southern states: common in the pine forests of New Jersey. Specimens in the Philadelphia Museum; one eight feet in length, from New Jersey; Cab. of the A. N. S.

Coluber melanoleucus. Var. Say. *Char.—Above* black and yellowish-white; the black arranged in large blotches, the white in transverse bands: *beneath* yellowish-white, with square blotches of black.

Length about five feet. Abdominal plates 253: caudal scales 80.

Inhabits Missouri. Described from a specimen in the Philadelphia Museum.

Coluber *eximius*.

C. *eximius*, Dekay, (Manuscript Notes.) Vulgo, *House snake*, *Chicken snake*, or *Thunder and lightning snake.*

Char.—Above blackish, banded with white; the white bands bifurcating on the sides, and becoming confluent: *beneath* yellowish-white, spotted with quadrangular black spots: eyes small and red: head smaller than the diameter of the body: scales not carinated.

Length; grows to the length of the black snake, (C. *constrictor*,) but is much thicker; the colours are very lively and beautiful. Abdominal plates 250; caudal scales 60.*

Inhabits Pennsylvania and New Jersey. Young reddish-brown above. Specimens in the Philadelphia Museum and Cab. of the A. N. S.

* In one living specimen there were thirty-three pairs of caudal scales.

Coluber *floridanus.*

C. *floridanus*, (Nobis.) Vulgo, *Red Chicken snake* of Florida. Probably the C. *guttatus*, Lin.

Char.—*Above* red or cupreous, with obsolete, narrow, transverse fasciæ, bordered with black: *beneath* yellowish, or reddish-white.

Total length three feet four inches; tail five and one-half inches. Abdominal plates 225: caudal scales 47.

Inhabits East Florida and Carolina. Cab. of A. N. S.

Coluber *vernalis.*

C. *vernalis*, Dekay, (Manuscript Notes.) Vulgo, *Green snake.*

Char.—*Above* of a universal deep green colour: *beneath* greenish-white: *scales* oblong, rhomboidal, not carinate: plates on the head, seven.

Total length one foot seven inches: tail six inches. Abdominal plates 127: caudal scales 57.

Inhabits Pennsylvania and New Jersey. A specimen in the Cab. of A. N. S.

Coluber *cauda-schistosus.*

C. *atrifuscus*, First ed.

Char.—*Above* uniformly blackish-brown, with strongly carinated, oblong, rhomboidal scales: *beneath* whitish: plates plumbeous at base, and at their union with the lateral scales: beneath the tail plumbeous, spotted with yellowish: *head* covered with seven plates.

Length from two to four feet; tail one-fifth. Abdominal plates 130: caudal scales 50.

Inhabits the southern states; climbing trees in search of game. Described from a specimen in spirits. Cab. of A. N. S. May prove a variety of C. *sipedon.*

Coluber *erythrogrammus.*

La couleuvre a rais rouges, Daudin, pl. 83. fig. 2.

Char.—Above dusky-black, with a longitudinal, vertebral, red line; and a similar lateral line on each side of the back: *flanks* yellow; base of each scale red: *abdominal plates* red, bordered with yellow, with black on the middle, and on each extremity of the plates.

Length five feet; tail one-sixth. Abdominal plates 162; caudal scales 49.

Inhabits the United States.

Coluber *doliatus.*

Synonyma. C. *doliatus*, Linn. and Gmel.
L'annelèe, Daub. Lacépède, Latreille.
La couleuvre cerolée, Daudin.

Char.—Whitish, with black rings; the rings disposed alternately beneath: more regular on the back: *head* sometimes blackish: *scales* smooth, rhomboidal.

Length seven inches: tail one inch five lines. Abdominal plates 164; scales 43.

Inhabits Carolina and New Jersey. Cab. of A. N. S.

Coluber *maculatus.*

Synonyma. C. *maculatus*, or *La couleuvre tachetée*, Daudin.
La couleuvre tachetée, Lacépède, Latreille.
Corn snake, Catesby, Carol. v. 2. pl. LV.

Char.—Above whitish, with large reddish spots, bordered with blackish; a double row of these spots forming a zig-zag line: *beneath* whitish, sometimes spotted: *scales* carinated.

Length two feet. Abdominal plates 119. Caudal scales 70.

Inhabits Carolina and Louisiana.

Coluber *guttatus.*

Synonyma. C. *guttatus*, Linn. and Gmel.
La mouchetée, Daudin, Lacépède.
La couleuvre a gouttelettes, Daudin.
Bead snake, Catesby, Carol. v. 2. pl. LX.

Char.—Colour livid, marked above with red and black spots; with small lines on the flanks; with alternately square, black spots beneath: scales on the back slightly carinated.

Length from two to four feet. Nearly of equal thickness throughout. Abdominal plates 223 or 230; caudal scales 60.

Inhabits S. Carolina. Principally found in potato patches.

Coluber *molossus.*

Synonyma. C. *molossus*, or *La couleuvre molosse*, Daudin and Latreille.
C. *guttatus*, Merrem.

Char.—*Head* elongated, rather flattened, brick-red, with two rays more deep, bordered with brown: lips white, spotted with brown: *above* of a pale-brick colour, with blackish-red, sub-quadrangular spots, bordered with brown: sides with smaller spots disposed in fasciæ: *beneath* white, with square brown spots.

Total length twenty-three inches; tail three inches. Abdominal plates from 220 to 226; caudal scales 60 to 64.

Inhabits S. Carolina, under bark, in the forests.

Coluber *reticularis.*

Synonyma. C. *reticularis*, or C. *reticulaire*, Daudin, Latreille.

Char.—Covered above with whitish scales, bordered with white; giving to the animal a reticulated appearance: dorsal scales smooth and losange form.

Length four feet; tail one-fifth. Abdominal plates 220; caudal scales 80.

Inhabits Louisiana.

3d Genus. VIPERA. Daudin.

Characters of the Genus.—Differing from the genus *Coluber* in having poisonous fangs, and the head contracted in length, and broader posteriorly, covered sometimes with small plates; in others, with scales similar to the dorsal, and seldom with large plates, as in the Coluber.

Vipera *fulvia.*

Synonyma. *Coluber fulvius*, Linn. and Gmel.
La noire et fauve, Daudin, Lacépède, and Latreille.
La couleuvre fulvie, Daudin.
Elaps, Schn. and Cuv. R. A.

Char.—Marked with twenty-two black rings, alternately with an equal number of yellow rings, spotted with brown: these last rings being white before and behind: *head* covered with large plates: scales sub-imbricate, not carinated.

Length about two feet; tail $\frac{1}{12}$. Abdominal plates 218; caudal scales 31.

Inhabits the southern states. It is by no means innocuous, as is asserted by Daudin, and may be fatally mistaken for the scarlet snake, (Coluber coccineus.)

Vipera *fulvia.* Var.

Synonyma. *Coluber fulvius*, Linn. Var. (H.) Harlan. Journal of the Acad. Nat. Sc. Vol. V. p. 154.
Coluber coccineus, Say. Notes on Herpetology, Silliman's Journal, Vol. I.

Char.—Eighteen deep black rings, with as many scarlet or blood-red intervening ones, separated by narrow rings of whitish-yellow: scales subimbricated, not carinated.

Total length two feet; tail three inches. Abdominal plates 202; caudal scales 40.

Inhabits S. Carolina. A specimen in the Cab. of the A. N. S.

4th Genus. CENCHRIS. Daudin.

Characters of the Genus.—Body rather thick, cylindrical: tail short, cylindrical: plates on the front of the head; scales on the back of the head; entire plates on the centre: double plates beneath the anterior portion of the tail, entire plates on the remainder: anus transverse, simple, and without spurs: jaws armed with sharp teeth; poisonous fangs in the upper jaw.

Cenchris *mokeson.*

Synonyma. *Cenchris mockeson*, Daudin, pl. 70. Coloured apparently from a specimen in spirits. Vulgo, *mockeson.*

Char.—*Head* large, covered with plates before, with scales behind: scales slightly carinated: *neck* contracted: *above* brown, covered with transverse black spots; in some places confluent, occasionally transverse striæ: *beneath* dirty white, with smaller black spots.

Length one and one-half feet; tail one-fifth. Abdominal plates 157: sub-caudal plates 3: caudal scales 32.

Inhabits S. Carolina.

Cenchris *mokeson.* Var.

Heterodon, of others.

Among a numerous collection of Reptiles, presented to the Academy, by their corresponding member, Dr. William Blanding, of Camden, S. Carolina, is a remarkable variety of this genus, if not a distinct species. It offers the strongest resemblance to the *Crotalus miliarius* without its rattle.

Char.—Above fuscous, with large, black, distinct blotches: *beneath* whitish: *head* broad, and rather flat: *neck* contracted: *body* thick: *tail* short and cylindrical: *nose* flattened and reflected, as in the *Coluber heterodon*: *tail* strongly corneous.

Length about two feet. Abdominal plates 139: subcaudal plates 11: scales 20.

Inhabits S. Carolina. Cab. of the A. N. S. (Not before described.)

5th Genus. SCYTALE. Daudin.
ECHIS. Merrem.
TRIGONOCEPHALUS. Oppel.
BOTHROPS. Spix.
TISIPHONE. Fitzinger.

Characters of the Genus.—Body robust, elongated, cylindrical: head thick, obtuse, swollen posteriorly, covered with plates anteriorly, with scales posteriorly: scales carinated, reticulated, and rhomboidal: beneath the abdomen and tail furnished with simple transverse plates: jaws furnished with sharp teeth; poisonous fangs in the superior.

Scytalus *piscivorus*.

Synonyma. *Scytale piscivorus*, Daudin.
Water viper, Catesby, Carol. pl. 43.
Le piscivore, Lacépède.
Le scytale piscivore, Latreille. Hist. Nat. des Reptiles, in-18, Tom. III. p. 163.

Char.—Above brown: *beneath* black, with irregular, transverse, yellow bands, or yellow and black, alternately: sides of the neck, black: *head* large; *neck* contracted: *tail* strongly corneous.

Length, five or six feet. Abdominal plates ——? Caudal plates ——?

Inhabits South Carolina.

SCYTALUS *niger*.

SYNONYMA. *Scytale noir*, Daudin.
Black snake, Catesby, Carol. pl. 44. Probably a variety of the Heterodon.

Char.—Colour dusky black, sometimes approaching to redness: *head* short and broad: *tail* short: *body* contracted.

Length about two feet. Plates and scales not enumerated.

SCYTALUS *cupreus*.

S. *cupreus*, Rafinesque. Silliman's Journal of Science. Vol. I. p. 84.
Cenchris mockeson, Say. Journal of Science. Vol. I. p. 256.
Vulgo, *copper-head*, *copper-belly*, *copper-adder*, *copper-viper*, *chunk-head*, *deaf-adder*, *Rattle-snake-mate*, &c.

Specific characters.—Tail one-eighth of total length, with 45 caudal plates entirely brown: 150 abdominal plates, the last very broad; *head* oval, coppered above, yellow beneath; *scales* carinated on the back, which is of a copper colour, with reddish-brown rings cross-shaped; belly variegated with brown.

Total length, three feet; body proportionably thicker than in the Colubers; head large, broad, oval, obtuse, very distinct from the neck, nearly two inches long, with large smooth scales above, and with rhomboidal smooth scales beneath; fangs yellowish-white; back covered with small rhomboidal, obtuse, keeled scales, those of the sides larger and smooth, not keeled; above of a brownish-copper, sides of a bright copper colour, broad bands of a reddish-brown, becoming bifurcated on the sides; a brown spot opposite the sinuses; scales of the sides minutely spotted with brown; abdominal plates of a pale copper colour, with two longitudinal rows of brown spots, each plate emarginate with white; tail short, cylindrical, tapering, four inches long, brown, immaculate, terminated with an obtuse, horn-claw, of an oblong, compressed shape, and carinated beneath.

Inhabits New England, New York, New Jersey, and Pennsylvania. Cab. of A. N. S.

Having examined specimens, both living and dead, since our first edition, we are enabled to pronounce this a true species.

Scytalus *tisiphone.*

Coluber tisiphone, Shaw. Vipère brune de la Caroline, or *Brown water-mockeson* of Catesby.

Char.—Subcaudal plates simple; *head* furnished with plates as far back as the eyes; *tail* tipped with horn, brown, with cloudy spots of a deeper hue.

Inhabits Carolina.

6th Genus. CROTALUS. Linn.

Characters of the Genus.—Body robust, elongated, cylindrical: tail short, cylindrical, terminated with a sonorous rattle, which is a corneous production of the epidermis; this rattle is cast annually, (consequently, no inference as to the age of the animal, can be drawn from the number of pieces which compose the rattles:) head thick and broad, covered before with small plates, behind with carinated scales: abdomen and beneath the tail covered with plates: jaws furnished with sharp teeth; upper jaw with long, curved, poisonous fangs, replaced, when broken, by smaller ones in the rear. A poison bag, occupying the whole length of the upper-jaw, beneath the skin, and opening into the fang at its base.

CROTALUS *durissus*.

SYNONYMA. *Crotalus durissus*, Linn., Gmel., Kalm, and Catesby, Carol. pl. 41.

Caudisona durissus, Laurenti.

Crotalophorus, Gronovius.

Crotalus atricaudatus, or *Le Crotale a queue noire*, Daudin, and Bosc: variety from young age?

Le Crotale durissus, of the French. Vulgo, *Banded Rattle-snake*.

The epithets "banded," and "diamond," have been used by some authors indiscriminately.

Char.—*Above* cinereous, tinged with yellowish or greenish, with transverse, irregular black bands, bordered with a clear tint; each band terminating on the flanks in a quadrate black spot; *tail* black; *beneath* yellowish-white freckled with black; *scales* rhomboidal, carinated; a row of smooth, round scales on each flank.

Length four or five feet. Abdominal plates, from 163 to 174; caudal plates, from 16 to 30.

Inhabits the northern and middle states; very common in Pennsylvania. 45° is its northern limit according to Kalm. Cab. of the A. N. S.

Observations.—In the month of June, 1826, there was exhibited in Philadelphia, a collection of "*Banded Rattle-snakes,*" 150 in number. These animals were all taken in the counties of Wayne, Pike, and Susquehanna, in the state of Pennsylvania, and in Sullivan county, in the state of New York, during the months of April and May preceding. They had not been offered any food the present year, and yet appeared very lively.

The operation of casting their exuviæ was frequently witnessed. The process, generally, lasted about fifteen minutes: after its completion, the colours of the skin appeared very brilliant. When at rest, the pupil of the eye is oblong vertically, but they possess the faculty of rendering the pupil oval, and even nearly circular.

It is a remarkable fact, that these reptiles were never known to injure each other, though crowded together in close boxes, and subjected to continual irritation from visiters, and the living animals on which they were subsequently fed; as if aware of the fatal consequences of their venom, instinctive harmony prevailed amongst them.

The shades of colour offered to view by the animals in this collection were exceedingly various, from light cinereous to deep black, the bands occasionally interrupted, giving the back a spotted appearance, though the characteristic markings were more or less permanent. Several specimens displayed the following peculiar differential traits, if not specific characters.

Char.—Above blackish slate-colour, with the carina elevated and tipped with cinereous, giving to the back a longitudinally striated appearance: *back* marked with transverse black bands, rather obsolete: *beneath* yellowish, the plates being plumbeous at base, and yellow at the edges; beneath the throat and lower jaw, impure white: *head* very black: *tail* black, striated longitudinally, without bands.

Length between three and five feet.*

Crotalus *horridus*.

Synonyma. *Crotalus horridus*, Linn., Gmel., Boddaert, &c.
Caudisona terrifica, Laurenti.
Boiquira boicininiuga, by the Brazilians.
Cascavel, by the Portuguese.
Teuhtlacot zauhqui by the Mexicans.
Boiquira, Lacepède, Latreille, &c.
Vipera caudisona, and *Anguis crotalophorus*, Ray. Syn. Anim.
Boiquira ayug, Maregrave, Hist. Nat. Brazil.
Crotalus rhombifer, and *Le crotale a lozanges*, Daudin and Latreille. Vulgo, *Diamond Rattle-snake*. The South American species is said to be distinct from the *horridus*.

Char.—Above cinereous, with four black lines on the side of the neck; beneath the lines a row of black points

* A Rattle-snake lived in the Philadelphia Museum two years, without taking nourishment. A female Rattle-snake brought forth twelve young, early in September 1827—This was one of 150 specimens exhibited in Philadelphia by Elmworth and Murray. Another Crotalus put forth an immature fœtus, and discharged several imperfect ova late in October, 1828.

longitudinally disposed: *back* with from twenty to thirty black rhomboidal figures, distinct, and having their centre and border of an impure white colour: *beneath* yellowish white, immaculate: *tail* black, terminating in a rattle, consisting of from one to twenty pieces: *body* above furnished with twenty-nine longitudinal rows of scales, more or less hexagonal; the twenty-seven intermediate ones carinated.

Length from three to six feet; tail about one-ninth. Abdominal plates from 167 to 170: caudal plates from 20 to 30.

Inhabits the southern states and territories; the Antilles, and intertropical parts of America. Cab. of A. N. S.

Crotalus *miliarius*.

Synonyma. *Crotalus miliarius*, Linn. and Gmel.

Le millet, Daub. Enc. Meth. Lacépède, Latreille, Catesby, Carolina, pl. 42. Bartram's trav.

Le crotale millet, Daudin. Vulgo, *Ground Rattle-snake*, or *Little Rattle-snake;* and by others, *Bastard Rattle-snake.*

Char.—Above reddish gray, cinereous, or fuscous, with a longitudinal series of black spots, rounded and bordered with white: *flanks* with two or more ranges of black spots: *beneath* white, freckled with similar black spots: *scales* on the top of the head suboval and carinated; front of the head and snout covered with nine smooth plates, disposed in four rows.*

Length eighteen inches; tail one-eighth. Abdominal plates 132: caudal plates 32.

Inhabits the southern states: there are several varieties, differing in the colour and arrangement of the spots. Specimens in the Cab. of A. N. S.

* On this arrangement of *plates* is founded the genus Crotalophorus of Gray, and that of Caudisona of Fitzinger.

CROTALUS *confluentis.*

Crotalus confluentis, Say. Long's Exp. to the Rocky Mountains, Vol. II. p. 48.

Char.—Above brownish-cinereous, varied with greenish yellow; a triple series of fuscous spots, edged with greenish white, transversely oblong-oval, anteriorly confluent: *tail* banded: *beneath* yellowish-white, immaculate.

Length ——? about three feet. Abdominal plates 197: caudal plates 27.

Inhabits the western territories, near the base of the Rocky Mountains; frequenting the holes of the Prairie-dog, (ARCTOMYS *ludoviciana.*) Specimens in the Philadelphia Museum.

CROTALUS *tergeminus.*

Crotalus tergeminus, Say. Long's Expedition to the Rocky Mountains, Vol. I. p. 499.

Char.—Above cinereous brown, with a triple series of fuscous spots, transversely oblong oval, and obsoletely edged with whitish: sides spotted, with an alternating fuliginous series: a black vitta passes through the eye, and terminates on the neck: *beneath* spotted with black: *tail* above, fasciated with fuscous, terminating with six bifid plates.

Length two feet, two inches; tail two inches. Abdominal plates 152; caudal plates 20; scales at tip 6.

Inhabits the western territories; frequents the cells of the Prairie-dog. Specimens in the Philadelphia Museum.

ORDER. SAURIA.*

Characters of the ORDER.—Heart composed of two auricles, and, in some instances, of two ventricles: ribs

* From σαῦρος, (Lizard.) This order includes the genera *Lacerta* and *Draco* of Linnæus.

and sternum perfect: lungs vesicular: voice generally restricted to hissing: jaws armed with teeth: tongue, for the most part, slender and extensible: skin covered with scales or plates: generally furnished with four legs, each with five unguiculated toes: male furnished with an exsertile penis, sometimes simple, at others bifurcated; impregnation internal: oviparous; eggs covered with a shell more or less hard: mostly carnivorous.

1st Genus. AMEIVA. Cuvier.

Lacerta ameiva, Gmel., Lacépède,
Les Sauvegardes, Cuvier.
Le Tupinambus, Daudin, &c.

Species of this genus exist in Asia, Africa, and America: the Baron Cuvier thus characterizes the genus. All the scales small, without carina: an obsolete range of pores beneath each thigh: teeth notched, (dentelées.) The same author divides the genus into two sections, viz. *Sauvegardes*, with the tail more or less compressed: scales of the abdomen longer than broad: living on the borders of streams. 2d, *Ameiva*, properly so called; which differs from the preceding, in having the tail cylindrical, and furnished like the abdomen, with transverse ranges of square scales, broader than long: all the scales of the throat small: head pyramidal: those included in the last division are inhabitants of America. Whilst South America furnishes us with numerous species, one only has hitherto been discovered as an inhabitant of the United States.

Ameiva *tesselata.*

A. *tesselata*, Say. Long's Exp. to the Rocky Mountains, Vol. II. p. 50.

Char.—*Above* black, marked with nine or ten longitudinal lines, and eighteen or twenty transverse ones, dividing the whole surface in a tesselated manner, the lines being brownish on the back, yellowish on the sides: scales of the back small, convex, and rounded: *beneath* bluish-white, throat and neck yellowish: *head* olivaceous, covered with plates: scales on the throat, somewhat larger than those on the back: anterior feet yellowish within, covered with minute scales, on the exterior and posterior sides, greenish-white, with confluent black spots and minute scales, the anterior side yellowish, with larger scales: *pores of the thighs* very distinct and prominent: *tail* elongated, brownish above, spotted with black near the base: *beneath* impure white, immaculate: the scales carinated,* and placed in transverse series.

Length one foot: tail eight and a half inches.

Inhabits the Arkansa territory.†

The last family of this order, according to the arrangement of M. Cuvier, is the "*Scincoidiens,*" distinguishable by the shortness of their legs, the fixidity of the tongue, and by the regular imbricated scales.

2d Genus. SCINCUS. Daudin.

Characters of the Genus.—Body more or less cylindrical, covered with uniform, shining scales, imbricated as in the Carp: tongue fleshy, scarcely extensible, and notched: jaws armed with closely approximated teeth, with two small palatine rows: the anus, penis, eye, and ear, resemble those of the Lizards.

There are numerous species of Scinks in the warm climates of both continents. Four species are at present known as inhabitants of the United States.‡ Not venomous.

* The carinated scales appear to be peculiar to this species of the genus Ameiva.

† Perhaps *Ameiva 6-lineata*, Catesb. 68? or Seps. of Cuv.

‡ The Baron Cuvier remarks with his usual learning: "The Greeks and the Romans gave the name of *Scincus* to the *terrestrial crocodile*, consequently to a *sauvegarde*, (Ameiva,) to which they attributed great virtues; but since the middle ages,

Scincus *quinquelineatus.*

Synonyma. S. *quinquelineatus*, Schneider, Hist. Amphib. fasc. secund. p. 201.
Lacerta quinquelineata, Linn. and Gmel.
Lacerta 5-lineata, var. Green. Journ. A. N. S. Vol. I. p. 348.
La Scinque à cinque raies, Daudin, Hist. Nat. des Rep. p. 272. pl. LV. fig. 1.
Le lézard strié, Daub. Lacépède.
Lacerta fasciata, Var. Linn. et Gmel.
Lacerta caudâ cœruleâ, Catesby, Nat. Hist. Carol. Vol. II. pl. 67.
Lacerta marianus minor caudâ cœruleâ, Petiver, Mus. Tom. I. pl. 1. fig. 1.
Le lézard à queue bleue, Daubenton, Encyc. Method. Idem. Lacépède, Latreille.
Vulgo, *The five-lined lizard.*

Char.—Above blackish-brown, marked with five whitish longitudinal lines, the dorsal one bifurcating near the neck: *beneath* of a clear silver-blue: *head* covered with plates, brown, elongated, and flattened, with six longitudinal whitish lines, one above and beneath each eye, with two on the summit, joining before and behind: *tail* similar in colour to the body, the lines gradually effacing, are lost about the middle: all the limbs brown without, marked with a single white line posteriorly, within whitish: posterior extremities with the toes longer than the anterior.

Total length from seven to ten inches; tail nearly the length of the body.

Inhabits South Carolina, New Jersey, Virginia, and Missouri, beneath the bark of trees. Specimens in the Cab. of the A. N. S. When the tail of the Scink is broken and reproduced, it is of a blue colour.

Scincus *americanus.*

S. *erythrocephalus*, Gilliams. Journal of the A. N. S. Vol. I. p. 461. pl. XVIII.
Vulgo, *Red-headed scorpion.*
S. *americanus*, Petiver, Gazophylacii Naturæ et Artis, 1711, tab. 69, fig. 13.

Char.—Above reddish-brown, tinged with cupreous: *beneath* whitish: *head* red above, whitish beneath, wider posteriorly than at the neck.

the S. officinalis is generally sold under this name, for similar purposes. The orientals, in particular, regard it as a powerful aphrodisiac." Cuv. Regne Anim. V. II. p. 53.

Total length eleven inches; tail rather longer than the body, or six and a half inches.

Inhabits the southern states. Cab. of the A. N. S.

Scincus *bicolor.*

S. *bicolor*, Harlan. Journal of the A. N. S. Vol. IV. p. 286. pl. XVIII. fig. 1. According to Say, this is a bleached specimen of Scincus 5-lineata.

Char.—*Above* dusky-brown, darkest on the head: *beneath* silver-white: two longitudinal whitish lines on each side of the body: *tail* cylindrical and tapering: two obsolete lines on the posterior part of the thighs.

Total length nine inches four-tenths; tail five inches four-tenths.

Inhabits the southern states. A specimen in the Philadelphia Museum.

Scincus *lateralis.*

Synonyma. S. *lateralis*, Say. Long's Exp. to the Rocky Mountains, Vol. II. p. 324.
Scincus unicolor, Harlan. Journal of the A. N. S. Vol. V. p. 156.

Char.—*Above* light-brown, with a lateral blackish line: *beneath* greenish-white: *head* with the rostrum rather short; a transverse row of scales behind the plates larger than the remaining cervical scales.

Total length four inches; tail two inches two-fifths.

Inhabits the southern states. Cab. of the A. N. S.

3rd Genus. AGAMA. Daudin.

Characters of the Genus.—Body oblong, covered with carinated and reticulated scales: tongue short, thick, and slightly notched at the extremity: head large, callous, and generally spinous on the occiput, covered above with small rhomboidal scales.

Daudin has divided this genus into six sections, three of which will include all the species which inhabit the United States.

Agamas, properly so called.

Forming the second section of Daudin.

Body oblong, more or less slender; tail cylindrical. Erroneously represented by this author as destitute of femoral pores.

Agama *undulata.*

Synonyma. *Lacerta undulata*, Bosc.

Le stellion ondulé, Daudin, Hist. Nat. des Rept. par Latreille, Tom. II. p. 40.

L'agame ondulé, or *Agama undulata*, Daudin, Hist. Nat. des Rept. suite de Buffon.

Lacerta hyacinthina, Green, Journal of A. N. S. Vol. I. p. 349.

Lacerta fasciata, Idem.

Char.—Above cinereous, with irregular, transverse, brownish, bands or undulations: *beneath* bluish, with a large whitish cross: beneath the thighs, with porous grains.

Total length six inches four lines: tail three inches three lines.

Inhabits the middle, western, and southern states. Cab. of the A. N. S.

Agama *umbra.*

Synonyma. *Iguana umbra*, Linn. Gmel.
Iguana chalcidica, Laurenti.
Iguana tuberculata, Laurenti.
Le lézard umbre, Daud. Lacépède.
Iguane umbre, Latreille.
Agama umbra, Daudin.

Char.—Above of a burnt chestnut colour: *beneath* pale cinereous: *throat* yellowish: beneath the neck, a large spot of deep blackish violet, prolonged upon the occiput:

Fig 1. Fig 2. Fig 3.— Fig 4.—

Fig 1. Agama cornuta Fig 2. Ventral view of the same Fig 3. Agama douglassii Fig 4. Agama collaris

Lehman & Duval Lith.

body long, cylindrical: occiput callous, spiny: *back* longitudinally striated.

Total length one foot three inches; tail nine inches six lines.

Inhabits Mexico, California, and the south-western territories. Cab. of A. N. S.

Orbicular Lizards.

3rd Section of Daudin, or TAPAYIA. (Tapayes.)

Having the skin covered with small scales, and with warty or spiny processes: the form is broad and contracted: body susceptible of inflation; furnished with minute femoral pores.

Agama *cornuta.*

Agama cornuta, Harlan. Journal of the A. N. S. Vol. IV. p. 299. pl. XX. Vulgo, *Horned lizard, Horned toad*, &c.
Tapajaxin, B. S. Barton. Med. & Phys. Journal, Vol. III.

Char.—Above variegated-fuscous: *beneath* whitish: *body* depressed oval, scabrous: *head* above quadrangular: *tail* depressed at base, slender and teretile at the extremity, shorter than the body.

Total length four inches; tail one inch five-tenths—of greater proportional length in the female.

Inhabits the trans-Mississippi territories as far west as the plains of the Columbia river, and as far south as Mexico. Specimens in the Philadelphia Museum, and A. N. S. and A. P. S.

Agama *douglassii.*

A. *douglassii*, Bell. Trans. Lin. Soc. Lond. Vol. 16. pt. 1. 1829.

Char.—Head obtusely triangular, with a distinct ridge overhanging the orbits: *body* suborbicular and depressed: *tail* tumid at base, abruptly contracted, and teretile at the extremity: superior portions of the body covered with small raised scales, interspersed with larger ones which are aculeated, and mostly quadrangular, forming ridges over the eyes and ears, across the occiput, and along the sides of the body: *beneath*, with small uniform smooth scales: the gular fold is of considerable size: *colour* above of a yellowish white mixed with piceous disposed in dots, with transverse dorsal series of piceous ocelli margined with white. A white longitudinal central line from the occiput to the end of the tail; beneath, white; femoral pores yellow, twenty on each side.

Inhabits the plains of the Oregon or Columbia river, feeding on insects and vegetables. Cab. A. N. S.*

Lacertine Agamas. (Les Agames Lézardets.)

4th section of Daudin.

These, like the Lizards, have the head covered with plates, and a row of porous grains beneath the thighs; tail cylindrical.

Agama *collaris*.

Agama collaris, Say. Long's Exp. to the Rocky Mountains, Vol. II. p. 252.

Char.—*Above* with five or six dusky broad bands, alternating with narrow fulvous bands, which have each a series of yellow or cinereous spots: sides greenish-yellow: sides of the neck fulvous, varied with red, banded with black: *beneath* pale: thighs with a series of pores: *eyes* silvery, pupil black: *tail* long, cylindrical, and tapering: *scales* destitute of carina.

Total length nine inches two-fifths; tail five inches two-fifths.

* The A. *cornuta*, A. *douglassii*, A. *umbra*, A. *undulata*, &c. constitute Cuvier's sub-genus Tropidolepis.

Inhabits the Arkansa territory. Neosho river of Arkansa. Specimens in the Philadelphia Museum. (Vide plates opposite.)

4th Genus. ANOLIS. Daudin.

Characters of the Genus.—Body elongated, covered with very small scales, disposed in irregular transverse rows, reticulated on the tail, which is long and cylindrical: tongue short and thick, very slightly notched at the extremity: head elongated, quadrangular, covered with numerous small scales: throat susceptible of inflation during the season of their amours, or when the animal is irritated: four legs, each with five long slender toes, the last phalanx broad, and furnished beneath with imbricated scales, forming transverse striæ, as in the Geckos: hooked nails projecting from the extremity of the last phalanx.

Anolis *strumosa.*

Synonyma. *Anolis bullaris*, Daudin, Hist. Nat. des Rept. suite de Buffon.
Le Roquet, Lacépède, Valmount, Dutertre, Ray.
Lacertus cinereus minor, or the *Least light brown, or gray lizard*, Sloane, Antille, Tom. II. pl. 273, fig. IV.
Lacerta bullaris, Linn and Gmel. Syst. Nat. p. 1073, No. 32.
Lacerta strumosa, Linn. and Gmel. Syst. Nat. p. 1067, No. 33. And of Seba. II. XX. 4.
Lacerta viridis jamaicensis, Catesby, Carol. Vol. II. pl. LXVI.
Lacerta viridis carolinensis, Idem, pl. LXV.
Le lézard rouge-gorge, Daub. Lacépède.
L'Iguane rouge-gorge, Daud. Hist. Nat. des Rept. par Latreille.
Salamandra strumosa, Seba and Laurenti.
Le goitreux, Daud. Lacépède. Vulgo, *Chamelion* in the southern states.*

Char.—*Above* green, changing to brownish, or reddish; a black spot on each temple: *beneath* whitish-gray, spotted with pale fawn: *tail* cylindrical, destitute of carina; the throat becoming red when inflated.

* The West Indian and North American species have been confounded; it is now ascertained that the *Carolina anolis*, or *Iguane goitreux*, Brongn. and Catesby, is a distinct species. Vid. Cuv. R. A. last ed.

Total length five inches; tail three inches.

Inhabits Carolina, frequents trees, garden walls, &c. Cabinet of the A. N. S.

5th Genus. LACERTA. Daudin, Cuvier, &c.

Characters of the Genus.—Body elongated, covered above with very small scales, transversely disposed: abdomen covered with six or ten rows of longitudinal, square, smooth plates: a scaly collar beneath the neck, (excepting the *Ameiva* lizards, which form the first section of Daudin.) Tongue long, extensible, and bifurcated: head oblong, quadrangular, sloping before, covered above with plates: tail long, cylindrical, and verticillated: four strong legs, with each five unguiculated toes: a row of porous grains beneath the thighs: jaws armed with teeth:* the cranium advancing over the temple and orbits, in form of a bony shield.

Striped Lizards.
Forming the third section of Daudin.

Having a transverse collar under the neck, formed of several large scales; colour bluish; striped above with longitudinal white lines.

Lacerta *sexlineata.*

Synonyma. *Lacerta sexlineata*, Linn. and Gmel.
Le lion, Daud. and Lacépède.
Le lézard à six rais, Latreille and Daudin. Figured by Catesby, Nat. Hist. Carol. Perhaps an *Ameiva.*

Char.—*Above* brown, deeper and nearly black upon the back and sides; slate-blue on the flanks: *beneath* pale yellowish-white: *back* striped with six longitudinal whitish lines, the neck with eight lines.

* According to Cuvier, the Lizards are characterized by "two palatine rows of teeth;" we have not been able to detect these teeth in the *Lacerta 6-lineata.*

Total length eight inches two lines; tail five inches six lines.

Inhabits Carolina. Cabinet of the A. N. S.

Dracenoide Lizards.

The sixth section of Daudin.

With two folds under the neck: anterior half of the tail verticillate, posterior half reticulated. The section includes but one species.

Lacerta *quinquelineata*.

Synonyma. *L.* 5-*lineata*, Daudin.

Lacertus major, cinereus, maculatus? Sloane, Hist. Jam. p. 333, pl. CCLXXIII fig. 3.

Char.—*Above* impure azure-blue, deeper on the body: *beneath* pale: *back* marked with five longitudinal black lines: *flanks* with whitish spots: *tail* verticillated anteriorly, reticulated posteriorly.

Total length six or eight inches; tail about three-fifths.

Inhabits Carolina? and probably the Antilles. Cab. of the A. N. S.—The existence of this species in the U. S. is ambiguous; perhaps there is no true *Lacerta* in this country.

6th Genus. CROCODILUS. Brongniart.

Characters of the Genus.—Of large stature: back and abdomen covered with several rows of large plates, those above with an elevated crest: tongue thick, short, adhering to the lower jaw: skull flat and broad: tail strongly compressed, furnished above with a serrated crest, double anteriorly: legs robust; five toes before, four behind, three internal only furnished with nails, all more or less united by a membrane. Heart with two auricles, and two ventricles; the large arteries uniting and forming distinct sacks immediately before the heart.*

CAIMANS. (Alligator.) Cuvier.

3d Section of Daudin and others.

Having the snout broad and obtuse: teeth unequal: the fourth lower tooth enters a hole, and not a groove, of the upper jaw, when the mouth is closed: feet semi-palmated.

CROCODILUS *lucius*.

SYNONYMA. *Crocodilus lucius*, or *Le Caiman à museau de brochet*, Cuvier. Ann. du Mus. Vol. X. Regne Anim. Tom. II. p. 22. Anim. Foss. Vol. IV.

Crocodilus mississippiensis, Daudin.

Alligator, or *Crocodile of Florida*, Bartram, Trav. Idem, Catesby, Carol. Pl. LXIII. figure inaccurate.

Idem, Hentz, "Some Observations on the anatomy and physiology of the North American ALLIGATOR," (*Crocodilus lucius*, Cuv.) Transactions of the Am. Phil. Soc. Philad. Vol. II. New Series, p. 216, Pl. II. 1820.

Char.—*Above* dark cinereous or blackish-brown, tinged with green: *beneath* whitish: *snout* broad and depressed: *neck* above with four carinated plates disposed in a square.

Length from ten to twenty feet; tail nearly the length of the body.

Inhabits the southern states, in fresh water lakes and rivers. Not found north of Carolina on the Atlantic, nor north of Red river on the Mississippi. Cab. of the A. N. S.†

* For some account of the circulation in the Alligator, vid. present volume, "Description of two Sp. of Linnæan lacerta," &c.

† Found in the lower part of the Arkansa river, according to Mr. Nuttall.

7th Genus. CHIROTES. Cuv.

Character of the Genus.—Scales verticillated; head obtuse. Furnished with two anterior feet.

Chirotes *lumbricoides.*

Synonyma. *Le Bimane cannelé*, or *Bipède cannelé*, Lacépède.
Chamæsaurus propus, Schn.
Lacerta lumbricoides, Shaw.
Chirotes lumbricoides, Say. Long's Exp. to the Rocky Mountains, Vol. I. p. 484.

Char.—Two anterior feet, each with four toes, and a rudiment of a fifth: furnished with scapula, clavicle, and small sternum; the remaining portion of the skeleton resembling that of the amphisbena.

Length from eight to ten inches, and of the thickness of the little finger: of a flesh colour; covered with about one hundred and twenty semi-rings on the back, alternating with an equal number on the belly.

Inhabit Mexico, and south western provinces of the United States. Feed on insects, &c.

Order. CHELONIA.

TESTUDO. (Linn.)

Characters of the Order.—Heart composed of two auricles, and of a ventricle with two unequal chambers communicating together, wherein the systemic and pulmonic circulations meet, propelling mixed blood through the aorta. Body enclosed in a double shield, a superior, or back-plate, (carapace,) an inferior, or breast-plate, (plastron.) The former composed of eight flattened ribs united to each other, and to the dorsal vertebræ: the latter composed of the sternum, consisting of many pieces united by suture. The cervical and caudal vertebræ are alone moveable. Respiration performed by means of the muscles of the throat, as in the *Batraceans:* jaws destitute of teeth, but furnished with a corneous beak; in some instances serrated: tongue short: œsophagus, in some instances beset with fleshy, conical protuberances, having a cardiac direction: stomach simple: bladder large: urine limpid: penis simple, exsertile, grooved the whole length of the inferior surface: eggs covered with a shell sometimes hard, at others soft.

This *Order*, including only the Linnæan genus Testudo, is very properly divided into several genera, included under three great families, viz: The Land, Fresh-water, and Sea, Tortoises.

1st Family. LAND TORTOISES.

1st *Division*—With the sternum simple, or without a valve; shell ventricose.

1st Genus. TESTUDO. Brongniart.

Characters of the Genus.—Back plate ventricose: legs short and clumsy; toes short and thick, covered with skin which unites them nearly to the last phalanx, armed with strong nails, five behind, four before: sternum simple, generally projecting at the anterior extremity. Exemplified in the *Græca*, the *Indica*, the *Geometrica*, &c., together with the only species observed in the United States.

Testudo *polyphemus.*

Synonyma. *Testudo polyphemus*, Daudin.
Gopher, Bartram's Trav. Vol. I.
Testudo carolina? Linn. and Gmel.
T. *polyphemus*, Say. Jour. of the A. N. S. Vol. IV. p. 207.
T. *tabulata*, Shœpff, 56. t. 13.
Emys polyphemus, Schw.
T. *depressa*, Lesueur; Guerin, Icon. Rept. t. 4. fig. 4. Vulgo, *Mongoofa.*

Char.—*Above* depressed: sternum composed of twelve plates, elongated anteriorly, surpassing the anterior margin of the back-plate in the female only: *tail* short: *nails* depressed, quadrate: *jaws* denticulated.

Length one foot six inches; breadth twelve inches.

Inhabits Georgia and the Floridas. Specimens in the Philadelphia Museum.

2nd *Division*—Sternum bi-valvular, giving full protection to the head and members of the animal, when withdrawn into the cavity. Cuvier subdivides the genus into such as have two lids, and such as have but one. We transfer these subdivisions to the family Emydidæ.

2nd Genus. CISTUDA. Bloch. Fleming.

Synonyma. *Terrapene*, Merrem. Bell.
Testudo, Linn. and Gmel.
Les Tortues à boite, Cuvier, Regne Animal.
Cistuda, Fleming. Philosophy of Zoology, Vol. II. p. 270. 1822.—Idem, Say, Journal of the A. N. S. Vol. IV. p. 205. 1824.
Sternotherus, Bell.

Characters of the Genus.—Sternum divided into two lids by a hinge-like articulation, united to the back-plate by a moveable articulation: shell ventricose, and the feet resembling those of the *Testudo*, (Brongn.)

Cistuda *clausa*.

Synonyma. *Testudo clausa*, Gmel. Daudin, and others.
Terrapene clausa, Merrem.
Cistuda clausa, Say, ut supra, who attributes *Testuda carolina*, Linn., as a synonyme.
La tortue courte-queue, Daud. suite de Buffon, Tom. LXXX. p. 207.
La tortue a goutelettes, or *Testudo virgulata*, Daudin.
Testudo tessellata minor caroliniana, Edwards, Av. 205.
Cistuda carolina, (American box terrapin,) Gray, Synop. Rep.
Testudo incarcerata striata, Bonat.
Test. virgulata, Daud.
Test. carinata, Lin.
Emys dubia, Schw.
Terrapene carolina, Bell.

T. guttata, Bell.
T. nebulosa, Bell.
Emys schneideri, Schw. Edw. t. 205, Cop. Shaw Zool. iii. t. 7, and Seligman vi. t. 100, and Bechst. Lacep. t. f.—Shœpff. t. 7.—Bloch, Bert. Naturf., t. 1. f. 1, 2.—Grew, t. 3. f. 2.

Char.—*Shell* convex, oval: *sternum* consisting of twelve anchylosed plates, bivalvular, posterior valve the largest: *superior mandible* hooked, *inferior* elevated at tip and acute: *tail* short: vertebral plates slightly carinated; marginal plates occasionally differ in number in this species.

Colours and markings varying in different individuals; plates sometimes sculptured, at other times glabrous.

Length of shell five and a half inches, breadth four inches, height two or three inches.

Inhabits the southern and middle states. Cabinet of A. N. S.*

2d Family. FRESH WATER TORTOISES.

EMYDIDÆ. Merrem.

Having the toes webbed, and furnished with long, sharp nails, five before, four behind: sternum composed of twelve plates, either continuously solid, or furnished with one or more imperfect hinges: shell generally rather depressed.

1st Division—Sternum continuously solid.

3d Genus. EMYS. Brongn.

Characters of the Genus.—Toes longer and more separate, and nails longer than in other tortoises; five before and four behind; the form of their feet, particularly the

* This species is long-lived; a specimen was lately found on the farm of George Hunter, in Newton, Delaware County, marked J. H. 1761.

October 27th, 1830.—Examined a living young C. *clausa*, with two distinct heads and necks—found in Chester county.

posterior, being strongly webbed, renders them aquatic, and enables them to swim with velocity: back shell more depressed than in the land tortoises.

Emys *picta.*

Synonyma. *Testudo picta*, Linn. Gmel. Shœpff, Herm.
La tortue peinte, Daudin, Latreille.
Testudo cinerea, Shœpff.
Painted tortoise, Shaw, Zool. t. 10.
Emys picta, Schw. No. 22. *E. cineria*, Schw. No. 23.

Char.—*Above* dark brown, with the margins of the plates yellow: *head* and *neck* with longitudinal stripes of yellow: *jaws* denticulated.

Length five and a half inches, breadth four inches, height one and a half inches.

Inhabits the middle states; very common in the fresh water brooks of Pennsylvania. There are three or four varieties, including *T. cinerea* of Shœpff, which appears to have been described from a young specimen. Specimen in the Cabinet of A. N. S.

Emys *punctata.*

Synonyma. *Testudo punctata*, Shœpff, Hist. testud. p. 25, pl. V. Bosc.
La tortue ponctuée, Daud. p. 159. pl. XXII. Idem, Latreille.
Testudo guttata, Shaw, Zool. 3. Pt. I. p. 47. pl. X.
Emys guttata, Schw.—*Test. anonyma*, Schw. Vulgo, *Spotted turtle.*

Char.—*Shell* blackish, with remote bright, yellow, round spots: *superior jaw* emarginated: *inferior jaw* acute.

Length of the shell four inches, breadth of shell two and a half inches, height one and a half inches.

Inhabits Pennsylvania, and all United States. Cabinet of the A. N. S.

There is a variety with the shell more depressed, and the spots more numerous; figured in Shœpff's work.

EMYS *muhlenbergii.*

SYNONYMA. *Testudo muhlenbergii*, Shœpff, Hist. Testud. who figures the back and breast-plates, from a specimen sent by Dr. Muhlenberg, from Pennsylvania.
Emys muhlenbergii, Schw. No. 30.
Chersine muhlenbergii, Merrem.
Emys biguttata, Say. Jour. of the A. N. S. Vol. IV. p. 205.

Char.—*Shell* oblong-oval, slightly contracted laterally in the middle: *occiput* with two large fulvous spots: *superior jaw* emarginate: *inferior jaw* acute: *tail* rather long.

Length? rather smaller than E. punctata.

Inhabits Pennsylvania. Cabinet of the A. N. S.

EMYS *geographica.*

SYNONYMA. *Testudo geographica*, Lesueur. Journal of the A. N. S. Vol. I. p. 86, pl. V.
Emys geographica, Say. Journal of the A. N. S. Vol. IV. p. 204.
E. Lesueurii, Gray. Syn. Rept. 1831.

Char.—*Vertebral plates* sub-carinated, the anterior urceolate; anterior marginal plates slender: *shield* sub-oval, sides compressed: *sternum* nearly the length of the shield: *mandibles* sharp, simple: general colour, dusky, marked with pale sinuous stripes: *tail* banded with yellow.

Length of shell eight inches, width six inches, height three inches.

Inhabits Lake Erie; noticed by Major Long's exploring party on the Ohio and its tributaries.

EMYS *insculpta.*

SYNONYMA. *Emys specioca*, Bell and Gray.
Emys scabra, Say. Journal of the A. N. S. Vol. IV. p. 210.
And according to some authors *Emys pulchella* of Shœpff.

Char.—*Colour* dark greenish-brown above, fulvous beneath: *plates* sculptured with concentric and radiating lines, giving the shell a granulated appearance: *sternum* with a large black spot on each plate: *superior jaw* emarginate at tip; *inferior jaw* acute.

Length from three to nine inches.

Inhabits the northern and middle states. Cabinet of the A. N. S.

Emys *centrata.*

Synonyma. *Testudo centrata*, Latreille. Idem, Daudin.
Testudo concentrica, Shaw, Zool. III. pt. I. p. 43, pl. IX. Vulgo, *Terrapin.*
E. centrata, Schw.
Testudo palustris, Gmel.

Char.—Shell sub-ovate: *vertebral plates* sub-carinated, excepting the last: *plates* with concentric lines, more or less deeply impressed: *skin* whitish, with numerous blackish spots: *jaws* simple.

Length seven inches, breadth five inches, height three inches.

A smaller variety exists, with the concentric lines nearly obsolete.

Inhabits the southern and middle states, in the vicinity of brackish water. Specimens in the Cab. of the A. N. S.

Emys *reticulata.*

Synonyma. *Testudo reticulata*, Daudin, Bosc.
Testudo reticularia, Latreille.
La tortue reticulaire, Latreille, Daudin.
Emys reticulata, Say. Journ. A. N. S.
Testudo concinna, Le Conte. Ann. of Lyc. N. Y. Vol. III. p. 106.

Char.—Shell elongated oval, larger posteriorly, without carinæ; *plates* covered with small parallel striæ: *sternum* yellowish, rounded at both extremities: colour of the shell deep brown, reticulated with yellow lines: marginal plates at their sternal junction, with three black spots.

Length seven inches, greatest breadth four and a half inches, height near three inches.

Inhabits the southern states. Cab. of the A. N. S.

Emys *rubriventris.*

E. rubriventris, Le Conte, Ann. Lyc. Nat. Hist.
E. serrata, Say and Harlan. Journ. A. N. S.

Char.—*Shell* sub-orbicular; vertebral plates sub-carinated, lateral plates striated or rugous; six posterior marginal plates serrated; all the marginal plates beneath, with a black spot: *jaws* denticulated: *colour* blackish, marked with yellow: *sternum* reddish.

Length from ten to seventeen inches.

Inhabits the southern and middle states. Common in New Jersey, and in the vicinity of the Chesapeake. Cab. of A. N. S.

Emys *decussata?*

E. decussata, Bell. Gray's Synop. p. 28.

"Testa oblonga pallide fusca obtuse carinata postice subdentata, subtus lutescente, maculis subocellatis scutillis axillaribus inguinalibus suturque marginalium impositis; scutellis rugulosis irregulariter radiatim sulcatis; animal virescens, genis gulaque obscure pallide lineatis."

Inhabits southern states of N. A. We have never seen a specimen of this variety or species, and presume it must be rare.

Emys *serrata.*

Testudo serrata, Daud.
T. scripta, Shœpff.
Emys serrata, Merrem, Say, &c.
Emys reticularia, Bell.
Emys scripta? Gray, Syn. p. 29.
Emys decussata? Gray, Syn. p. 28.

Specific Characters.—"Testa oblonga longitudinaliter rugulosa olivaceo fusca—fasciis pallidis irregularibus transversis variegata, postice subdentata—scutellis vertebralibus obtuse. Carinatis, imo longe urceolato—reliquis longe hexagonalibus, marginalibus subtus maculis subocellatis ad suturas positis—sterno flavescente plano, lineis nigro marginata ornato."

Habitat.—Pretty generally distributed through the United States, if our observations be correct; which have not enabled us to distinguish satisfactorily this species from *E. reticularia, E. scripta,* and *E. decussata,* which we have quoted accordingly; and for similar reasons have added *E. rubriventris* of Le Conte.

Emys *floridana.*

T. floridana, Le Conte, Ann. of the Lyc. N. Y. Vol. III. p. 100.

Specific Characters.—"Testa ovalis, ecarinata, longitudinaliter rugosa, fusco-nigra lineis irregularibus flavis notata, lateralibus plus minus radiantibus; scutellum intermedium marginale triangulare, integerrimum: maxilla inferior edentula."

Habitat.—St. Johns river, East Florida.

This species is by no means sufficiently distinguished from the *T. rubriventris,* of the same author; the specific characters quoted being attributable to age and sex, in many instances.

2d Division.

Sternum with two ligamentous hinges, the middle lobe fixed, generally composed of eleven pieces.

Genus. Kinosternon, of Spix, Bell, &c.

Emys *pennsylvanica.*

Synonyma. *Testudo pennsylvanica*, Linn., Gmel., Shœpff., Bosc. Idem, Shaw, Zool. Vol. III. p. 60, pl. XIV. Encyc. Method. pl. V. fig. 1. Daudin, suite de Buf fon, p. 182, pl. XXIV.

La tortue rougeatre, Daudin, ut supra.

Terrapene pennsylvanica, Merrem.

Cistuda pennsylvanica, Say. Journal of the A. N. S. Vol. IV. p. 206.

Emys pennsylvanica, Harl. Idem, Schn.

Kinosternon pennsylvanica, Gray, Synop.

Terrapene boscii. Merrem.

Sternotherus boscii, Bell.

Char.—Shell oval, rather convex: *sternum* deeply emarginate, posterior angles rounded: *superior mandible* hooked at tip: *inferior mandible* elevated and acute: *tail* unguiculated.

Length of the shell three or four inches; breadth two or three inches; height one or two inches.

Inhabits the southern and middle states. Cabinet of A. N. S.

A variety with the sternum proportionably broader, and the femoral plates elongated posteriorly; observed by Major Long's exploring party, in the vicinity of the Missouri.

3d Division.

Sternum univalve, with a single ligamentous hinge, uniting the anterior lobe to the middle and posterior, which are immoveable.

Genus. Sternothærus. Bell.*

Emys *odorata.*

Synonyma. *Testudo odorata*, Daudin, suite de Buffon, Vol. LXXX. p. 189.
La tortue odorante, Daudin, Latreille, Hist. Nat. des Reptiles, Tom. I. p. 122.
Cistuda odorata, Say. Journal of the A. N. S. Philad. Vol. IV. p. 216.
Emys odorata, Harl. and Schw.
Sternotherus odoratus, Bell.
Kinosternon odoratum, Gray, Synop.
La tortue à battans soudés, Daudin, or *Testudo glutinata*, Idem. Vulgo, *Stink-pot*, or *Musk-tortoise.*

Char.—Shell oval, convex: *sternum* emarginate behind; posterior angles acute, a single plate anteriorly, very small; the whole breast plate narrower than in the *pennsylvanica*, with a single valve anteriorly: *head* flattened, pointed, of a brownish colour, with two yellow lines on each side: *chin* with some yellow tubercles in form of processes.

* London Zoological Journal, No. VII. p. 299.

Length four or five inches; breadth two or three inches; rather higher than the preceding.

Inhabits the southern and middle states, giving the preference to muddy ditches. Cab. of the A. N. S.

4th Genus. CHELYDRA. Schw.
CHELONURA. Fleming.
EMYS. Section B. Oppel.
SAUROCHELYS. Latreille.
RAPARA. Gray.
TESTUDO. Lin.

Characters of the Genus.—Tail about the length of the shield: back-plate carinated with spinous processes posteriorly: extremities incapable of being withdrawn into the shield.

Chelydra *serpentina.*

Synonyma. *Testudo serpentina*, Linn. Gmel. Shœpff.
La tortue serpentine, Daud. Lacépède.
Testudo serrata, Pennant, Supple. Arct. Zool.
Chelonura serpentina, Harl. Genera N. A. Reptilia, Ed. 1st. Say, Journal of Acad. Nat. Sc. Philad. Vol. IV. p. 217. Vulgo, *Snapping-turtle*, or *Logger-head*, of the middle states; *Alligator-tortoise*, of the southern states, *Coutta*, by the slaves.

Char.—*Shell* sub-ovate, depressed, posterior plates spinous: superior mandible hooked, acute: *tail* very long, compressed and serrated.

Length, sometimes four feet, to four and a half feet, of the shell about two feet; weighing about twenty pounds.

Inhabits the southern and middle states; preferring ditches and muddy pools. Cab. of the A. N. S.*

* *Tuesday, Feb.* 11, 1835.

Mr. Petival, civil Engineer, laid before the Academy of Natural Science of Philadelphia, for the inspection of the members, drawings representing three views of a new species of Chelonura, from a tributary stream of the Mississippi, which enters that river above Memphis, in West Tennessee. The skull of the animal was also displayed. This species is characterized as new by its enormous size, by the greater number of border plates, number of carina on the back plate and tail, by the great and peculiar curvature of the jaw, by the sutures of the cranium, markings, &c. on the plastron.

5th Genus. TRIONYX. Geoffroy.

Fam. Trionychidæ. Gray.

Characters of the Genus.—Destitute of scales; shield and sternum being covered with a soft skin, or cartilage: an osseous disk in the shield, from which project laterally several ribs, shorter than the cartilaginous border: feet palmated, three inner toes furnished with claws: a corneous beak covered with fleshy lips: nose prolonged into a fleshy trunk: vent situated near the extremity of the tail.

Trionyx *ferox.*

Synonyma. *Testudo ferox*, Pennant, Linn. Gmel. Shœpff.
La tortue molle, Lacépède, Latreille.
La tortue de Pennant, Daudin.
Trionyx ferox, Merrem. Say. Journal of the A. N. S. Vol. IV. p. 218.
The soft-shell tortoise, Bartram, Trav. Vol. I. p. 11.
Trionyx spiniferus, Lesueur. Mem. du Mus. d'Hist. Nat. 1827. *Trion. georgicus.* Geoff. *Trion. carinatus.* Geoff. Ann. du Mus. t. IV. *Trion. brongniartii*, Schw.

Char.—Sternum with two callosities; small smooth tubercles on the anterior and posterior part of the covering of the back: *tail* slightly projecting beyond the cartilaginous border, in the female; much longer and thicker in the male: *head* and *neck* very nearly the length of the body.

Length of the body about twenty inches, breadth about fourteen and a half inches; head and neck about thirteen and a half inches in length when protruded; weighing between twenty and thirty pounds.

Inhabits the Mississippi, the Ohio, the northern lakes with their tributary streams; also many of the rivers of

Total length of animal four feet eight inches, circumference of the head one foot ten and a half inches, length of the head eight inches.

Dr. Troost had previously, during the summer of 1834, notified me of his discovery of this species, which he names *Chelonura Temminckii* and the present drawings and specimen are now on their way to the Jardin des Plants, for publication. More than one specimen has been observed.

the southern states; not observed to exist further south than South Carolina on the sea board.

Specimens, male and female, preserved in spirits in the Cabinet of the A. N. S.

TRIONYX *muticus.*

Trionyx muticus, Lesueur, Mem. Mus. XV. 1827.
Armless Trionyx.

"Testa elliptica levissima, antice cum collo continua, dorso centro depresso, sterno 4 calloso, callis 2 posterioribus conjunctis."

Length eight and a half, breadth seven and a half inches, sometimes larger.

Inhabits Ohio river and tributaries.

TRIONYX *Harlani.*

Trionyx Harlani, Bell, Monog. Test. pl.

Char.—Body more ventricose, soft portions of the shell less extensive than in the other species. In general appearance approaching more to the genus Emys.

Inhabits East Florida. Mus. of Bell, Lond.

The Trionyx Bartrami, vid. Bartram's Travels in Florida, who describes it as from St. Johns river, has never been observed by any naturalist, and is most probably founded in error.

The preceding synopsis includes all the remarks, which our observations enable us to offer, in the two first great families of the *Order* CHELONIA. Concerning the third and last family, the Sea Tortoises, (Chelonia, of Brongniart,) we have enjoyed no opportunity of investigation, which would enable us to add to the facts already before the public. The ingenious Dr. Fleming, with considerable erudition, and a nomenclature always classical, has recently attempted a revision of this order.* According to this author, the sea tortoises are divided into two groups, consisting of three genera, thus characterized :

First Group.—Breast-plate interrupted by intervening cartilaginous spaces : extremities incapable of being withdrawn into the shield: fore legs remarkably produced, with the toes united, to serve as a fin : living in the sea.

1. Chelonia. Back-plate covered with corneous scales. *Testudo mydas.* L.

2. Coriudo. Back-plate destitute of scales. *Testudo coriacea.* L.

Second Group.—Lips fleshy, with a produced snout: toes webbed.

3. Chelys. (Dumeril.) Back-plate scaly : a protuberance on the hind feet, occupying the place of a web, but destitute of a claw : toes armed with claws: mouth destitute of a corneous beak. *Testudo fimbria,* Gmel.†

We close our observations on this subject, for the present, in offering a *catalogue* or methodical table, of the Reptilia inhabiting the United States ; together with a few additions and corrections.

* Vid. "The Philosophy of Zoology ; or a general view of the Structure, Functions, and Classification of Animals. By John Fleming, D. D. F. R. S. E., Minister of Flisk, Fifeshire." In two Vols. 8vo. 1824.—Vol. II. p. 268.

† For the species of Sea Tortoises which frequent the coasts of the United States, vide the methodical table at the termination of this essay. For an interesting history of the habits of the Sea Tortoises of the United States, vide Audubon's Ornithological Biography, Vol. II. p. 370.

CATALOGUE
OF
THE NORTH AMERICAN REPTILIA.

1st Order. BATRACHIA.

1st Genus.
AMPHIUMA.
means.
tridactylum.—2.

2d Genus.
MENOPOMA.
alleghaniensis.—1.

3d Genus.
SIREN.
lacertina.
striata.
intermedia.—3.

4th Genus.
MENOBRANCHUS.
lateralis.—1.

5th Genus.
SALAMANDRA.
subviolacea.
tigrina.
cylindracea.
fasciata.
sinciput-albida.
erythronota.
cinerea.
variolata.
fusca.
maculata.
subfusca.
longicaudata.

SALAMANDRA.
nigra.
flavissima.
rubra.
picta.
symmetrica.
porphyritica.
jeffersoniani.
cirrigeri.
dorsalis.—21.

6th Genus.
RANA.
pipiens.
clamata.
ocellata.
melanota.
halecina.
utricularius.
scapularis.
flaviviridis.
sylvatica.
palustris.
pumila.
gryllus.
dorsalis.
nigrita.—14.

7th Genus.
HYLA.
lateralis.
femoralis.
squirella.

HYLA.
delitescens.
versicolor.—5.

8th Genus.
BUFO.
musicus.
cognatus.
fuscus.—3.

2d Order. OPHIDIA.

1st Genus.
OPHISAURUS.
ventralis.—1.

2d Genus.
COLUBER.
obsoletus.
constrictor.
testaceus.
ordinatus.
parietalis.
filiformis.
flagelliformis.
sipedon.
saurita.
sirtalis.
proximus.
flaviventris.
striatulus.
punctatus.
amænus.
rigidus.
septemvittatus.
porcatus.
coccineus.
heterodon.
æstivus.
fasciatus.
getulus.
calligaster.

COLUBER.
melanoleucus.
eximius.
vernalis.
cauda-schistosus.
erythrogrammus.
doliatus.
maculatus.
guttatus.
molossus.
reticularis.—34.

3d Genus.
VIPERA.
fulvia.—1.

4th Genus.
CENCHRIS.
mokeson.—1.

5th Genus.
SCYTALE.
piscivorus.
niger.
cupreus.
tisiphone.—4.

6th Genus.
CROTALUS.
durissus.
horridus.
miliarius.
confluentis.
tergeminus.—5.

3d Order. SAURIA.

1st Genus.
AMEIVA.
tesselata.—1.

2d Genus.
SCINCUS.
quinquelineatus.

SCINCUS.
americanus.
bicolor.
lateralis.—4.

3d Genus.
AGAMA.
undulata.
umbra.
cornuta.
douglassii.
collaris.—5.

4th Genus.
ANOLIS.
strumosa.—1.

5th Genus.
LACERTA.
sexlineata ?
quinquelineata?—2.

6th Genus.
CROCODILUS.
lucius.—1.

7th Genus.
CHIROTES.
lumbricoides.—1.

4th Order. CHELONIA.

1st Genus.
TESTUDO.
polyphemus.—1.

2d Genus.
CISTUDA.
clausa.—1.

3d Genus.
EMYS.
picta.
punctata.
muhlenbergii.
geographica.
insculpta.
centrata.
reticulata.
rubriventris.
serrata.
floridana.
pennsylvanica.
odorata.—12.

4th Genus.
CHELYDRA.
serpentina.—1.

5th Genus.
TRIONYX.
muticus.
ferox.
harlani.—3.

SEA TORTOISES.

CHELONIA. (Brong.)

6th Genus.
CHELONIA.*
mydas.
caretta.
couana.—3.

7th Genus.
CORIUDO.†
coriacea.‡—1.

* *Chelonia*, Fleming.

† *Coriudo*, Fleming.

‡ *C. coriacea*, as frequenting the coasts of Carolina, on the authority of Lawson. "Hist. of Carolina." Specimens in the New York and Boston Museums, from the neighbouring coast.

Observations on the Genus Salamandra, and the establishment of the Genera Menopoma and Menobranchus.

During my researches in the Linnæan Lacerta, I found myself very much embarrassed by the confusion which exists in the present classification and arrangement of this department of zoology; the *Salamandra* has not unfrequently been confounded with the *Proteus* and *Siren*, and these latter described as the former; and in a few instances including individuals generically distinct from either. This confusion has been not a little increased by the late discovery of several individuals of this family, which cannot without violence be referred to any existing genera.

It will be readily presumed, that it was only after considerable attention, and minute anatomical investigation extended to a variety of these animals, that I have ventured to give publicity to the following observations.

The *Siren*, the *Proteus*, the *Amphiuma*, the *Triton lateralis*, (Say,) the *Salamandra gigantea*, (Barton,) or *Alleghaniensis*, (Michaux,) must form a family of reptiles distinct from all others, and these will again be naturally separated into such as have branchiæ, and such as have none; all being furnished with nostrils and spiracula. Those which are provided with *persistent* branchiæ having the skull composed of many separate bones, as the *Proteus* and *Siren*—those which have spiracula, without branchiæ or gills, having the skull composed of a solid piece, as the *Amphiuma* and *Salamandra gigantea*.

The *Triton lateralis* must not be confounded with the

Tritons* of Laurenti, or water-newts, (the *Salamandra aquatica* of Cuvier,) as, in the first place, these animals are furnished with five toes to the posterior extremities, and four to the anterior: the *Triton lateralis*, having only four toes to each extremity. 2d. The *T. lateralis* is furnished with persistent gills—in the *Salamandræ* these organs are deciduous. 3d. The *T. lateralis* has one rib less than the Tritons of Laurenti, and the *Salamandræ* proper.

This difficulty could not escape the minute observation of Mr. Say, who, in his paper on the *Triton lateralis*, (in the 1st Vol. Major Long's Expedition,) expressly states: "These four or five species [viz. the *Axolotl* or *Siren pisciformis*, (Shaw,) the *tetradactyla*, (Lacépède,) the *Sirène operculée*, (Beauvois,) and the *Proteus Neo-Cæsariensis*, (Green,)] might with propriety be separated from the genus to which they are referrible in the present state of the system, and placed in a separate genus, the external characters of which will be the same as those of *Triton*, with the exception of the persistent branchiæ.† Its proper station will doubtless be intermediate between *Triton* and *Proteus*, but far more closely allied to the former."‡

The animal described as the *Sirène operculée* by M. P. de Beauvois, (in the 4th Vol. of the American Philoso-

* *Triton*, as a generic term, should be discarded, it having been originally established by Laurenti, who mistook the larvæ of *Salamandræ* for perfect animals, as was remarked by Cuvier, in his essay "Sur le Protée." (Voyage de MM. Humboldt et Bonpland.)

† To this exception he should have added, that all the species he has mentioned, excepting the second, have *five* toes to the posterior extremities.

‡ I am happy in having it in my power thus early to correct an error I have made in detailing the anatomy of the *T. lateralis*, in the paper above alluded to, wherein I have stated that "the olfactory apparatus is similar to that of fishes, having no posterior nares," &c. This is incorrect. In examining lately a specimen of this animal, I observed these openings, which are situated in the space between the two rows of teeth at their posterior termination; they are covered over by a valvular production or duplicature of the lining membrane of the mouth, which circumstance misled me.

phical Transactions,) is furnished with four legs, and five toes to the posterior feet—it is merely the larva of a *Salamandra*, similar to that described by Professor Green, in Vol. I. of the Journal of the Acad. Nat. Sciences, of Philadelphia, as the *Proteus Neo-Cæsariensis.*

But the animal described by Lacépède, (in the 10th Vol. of the Ann. du Mus.) is worthy of particular notice. He named it "Un Protée, ou Salamandre tetradactyle;" and states that the place of its habitation is unknown, and the internal structure was not examined. It is furnished with four legs, and four toes to each foot, with persistent branchiæ; the form of the tail, and general external appearance, to judge from the plate, resembles the "*Triton lateralis;*" but both jaws possessed a double row of teeth, and a collar formed by a fold of the skin partially surrounds the superior portion of the neck, immediately anterior to the branchiæ. I have little doubt of its being a distinct species of the same genus described by Mr. Say as the *T. lateralis.*

The *Salamandra tridactyla* (Lacépède) is furnished with scales, and possesses other characteristics of the lacerta (Vid. Dict. d'Hist. Nat. Art. *Sal.*) The animal from the North American Lakes, which Dr. Mitchill has described (in the 4th Vol. of Silliman's Journal, and more at large in the 7th Vol. of the same) as a *Proteus*, and which he has strangely confounded with the *Salamandra Alleghaniensis* (Michaux) or that vulgarly termed "Hell-bender," and "Tweeg," in Dr. Barton's description of the same, (Vid. Barton's Tracts, Vol. II.) has in reality no affinity either to the *Proteus* or "Hell-bender," but is simply a variety of the *T. lateralis*, with which also the animal from Lake Champlain, described by Schneider (in his Historia Amphibiorum, Fasc. 1st, p. 50.) as early as 1799, specifically corresponds, notwithstanding Daudin erroneously supposed it to be the larva of the *Triton Alleghaniensis*, and Mr. Say has since supposed it to be the larva of the *Salamandra Alleghaniensis*. (Vid. Latreille, Vol. I. Acad. Nat. Sciences, notes on Professor Green's paper on the Amphibiæ by Mr. Say.)

The *Salamandra Alleghaniensis* is, I think, improperly placed among the *Salamandræ*. It differs in general form and proportion, as well as in the absence of branchiæ at all times. Cuvier, after describing the Mexican *Axolotl*, remarks, "from all of which I conclude, that the *Axolotl* of the Mexicans, or *Siren pisciformis* of Shaw, is nothing more than the larva of some gigantic *Salamandra*, probably precisely the same as the *Salamandra Alleghaniensis* of Michaux." But in this he was mistaken; the *Axolotl* possesses every characteristic of a perfect animal, never having been observed destitute of branchiæ: indeed, in the last edition of the "Regne animal," the illustrious author rather renounces the idea here referred to.* The *Salamandra Alleghaniensis* has never been observed possessing gills, although examined when quite young; they exist in great numbers in the Alleghany river; and I possess a specimen, a few months old, in which there does not exist the least remnant of branchiæ, and as the *Salamandræ* are supposed to carry their branchiæ at least for the term of one year, it is certainly fair to conclude that these appendages do not constitute a part of the organization of this animal; which alone is sufficient to separate it from the genus *Salamandra*. But a comparison of the anatomical structure of these animals, places the subject beyond a doubt; and as no history of the internal fabric of the *Salamandra Alleghaniensis* has ever appeared, the following detail cannot be devoid of interest.

I received through the politeness of Mr. Poe of Pitts-

* In a late notice of the *Axolotl*, by Sir E. Home, it is stated that this animal is proved to be a perfect animal, and no larva, as *the organs of generation are developed*. The same argument would prove the tadpoles to be *perfect* animals, the organs of generation being equally developed in them all—as was demonstrated by Cuvier, in the year 1800. (Vid. Obs. sur les Tetards, in Humb. Voy.)

burgh, whose zeal has in more than one instance advanced the cause of science, two specimens of this animal; one very young, the other of a middle size, which was brought alive as far as Baltimore, when it was killed by placing it in slightly brackish river water. They are sometimes observed to have attained two feet in length.

Total length of the present specimen twelve inches. From the vent to the end of the tail four inches; *vent,* a small longitudinal rima, rather depressed; girth, four and a half inches; width of the head, one and a half inches.

Organs of Sense. The eye is smaller proportionally than in the common Salamanders, in which respect it resembles the *Axolotl;* the ear, like that organ in the Salamanders, does not appear externally.

Organs of Digestion. Lower jaw furnished with a single row of teeth; upper, with two concentric rows, the interior semicircular, at the posterior terminations of which are the patulous openings of the posterior nares. Tongue free at the anterior portion; the operculum half way between the fore-leg and the posterior termination of the rictus of the mouth; opercular cartilages, three in number, the opening between the two inferior;* their posterior extremities, unlike the Salamanders, are free, or not united to the vertebræ; anteriorly they are united by synchondrosis to the inferior cornua of the os hyoides; the bones of the tongue differ widely from the same in the *Salamandræ* and *Proteus,* which will be comprehended by reference to the plate, and comparing them with the figures in the elaborate works of the Italian naturalists; "Descrizione Anatomica delle Salamandra aquatiche," by Dr. Rusconi, and "Del Proteo anguino, monografia da Configliachi," much better than from description: the parts were sketched, in situ, immediately after dissection,

* In this respect the *Salamandra Alleghaniensis* agrees with the *Amphiuma*—in both, the operculi exist through life. In the *Salamandræ*, and most other batracians, on the contrary, these openings do not exist in the adult state.

by Mr. T. R. Peale, to whom I am also indebted for two spirited drawings taken from life: one of this animal, the other of the *Triton lateralis.*

The œsophagus is short, and folded longitudinally; the stomach is large, and for the most part membranous, but becomes muscular near the pylorus; it contained two pebbles about the size of the finger-end, and two others much smaller, also the claw of a fresh-water lobster, which the animal had swallowed without comminuting. The intestinal canal is large, and thrown into numerous folds, and terminates finally in an unusually large cloaca. The liver is oblong, and divided into two lobes, between which is situated the gall-bladder, of a large size, whose duct opens into the intestine two inches from the stomach. The spleen is of a reddish yellow colour, and situated in the centre of the mesentery.

Organs of Respiration. Glottis opens one inch and a half from the extremity of the snout, (it is a mere rima.) Trachea membranous, one inch in length, dividing beneath the clavicles to enter two lungs, three inches in length. Lungs vesicular, elastic, vascular; in structure resembling those of the *Testudo;* they lay posterior to the other viscera.

Organs of Circulation. The vena cava inferior, traverses the liver, and enlarges previous to emptying into the auricle, which is single, and very large; this empties immediately into the ventricle, which is also single, and whence a large fleshy artery goes off, as in fish and the larvæ of Salamanders, but the distribution of this artery differs from the above-mentioned animals; after running three-tenths of an inch, it forms a sac, which gives off three branches, viz. one to each lung, and a larger one which continues down the spine to nourish the whole body.

Remaining viscera. The urinary bladder, testicles, and kidneys, resemble very much those organs in the *Amphiuma.* (Vide page 184, of this volume.)

Osteology. Skull composed of a solid piece of bone, articulated by two condyles to the atlas. From the head to the pelvis there are nineteen vertebræ, and eighteen ribs on either side, (or rather moveable rudiments of ribs, similar to the other individuals of this family,) the atlas only, as in the Salamanders, being deprived of this appendage. Having compared this part of the osseous structure with the analogous genera, I shall give the result in a tabular form.

From the head to the pelvis there exists in the	Vertebræ.	Ribs on each side.
Salamandra Alleghaniensis (Michaux), *gigantea* (Barton) - - - - - -	19	18
Salamandra rubra (Daudin)* - - -	19	18
Triton lateralis (Say) - - - -	19	17
Axolotl or Siren pisciformis (Shaw)† - -	16	15
Proteus anguinus - - - - -	30	7
Siren lacertina - - - - - -		7

The rudiments of ribs in the skeleton of the *Proteus anguinus* figured by Cuvier, (in Humboldt's Voyage) are represented as immoveable, or continuous with the trans-

* The skeleton of the *Salamandre terrestre*, figured in Sonnini's edition of Buffon, and which is said to have been taken from Latreille, (Histoire Nat. des Salamandres de France,) is represented with only fifteen vertebræ from the head to the pelvis, and fourteen ribs on each side. In a large aquatic *Salamandra*, (*Lacert. lacustris* of Lin.) whose skeleton I possess, there are sixteen vertebræ from the head to the pelvis, and fifteen ribs. In this animal there are thirty-two vertebræ to the tail, including the sacral, making in all forty-eight; though the extreme end of the tail appeared to be lost.

† The figure of the skeleton of the *Axolotl* (in Humboldt's Voyage, &c.) is represented with sixteen vertebræ from the head to the pelvis, and fifteen ribs on each side; thus making the figure to disagree with his description, which states seventeen vertebræ and thirteen pairs of ribs.—"The *Siren*," according to the same author, "has ninety vertebræ from the head to the pelvis, the anus being opposite to the forty-fifth. The *Salamandre terrestre* has thirty-eight, the aquatic nearly forty vertebræ in all; the pelvis is supported sometimes at the sixteenth, sometimes at the fifteenth, in the *terrestre;* and at the fourteenth or fifteenth in the aquatic. In the *Siren*, eight vertebræ (from the second to the ninth) are furnished with false ribs. In the *Salamandra terrestris* there are twelve or thirteen ribs; in the *Salamandra aquatica* only eleven. In the *Proteus*, there are fifty-six vertebræ in all, the pelvis is attached to the thirty-first; only six vertebræ, counting from the second, have ribs." The number of vertebræ and ribs in the aquatic *Salamandræ* appears to differ in different species.

verse process, whereas they are represented as moveable rudiments in the figures of the skeletons given in the works of Configliachi and Rusconi; the latter author reckons seven ribs from the third to the ninth vertebræ—the former, six, counting from the second to the seventh vertebræ. I am disposed to think Configliachi is correct, and that the errors noted above in Cuvier's figure of the *Protean* skeleton, arose from its having been badly cleaned, as in the view he has given of a separate vertebra enlarged, he has represented the rib as distinct from the transverse process, and bifid at its articular extremity, nearly similar to that of the *Salamandræ.*

The pelvis of the *Salamandra Alleghaniensis* is somewhat or nearly similar to that of the *Salamandræ;* a small process is given off laterally from the transverse process of the twentieth vertebra, which may represent the os ilium; from which another process (the ischium) descends to unite with the pubis; at the junction of the two last, the os femoris is articulated.

There are twenty-four vertebræ to the tail, including the pelvic or sacral, which makes in all forty-three for the *Salamandra Alleghaniensis;* both surfaces of the bodies of the vertebræ are remarkably concave, which in the recent animal are filled with a ligamento-cartilaginous ball. The articulating surface of the transverse process is very oblong vertically, the head or articulating surface of the rib is consequently very broad; this structure differs from those *Salamandræ* with which I have compared it, (viz. *Salamandra rubra* and *aquatica*) in them the head of the rib is bifid and articulated by two separate surfaces to the transverse process, which is also bifid, but approaches the manner in which the ribs are articulated in the *Siren.* Nothing remarkable or characteristic was observed in the remaining portions of the skeleton.

It follows from the above detail that the *Salamandra*

Alleghaniensis differs widely from the *Salamandræ* in the respiratory organs—in the circulating system—in the digestive apparatus—and, finally, in its osteological construction. I may here remark, that I was not surprised to observe the internal fabric of the *Alleghaniensis* so characteristically distinct from all the other animals of this family—it only confirms us in the opinion that anatomy alone can teach us the true affinities and relations of organized beings.

Naturalists are familiar with the dispute between the French and Italian zootomists concerning the *Siren lacertina:* the latter declaring it as their full conviction that this animal is the larva of some reptile, the genus of which is as yet unknown, and which will differ from its larva in not possessing gills, &c. Whilst Cuvier maintains that the *Siren* is a perfect animal, permanently amphibious.

I must refer to the works of these respective naturalists, as above quoted, where this subject is treated of in detail; and shall briefly remark, that the arguments of the Italian naturalists tending to prove the *Siren* a larva, from its anatomical structure, are shown to be groundless by a comparison of the internal fabric of that animal with the anatomy of the *Salamandra Alleghaniensis,* as above detailed.

With all due deference and respect for those very able anatomists above quoted, I may be permitted to correct an important error into which they have both fallen in the anatomical descriptions of the larvæ of the *Salamandra* and of the *Siren.*

I quote the words of the Italian naturalists:—" All zoologists, including M. Cuvier, now admit that frogs first receive air into the mouth through the nostrils only, and from thence force it into the lungs by an action resembling deglutition. But neither the *Proteus* nor the *Siren* are able to respire in this manner; for the nostrils in the former do not open into the mouth, but beneath the upper lip; and in the *Siren*, M. Cuvier observes, 'les narines, simplement creusées sur les cotés du museau, ne pénètrent point dans le bouche.' Neither do these animals respire in the manner of serpents, as they are destitute of (true) ribs." And further on, the authors continue,—"Between the *Siren* and these larvæ (*Salamandra*) there is the greatest resemblance, not only in regard to the branchial arches, but also to the nostrils; for in the *Siren*, as well as in these larvæ, *the nostrils do not communicate with the mouth.*"

Some years since I presented to the Acad. Nat. Sc. a specimen of the larva of the *Salamandra rubra*, (Daud.) in which I had passed a slender probe through the nose into the mouth by the posterior nares, on one side, and allowed the opposite side to remain untouched, in order that the committee who were to examine this essay, might at once convince themselves of the accuracy of this statement. It was indeed with some difficulty I found the posterior nares in this larva, as they open in the form of a small slit, which was closed by the lining membrane of the mouth; they are situate rather external to the posterior termination of the interior row of teeth.

I next proceeded to examine this structure in the *Siren*, two specimens of which are in the Philadelphia Museum; the smaller of the two being very young, it was not easy to pass a probe through the nostrils, though the posterior nares are visible; but in the other, which is about one foot in length, I passed a probe of considerable size through the nostril, into the mouth, down the throat, where I allowed it to remain, for the convenience of those who may wish to examine the same.

I experience the less hesitation in making these strictures and corrections, as the error is one into which I was myself betrayed, in my description of the anatomy of the

Triton lateralis. These openings in the *Siren* are situate on the *outer* side of the teeth.*

The *Amphiuma,* the *Siren,* the *Proteus,* and the *Salamandra,* will be acknowledged by all to constitute separate genera. The *lateralis* and *Alleghaniensis* not belonging to any of these, will require appropriate generic names, in order to introduce them to that independent station in the systems, to which they possess every claim. As the most prominent feature distinguishing the *T. lateralis, Sal. tetradactyla,* and *Axolotl* from the *Salamandra,* is their persistent branchiæ; we have preferred a name significative of the same.

The *Alleghaniensis,* on the contrary, being characterized by the negation of branchiæ, the most appropriate name will be one expressive of that circumstance.

In the October number of the "Bulletin des Sciences Naturelles," for 1824, Dr. J. C. Van Hasselt has proposed the name of *Abranchus* for a genus of Molusca inhabiting the island of Java. As this name has the priority of my own, I have determined to propose in its stead the generic term, Menopoma, (persistent operculi.)

Genus 1. Menobranchus.

Generic Characters.—Persistent branchiæ; four-footed, clawless; teeth in both jaws.

Menobranchus lateralis.—A black vitta from the nostrils passing through the eyes, and dilated on the sides, becoming obsolete on the tail: two rows of teeth in the upper, and one row in the lower jaw: four toes to each foot.

Menobranchus tetradactylus.†—Two rows of teeth in each jaw: duplicature of skin forming a collar on the supe-

* In the Dict. d'Histoire Nat. Article *Siren*, by Professor Bosc, it is stated that "the *Siren* is clothed with scales, and furnished with claws." It is only necessary to notice these errors, inasmuch as they may confuse the student.

† We have never seen this species.

rior part of the neck, immediately anterior to the branchiæ: four toes to each foot.

This genus will also include the Axolotl of Mexico, or the Siren *pisciformis* of Shaw.

Menobranchus pisciformis.—Two rows of teeth in the upper, one row in the lower jaw: four toes before, five behind, clawless.*

Genus 2. Menopoma.

Generic Characters.—Persistent operculi: destitute of branchiæ at all times, these organs being replaced by the operculi: teeth in both jaws: four-footed, clawless.

Specific Characters.—Head broad: nasal openings projecting: mouth wide: a dark lateral line passing through the eyes: body slate-colour, mottled above with dark spots: tail compressed: five toes to the posterior, four to the anterior extremities, the outer edge of the feet fimbriated, two outer toes of the hind feet palmated, clawless: two rows of teeth in the upper, one row in the lower jaw.

* We have recently been favoured by Professor Del Rio, of Mexico, with a fine collection of the Axolotl, and offer the following anatomical observations as the result of the dissection of one of them.

Two rows of teeth above, and one row below: four toes before, five behind, clawless: three fimbriated branchiæ on each side, four fleshy gills, gill-openings extending across the throat; posterior nares opening, one on each side, near the tip of the tongue, which is broad and fleshy, free at its anterior extremity: a pair of cellular lungs, extending, when collapsed, nearly one-half the length of the abdomen: stomach containing portions of a semi-digested crustacea: sixteen vertebræ: fifteen moveable rudiments of ribs on each side: skull, in the adult, consisting of one consolidated piece of bone. In general form resembling that of fishes. Total length eight and one-half inches: of the tail, three inches six-tenths: girth three and one-half inches: of the head one and one-half inches.

We have been indebted to Wm. Maclure, Esq., President of the Acad. Nat. Sc. of Philadelphia, and now resident of Mexico, for the following remarks on the habits of the Axolotl:

"They seem to partake of the nature of the frog, coming to the surface of the water frequently to let out a certain quantity of air, and likewise, I suppose, to take some in. They are found on the cleaning of ditches and canals, buried in the mud, and brought to market with the frogs, as they are ate by the natives, and considered a delicacy."

Habit.—Carnivorous: exceedingly voracious: living in the water: feeding on worms, fish, crabs, &c. Inhabits the Alleghany and Ohio rivers.

EXPLANATION OF THE PLATES.

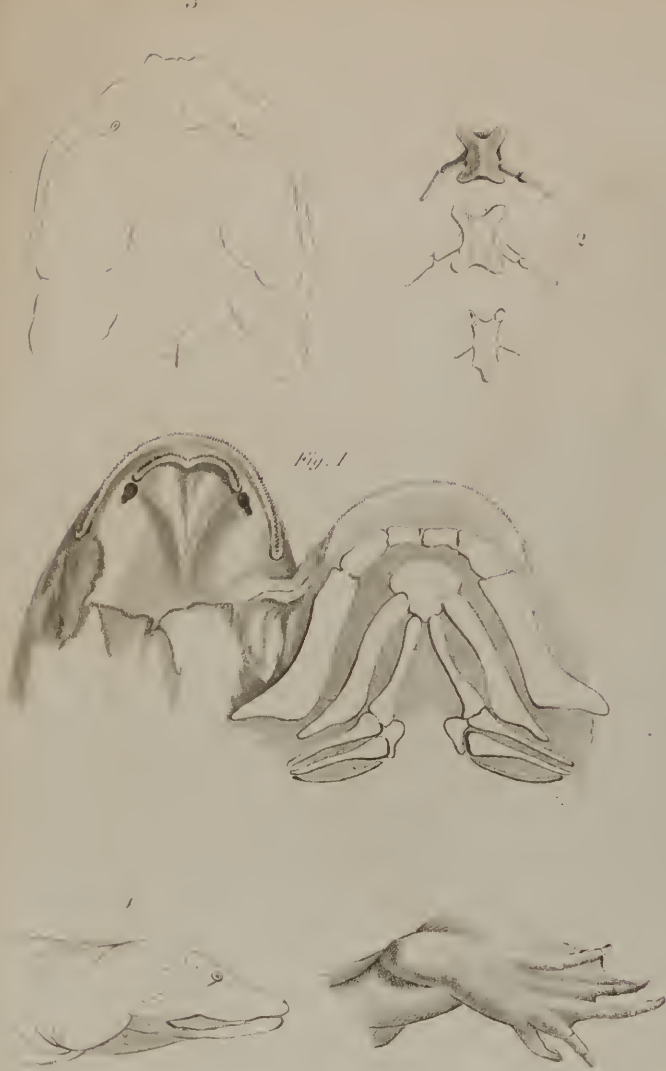
No. 1. Menobranchus *lateralis.*
2. Abranchus *Alleghaniensis.*
3. Details of organization of *A. Alleghaniensis.*
Os hyoides and spiracular cartilages, fig. 1.
Vertebræ, fig. 2.
Upper and side views of the head, fig. 3, 4.
Hind foot, fig. 5.

MENOBRANCHUS LATERALIS.

T. R. Peale ad nat. del

Emily Maverick sc.

ABRANCHUS ALLEGHANIENSIS.



Description of the Salamandra flavissima—a new Species, inhabiting Pennsylvania.

Char.—Brownish-yellow above; clear bright yellow beneath; back marked with three black lines; tail compressed, longer than the body.

Dimensions.—Total length three inches two-tenths; of the body, head inclusive, one inch three-tenths.

Description.—A long and slender animal, head broader than the body, rather depressed; eyes prominent, iris gilt yellow; a broad black line on each side of the spine extending from the eye to the end of the tail; a narrow depressed black line extending along the spine from the occiput to the base of the tail; all the under parts of the animal of a deep yellow; head separated from the neck by a transverse line under the throat; tail compressed, much longer than the body and head.

Note.—I have caught several of these animals beneath the stones in moist places, or on the borders of brooks in shady situations; it is a very active species, and sometimes attains to three inches in total length; the black line in the dorsal furrow is sometimes wanting, in which case the back is mottled with black—placed in spirits the yellow colour is destroyed. This species will occupy an intermediate station between the S. *bislineata* and S. *rubriventris*. (A specimen in the cabinet of the Acad. of Nat. Sc. of Phil.

Description of the Salamandra dorsalis.

SALAMANDRA *dorsalis.*

Char.—*Above* fuscous; *beneath* yellowish-white; *tail* longer than the body, strongly compressed, ancipital: a whitish dorsal line extending from the occiput, over the tail; a row of whitish coloured oblong spots on each side of the dorsal line: *tail* and inferior portions of the body, freckled with black dots, more sparsely on the throat: *vent* large, protruded, and puckered: *length* three inches and eight-tenths,—body one inch and five-tenths,—tail one inch eight-tenths.

Inhabits South Carolina. Cabinet of the Academy of Natural Sciences of Philadelphia.—My collection.

Description of a new Species of Salamandra.

SALAMANDRA *picta.*

Body blackish or dark slate colour above, yellowish or light orange colour beneath; skin beneath the neck folded; head large; legs strong; tail compressed at its inferior portion nearly the length of the body.

Dimensions.—Total length nearly four inches; *body* rather more than two inches; *tail* less than two inches; length of the head six-tenths, breadth five-tenths; length of the hind legs six-tenths; of the fore-legs four-tenths.

Description.—*Head* large, rather flat: *occiput* broad, slightly protuberant: *snout* obtuse, rounded anteriorly: rictus of the mouth wide, extending posteriorly to the eyes; anterior borders of the lips slightly undulating: *skin* of the throat folded, so as to form a collar nearly surrounding the neck: *body* above blackish; a longitudinal furrow extending from the occiput along the back to the base of the tail; inferior portion of the body obsoletely punctured with dark spots, more visible on the sides: *legs* short, strong and thick, externally of the colour of the back; internally of the colour of the belly: *tail* sub-quadrangular for the first two-thirds; the remainder or inferior portion abruptly compressed, pointed, with the superior and inferior borders carinate.

The above description is from several specimens of different ages, taken in the vicinity of Philadelphia. In the cabinet of Mr. W. Hyde, I have observed a specimen much larger than the present.

Inhabit shallow brooks in the vicinity of this city.

Description of a variety of the Coluber Fulvius; of the Scincus unicolor; and two new Species of Salamandra, —S. cylindracea, and S. symmetrica.

Dr. William Blanding, a corresponding member of the Academy, has recently presented to the Society, a splendid collection of Reptilia, Crustacea, Insecta, &c. from the vicinity of Camden, South Carolina, his place of residence. The present specimen is one of that collection.

Col. *fulvius,* Linn. Var. (H.)

Char.—Coluber with eighteen deep black rings, with as many scarlet or blood-red intervening ones, separated by narrow rings of whitish-yellow bands.

Dimensions.—Length two feet, of which the tail includes three inches. Abdominal plates two hundred and two: subcaudal scales forty pairs.

Description.—A single row of teeth in the upper jaw, with a perforated fang on each side: consequently this species is to be considered as poisonous: in which it differs from the Coluber *coccineus,* (as well as in the disposition of the colours:) but agrees with the *fulvius* in possessing fangs, though Daudin describes the latter as innocent.

The black rings are broad above and narrow below; the reverse is observed of the scarlet rings; the latter display a mixture more or less of a blackish colour. In the centre of many of the scarlet rings on the abdomen, there is a large circular black spot: on the tail the yellowish-white and black rings alone prevail, as in the *fulvius.* The rings commence with yellowish-white, surrounding the occiput. The face is black.

Inhabits Charleston, South Carolina. A specimen in the Cabinet of the Academy of Natural Sciences.

NOTE. It appears to be this variety which Mr. Say has compared with the C. *coccineus*. Vid. Silliman's Journal. The *fulvius* of Linn. has no *red* bands.

SCINCUS.

S. *unicolor*. *Char.*—Universal colour, a dark silver gray; head small; snout acute; tail about the length of the body.

Dimensions.—Total length $3\frac{5}{10}$ inches; of the tail $1\frac{8}{10}$ inches.

Description.—Head small and triangular, less thick than the body; covered above with nine plates; superciliary ridge composed of four plates; meatus externus rather large, transversely oval: *tail* small, abruptly conical: universal colour dark silver gray, lighter beneath: *back* obsoletely striated.

This species, the smallest of the family, belongs to the collection in the Philadelphia Museum; it is not known certainly from whence it came, but is supposed to inhabit the Southern States.

SALAMANDRA.

1. S. *cylindracea*. *Char.*—General colour blackish, clouded with confluent white blotches on the sides; head thick and oval; tail cylindrical, longer than the body; all the toes fissile.

Dimensions.—Total length about five inches; from the snout to the base of the tail $2\frac{4}{10}$ inches; extremity of the tail lost.

Description.—Male. Head larger than the neck, oval and slightly protuberant at the occiput; eyes large, protuberant; snout obtuse: tail cylindrical, thick and gradually tapering; skin beneath the neck folded transversely; vent, a simple longitudinal rima: general colour blackish or dark slate green, lightest on the throat and underneath the tail; sides clouded with confluent white blotches.

Female of a darker colour, with the head flatter, and with a slightly impressed longitudinal furrow along the spine.

Habit.—The tail of this species being perfectly cylindrical, would appear to indicate its terrestrial nature.

Inhabits South Carolina. Presented to me by Dr. Blanding.

2. S. *symmetrica.* *Char.*—Colour dusky-brown, or fuscous above; orange yellow beneath; a row of deep orange-coloured spots on each side of the spine, symmetrically arranged; tail compressed, longer than the body.

Dimensions.—Total length 3 inches; of the tail $1\frac{3}{10}$ inches.

Description.—Female. A delicate and well proportioned animal, head rather small, somewhat flattened; in some specimens marked with three small spots above; skin of the neck not folded transversely; eyes rather large, though not protuberant; a row of deep orange coloured oval spots, nine or ten in number, lining each side of the spine; and arranged symmetrically; vent, very protuberant, circular, and puckered in both sexes. Colour of the lower parts of the body, orange yellow, sparsely spotted with minute black dots; upper surface of the body dusky brown. From the appearance of the generative organs, these animals must have died in the season of their amours.

Male of a larger size and lighter colours; with a broad ancipital tail.

Inhabits South Carolina. Presented by Dr. Blanding.

NOTE. This species bears no resemblance to the S. punctata Daud., which is the Lacerta aquatica, var. β.

Gmel., and which Professor Barton and others have confounded with the "Stellio" of Catesby: the latter being in fact, only a variety of the S. *subviolacea* of Barton, as is clearly demonstrated by a specimen I have lately received from Camden S. C., through Dr. Blanding. Mr. Say, on the contrary, appears to have confounded the S. *symmetrica* with the Stellio, in his "Notes on Herpetology." Vide Silliman's Journal, vol. 1. p. 264.

Description of the Amphiuma Means.

The specimen was sent from Georgia to Dr. Mease of this city. An account of a similar animal has lately been published under the name of "Chrysodonta larvæformis."*

Having of late been familiar in the dissection of Proteiform animals, "les reptiles douteux" of Humboldt, and having had the opportunity of observing and dissecting this specimen in a living state, I experience less hesitation in making the following observations, more especially as the account alluded to above, is by no means free from imperfection and error.

The animal I dissected was eighteen inches in length; the branchial cartilages are four in number, united to each other at their inferior end, but unconnected with the other parts of the skeleton; the branchial orifice is situate between the two inferior, the other cartilaginous slips are covered by the internal lining membrane: these orifices cannot be considered as connected with the process of respiration, are by no means breathing holes, not being furnished with membranous fringes, and would appear to subserve no other purpose than to evacuate the water taken into the mouth with the food of the animal.

The nostrils are small and situated near the point of the snout, they communicate with the fauces, opening immediately behind the palatine row of teeth.

The lower jaw contains a single row of teeth of about thirty in number; the upper jaw contains a row on the maxillaries, and another on the palatine surface, consisting of about forty in number; they point backwards, are very minute, the tips reflect the golden rays, provided

* Vide Medical Recorder, July, 1822, No. 19.

they be viewed through the medium of a microscope; they are not processes of the jaws, but are attached to the bones at their bases by a slightly moveable articulation, somewhat similar to the teeth of the shark: that is to say, neither by gomphosis nor anchylosis.

On the top of the head are the orifices of two rows of glands, extending from the eyes to the tip of the nose: the eyes are covered with cuticle as in the Siren and Proteus.

The tail is short, cylindrical at base, and flattened vertically towards the extremity.

There are no ribs, except the motionless rudiments, in which it differs from the Proteus, the Siren, and the Tritons, which have moveable rudiments of ribs.

The *tongue* is cartilaginous, possessed of very little freedom of motion. In the appearance of the circulating system, the alimentary canal, the cellular lungs, and the urinary organs, this animal presents no material difference from the *Siren*.

The testicles are flat in this animal and cylindrical in the Siren. The parts about the region of the cloaca being somewhat mutilated, I was unable to determine exactly where the ureters entered the bladder.

This animal cannot be considered, strictly speaking, as amphibious (breathing in air or water) not being furnished with branchiæ, and is not calculated for progression upon land. Indeed the most remarkable peculiarity in its organization, is its four cartilaginous legs terminated by two toes, the external toe being the longest.

Whatever may have been the case during the early settlements of North and South Carolina, at present this animal is comparatively rare, as few of our museums contain a single specimen, nor was I aware that a specimen had ever been sent to Europe, until I was informed by Dr. De Kay, of New York, (after having finished this description) that a similar animal had been noticed by Dr. Garden in

"*Smith's correspondence of Linnæus,*" under the name of "Amphiuma means," on referring to which work I found that this animal had indeed been noticed under that name.*

It will be observed that the description of Dr. Garden agrees with mine, with the exception of a few minor differences as respects the tongue, the pulmonary system, &c.

* Extract from a letter of Dr. Alexander Garden, to Mr. Ellis, dated Charleston, May 15th, 1773.

"I have not as yet been able to procure another of the *Amphiuma means*, which he (Linnæus) calls Sireni simile. This appeared to me to be a still more singular animal than the Siren, as you might observe by my remarks, &c. &c."—Vol. I. p. 599.

In a letter to Linnæus, with which he sends a specimen, Dr. Garden gives the following descriptions of the *Amphiuma*.

"I must now say something of an unknown animal, which you will find in a glass bottle, and which I have no doubt will afford you much satisfaction; the specimen here sent is the only one I ever saw, and I shall think myself fortunate if it reaches you in safety.

"When I first received it, the length was thirty-seven inches, though the animal was then become somewhat contracted. At first sight I suspected it to be another species of Siren, but upon nearer examination I found so many differences, that there proves to be no relationship whatever between them. Can this animal form a link between the Lacertæ and Serpentes? is it allied to Anguis quadrupes?

"It differs in many particulars from the Siren, most evidently in the following. This animal has four feet, with two toes to each, without claws. The Siren has only two feet. It wants the gills and their wing-like coverings. It has no scales, nor, which seems to me very singular, any tongue! all which are found in the Siren. I have opened the throat, and satisfied myself respecting the presence or absence of the gills. The following are the characters I have drawn up of this ugly animal.

"*Head*, rather long, depressed, tapering, serpent-like.

"*Mouth*, extending half the length of the head.

"*Lower jaw*, furnished with a single row of sharp, distinct teeth.

"*Upper*, with four rows with similar curved teeth.

"*Upper lip*, covering the under one.

"*Tongue*, none. *Nostrils*, two openings at the very extremity of the upper lip.

"*Eyes*, dull, at the upper part of the head, on each side, covered with a thick tunic.

"A thin retractile membrane covers each cartilaginous lateral spiracle or orifice, by which the animal breathes.

"*Body*, thick, nearly cylindrical, tapering and keeled at each side, beyond the vent. Tail recurved. There is no *lateral line*. *Vent*, a large opening immediately behind the hinder legs.

"*Feet*, four, two of them before, close to the spiracles, each with two toes, destitute of claws, two behind, at the bottom of the belly, with similar toes.

"Inhabits deep ditches, and lakes of fresh water."—Vol. I. p. 333.

Dr. Garden did not seem to be aware that the *Amphiuma* respired with two cellular lungs; by his own account, the specimen he described had been *preserved in spirits*, which circumstance will sometimes give rise to inaccuracies.

From the above description, the "*Amphiuma*" must be acknowledged as generically distinct from the Batracian animals hitherto described; the similarity of internal organization would place it between the *Proteus* and *Siren*.

This very curious animal lived for several weeks in the possession of Dr. Mease, by whose request a drawing of the living animal was taken by Mr. *C. A. Lesueur*. To the former gentleman, who has shown himself on many occasions active in the cause of science, I am indebted for the opportunity of dissection.

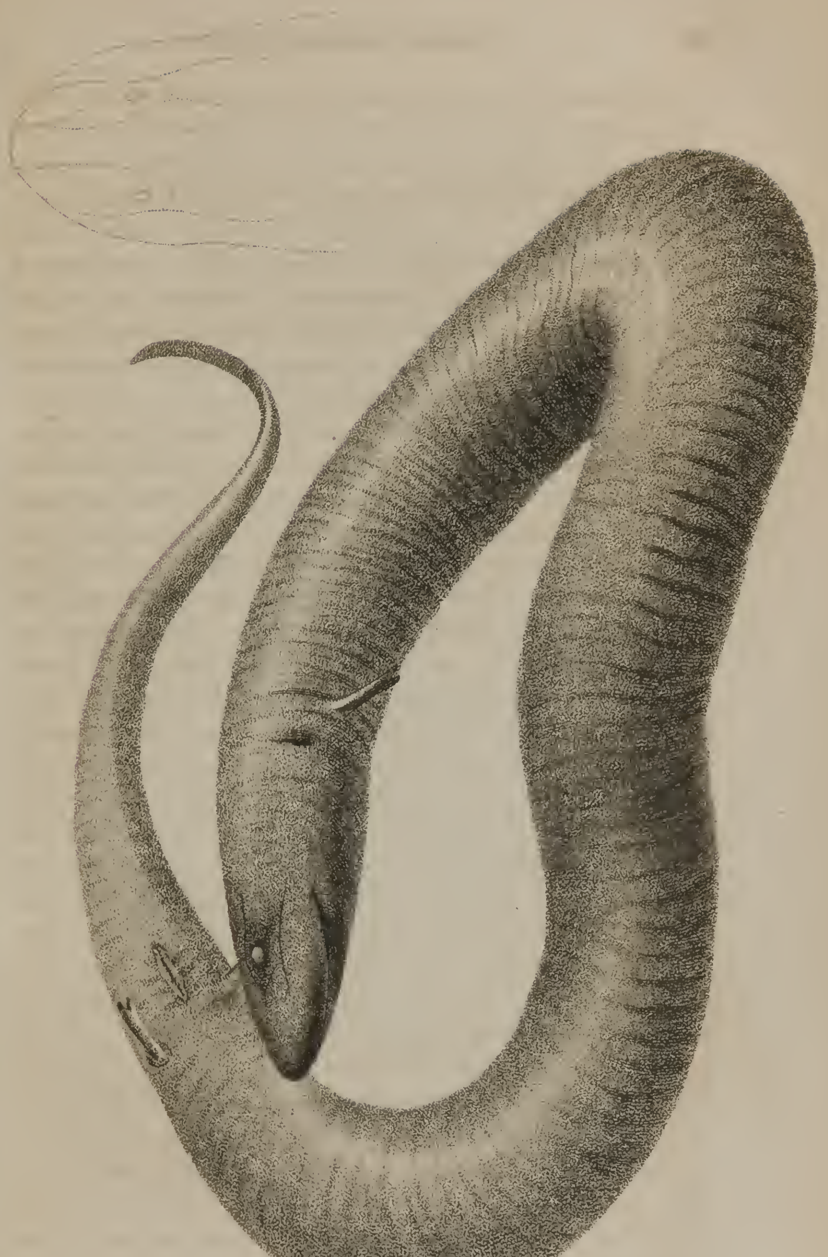
This specimen is deposited in the Philadelphia Museum, under the name of *Amphiuma means*.* (*Garden*.)

* Since this memoir was first communicated to the Acad. Nat. Sc. of Phila., numerous specimens have been received from South Carolina, Florida, and Alabama, as well as the three-toed species described by Cuvier, from Louisiana.

Further Observations on the Amphiuma Means.

In the third volume of the Journal of the Academy of Natural Sciences of Philadelphia, I published an account of this animal. Since that period, I have examined three other individuals, and have thus been enabled to correct some misstatements in that paper.

It was stated that in the *Amphiuma* "there are no ribs, only motionless rudiments, resembling in this respect the *Proteus anguinus.*" There are in fact no ribs in this animal, but in this it does not resemble the proteus, which is furnished with moveable rudiments, as in the siren. This is an error into which I was led by comparing it with the engravings of the skeleton of the Proteus which accompanies Cuvier's Essay on the doubtful reptiles, (in Humboldt's Voyage, part II. livraison 3,) where the ribs are thus represented. It was also omitted to be mentioned, that the anterior and posterior surfaces of the vertebræ are deeply concave, as in fishes. Externally there is no appearance of tympanum. Found in ponds and ditches about New Orleans, in Florida, Georgia, and South Carolina. They are capable of living on dry land, but how long, has not been accurately ascertained. The individual in the possession of Dr. Mease, escaped from the vessel in which it was confined, and when found, several days after, was brisk and lively; and I am informed by Major Ware, that they are sometimes discovered two or three feet under mud of the consistence of mortar, in which they burrow like worms, as was instanced in digging near a street in Pensacola, when great numbers were thrown up during the winter season. It is called in Florida, "Congo Snake," by the negroes, who believe them poisonous, but without foundation.



P. Maverick sc.

I have lately received through the politeness of Mr. N. A. Ware, specimens which were sent to him from Florida by Mr. La Rue, of Pensacola. The smallest was very interesting, as it was but three inches in length, and yet did not exhibit the least appearance of branchiæ. Total length of the largest was two feet two inches; breadth of the head across the eyes eleven-tenths of an inch: distance between the eyes seven-tenths; between the nostrils three-tenths; from the eyes to the tip of the snout seven-tenths; distance between the anterior and posterior extremities twelve inches and three tenths. Vent, a distinct longitudinal rima, situated immediately behind the posterior extremities. From the vent to the extremity of the tail six inches and three tenths; tail tapering and compressed at the lower half. Girth four inches and two-tenths; length of the posterior extremity six-tenths: of the anterior, four-tenths, perhaps somewhat contracted by spirits.

I am indebted for the accompanying drawing to Mr. Titian Peale.

Description of the Testudo Elephantopus, from the Gallapagos Islands.

TESTUDO *elephantopus,* (nobis.)

T. *indica*, Bell.
Elephant Tortoise, of mariners, vide "Porter's Journal," Vol. I. p. 161. *Gallapagos Tortoise*, of others.

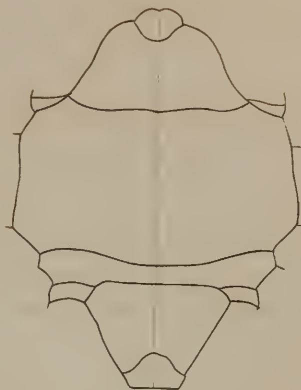
Char.—Shell reflected over the head, and over the posterior extremities: all the back-plates irregularly pentagonal, with elevated concentric ridges, and with a smooth space in the centre: tail short, thick at base, without a corneous tip.*

DIMENSIONS.

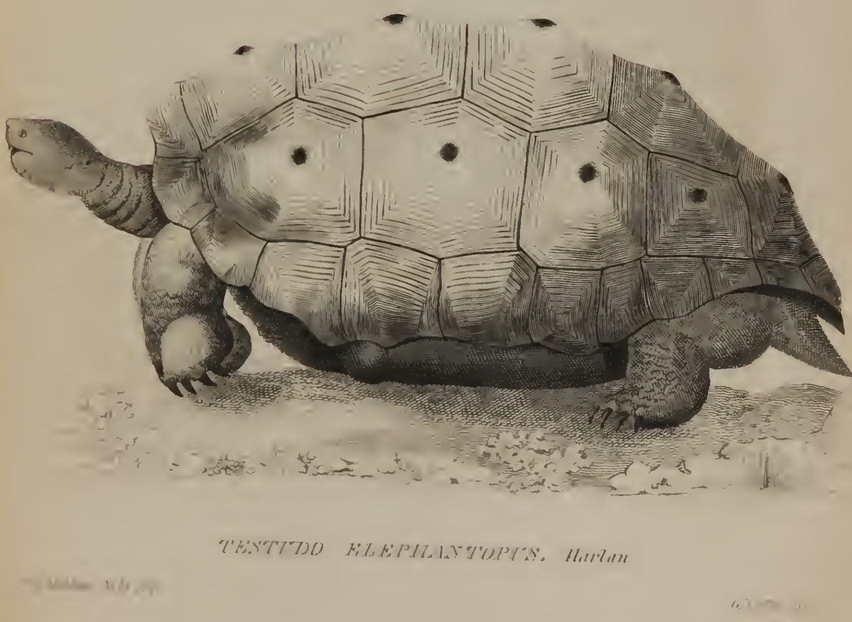
	Ft.	Inches.	Tenths.
Length of the back-plate, following its curvature,	1	9	6
Breadth of the back-plate, following its curvature,	1	10	6
Vertical diameter, or height of the animal,	0	9	0
Lateral diameter,	1	2	0
Circumference of the body,	3	0	0
Length of the posterior extremity,	0	8	0
Length of the anterior extremity,	0	9	0
Length of the neck and head,	1	0	0
Length of the head,	0	4	0
Breadth of the head,	0	2	5
Length of the tail,	0	3	5
Breadth of the tail at base,	0	2	0

Description.—General colour of the animal plumbeous: the shell appears somewhat oval, though on measurement is found to be nearly as long as broad. The marginal plates are reflected upwards anteriorly, and also over the posterior extremities, in order to afford greater freedom in the motions of the head and extremities. The poste-

* Testa supra collum et crura reflexa: scutellis disci pentagonis, striisque elevatis, concentricis, cum læve macula centrale. Cauda brevis, crassa ad basim, sine apice cornuto.



Sternal Plates



TESTUDO ELEPHANTOPUS, Harlan

rior marginal plate is bent abruptly downwards: the *head* is very small; and like the neck, extremities, &c. is enveloped in a rugous, lax, and granulated covering; the skin being produced into flattened protuberances, somewhat corneous in structure: these protuberances are larger and more dense about the joints and other parts of the body most subjected to pressure; two of these larger tubercles are found on each side of the elbow.

Jaws slightly serrated; the superior emarginate at tip, with two small dentiform processes, which are sometimes destroyed: the inferior jaw closing within the upper, like scissors. There are two palatine ridges within the upper jaw; the inner one smooth, the outer serrated: one serrated ridge in the lower jaw: these ridges occupy the place of teeth; the inferior ridge, closing between the two superior, forms, with the two mandibles, powerful organs of mastication. Under jaw, and upper part of the throat, marked with yellow blotches. *Tail* short, and exceedingly thick at base, abruptly terminating without a corneous tip: vent opening about one inch from the tip.

Marginal scuta twenty-three in number; eleven on each half of the shell, and a single one posteriorly; the six anterior, elevated or reflected, and crenated at their sutures: six posterior, (with the exception of the terminal one,) elevated, slightly reversed, and crenated at their sutures. *Vertebral plates,* five in number, not carinated: *costal plates,* four on each side: all the plates of the shell of an irregular pentagonal form, displaying elevated, concentric ridges, with obsolete radiating lines, dividing each plate into different compartments; a smooth space being left in the centre. *Sternum* composed of sixteen unequal plates, two anterior very small; next come two larger pentagonal plates; then follow two narrow plates, with a small one at their anterior and terminal borders, which, with two similar ones at the posterior and terminal borders of the two largest central plates, constitute the suture between the back-plate and sternum: posterior to the large central plates, are two of a medium size, followed by two small terminal plates. The anterior extremity of the sternum projecting forwards between the fore legs, as in the Gopher, (T. *polyphemus*, Linn.) though not projecting beyond the anterior margin of the back-plate, as in the latter species.

Toes not fissile, covered with the thick shagreened skin of the legs, like those parts in the elephant. Five claws before, four behind, broad, flat, and blunt, the longest measuring three-fourths of an inch.

Observations.—The animal which is the subject of the present observations, is no doubt young, although larger than a similar species which lately lived for several months in the Philadelphia Museum. If we are permitted to judge from the shortness of the tail, and still less certain sign, the planeness of the sternum, our specimen is a female. Its weight is forty pounds.

The only species with which there appears any probability of confounding the present, is the T. *indica*, of Vosmaer; a description of which, with an indifferent figure, may be seen in Shœpff. (Hist. Test. p. 103, tab. xxii. fig. B.) On comparing these two species together, the distinctive characters of the T. *elephantopus* will be found sufficiently clear; differing widely in the number of plates, both of the sternum and shell, as well as in other essential particulars.

That the T. *indica* of Perrault, is specifically distinct from the animal of the same name described by Vosmaer, we have no doubt; and think that a reference to the figures and descriptions afforded us by Shœpff will satisfy the most sceptical. On comparing the present specimen with the T. *indica* of Perrault, an individual of which lived many months in the Philadelphia Museum, we were enabled to detect still less analogy.*

* As copies of Shœpff's work, ("Historia testudinum, iconibus illustrata, 1792,")

The present individual displays great docility of temper, never attempting to bite, except when much irritated; the force of its jaws is very great. Some idea may be formed of the muscular power of this animal, from the fact, that a large man seated on its back, appeared to occasion no great inconvenience to its progressive motion. During warm weather, in our climate, they are enormous gluttons; and in a state of nature, are exclusively phytivorous, eating without much discrimination, succulent vegetables of all descriptions; where the food is dryer, they drink large quantities of water: like our Box turtle, (CISTUDA *clausa*,) they are naturally timid, seeking retirement and shade, displaying equal impatience when exposed to the rays of the sun, or to a shower of rain.

Thus much of their habits we are enabled to detail from personal observation; a much more extensive account of these interesting animals may be found in "Porter's Journal."*

If there be not some mistake, the enormous size to which they are said to attain in some instances, is truly astonishing; the author above quoted, states, that some individuals weighed more than 300 lbs., and that others measured five feet in length; he however states his conviction of the existence of two distinct species, as inhabiting the different Gallapagos islands.

"Those of James' Island appear to be a species entirely distinct from those of Hood's and Charles' islands; the

are rare in this country, we subjoin a description by Vosmaer, of his T. *indica*. "Testa supra collum reflexa, disci scutellis anterioribus lævibus; margine crenato.

"Ex promontorio Bonæ spei testa hæc, absque ulla ulteriori notitia, ad nos pervenit. Ad testudines terrestres eam pertinere, primo intuitu adparet. Scuti longitudo ped. 2. poll. 8. Latitudo ped. 1. poll. 6½. Altitudo ped. 1. poll. 2. Discus scutelli xiii, margo xxv, habet; anteriora nempe 6, postica 9, lateralia utrinque 4. Sterni scutella duo media majora, his anteriora 5, posteriora 7, horum duo, scutellis marginalibus proxime adjacent, reliquis minora sunt. Color scuti nigricans, sterni cinereus."

* Vid. Journal of a cruise made to the Pacific Ocean, by Capt. David Porter, in the U. S. frigate Essex, in the years 1812, 13, and 14, vol. I. pp. 161, 165, 171, 173, 227, 228.

form of the shell of the latter is elongated, turning up forward in the manner of a Spanish saddle, of a brown colour, and of considerable thickness; they are very disagreeable to the sight, but far superior to those of James' Island in point of fatness, and their livers are considered the greatest delicacy. Those of James' Island are round, plump, and black as ebony; some of them handsome to the eye, but their liver is black, hard when cooked, and the flesh altogether not so esteemed as the others.

"The shells of those of James' Island are sometimes remarkably thin, and easily broken, but more particularly as they become advanced in age; for then, whether owing to the injuries they receive from their repeated falls in ascending and descending the mountains, or otherwise, their shells become very rough, and peel off in large scales, which renders them very thin, and easily broken.

"Nothing," continues Capt. Porter, "can be more disagreeable or clumsy than they are in external appearance; their motion resembles strongly that of the elephant; their gait slow, steady, and heavy; they carry their body about a foot from the ground, and their legs and feet bear no slight resemblance to the animal to which they are likened; but hideous and disgusting as is their appearance, no animal can possibly afford a more wholesome, luscious, and delicate food; the finest green turtle is no more to be compared to them in point of excellence, than the coarsest beef to the finest veal; these animals are so fat, as to require neither butter nor lard to cook them; and this fat does not possess that cloying quality, common to that of most other animals. But what seems to be most remarkable in this animal, is the length of time it can exist without food. It has been well ascertained, that when piled away among the casks of a ship, they have lived eighteen months; and when killed at that time were found to have suffered no diminution of fatness.

They carry with them a constant supply of water in a bag at the root of the neck; and on tasting that found in those we killed on board, it proved perfectly fresh and sweet."

Capt. Porter asserts, that these animals are entirely destitute of hearing; as the loudest noise, even that of a gun, did not seem to alarm them in the slightest degree; and at night, or in the dark, they appear totally blind. In one instance, they had to regret that numbers of these animals had been thrown overboard by the crews of the vessels, previous to their capture, to clear them for action; but a few days afterwards, were so fortunate as to find themselves surrounded by about fifty of them, which were picked up, as they had been lying in the same place where they had been thrown, incapable of any exertion in that element, except stretching out their long necks. On making the experiment, we have found this animal specifically lighter than even fresh water.

The great profusion in which the Gallapagos tortoises are found, as well as their average size, may be estimated by the following extract from the Journal above quoted. "Four boats were despatched every morning, to bring in a stock of tortoises, and returned at night, bringing with them from twenty to thirty each, averaging about 60 lbs.; and in four days, we had as many as we could conveniently stow. They were piled up on the quarter-deck for a few days, in order that they might have time to discharge the contents of their intestines, which are considerable; after which, they were stowed away below, like any other provision. They require no food or water for a year, nor is any further attention to them necessary, than that their shells should be preserved unbroken."

The temperature of the air of the Gallapagos islands, varies from 72° to 75°; that of the blood of the tortoise is always 62°. The eggs of this tortoise are perfectly round, white, and two and a half inches in diameter.* The islands are situated beneath the equator, between 85° and 90° of west longitude.

The present specimen is living in the possession of Mr. Whitton Evans. For the drawings which accompany the description, we are indebted to Dr. S. G. Morton.†

* The eggs of the fresh water tortoises, (Emys,) are oblong-oval, and of a white colour.

† Since writing the above, *Dr. Dekay* has obligingly communicated to us the following note, containing his observations on the T. *indica ;* two specimens of which from the Isle of France, one adult, the other young, are contained in the Cabinet of the Baltimore Academy of Sciences.

"T. *indica.* Marginal plates 24 to 25; anterior marginal plate very small and unequal in the young; all deeply furrowed by subquadrate concentric lines, with four other impressed lines radiating from the centre. The dorsal plates elevated in the centre; in the adult or old specimen, these lines disappear, but the bases of the dorsal plates remain, and give an undulating appearance to the dorsal disks. This same appearance is observed in the *Gallapagos* more evidently. Length of the buckler, (in the adult) twenty-six, breadth seventeen, height thirteen: anterior feet eleven: tail two and a half: head eleven inches.

The separation of the plates very deep in the "*indica ;*" in the "*Gallapagos*" these are simple, slight furrows. In the "*indica*," the anterior plates beneath are deeply emarginate, and this emargination increases with age; in which circumstances it also differs from the "*gallapagos tortoise.*"

"*Gallapagos tortoise*," (full grown.) Marginal plates 23 in number.

Dimensions.—Breadth nineteen and a half inches, length twenty-five inches, height thirteen inches. No central marginal plate anteriorly; the costal plates descending laterally, to unite with the marginal plates, form a deep concavity, which does not exist in the T. *indica ;* in the adult specimen of which the post-marginal plates are turned up, in which respect again it differs from the "Gallapagos tortoise."

Description of two new Species of Linnæan Lacerta, and Construction of the new Genus Cyclura;—with observations on the Anatomy of the Heart, and the Circulation in the Crocodile.

Species 1st.—This animal was brought from Turk's Island, and presented to the Museum immediately after its death. The colour of the skin is of a dirty deep brown; in general, the form of the head resembles that of the Iguana, but the scales on the top of the head and end of the snout are of much smaller size; their form being pentagonal, a series of corneous scales line the infraorbitar ridge. Neck, breast, and body, clothed with uniform fine smooth scales, of a square form, and slightly imbricate.

Skin of the inferior portion of the neck, loose, and folded transversely: *scales* upon the top of the back elevated and compressed into long, slightly recurved, flexible spines, forming a crest, or fringe, extending from the occiput to the base of the tail; this fringe is wanting where the neck moves on the body, leaving a smooth space half an inch in length, between the scapulæ; the same is to be observed at the setting on of the tail: *scales* on the thigh, smooth; those on the leg and front of the foot, bristled over with minute sharp spines pointing downwards. A series of pores, twenty in number, line the inner part of each thigh: *tail* verticillate, circular at its base, slightly compressed at its upper part in the middle; becoming again cylindrical at the extremity, where it ceases to be verticillate; carinated above, by thick and sharp spines, pointing backwards, and terminating four inches from the end of the tail; the remaining portion being clothed only with equal elongated carinate scales; the spinous bands are twenty in number, extending rather more than two-thirds around the tail, leaving a smooth surface beneath. They consist of thick oblong scales, with an elevated carina or an obtusely angular spine projecting backwards from their centre: these bands are separated from each other by a circular series of smaller scales depressed and imbricate, becoming carinate towards the extremity, generally three rows in number, becoming more numerous beneath: *claws* resemble those of the Iguana.

Anatomy.—Tongue fleshy, extensible, and partially slit, or rather indented at its apex: *teeth* resembling the Iguana's in form and mode of articulation; twenty-five in number on each side of both jaws: *palate* destitute of teeth; trachea lies exposed on the floor of the œsophagus, which is enormously large; the opening into the trachea is furnished with a complete epiglottis, in which respect it is more perfect than the Iguana, in which this organ is incomplete; os hyoides has two cornua on each side, and a bifid one in the middle, reaching downwards to the loose skin of the throat; the intestine, a few inches above the cloaca, is dilated into a sack or pouch, with thick parietes: *urinary bladder* large, and opens with the fallopian tubes into the cloaca: *anus*, a transverse slit.

Circulatory system.—I was desirous of comparing the structure of the heart with that organ in the crocodile, which is very unlike the heart of the *Tortoise*, to which Cuvier has compared it, (*Lec. d'Anat. Comp.*) As no correct description of the anatomical structure of the heart in the *Saurien* reptiles has ever been given to the public, I shall offer a brief outline of the organs of circulation in the "CROCODILUS *lucius*," which will serve as a type for all the LACERTA.

I abstract the following observations from my notes of a dissection of an alligator, which I performed for the fourth time in January, 1824.

1*st.* I forced air into the vena cava ascendens, which injected the right auricle and ventricle, and passed into the lungs through the pulmonary artery; into the splanchnic aorta; also into the systemic aorta through the valvular opening at its base; the blood in both superior cavæ regurgitated.

2*d*. I forced air into one of the pulmonary veins, which inflated the left auricle and ventricle, passed into the systemic aorta, and the subclavian trunks which leave the super-cordal sacks, (each of the large arteries are dilated immediately on leaving the heart, and are so united as to appear externally as a single sack.)

The circulation in these animals is briefly as follows:—1st, the blood passes from the right auricle into the ventricle of the same side; in this cavity there are four openings, 1st, one leading from the auricle; 2d, one into the pulmonary artery; 3d, one into the splanchnic aorta, carrying black blood to the viscera; and 4th, one into the systemic aorta, by the valvular communication at its base, which allows the continuation of the circulation, when that through the lungs is impeded by expiration. During expiration there is still some pulmonic circulation, a small quantity of blood passing from the lungs, through the left auricle to the ventricle of the same side, from whence it has a direct passage into the systemic aorta; the valve at its base will not even permit air to pass into the right side of the heart, nor will the semilunar valves of the aorta permit regurgitation, so that the only mixture of black and red blood takes place in the systemic aorta during expiration, or collapse of the lungs. The systemic and splanchnic aorta do not unite until after the viscera have been supplied with blood by the latter.*

* These observations were first published in 1824. Some allusion to them is made in Dr. Gore's translation of "Carus's Comparative Anatomy," but without reference to the author. Dr. Roget's description of this circulation is rather obscure. —"The heart of the crocodile has not only two auricles, but its ventricle is divided, by two partitions, into three chambers: each of the partitions is perforated to allow of a free communication between the chambers; and the passages are so adjusted

After this digression it will be very easy to comprehend the structure of the heart in the animal immediately under consideration. The heart, in fact, is similarly constructed externally: but, as this animal is terrestrial, there is no necessity for that complicated structure which exists in the crocodiles, and the ventricles communicate freely with each other. The three arteries which dilate immediately above this organ, uniting to form a complete sack, in the alligator, are indistinctly *observable*, or partially divided, in this animal; and in which also the splanchnic and systemic aorta unite, *previous to giving off the mesenteric branches*.

Dimensions.—Total length of the animal, two feet four inches; length of the head, three inches; breadth of the head, two inches; length of the body, ten inches; length of the tail, one foot three inches.

Species 2d. Another species of the same genus brought from Tampico, and presented by Captain Dallas, has been living in the Philadelphia Museum for several months, and latterly in my possession. During the present month, (November) this animal has eaten nothing of its own accord, but when raw meat or fruit is placed in the mouth, he swallows it leisurely without chewing, showing most preference for the former, but always rejecting cooked meat. During the summer he subsisted chiefly on fruit, and was never observed to drink; of late he has become considerably torpid, remaining in one position for hours, without any disposition to move unless roused, when he displays considerable activity. He is exceedingly tame, and fond of being washed with a wet sponge; has shown not the least disposition to bite, but when teased or tickled

as to determine the current of aërated blood, returning from the lungs, into those arteries more especially, which supply the head and the muscles of the limbs; while the vitiated blood is made again to circulate through the arteries of the viscera."—Vid. Animal and Vegetable Physiology—Bridgewater Treatises, 1834.

on the leg, will defend himself with his prickly tail, with which he is able to strike in every direction.

Description.—Colour of this species, dark green, on some parts of his back, brilliant or glistening : *head* nearly quadrangular, occipital portion swollen by the large muscles of the jaws : *scales* pentagonal, largest about the snout : *skin* beneath the throat loose, and folded transversely. I never have observed this inflated, even when the animal laboured under the greatest degree of irritation : scales on the body, square, small and imbricate, (as in the Iguana) those of the sides, arms, and thighs, as well as the legs and fore-arms, bristled over with minute prickly spines : the dorsal crest or fringe composed of an uninterrupted series of corneous scales, extending from the occiput to the sacral region, where the back is without spines for the space of one inch, when the prickly tail commences : *tail* beautifully verticillate, perfectly cylindrical, tapering gradually towards the extremity, about two inches of which is lost ; the spiniferous rings are about twenty-four in number, and appear to have extended the whole length of the tail ; the scales which constitute the rings, are oblong, thick, and remarkably imbricate, so that a transverse section of the tail, including a spiny ring, with the two circular rows of depressed scales, would appear to be set into the ring which precedes it. The spines are longer, sharper, and more slender, than in the preceding species, and being all nearly of an equal size on the upper surface of the tail, there is no distinct carina, only there exists always one more spine than ring, intervening between the rings immediately upon the top of the tail ; these spiny rings extend completely around the tail, becoming smaller, shorter, and less vertical on the lower surface : the rings are separated by two rows of smaller, depressed, and spineless scales, with the exception of those beneath, where all are furnished with spines ; in the first four verticillations at the base of the tail the spines exist only on the upper surface: the claws are similar to those of the Iguana; there exists a row of glandular orifices, seven in number, on the inside of each thigh: *teeth* are small, conical and pointed; a single sharp, conical tooth occupying the usual situation of the middle incisor of the upper jaw is received into a hole of the inferior maxilla: *tongue* fleshy and extensible, merely notched at the tip; *palate* destitute of teeth: *trachea* as in species 1st, furnished with an epiglottis. Anatomy, nearly similar to species 1st, the three arteries which form the supercordal sack are merely united above the heart: *omentum* loaded with fat.

Dimensions.—Total length of the animal, one foot eight inches and a half, (allowing two inches for the lost portion of tail;) length of the head, two inches and a half; breadth of the head, one inch and a half; length of the body, seven inches; actual length of the tail, nine inches; (supposed length of the tail, eleven inches.)

Observations.—On the most accurate comparison of the above described animals, with those *subgenera* to which they are most nearly allied, it appears to me, that they cannot be appropriately united with either, agreeably to the present state of the systems; for although both the individuals of which we are now treating, are unquestionably related in some traits of their organization, to the *Iguana*, the *Stellio*, and the *Agama*, yet they will be found to differ as much from either of these, as they respectively differ from each other.

The first described individual approaches the *Iguana* most nearly; the second, to the *Stellio;* they would therefore naturally occupy a station as a subgenus between the two. It is not improbable that other species may yet be discovered, and thus furnish another example of that arrangement which causes the productions of nature to succeed each other by almost imperceptible shades.

The most remarkable peculiarities common to both these individuals, being the form and structure of the tail, we propose to designate them by a term significative of this circumstance.

Subgenus CYCLURA.*

Generic characters.—*Palate* destitute of teeth ; *tongue* fleshy and extensible, cleft at the tip ; skin of the throat folded transversely ; back furnished with a flexible crest or fringe : *tail,* about half the total length : *scales* which form the elevated rings, separated by two or more rows of depressed spineless scales above.

Species 1st.—*C. carinata.* Pl. 1.—Crowns of the teeth dentated ; a row of corneous scales lines the infraorbiter ridge ; dorsal crest wanting between the scapula, and also over the sacrum ; scales of the body uniform, square, small, slightly imbricate, and spineless : leg and foot furnished with scales, having minute spines pointing downwards : *tail* carinated above and slightly compressed in the middle ; spiny bands terminating four inches from the extremity, and separated from each other by three rows of depressed scales.

Species 2d.—C. *teres,* Pl. 2.—*Teeth* small, uniform and pointed ; dorsal crest wanting only over the sacrum ;

* In the last edition of Cuvier's Regne Animal, vol. 2. p. 45, is appended the following note in relation to the new genus CYCLURA.

"IGUANA *cyclura*, Cuv.

"NOTE.—Il me semble aussi que cet iguane est le même que M. Harlan (An. des Sc. Nat. de Phila. p. iv. pl. xv.) appelle *Cyclura carinata ;* mais alors il y aurait, comme pour l'amblyrhynchus, erreur relativement aux dents palatines. Ces dents existent dans tous mes iguanes, je m'en suis assuré."

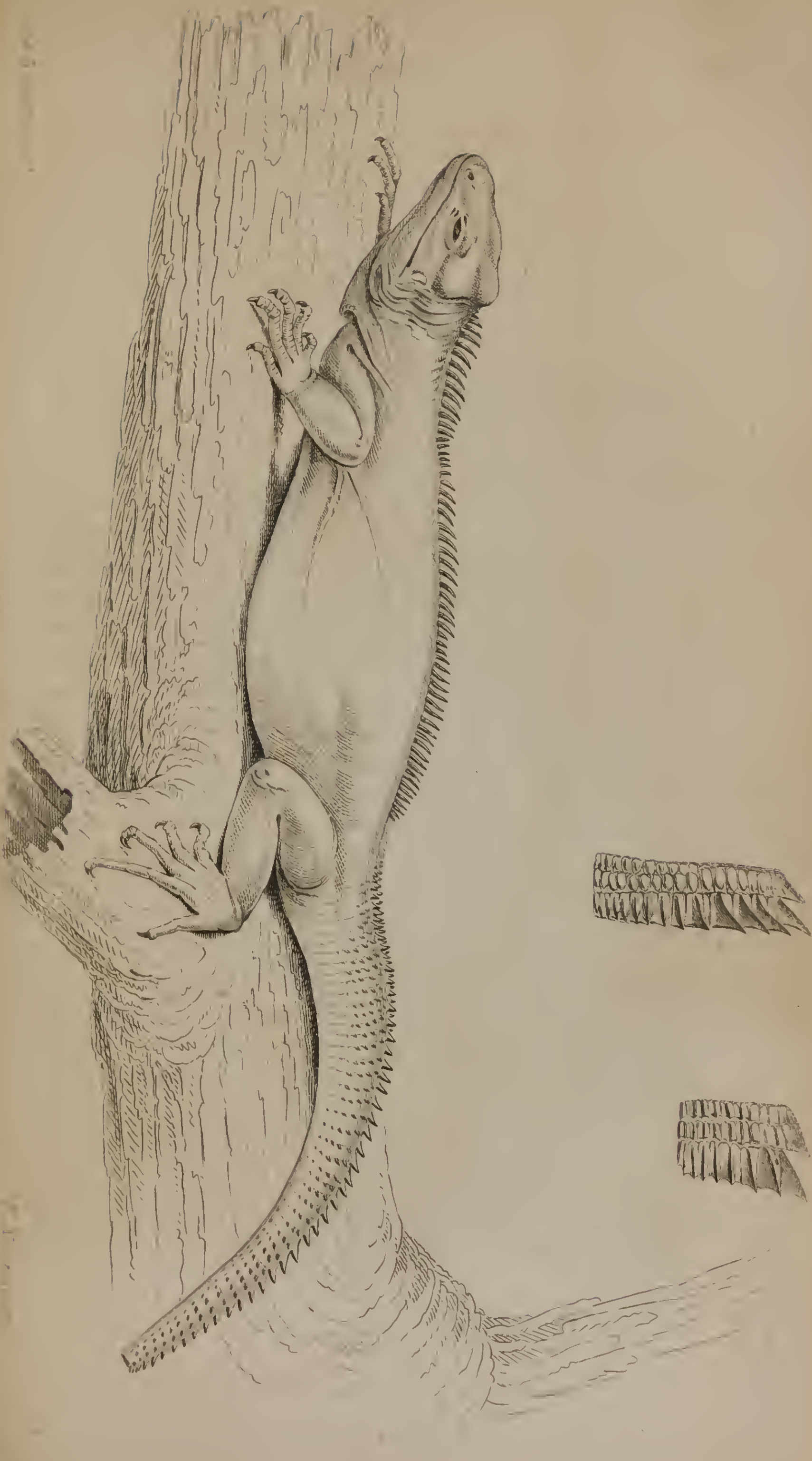
The "error," however, is not with us ; we can repeat with confidence, what we were well assured of before, that the species of our Cyclura, are *destitute of palatine teeth.*

scales on the sides, thighs and legs, bristled over with minute spines: *tail* cylindrical, tapering gradually towards the point; spiny rings encircling the tail, separated by two rows of depressed scales without spines above; spines on the rings nearly equal, extending to the end of the tail.

EXPLANATION OF THE PLATES.

No. 1.—Cyclura carinata.
No. 2.—Cyclura teres.

Cyclura carinata.



Description of the Agama cornuta, or Horned Lizard.

AGAMA *cornuta.*

Corpore depresso ovato, scabro ; supra, fusco-variegato ; subtus albido ; capite supra quadrangulare ; cauda corpore sesquibreviore.

Total length four inches ; length of the tail one inch five-tenths ; length of the head six-tenths ; breadth between the eyes five-tenths ; length of the body from the nucha to the posterior part of the thighs, two inches ; greatest breadth one inch. The form of the body is nearly elliptical, flattened vertically, and umbilicate at the sides, covered over above with minute scales of various lengths and irregular forms ; their inferior borders pointing outwards, giving a prickly, scabrous appearance, as if shagreened ; a groove commences at the nucha and runs the whole length of the spine, becoming obsolete on the base of the tail : the sides of this groove are formed by slightly elevated scales, the bottom of very minute scales compactly imbricate ; sides of the body furnished with a whitish fringe, commencing immediately above the axillæ, and extending to the flanks; a smaller one immediately beneath, running parallel, between the anterior and posterior extremities, separating the back from the abdomen ; the scales on the abdomen, rhomboidal, small, imbricate, and disposed in transverse rows ; the breast and exterior of the thighs and legs clothed with oblong, carinate scales, with their inferior borders elevated and pointed ; scales on the interior of the legs and thighs minute, compactly imbricate, and for the most part not carinate ; head flattened on top between the eyes ;

a slightly projecting ridge over the orbits, lined with five or six small, oblong plates; top of the head clothed with minute verrucose plates, (or scales not imbricate;) snout rapidly attenuated, forming with the top of the head an acute angle; occiput descending backwards from the vertex, forms an oblique angle with the top of the head; occiput flattened laterally and posteriorly, forming a ridge which projects over the neck, the posterior margin of which is furnished with from four to six spines or horns, from one to three tenths of an inch in length; scales on the occiput of a pyramidal form: *ear* placed beneath the occipital ridge, directly posterior to the angle of the mouth; teeth small, pyramidal, flattened laterally and pointed: *eye* large; borders of the lower jaw serrated, with six corneous, approximate scales, projecting obliquely backwards: *tail* about one half the length of the remainder of the body, thick and depressed, or flattened at its base, rapidly attenuating, becomes tapering and verticillate at its extremity.

The very interesting little reptile which forms the subject of this description, differs remarkably from any hitherto described. It approaches nearest the Agama *orbicularis*, Daud., or the Lacerta *orbicularis*, Linn., the *Tapayaxin* of Seba, who has given three figures of this species; (Thes. Vol. I. Pl. G. ix fig. 6. Pl. 83. fig. 1st and 2d.) That figured by Daudin, *Hist. Nat. des Reptiles*, from a specimen in the Museum of Nat. Hist. at Paris, appears to differ, as it wants the row of spines on the back. He represents it as the ugliest reptile hitherto known, on account of its squat body, being nearly as broad as it is long, terminated by a short, slender, and pointed tail. The animal figured by Seba, is represented as six inches in total length, the tail being two inches six lines.

The A. *cornuta*, on the contrary, is elegantly proportioned; its beauty indeed is such as to attract the attention and excite the admiration of the most superficial observer. I consider it unnecessary to enter into any further detail, in order to discriminate this species from that to which it is most nearly allied; it will be sufficient to contrast the above with the figures of Seba, and with the description and figure by Daudin: the specific characters are so striking as to be perceptible at the first glance.*

* For the convenience of those who may not have it in their power to refer to the authors above quoted, I shall barely notice some of the most prominent specific peculiarities of the *cornuta.*

According to Daudin and Brongniart, *generic* characters must be drawn principally from the organs of motion, taste, and touch; that is to say, they ought to consist in the form and disposition of the extremities and their phalanges, of the scales, and of the tongue, as well as in the form of the tail: agreeably to this definition of *generic characters*, it will be observed, that it requires some constraint to class the Agama *cornuta* with even the *orbicular* lizards.

1st. The *cornuta* differs entirely from all other lizards in external form and proportion of the body in general, and of the head and tail in particular; and this in despite of all errors from stuffing, or from difference of age; my description having been drawn from three specimens, two perfectly prepared; the third a very large one, not stuffed; the individual having died, and having been merely dried in the sun. I have been informed that there are two specimens of the same animal in the Baltimore Museum. 2d. It differs from the species most nearly allied in the proportional length of the tail, which is nearly twice the length of the body, in the *orbicularis*, and one-half the length of the body in the *cornuta*, gradually tapering from the root to the point, in the first named species; flattened and enlarged at the base, and rapidly attenuated in the latter. 3d. In the presence of two rows of fringes on the sides of the body in the *cornuta.* 4th. In the longitudinal dorsal groove. 5th. In the large horns with which the *cornuta* is furnished, there being only small spines in the *orbicularis.* 6th. In the flattened borders of the occiput which projects over the neck of the latter. 7th. In the form of the head, position of the nostrils, and in the angles formed by the frontal and occipital surfaces, with the top of the head, as well as in other less remarkable traits. Any one of the above named characters would be sufficient to establish a new species. The fact is, the Agama *cornuta* differs as much from either of the eight orbicular lizards described by Daudin, as any two species of any genus differ from one another.

The reptile described under the name of "Tepayaxin," by Hernandez, (*Hist. of New Spain,*) and that figured and described under the same name by Clavigero, (*Hist. of Mexico*, Vol. I. p. 66,) is, in reality, a distinct species from the Agama *orbicularis*, (Daud.) or the Tapayaxin, of Seba, and yet perfectly distinct from the A. *cornuta.*

Clavigero thus describes his lizard:—"It is remarkable for its shape, being perfectly round and cartilaginous; the body is six inches in diameter;" in the plate it is represented with a *ridge* along the spine, with six transverse bands on the back; eight spines on the occiput; "the head is hard, and spotted with various colours;" the tail is yet shorter in proportion than that of the *cornuta.*

The AGAMA *cornuta* inhabits the great plains east of the Rocky Mountains; possessed in some degree of the power of changing their colour, individuals of the same species will, of course, differ in this circumstance; of the two prepared specimens of this animal deposited in the Philadelphia Museum from the plains of Arkansas, one is rather larger than the other, and possessed of longer horns, but no *specific* difference is observable. A single specimen only, is perfectly prepared by Mr. Griffith; and those who are acquainted with this gentleman's talent in preparing, and giving life and expression to the various objects of nature, will not question the accuracy of the present specimen. The zoologists to Major Long's "Expedition to the Rocky Mountains," frequently mention this reptile as "*the orbicular lizard*," LACERTA *orbicularis*, Linn., but have not given any description of the same. In Vol. I. of that most useful work above mentioned, it is stated, "In ascending the Konsas river, one hundred or one hundred and twenty miles from the Missouri, you discover numerous indications, both in the soil and in its animal and vegetable productions, of an approach to the borders of the great sandy desert, which stretches eastward from the base of the Rocky Mountains. You meet there the orbicular lizard, or "horned frog," an inhabitant of the arid plains of New Mexico; (p. 138.) and further on, when encamped at the base of the Rocky Mountains, "orbicular lizards were found about this camp, and had been once or twice before noticed at the base of the mountains:" (Vol. II. p. 35, ut ubi supra.) Again, "several rattle-snakes were seen, and orbicular lizards; these are evidently of two distinct species, differing from each other in the length of the spines, and the position of the nostrils. Scarce any two of either species are precisely similar in colour, but the markings are permanent; both species possess, in a slight degree, the power of varying the shades of colour. We could find no conspicuous difference marking the different sexes in the species with long spines, the other we have not had sufficient opportunity to examine." (Vol. II. p. 89.)

Though there can be no doubt that various species may exist in the plains of Missouri, yet, in the instance before us, I should attribute the greater length of the spines to sexual difference. The immense labour requisite to bring before the public the mass of most valuable information contained in Major Long's Expedition, and the naturalists being obliged to extend their investigations throughout the boundless regions of natural science, were prevented in a few instances from bestowing that minute attention on some of its objects which their importance would seem to require.

Many years ago, Mr. Thomas Jefferson presented to the Amer. Philos. Soc. a beautiful living specimen of this animal, on comparing which with the present species, a perfect resemblance was observable, excepting that the former had lost part of its tail.*

* Vide plates and additional species at p. 141 of this volume.

Description of a new Species of Biped Seps.

SEPS *sexlineata.*

S. *sexlineata.* Pl. fig. 2. *Body* above and beneath, whitish, clothed with equal rounded scales, compactly imbricate; top of the head blackish, furnished with twelve irregularly shaped scales or plates, (similar to those of the OPHISAURUS) of different figures and unequal sizes; the three largest of the plates are placed one before the other, and the nine smaller are distributed around the three first. Three dark punctuated lines on each side of the body, extend from the neck to the middle of the tail, run into each other anteriorly, and form a single black line which passes through the eyes, extending to the nostrils: rictus of the mouth wide: *nostrils* situate on a line with the eyes near the extremity of the snout: a single row of minute teeth line each maxilla: *tail* rather more than one-fourth the length of the body, cylindrical, somewhat subulate: *anus* a transverse slit, one inch from the extremity of the tail: on each side of the vent, projects a small leg, terminating in two corneous toes, somewhat aduncate, the external considerably the longest: external ear, or membrana tympani, a scarcely visible point posterior to the angle of the mouth.

Total length four inches; from the tip of the snout to the vent, two inches and eight-tenths; from the vent to the extremity of the tail, eleven-tenths; length of the head, three-tenths; breadth of the head, two-tenths; length of the legs, three-tenths; girth, seven-tenths.

Observations.—The BIPED SEPS have been discovered in Europe, Africa, America, and India. I know not from what part of the globe the present specimen was obtained,


b
c
2
d
1
a

I found it among the LACERTÆ belonging to the Philadelphia Museum, where it had remained for several years preserved in spirits.

Three species only of BIPED SEPS have been acknowledged by Daudin—viz. 1st, S. *didactyle,* described by Schneider, (2d *fascic. Hist. Nat. des Amphib.*) 2d, S. *subdidactyle* or the *Shettopusick* of *Pallas,* and 3d, S. *monodactyle* of Gronovius; to neither of which can our reptile be referred; it resembles still less the "*Bipède lèpidopode,*" of New Holland, described by Lacépède (*Annales du Musèum,* Vol. iv.) It approaches nearest to a variety of the third species or S. *Gronovii,* which was described by Gronovius, under the name of "CHAMÆSAURA BIPES," as follows, "A Scincus, having the posterior extremities very short, subulate, single toed, destitute of anterior feet; the tail almost as short as one half the body, cylindrical, with its extremity smooth, naked and conical, some black lines prolonged upon the back, and the flanks; the abdomen whitish: total length four inches. (*Zoophil.* No. 44. page 11.) On comparing this description with that of the "*sexlineata,*" as above detailed, the latter will be found evidently a well characterized distinct species. On examining the collection of the Jardin des Plantes, in 1833, no species similar to this was observable.

EXPLANATION OF THE PLATES

Fig. 1. Scincus bicolor.
Fig. 2. Biped Seps.
Letter B. Back of head, magnified.
C. Abdominal view of the lower part of the animal, magnified.
D. Scales, magnified.

Description of a new Species of Scincus.

Scincus *bicolor.*

S. *bicolor*. Pl. fig. 1. Supra fuscus; subtus albido-argenteus; lineis duabus longitudinalibus albis in utroque latere; cauda, tereti, corpore paulolongiore; palmis, plantisque pentadactylis.

Total length, nine inches, four-tenths; length of the head, neck and body, four inches; length of the tail five inches four-tenths; length of the head, nine-tenths; breadth of the head, eight-tenths; length of the neck, six-tenths.

Body above dusky brown, darkest on the top of the head, which is swollen at the maxillary angles: *body* beneath of a silvery white throughout; a white line commencing at the occiput, on each side of the spine extends two or three inches on the tail; another line commencing at the tympanum and passing immediately above the thigh is lost on the tail; two faint longitudinal lines mark the posterior part of the thighs, the lowermost extending to the outer toe: *tail* tapering, cylindrical, and pointed: *tympanum* large, vertically oval; the palpebral and infra-orbitar ridge, clothed with minute quadrangular plates or scales.

The genus Scincus, originally established by Brongniart, and adopted by Latreille, Daudin, and others, includes about twenty species; only two of which are said to inhabit the United States: viz. the S. *quinquelineata* and the S. *erythrocephalus;* to which must be added the species under consideration, which differs from the *erythrocephalus* described by Mr. Gilliams (Journal of the A.

N. S. Vol. i.) in form, proportion, colour, and markings. Of all the species of this genus hitherto described, the *bicolor* approaches most nearly the S. *quadrilineatus*, (Daudin,) LACERTA *lineata* (Linn.) or L. *quadrilineata*, (Gmelin.) This reptile, first described by Linné (from a specimen in the Museum of Prince Adolph Frederic,) is furnished with only four toes to the anterior extremities, which could not have been the result of accident, as Linné informs us he had observed several specimens of the same species; the total length of this species is represented as about four inches and a half; although it is marked by four white lines in common with the *bicolor*, these are differently arranged; in the "*quadrilineatus*," one line as white as snow, is prolonged from the extremity of the snout on each side of the back, as far as the base of the tail; another passes from the angle of the mouth, through the flanks to the thighs.

After this description there can be no danger of confounding the two. The reptile which forms the subject of this detail, is preserved in spirits in the Philadelphia Museum.

SCINCUS *erythrocephalus*. Gilliams. var. *Body* above of a dark green, approaching to black: *head* above of a reddish yellow: *body* beneath of a yellowish white; total length, eleven inches: *tail* a little longer than the body, round, and tapering; from the tip of the snout to the commencement of the hind legs, four inches and a half; length of the head, one inch and two-tenths; breadth of the head, one inch.

Two specimens in the Philadelphia Museum; being dried, their colours must have faded.

*Descriptions of several new Species of Batracian Reptiles, with Observations on the Larvæ of Frogs.**

The genus Rana of Linnæus is subdivided by modern erpetologists into three sections, which include the genera Rana, Hyla, and Bufo of Lacépède, Brongniart, Latreille, Daudin, and others.

The unmerited neglect with which this class of animals has been treated by American naturalists, is unaccountable, when we consider the important station they maintain in the scale of beings.

The interesting phenomena attending the metamorphosis of the young frog or tadpole, early attracted the attention of men of science; and the works of Swammerdam, Roësal, Malphighi, Laurenti, Galvani, and Spallanzani, furnish the most curious details concerning their organization, development, and functions. The science of experimental physiology has been more indebted to this than to any other class of animals. Frogs, being easily

* The present essay was nearly completed and ready for the press, when No. IX. of the Ann. of the Lyceum of Nat. Hist. of N. York appeared, containing a paper by Capt. J. Le Conte, entitled "Remarks on the American species of the genera Hyla and Rana." In its publication, this learned and indefatigable naturalist has anticipated four of my new species, viz. *Hyla versicolor*, *H. delitescens*, *Rana palustris*, and *R. sylvatica*.

In the indications of his new species *fontinalis*, *pumila*, and *gryllus*, the author has been so exceedingly laconic, and the characters he has noticed are so indecisive, as to render it impossible for me to say, whether or not they really differ from some of my species; the characters of the "*fontinalis*," for example, will apply with equal certainty to three or four distinct species.

On the contrary, his *R. nigrita* is a beautiful, well determined new species, and forms a valuable acquisition to this department. It is thus characterized: "*Rana nigrita*—above black, speckled with small white warts; middle of the back cinereous with an interrupted stripe of black; upper lip with a white line; beneath granulate whitish; irides golden; legs barred with whitish, hind part of the thighs brown; hind legs very long."

procured, and submitting to torture without any expression of pain, either by cries or convulsions, have always been preferred by physiologists as objects of experiment, when the peculiarity of their organization offered no barriers to their views. For this purpose their remarkable tenacity of life offered further facilities. The heart and entrails may be torn out of the body, without the animal appearing to suffer to a great degree, and produces death only at the end of some hours. The heart, indeed, affords signs of sensibility for many days after the appearance of life has ceased in other parts. The millions of these animals which have perished beneath the recipient of the air-pump, the excitations of the electrical machine, or the scalpel of the anatomist, have given rise to the most important facts in physiology, anatomy, and natural philosophy. In every stage of their existence, the frogs are exposed to become the prey of many enemies: some quadrupeds, birds, serpents, and fish, live habitually upon them. In order to support this immense destruction, they live to a considerable age, when they escape their enemies, and each female discharges from six to twelve hundred eggs annually.

Notwithstanding the talent which has been employed, and the length of time which has elapsed, since these reptiles have occupied the attention of the learned of several nations, there exist at the present day some points of their organization involved in obscurity, and some errors have been perpetuated from author to author.

In order to become better acquainted with their habits, and watch the progress of their development, I have this season confined great numbers, of both tadpoles and frogs, in convenient receptacles.

My observations on the former were interrupted by an accident, after an attention of rather more than two months. I have, however, collected a few facts worthy of publication. My specimens were of different species and of various ages; but observation was more particularly directed to the larvæ or tadpole of the *Rana pipiens*, Linn. as being larger than any others inhabiting this state.

Though not full grown, about the latter end of May they generally measured in total length four inches five-tenths; length of the tail two inches eight-tenths; general colour dark slate-green; abdomen white or yellow, sometimes mixed; beneath the throat mottled; tail elongated, compressed, furnished with a membranous fringe on the upper and lower borders.

The extremities, or legs, which are about appearing, are not merely hid beneath the skin, as was asserted by Daudin, but exist as mere rudiments, and grow out like the stem of a tree.

It has not yet been accurately ascertained how long a time it requires for these larvæ to complete their metamorphosis, or how frequently during the year the frogs produce their spawn: we know that some of the young of these animals pass the *winter* in a larva state. About the commencement of April, in the vicinity of Philadelphia, they were observed with the posterior extremities half formed, and, a few days later, an immense quantity of spawn with the fœtuses nearly ready to escape. In warmer situations indeed, the bottoms of the ponds were already covered with young tadpoles.

According to some authors, the young are hatched in fifteen days, and are transformed into frogs in two months* (Lacépède): according to others, two years are required for this metamorphosis. The *Jackie* of Surinam remains sometimes for more than two years under the form of a tadpole; and even after it has become a perfect animal, it still preserves its tail for a certain time, which has

* This period varies under various circumstances, as the degree of heat, &c. to which the spawn is exposed. Shaw, in Gen. Zool., mentions one month, or five weeks.

given rise to the notion, that it is converted into a fish, and accounts for the name, *Rana paradoxa.*

A similar phenomenon has been observed in the *Bufo scorodasma.* (Vide Dict. des Sc. Med., Art. Germ, p. 259.)

It was by inquiries directed to this stage of the animal's existence, that Spallanzani, after Swammerdam, was enabled to detect one of the most curious facts which physiology has gained from natural history. The egg of a frog plunged into water, swells, and, becoming transparent, "permits us to see a blackish body, which the microscope proves to be a tadpole." And Spallanzani convinced himself of the *existence of tadpoles in the eggs laid by a female which had been entirely excluded from the male.** Concerning the rapidity of the metamorphosis of these reptiles, Cuvier has only remarked, "On sait que la Jackie (Rana paradoxa) ne perd sa queue que fort tard et long tems apres ses branchies, et que ses branchies elle-même ne tombent que quand elle a déjà sa taille de grenouille." (Sur les animaux douteux, Voy. de M. Humboldt.)

It is very probable that the period required for the metamorphosis varies with the species. In the larvæ of the *Rana pipiens,* which we detained, expressly for examination, for more than two months, no sensible alteration was observed in this respect, or scarcely any visible approach towards perfection.

Numerous opportunities occurred to corroborate the remark of M. Cuvier, that the organs of generation exist nearly in a perfect state in the larvæ of the frog. "Among the many changes," continues M. Cuvier, "to which the tadpole is subjected in its passage to a state of perfection,

* Spallanzani perceived a dark speck in the ovum of the frog, which he considered the tadpole; though examined with a magnifying glass, no character or appearance resembling the tadpole is distinguishable. Vide *Notes on the reproductive function*, in the following pages.

we cannot include the appearances of the organs of generation. We already observed the ovaries and their fatty appendages; and if they be not entirely as large as they are in the frog at the epoch of its amours, they approach very near to what they are during the remainder of the year."

Agreeably to the observations of the author last quoted, "there are many species of tadpoles which have but one operculum on the left side; such are the larvæ of the R. *paradoxa*, and those of the brown toad; but those of the common frog (Rana temporaria, Linn.) appear to me to have two holes, both placed beneath."

This fact I have verified in all the tadpoles which I have subjected to examination: after dissecting great numbers of tadpoles, of different species and at different ages, both before and after the appearance of their legs, in no instance was there observed more than one opening or operculum, and that always on the left side; though dissection at all periods demonstrated the existence of gills or branchiæ on both sides, covered by integuments.—"Les seules *larves* ou *tetards* des *reptiles batraciens*, c'est à dire des *salamandres* et des *grenouilles*, *rainettes*, et *crapauds* rèunissent des branchies et des poumons, respirent à la fois, du moins pendant un certain temps, et l'air èlastique en nature, et celui que contient l'eau, participent par consèquent, d'une maniere ègale, de la nature des animaux aëriens et des animaux aquatiques, et peuvent donc, si l'on vent, porter le nom d'amphibies dans son acceptation la plus rigoureuse." (Cuvier Anim. douteux, Voy. d'Humboldt.)

In specimens which we subjected to examination, we found the lungs and nostrils to exist in a rudimentary state; the latter are small, and barely admit the passage of a very fine bristle; the former are of a deep black colour. That the larvæ do not depend altogether upon their branchiæ for the decarbonization of the blood, we were satisfied, by observing them to rise frequently to the surface of the water, in order to discharge the foul air and to respire: this process was repeated every three or four minutes, on some occasions, in a number of these animals confined in a tub of water. According to Swammerdam and Roësal, the branchiæ of tadpoles are *exterior* and free during the first days of their existence. This statement was not verified by observations we have made on very young tadpoles of this country, in which not the slightest vestiges of branchiæ or of feet are visible. We subjected a number of individuals to examination, both with and without the glass: the subjects appeared to have just emerged from the eggs, were nearly transparent, the viscera being apparent through the abdominal parietes; though it is not improbable that these organs may have existed at a still earlier period. The frog, in common with other batracians, being destitute of true ribs and a diaphragm, is obliged to force the air into the lungs by means of the muscles of the throat; this is effected by closing the lips, and forming a vacuum by protruding the muscles of the throat, when the air rushes into the nostrils, which open in the anterior portion of the palate, generally between two transverse palatine ridges. I could observe no valves at these openings, which, we are informed by several authors, exist there, for the purpose of preventing the escape of the air; and have little doubt but that the fleshy and free extremity of the tongue, by being applied to the palate of the mouth, performs the function of a valve. In addition to the ordinary permanent specific distinctions, I have observed good characters in the form, number, and size of the transverse palatine plates.

Some species of frogs possess, to a remarkable degree, the faculty, more or less peculiar to all the batracian order, of changing their colours. The Rana pipiens, or common bullfrog, I have observed to change, in the course of a few hours, from a light ash, or nearly dirty-white colour, to a light green and black, and the reverse; though the specific markings are more or less unchangeable.

Though the frog is subjected to change of cuticle, this does not take place throughout the body at once, as in the serpent, but falls off in detached pieces. I could not determine how frequently this process was repeated; but certainly not every "eight days." With these preliminary remarks, I proceed to the more immediate object of this paper, the description of several new species.

Sp. 1. RANA *flaviviridis*. (Nobis.) Yellow-throated green frog. Spring frog? Bartram, Manuscript Notes, penes me.

Char.—Body rather clumsy; abdomen large; snout a little obtuse; colour above clear lively green, beneath white; under the throat yellow; buttocks mottled with black spots.

Dimensions.—Length of the body three inches, of the hind legs four inches four-tenths; breadth of the head one inch.

Description. (Male.) Body rather contracted; abdomen enlarged; prevailing colour green; skin smooth, with the exception of the sides, which are tuberculated; the back is separated from the sides by a longitudinal cuticular fold; the sides are obsoletely spotted; tympanum very large, suboval, plane, and dark-coloured at the circumference, protuberant and green at the centre; buttocks and posterior part of the thighs mottled with black spots; thighs and legs above marked with obsolete black bands; toes of the hind feet palmated, granulated, and of a blackish colour.

Habit.—Not very active; destitute of any peculiar odour; destructive to small fish, grasshoppers, and worms.

Inhabit the middle states; abound in the vicinity of Philadelphia.

Sp. 2. Rana *sylvatica.* (Le Conte, Ann. of the Lyc. of Nat. Hist. of N. York, Vol. I. No. IX. p. 282. Wood frog.) This species I had described under the name of R. *Pennsylvanica.*

Char.—Olive brown or drab colour above, white beneath; a black vitta, commencing on the side of the snout, passes backwards dilating, and involves the eye and tympanum; posterior extremities obsoletely fasciated.

Dimensions.—Rather smaller and more slender than the R. *clamata.*

Description.—Body long and slender; snout rather elongated; a longitudinal black band on each side of the head, commencing anterior to the eye, involves two-thirds of the iris and the whole of the tympanum; lips with dark borders; lower parts of the body white, the flanks light green; upper parts of the body drab colour, with the exception of a few scattered spots posteriorly; and the hind legs with broad, obsolete, transverse, blackish bands.

Habit.—A great leaper; travelling far from the water in search of insects, &c.; is difficult of access, leaping with great facility and hiding beneath the dead leaves, which the colour of the upper parts of the body closely resembles; more frequently found in the woods than in the fields; this beautiful species is not very common.

Inhabit Pennsylvania and New Jersey.

Sp. 3. Rana *scapularis.* (Nobis.)

Char.—General colour above dark olive-brown; snout green; beneath the throat yellow; abdomen white; a golden coloured line above the scapulæ.

Dimensions.—Length of the body three inches; of the hind legs four inches.

Description.—(Male.) Dark olive-brown, white beneath; throat, anterior part of the thorax, and interior of the fore legs, of a bright yellow colour; the outer surfaces of the fore legs and thighs the same colour as the back;

leg, tarsus, and foot dark ash colour; sides tuberculous and mottled with black; membrane of the tympanum very large, with a greenish protuberance at its centre; an elevated golden coloured line passes from its inferior border across the scapulæ. Eyes very prominent, nearly approximate; snout contracted, and with the upper lip of a dark sea-green colour; legs obsoletely and sparsely banded with black.

This species resembles the R. clamata, but differs in the colour of its throat, in the form, colour, and length of the snout, in the size and proximity of its eyes, in the colour and size of its tympanum, (which is double the size of the same part in the clamata,) in the proportion of its limbs, and lastly in the golden line across the scapulæ.

Habit.—As far as observed, resembling that of the *clamata,* though less noisy and timid.

Inhabit Pennsylvania.

Sp. 4. RANA *palustris.* (Le Conte, Ann. of the Lyc. of Nat. Hist. N. York, vol. 1. no. ix.) This species I had described under the name R. *pardalis.* Leopard frog.

Char.—General colour dark cineritious above, white beneath, lighter on the snout, flanks, and extremities; interior surface of the limbs yellowish; a row of dark green spots on each side of the spine, extending the whole length of the back; two other longitudinal rows on the flanks; posterior extremities striped with broad, transverse, greenish lines or bands.

Dimensions.—Length of the body three inches; of the posterior extremities, four inches three-tenths; breadth of the head eight-tenths.

Description.—(Female.) Dark cineritious above, white beneath; interior of the limbs yellowish; end of the snout and upper surface of the thighs approaching to green; a longitudinal row of dark green oblong spots on each side of the spine, from eight to ten in number and symmetrically arranged; a dark green spot on the inner and upper surface of the orbits, another on the top of the snout, a dark coloured line on each side of the snout, extending from the nostrils to the eyes; a silver coloured line, or cuticular fold, extending from the orbit on each side along the back to the thighs, inclosing the dorsal spots; thigh, leg, and tarsus striped with broad, transverse, greenish bands; a row of spots on the sides of the body, extending from the scapulæ to the thighs; another irregular row of smaller spots beneath; anterior extremities spotted; hind feet completely webbed; all the toes with tubercles on the inner surfaces of the joints; body smooth, or, when viewed with a glass, embossed with fine tubercles; snout rather pointed; tympanum small, rather circular.

Habit.—Very active, timid, leaping to great distances, leaving the water in search of insects, always found in or near to ponds, &c.; diffusing a rank odour; the slime which covers the skin is more excoriating than that of other frogs: appear early in April; are not very noisy.

Inhabit ponds, ditches, &c. of the middle states; common in the vicinity of Philadelphia.*

Sp. 5. RANA *utricularius.* (Nobis.)

Char.—Colour dark olivaceous-green above, white beneath; with suboval blackish spots scattered over the back; a vocal vesicle on each side of the neck; legs and thighs with a few blackish bands.

Dimensions.—Length of the body about three inches; of the hind legs more than four inches.

Description.—Dark-olivaceous-green above, spotted with suboval dots; white or pale yellow beneath; snout

* If the *Rana zebra*, partially described in Nicholson's Encyclopædia, is intended to represent this species, the name is pre-occupied. Vide Shaw, Gen. Zool. vol. 3. pt. 1st.

small and angular; head rather flattened; a greenish vocal bladder, extending on each side of the inferior jaw and crossing the arms, in the male; in which respect this species resembles the R. *typhonia*, of Surinam, but is very different in its colour and markings.

Inhabit Pennsylvania and New Jersey.

Sp. 6. RANA *halecina*. (Daudin.)

R. *pipiens*. Schneider, Schreber, Shaw.

R. *aquatica*. Catesby, p. 70. vol. 2.

Shad frog. Bartram, Trav. N. America. p. 274.

R. *ocellata?* Kalm's Trav. in N. America, vol. 2. p. 88; who says that the Swedes call them sill-hoppetosser, or herring-hoppers, from their making their appearance early in the spring, at the commencement of the herring season.

Char.—Colour light cinereous above, white beneath; marked on the superior portions of the body with irregularly disposed blotches; body and limbs elongated.

Dimensions.—Length of the body three and a half inches; of the hind legs, five and a half inches.

Description.—Body above bright cinereous, beneath white, immaculate; back marked by several large, oblong, dark green blotches, irregularly disposed, and occasionally surrounded by a light green halo; body, limbs, and toes elongated; thighs and legs striped or spotted on the outside with dark green or purple on a black base; back and outer surface of the hind legs subverucose; sides separated from the back by a longitudinal cuticular fold; tympanum of moderate size, and in colour similar to the back; outer surface of the fore legs marked with three or four spots; toes terminated by a rose-coloured tumefaction; palate of the mouth with two middle serrated eminences; transverse eminences small; the posterior nares opening in cavities. This species in many respects resembles the R. *palustris*, but is distinguished, 1st, by its tympanum, which is much larger; 2d, by the colour; 3d, by the number and arrangement of the blotches; 4th, by the elongated form of the body, snout, legs, and toes; 5th, by the posterior nares, which are much larger, and open between two transverse palatine ridges in this species, there being but a single ridge in the palustris.

Habit and locality.—These are active hunters, and travel a considerable distance from the water; are common in the vicinity of Philadelphia, in ponds, canals, and marshes.

The following species have not hitherto been well described from the living animal.

Sp. 7. RANA *pipiens*. (Linn.)
Bull-frog. Bartram, Catesby, Brown, Kalm.
R. *maxima*. Catesby, Carolin. vol. 2. p. 72. pl. 72.
R. *catesbeiana*. Shaw, Gen. Zool. vol. 2. part 1. p. 106. pl. 33.

Char.—Brown-cinereous above, whitish beneath; buttocks mottled; arms and legs striped with black; head and fore part of the body more or less green.

Dimensions.—Length of the body from six to ten inches; of the hind legs from eight to twelve inches.

Description.—Eyes very prominent, iris golden mottled with black; tympanum large, brownish, with a semilunar border posteriorly, extending anteriorly to the eye. Internal border of the upper jaw serrated, covered with the upper lip; within this border is a semilunar ridge, palate divided by a transverse ridge, interrupted in the middle by two serrated eminences; borders of the lower jaw not serrated, notched anteriorly; colour above cinereous-brown, or deep olive-green, beneath dirty white; throat greenish-yellow; exterior surface of the extremities, or legs, irregularly striped with black.

Habit.—This unwieldy animal frequents ponds, ditches, marshes, lakes, and canals; is exceedingly gluttonous, swallowing young chickens, aquatic birds, small frogs, and tadpoles. The late Mr. Bartram states, that, on whipping one, it vomited forth three live frogs of considerable size; when confined and starved, they have been known to attempt swallowing each other; they are most destructive to fish ponds; seldom leave the water for any length of time. Their voice is harsh, somewhat resembling the suppressed voice of the bull; hence their vulgar name, "bull-frog." When taken, they frequently utter a cry like the squeaking of a rabbit: when whipped, they cry like a child. They appear early in April, but are not heard to make much noise until the weather becomes warm, or during the season of their amours, when they may be heard at the distance of a mile, more particularly during the silence of the night. This species is not known by the name of "shad-frog," as was stated by Daudin; that name being applied to the *halecina* and *palustris*: though I have not observed that any one species makes its appearance much earlier than the others. When immersed in spirits, this frog changes to a lively green, with a stripe along the back; in which state it was figured by Daudin.

Inhabit the middle states; very common near Philadelphia.

Sp. 8. RANA *clamata*. (Daudin.)

Char.—Colour above dusky cinereous, beneath whitish; snout more or less green.

Dimensions.—Length of the body three inches; hind legs four inches and two-tenths.

Description.—(Male.) Body above dark cinereous, approaching to green, tuberculous; snout green; beneath the throat, breast, and interior of the fore legs, bright yellow; tympanum large; longitudinal folds of the back not extending the whole length of the body, and of a light colour; the belly and interior of the legs white; thighs and legs obsoletely banded or spotted with black; sides more or less striped with black; buttocks mottled. (Female rather larger, lighter, and altogether white beneath.)

Habit.—Noisy; generally crying just as it leaps into the water, and skimming over the surface previous to diving; screaming when caught in most instances; very active and tenacious of life. A dog of Mr. Bartram's having accidentally swallowed one of these animals, it was observed to struggle and to cry piteously for at least half an hour, to the great diversion of the spectators, and no small confusion of the dog, who was at a loss to comprehend this species of intestinal eloquence.

Inhabit the middle states; the most common of all our frogs.

Sp. 9. RANA *ocellata.* (Linn.)
R. *maxima virginiana.* Seba.
R. *pentadactyla.* Linn. Gmel. Argus frog. Shaw, Gen. Zool. vol. 2. pt. 1. p. 108. pl. 34.
Grunting frog. Bartram, Trav. in N. Amer. p. 272. pl. 34.

This species is badly figured by Daudin from a specimen in spirits. I have not observed the species in a living state; it is very doubtful whether they exist north of Charleston.

Char.—In form and size resembling the "pipiens." Body above brownish or greenish, with irregular deeper coloured spots; a small cuticular fold extends from the eye to above the flank; body beneath whitish, granulated under the belly and thighs; round brownish spots, surrounded with a clear teint, upon the flanks, buttocks, and thighs; fingers and toes furnished with small callosities beneath each articulation of the phalanges.

Inhabits Florida and Mexico.

Sp. 10. RANA *melanota.* (Rafinesque, Annals of Nature, first annual number, 1820.)

Char.—Back olivaceous-black ; a yellow streak on the sides of the head ; chin, throat, and inside of the legs, whitish with black spots ; belly white without spots ; eyes large, iris gilt-violet ; anterior feet four free toes ; hind feet five palmated toes.

Dimensions.—Total length two and a half inches.

Inhabit Lake Champlain and Lake George : vulgar name *Black frog.*

RANA *grunniens.* (Daudin.) "Rana fusca, aut subrubra, luteo post oculos maculata." This species, which Daudin erroneously refers to the grunting-frog of Bartram, I believe to be the R. oculata ; it is most probably not a native of North America.

Description of three Species of the Genus Astacus, inhabiting the United States.

Astacus *blandingii.* (nobis.)

Rostrum mucronate, canaliculate, slightly notched at the extremity: a spine behind each eye; arms tuberculated; fingers unequal.

Inhabits the southern states, where it is common in the marshes and rivulets.

Cabinet of the Academy of Natural Sciences. Presented by Dr. W. Blanding, Camden, S. C. Vid. pl. fig. 1.

Description.—The hands and arms, and sides of the body tuberculated; conspicuously large on the hands; thorax with a small spine on the side, behind the transverse arcuated band; first and second joints of the peduncles of the exterior antennæ furnished with each a single spine: rostrum elongated, angular, attenuated anteriorly, and obsoletely notched near the extremity, extending nearly to the tip of the third joint of the peduncle of the exterior antenna, carinated on each side of the base, and terminating in a post-ocular spine: anterior feet, third joint very long, with a double longitudinal series of spines beneath: carpus four-spined; spines irregularly distributed about the anterior margin: hands long, tuberculated throughout; fingers elongated, slightly curved inwards, the innermost the longest, terminating in a small spine opposed to the thumb: caudal lamellæ ciliated, lateral segments with an elevated longitudinal spine; the penultimate and antepenultimate legs of the male furnished with an obtuse apophysis at the base of the second joint.

Dimensions.—Length from the tip of the rostrum to the tip of the tail three inches eight-tenths; breadth of the thorax one inch; length of the anterior feet nearly four inches; length of the hand and finger nearly equal.

The present species, in size and markings, is most nearly allied to the A. *affinis* of Say; but differs in the form of the rostrum; in the proportional length of the arms; in being furnished, in the male, with an apophysis on the third joint of both the penultimate and antepenultimate legs; in the disposition of the spines; and in being tuberculated.

The present species will bear no comparison with the A. *bartonii*, with which, nevertheless, Mr. Say appears to have confounded it, when he assures us that the last named species are " extremely common in the pine barren marshes of the southern states, and particularly in those of Georgia and Florida."—Vid. Journ. Acad. Nat. Sc. Philad. vol. 1. p. 443. All the crawfish which I have seen from the southern states, are of the same species with that now described.

Astacus *bartonii*. Vid. pl. fig. 2.

A. *bartonii*, Bosc, Hist. des Crust. Idem, Latreille, Gen. Crust. et Insect. Vol. vi. p. 240.—Not figured. Vulgo, Fresh water Lobster, or Crawfish.

Specific Characters.—Rostrum mucronate, concave; thorax unarmed; hand short, destitute of spines; fingers moderate in length.

Length from the tip of the rostrum to the end of the tail, two inches. Very common in the fresh water rivulets in the vicinity of Philadelphia. The flesh is esteemed by many as a delicacy. Cab. of the A. N. S.

Astacus *affinis*. Vid. pl. fig. 3.

A. *affinis*, Say, Journ. A. N. S. Philad. Vol. i. p. 168.—Not figured.

Specific Characters.—Rostrum mucronate, subcanalicu-

Fig. 2

Fig. 3

Fig. 1

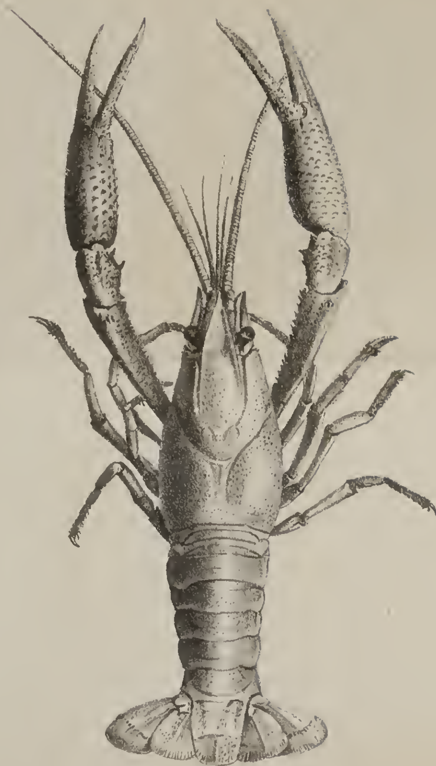


Fig. 1 *Astacus Blandingii* Fig. 2 *Astacus affinis* Fig. 3 *Astacus Bartonii*

Lehman & Duval Lith.rs

late, two-spined; a spine behind each eye, and a larger geminate one, on each side of the thorax; hand and thumb on the inner edge scabrous.

Length from the tip of the rostrum to the end of the tail, about three inches; breadth of the thorax nine-tenths.

Inhabits the river Delaware, and its tributaries.

Cab. of the A. N. S.

On the Successive Formations of Organized Beings.

"The interests of society often render it expedient not to utter the whole truth, the interests of science never; for in this field we have much more to fear from the deficiency of truth, than from its abundance."

It is proposed in this memoir to endeavour to trace the successive formations of organized beings, commencing with the earliest periods of animal existence, in order to examine their various modifications, from the simple to the most complex.

The present view is offered merely as an outline of one of the most interesting, as it is one of the most recondite subjects of such researches: we shall first examine the validity of that doctrine which attributes an *uninterrupted* succession in the formation of living beings, which doctrine has been recently most fully developed by Mr. Virey. (*Dict. d'Hist. Nat. Art. Nature.*)

Concerning the successive formation of living creatures, Virey remarks, "all animals, and all plants, are originally only the modifications of a single animal, and of a single vegetable; we may pursue in the composition of their organs, the whole chain of their resemblance. Let us take, for example, *physical man*, or the most perfect of *trees*. If we unfold the first, layer by layer, if we abstract by degrees all his parts, we shall deduce from him the whole series of animals, and shall reduce him at last to the most simple term, the primitive type of animality. We may do the same with the vegetable. It is then evident, that this complication of organs, which we observe in the most perfect beings, is produced only by a successive progression, a species of organic maturity, or continued development. The animal kingdom is in some degree only a single animal, but varied and composed of a multitude of species, all dependant on the same origin. In the same manner the vegetable kingdom has been formed from a single vegetable, and it may be said that animals are all brothers, as plants are all sisters.

"This admirable chain of organization in animals and plants, is extended even to the *generation* of each individual. The embryon of a quadruped, for example, during the first periods of fecundation, is nothing but a living jelly, very similar to the substance of a polypus, or to the organized glaire of the zoophite. Some days after, the first rudiments of its members renders it similar to the worm and to other animals of this family; it soon acquires vital faculties analogous to those of the larvæ of insects or of the mollusca. It passes afterwards to a state similar to that of fishes, and like these animals it swims in a fluid. In the first stage of its being it enjoys scarcely more than the sluggish and obscure life of a reptile,—like which, the young animal is scarcely able to drag itself along; at length it rises to the rank which nature has prescribed for it. The same may be observed of vegetables. Young animals and young plants are of a soft, humid and spongy texture; and old vegetables, like aged animals, are of a dry and hard temperament. In the same manner the most imperfect animals, as the polypes, vermes and mollusca, like the most simple plants, as the mushroom, moss and liliacea, are of a very moist and soft constitution. On the contrary, birds and quadrupeds, trees and shrubs, are of a firm and solid consistence. Thus the most simple animals and vegetables represent the youth of living nature; whilst the most complicated animals and vegetables represent the old age of nature.

"Each class of these two organized kingdoms offers to us a scale of the vivification of matter. Life, indeed, so obscure in the simpler forms of being, becomes increased and developed in proportion as we advance to beings more perfect; plants possess only a vegetative existence, imperfect animals appear rather to vegetate than to feel; finally, the most perfect races live, feel and think. In proportion as the vital power concentrates, forming but one absolute whole, the more it is perfected and enriched with organs. All beings tend to vital perfection; thus each individual receives a greater development of faculties in proportion as it advances in age; in the same manner the most imperfect beings aspire to a nature more perfect; it is on this account that species rise incessantly in the chain of organized bodies, by a sort of vital gravitation. For example, the polypus tends to the nature of a worm, which tends to the organization of an insect; the insect aspires to the conformation of the mollusca, the latter endeavours to change into a fish, and so on even to man! Thus, we may say, the monkey aspires, by successive modifications, to the organization of the negro, and the negro inclines to that of the white man. Among plants the same gravitation is observable, because nature always aspires to the perfection of her works. It appears then manifest, that the most perfect beings spring from the least perfect, and that they become perfected by a succession of generations. All animals incline towards man; all vegetables aspire to animality; minerals tend towards vegetables; but the more vital the matter, the greater is its liability to death, because it is possessed of more unity, which may be destroyed at one blow. On the contrary, the most imperfect of animals are the most prolific; they are even só tenacious of life, that they live after having been divided; and reproduce the parts cut off by the knife, and even multiply into as many individuals, as there are pieces, as is exemplified in the hydra and actinea, &c. Vegetables themselves are very tenacious of life, being reproduced by slips, suckers, shoots, and various other means besides grafting and seed. Those beings the least favoured in regard to complexity of life, are indemnified by their fecundity.

"Man is much more easily killed than the earth worm, all proportions considered; if we enjoy more intelligence and sensibility than the fish, this animal is a thousand times more prolific, and more vivacious. Imperfect animals and vegetables are endowed with more physical vitality, ourselves with a greater proportion of sensitive life, and moral feeling. Our existence is principally occupied with the functions of the brain and nerves. Animals spend their life principally in the functions of generation and nutrition.

"Every being, therefore, has an equal proportion of life, but each consumes it after his own manner. The more vitality is expended externally through the medium of sensibility and intelligence, the sooner do the internal organs decay. Animals being chiefly occupied with the internal functions, are more robust and prolific, as well as more exempt from the diseases and infirmities of man, who, in proportion as his existence is more occupied in thought, sentiment, and exterior affections, has his internal organs debilitated, and his physical powers diminished.

"We thus observe several orders of life; 1st, that of intelligence, which appertains to man; 2nd, that of sensation, which characterizes animals; 3d, that of nutrition, or the vegetative faculty, which is more peculiar to plants, although animals are not deprived of it: but all these different modes of existence emanate from a common source, viz. the soul of the world, or the spirit of God; it is for this reason we say, He fills the world, exists everywhere; that we live and breathe through him alone. Our souls even are nothing more than emanations from this soul of the Universe, which establishes throughout, harmony and concord.

"It is evident that nature having created a series of plants and animals, and having finished with man, who forms the superior extremity, she has concentrated in him alone all the vital faculties which she had distributed to the inferior races. Man, then, possesses the essence of all organic power; it is in his brain, that the divine power, which has presided over the formation of beings, begins to display itself. It is thus that man is capable of knowing all that is beneath him, for it is only necessary to cause his intelligence to return by that route followed in the organization of the body. It is in some respects, a reminiscence of the soul, since it passes through the whole chain of animals until it ascends even to man. In order to understand, we have only to develop the inherent faculty of thought, which contains in itself all the elements of human science; this regular development is what we call reason, which exists in every man, though not equally developed in all.

"If this was the proper place we might show further, that the soul aspires to elevate, the body to debase itself! all the inferior parts of animals tend principally to physical life, such as nutrition and generation; whilst the superior parts, on the contrary, containing the nervous ramifications, the senses and the brain, tend principally to moral and intellectual existence. It may be added, that animals excel by brutal qualities, and men by intellectual; and that animals diminish in the former respect, in proportion as they approach the latter. It would be still possible to conceive that if nature should one day create beings superior to man, they must necessarily be endowed with greater intellectual energy, and less of brutal propensity, just as the inverse is observable in the inferior orders of beings; commencing even in the negro. Such superior beings may possibly come within the plan of nature, as all the nations of the earth appear to have anticipated them in genii, demons, spirits, and angels, which convince us that the human soul aspires, throughout the earth, to a state of higher perfection, and endeavours to ascend the chain of all possible existence, even to the throne of divinity. We are, indeed, nothing else than the starting point of a more perfect type, just as animals are nothing more than successive points of imperfect man; and as plants are the commencement of animals, or the first stage of their organization."—(*Virey, Dict. D'Hist. Nat. Art. Nature.*)

He continues to state, that we can no longer doubt of the common origin of beings, when we consider their resemblance; thus, all the different kinds of rats, mice, &c. are absolutely the same animal, differing only in size, colour, and other superficial characters, occasioned by greater abundance of nourishment, light, heat, moisture, and climate, which are the chief agents in modifying the formative principle of animals. In the same manner, "the cat, lynx, panther, leopard, tiger, lion, &c. belong absolutely to the same original stock." Among birds similar analogies are observable; and this resemblance is equally ascertained among vegetables; every variety of mushroom, the umbellifera, the liliacea, &c. afford still more complete proofs of this truth; and among insects, all the papiliones, the whole family of fleas, flies, and spiders, &c. Nature need only vary in a slight degree the numerous generations of the same plant, or of the same animal, in order to create a multitude of analogous animals, which we name *species*. The most remarkable variations are denominated classes, orders, genera: and all this scaffolding of methods has been invented by the human mind, in order to facilitate the knowledge of objects; but which is by no means acknowledged by, or founded in nature; she having produced at first only a single animal, and the most simple vegetable, which she has varied "ad infinitum," and complicated by easy grades, even to the most perfect creatures. "All this diversified machinery of animal existence is co-ordained and united together, like the various pieces of an immense edifice;—and evidently proves the impossibility of *spontaneous* generation. If an animal could be produced by matter, in a state of putrefaction, why should nature employ such complicated apparatus for the purpose of reproduction? whence the necessity of these meanderings, these labyrinths, in order to elaborate, appropriate, and perfect a vivyfying fluid? to extract it from the blood and impregnate it with the nervous influence, in order to impress upon it the highest degree of vital energy? Wherefore this superfluous pomp in all the organs consecrated to reproduction?"

The author above quoted, grounds his disbelief in spontaneous generation, principally on two experiments, 1st, Leuwenhoeck, the first discoverer of animalculi infusoriæ, declares, that having taken a piece of fresh veal, and hermetically closed it in a glass vessel during many months, he observed an infectious serosity to flow from it; this he immediately examined with the microscope, and repeated his examination at various periods, always exactly closing the vessel, and was never able to discover the slightest appearance of animalculi. (This experiment was performed in 1686.)

Since this time Spallanzani and others have repeated these experiments, either in closed vessels, or by placing the substances in a state of putrefaction, in gas *deprived of oxygen;* but not the least signs of animation were ever visible; hence M. Virey concludes, primitive germs are absolutely indispensable in procreation. To me these experiments are both questionable on the same principle, viz. that oxygen is necessary in some form or other to all stages of animated beings, and this is precisely what was denied in all the experiments above alluded to.

The reasoning which follows is much more conclusive. It appears to us, says M. Virey, as utterly impossible, that the simplest atom of living matter could organize itself in putrescent matter, as, that a horse or an ox could leap forth from a mountain of smoke; for if we should combine a sufficient quantity of putrescent or decomposing matter together, why should not an elephant or a man be produced, in preference to animalculi? Another argument of the falsity of equivocal generation, of the weakness, (or if we may be allowed the expression,) the "*putridity*," of such an opinion, is, the little probability that chance, (which they say presides over such creations,) would at all times produce well formed and very distinct species. It is scarcely possible, if chance was really the parent of these animals, that monstrosities and the most imperfect efforts would not sometimes occur; there is no reason why one sort should be produced to the exclusion of others, or why an assemblage of new species, or thousands of proteiform infusoria, should not occur to baffle description. Why always vibrios for example, from paste or vinegar, and not every other imaginable species? is it denied this matter, to construct a fish, a crustacea, or any other figure, inasmuch as the thousand circumstances of chance are so variable? Far from this! there are always exactly the same forms, the same species of intestinal worms, or infusoria, which are regularly propagated. And whilst we observe on the surface of the globe different species, as the horse and the ass, mixing together and producing hybrids, *putrefaction* by the rarest privilege, although submitted to chance, preserves, on the contrary, the precise forms of animalculi, constant and perfect species of *cysicircus, vorticella, volvoces*, &c. It is thus sexual generation only, which produces monsters; whilst the pretended *chance* of putrefaction affords the most pure and permanent species; this would be wrong presiding over right, and the laws of wisdom contradicting themselves.

The doctrine of spontaneous generation would appear then, in direct opposition to the established laws of nature;

its admission has been generally opposed by theologians, inasmuch as it has been occasionally used by atheists and materialists, as a support to their systems. But all theological considerations aside, we would be inclined to take the facts as they are; and if spontaneous generation can be proved, would admit the same, with all the consequences, whatever these might be.

Theologians, nevertheless, formerly admitted with the peripatetic school, the doctrines of spontaneous generation; and St. Thomas, in many parts of his theological visions, established, that the virtue of Heaven, or what in the present day is called "*cosmic power*," was sufficient to produce the *imperfect* animals, such as insects; but not the more perfect, as quadrupeds or birds. But theology never decided that new species or unknown races were created in this manner; on the contrary it establishes, that those species which are the daily product of putrefaction, were "*originally produced in their principles*," in the days of the creation of the world, by the Supreme Author. Which is to say, that their germs, or their primitive forms, were assigned them according to general laws from which they cannot deviate. Here then is the hand of God placed over the pretended generation of chance.

The *true* science of nature will thus lend at all times, and under all circumstances, the firmest support to religious sentiment in manifesting the creative wisdom of God.

The idea of the successive formation of organized beings, by means of progressive improvement, was first, among modern authors, seriously maintained by Lamarck.

The object of the "Philosophie Zoologique," of Lamarck, is to trace the steps by which the whole of the animal creation has been constructed, through the gradual working of the natural tendencies of the animals themselves. The world of life had its origin, it seems, in certain "petits corps gelatineaux." Such elementary bodies formed the lowest classes of animals; and these again, by their feeling of their wants, by their efforts, by the operation of a "sentiment interior," first acquired organs, and then developed and multiplied these acquisitions, till they had passed through all the varieties of animal being which now exist or have existed. Finally, among these creatures there arose a dominant race, which, having acquired a supremacy over the others, succeeded in placing a considerable distance between themselves and the other tribes. To this race of animals we and our readers have the honour to belong. It is not the organs, or, in other words, the nature and form of the parts of the body of an animal which have given rise to its habits and its particular faculties; but, on the contrary, its habits, its manner of living and those of its progenitors have, in the course of time, determined the form of its body, the number and condition of its organs—in short, the faculties which it enjoys. Thus otters, beavers, water-fowls, turtles, and frogs, were not made web-footed in order that they might swim; but their wants having attracted them to the water in search of prey, they stretched out the toes of their feet to strike the water, and move rapidly along its surface. By the repeated stretching of their toes, the skin which united them at the base acquired a habit of extension, until, in the course of time, the broad membranes which now connect their extremities were formed. In like manner the antelope and the gazelle were not endowed with light agile forms, in order that they might escape by flight from carnivorous animals; but having been exposed to the danger of being devoured by lions, tigers, and other beasts of prey, they were compelled to exert themselves in running with great celerity, a habit which, in the course of many generations, gave rise to the peculiar slenderness of their legs, and the agility and elegance of their forms. The cameleopard was not gifted with a long flexible neck, because it was destined to live in the interior of Africa, where the soil was bad and devoid of herbage; but being reduced, by the nature of that country, to support itself on the foliage of lofty trees, it contracted a habit of stretching itself up to reach their high boughs, until its fore legs became longer than the hinder, and its neck so elongated, that it could raise its head to the height of twenty feet above the ground.

Virey thinks he is able to trace that vast and complicated machinery, *man*, through his various gradations, (or rather degradations,) down to the primitive monade, the first invisible atom of organic existence; or "mounting upwards, link by link, with step aspiring trod, he climbs through nature, up to nature's God!"

The doctrine thus attempted to be taught has been ridiculed by some, and viewed with contempt by others; but whilst we are inclined to consider the views of the authors as a splendid specimen of the *Nugæ Philosophicæ*, or of captivating eloquence; they demonstrate to us the necessity, in matters of science, of restraining the imagination within the range of sober judgment; for surely, it is scarcely possible to conceive of a philosophical disquisition approaching nearer to reverie; but as it appears to have been conducted in the spirit of philosophy, in the same spirit it should be viewed as worthy of cautious consideration. The author to whom these remarks more particularly apply, is confessedly one of the most eloquent writers of our age. But unfortunately for science, M. Virey is not a skilful naturalist, and when occupied with subjects purely scientific, which require minute detail, it is no wonder, that his unlimited and *general* views, should occasionally seduce him into error. He who could observe in the different stages of the embryotic fœtus, nothing more than a constrained analogy to the polypus, the worm, the larva, the fish and the reptile, would, by an acquaintance with the laws of co-existence, or the mechanical philosophy on which organic bodies are constructed, have been enabled at this early period of the embryon, to contemplate the rudiments of the most complex and perfect animal; he would have been compelled to acknowledge, that throughout the whole animal creation, no one being is *imperfect;* but that each is equally finished and perfectly adapted to perform its part in the sphere in which its destiny had placed it.

It will not be denied that nature aspires to the perfection of her works; that is to say, that each individual of the most complicated animals proceeds from the most simple point of organization.

The sturdy oak, whose luxuriant foliage constitutes the pride of the forest, at one time formed but a speck in the acorn; and man himself, the self-reputed lord of the creation, sprung from a few atoms, of less importance than the fluids of an animalculus; but we maintain that each animal is equally perfect in its kind; and consequently, that the "*perfect*" [complex] do not proceed from the "*imperfect*" [simple.]

Nor would we deny, what indeed is self-evident, the general polity of nature, that is to say, the constant and inseparable connexion of her various productions. Vegetables depend immediately for their subsistence upon earthy, æriform, and inorganic particles; animals animalize vegetables; and man subsists upon them all; and in this way *only* can vegetables be converted into animals; the most simple into the most complex beings; and not by *successive* generations. So far from this indeed, we believe that every truly specific difference observed in animals or vegetables, is solely dependant on a specific difference in the constitution of the primordial germ; and that it is totally beyond the power of art, or any external circumstance, to change this order of things: to convert the lion into a tiger, a mouse into a rat, or cause the leopard to change his spots. On the contrary, we have not a single plausible reason for supposing that during three thousand years, or as far back as the records of history go, the least perceptible change has been effected on the most simple animals; some of which were accurately described by Aristotle, two thousand one hundred years ago. We have every reason to conclude, that every distinction of existing species has existed from the earliest periods of the formation of the present world; and has its origin ultimately in the nature of the *soil;* every variety of which is marked by a corresponding variety in its animal and vegetable productions; and many of these are limited by geographical distribution. When the island of New Holland was first discovered, the extraordinary peculiarity of its climate, soil, animal and vegetable productions, were for a time the astonishment of the world.

On the same principle, it is rational to presume, that if by any extraordinary revolution of nature, the present state of the surface of our globe should become totally changed, such a revolution must necessarily be attended with a corresponding change in its animal and vegetable productions. New races of animals would march forth, the least intelligent of which might possibly be enabled to contemplate with wonder and admiration, the strange and outré organization, exemplified in the remains of a former world, as we at the present moment behold the mastodon, megatherium, palæotherium, and other fossil reliquiæ of the preadamitic worlds. Who shall presume to set bounds to that power which commanded, "let there be light, and there was light;" which after having formed the fish of the sea, and birds of the air, said, "let the *earth* produce living animals, reptiles, and beasts of the fields, according to their species; and it was done." Finally, to perfect the whole,

"*Let us make man!* with beauty clad,
And health in every vein;
And *reason* thron'd upon his brow,
Stepp'd forth *majestic man;*

"Around he turns his wond'ring eyes,
All nature's works surveys;
Admires the earth! the skies! himself!
And tries his tongue in praise!

"Ye hills and vales! ye meads and woods!
Bright sun and glittering star!
Fair creatures, tell me if you can,
From whence and what we are?

"What parent power, all great and good,
Do these around me own?
Tell me, creation, tell me how,
To adore the Vast Unknown!"—Darwin.

Between species and species nature has drawn a line of separation, which time cannot change nor the sophistry of man obliterate. In our observations on the polity of nature, nothing is more calculated to arrest the attention of the naturalist than that immutable law, which from the very commencement of organic existence, has impressed upon her productions *specific* characters; and which continues to maintain them in despite of innumerable opposing causes.

The domestic dog, (the proteus of carnivorous animals, which Pallas and some others believe to be a prolific hybrid,) has like a faithful slave followed the destinies of his master in every climate, has been subjected to every variety of food, education, and discipline, yet in no case has this animal so far departed from its original type as not to be easily recognised by the most indifferent observer; deformities and monsters are indeed to be met with, but in no instance has it given origin to a race resembling in specific characters the wolf, fox, jackall, or hyena, animals most nearly related to him in external form and internal structure.

Such being the ordinary march of nature (which an impartial examination of her laws impels us to believe is really the case,) where shall we look for the proofs of the common origin, or successive and uninterrupted formation of living creatures?

If we now turn our regard towards the great truths unfolded by *geological science*, we shall at every step be met by additional arguments in favour of the position we have taken; we shall be convinced that the surface of the globe we inhabit has been subjected to many revolutions, immense in their extent, and tremendous in their consequences; all of which bear the most unquestionable evidence of the presence, foresight, and intelligence, of a *first great cause*, the Supreme Director of the Universe.

When we endeavour to penetrate the dark night of time, obscured by the dust of accumulated centuries, and reflect for a moment on the state of our globe anterior to the creation of all living beings, we wander into regions over which the torch of science sheds but a dim and feeble light, to render "darkness visible."

Of the interior of our globe we know nothing; the first three strata of primordial rocks,—granite, gneis, and mica-slate,—possess every appearance of having been held in a state of solution, and of having become rocks long before living nature had established her laws; whilst the ocean was a sterile empire, ere yet the monstrous whale had sported on its billows, and thousands of sparkling fishes and shells were wanting to animate the fathomless depth.

When we wish to ascend to the causes of the formation of beings, positive facts, for the most part, are known to us only by their results, or by the inductions that we are enabled to draw from them; since we have no contemporaneous witness of these great events. It is not certainly by an accumulation of minute details, that we can expect to advance in the study of nature; they rather serve to surcharge it with a useless luxury: those great laws which have formed the universe are much more worthy of our observation; we are but little benefited by travelling incessantly in the same circle of knowledge, without endeavouring to escape from this terrestrial prison, without raising our regards towards the All-powerful arm which gives life and movement to matter. But from the absence of much precise knowledge which we can never acquire, we are forced to recur to philosophical inductions, and to admit the most rational principles we may be enabled to discover by our thoughts; but besides that these inductions and principles become legitimate instruments of reason, when it is necessary to penetrate by means of meditation into the mysterious sanctuary of first Cause, there are no other means by which we can become acquainted with them; we have no other choice but to make use of them, if we wish to advance in the study of nature.

I trust I shall meet with indulgence in offering my feeble efforts to trace those mighty revolutions to which our earth has been subjected; remains of myriads of fossil animals, its former inhabitants, those archives of nature imprinted upon the rocks, and imbedded in the interior of mountains, offer to our inspection irrefragable proofs; the contemplation of which excites in our minds conceptions of the state of the primitive earth, such as we may have of the splendour of an ancient city, by wandering over its remains, and viewing its fallen columns, its decaying monuments, and its buried edifices!

With this view let us divide the creation into several *distinct* though *arbitrary* periods. The first epoch produced the primitive monades, which have left no impression; the mollusca nuda, and corollines, together with multilocular shells, succeed; then follow univalves, bivalves, and crustacea, &c.; all the above are peculiar to salt water formations, at least there does not appear any evidence of fresh water formations in the mineral kingdom, or in the impressions of the fossil remains which must necessarily have accompanied such formations.

Proceeding upwards, towards the present surface of the earth, we discover proofs of the many revolutions to which it has been successively subjected; always accompanied with greater or less changes in the nature of its animal and vegetable productions, relics of which are found more or less scattered among the fossil reliquiæ of *former* worlds —for it does not appear that every revolution has been attended with entire destruction of animal existence; on the contrary, some of these, as the *cornua ammonis,* for example, are found dispersed throughout various succeeding strata, and extending over a great portion of the globe. —But generally speaking, each grand revolution forming extensive strata, has occasioned the destruction of most of the old, and formation of many new animals and vegetables; constituting new orders, genera, and species;—each successive generation differing from that which precedes it, less and less in proportion as we advance towards the diluvial formation which covers many parts of the present earth's surface. No remains of fresh water, or land animals, have been discovered previous to the secondary formations—in which, as in the oolite and lias formations, we discover for the first time amphibious and land animals. The strata above-mentioned, together with the calcareous schistus, furnish us with the remains of the ichthyosaurus, plesiosaurus, saurocephalus, megalosaurus, iguanadon, hylæosaurus, crocodilus, &c.; advancing upwards to the gypsum formation, we are struck with the novelty of its fossil remains; we here, for the first time, meet with land mammiferous quadrupeds, viz. Palæotherium, seven species;—Anoplotherium, five species, (these quadrupeds partake somewhat of the hog and deer in their organization,) a species of sus, canis, vivera, and didelphis: three or four species of birds: two species of reptiles: three or four of fishes: these animals are all found imbedded in the gypsum, which is covered over with a light layer of white marle, containing phytolithites, fragments of fishes, with specimens of limneus and planorbes, with other fresh water shells; the whole of which is covered with a marine formation, filled with sea-shells. It was most probably after the destruction of the animals above enumerated, that the earth was fitted to support the immense quadrupeds whose remains are discovered in the upper formations of the present surface of the earth; such as the mastodon, elephant, megatherium, megalonyx, rhinoceros, hippopotamus, &c. all extinct and mammoth species of animals.* It would appear, indeed, that at this period nature delighted in the creation of gigantic beings. Thus fossil whales have been discovered measuring upwards of one hundred feet; sharks sixty or seventy feet; reptiles fifty to an hundred feet, &c. The same deluge of which we are speaking, doubtless destroyed and inhumed the denizens of those caverns, so successfully investigated by Professor Buckland (Reliq. Diluv.) among which were the hyena, tiger, bear, wolf, fox, weasel, horse, ox, deer, hare, rabbit, rat, mouse, raven, pigeon, lark, duck, and partridge. These fossils possessed appearances which rendered it certain, that they had lived and died in the same regions where they were discovered; as did also the Siberian elephant, which proves that the northern latitudes were then *warmer* than they are at present, which is further demonstrated by the fossil vegetables and animal remains found within the arctic circle.

The fossil bones of the rein-deer are discovered south of the Mediterranean; these animals do not now exist south of the Baltic sea; these latitudes were then at some period *colder*, as is testified by other well authenticated facts. No remains of man; of *human* art or invention; or those animals most nearly allied to him, as the monkey, bat, &c.; or of any animals of a similar species with those he has domesticated, such as the sheep, hog, dog, cat, ox, goat, &c. &c. have ever been discovered (fossil) in this or in any other situation; consequently it is probable, that the diluvian animals were destroyed anterior to the existence of man. Among these remains are found extinct

* In France, a species of mastodon has been found in the Eocine or lower tertiary formation.

genera and species; consequently they could not have been victims to the flood of Noah, as we are informed that a specimen of every living being was preserved in the ark.*

It is clearly ascertained, says M. Cuvier, that the oviparous quadrupeds are found considerably earlier, or in more ancient strata, than those of the viviparous class. Thus, the crocodiles of Honfleur, and of England, are found immediately beneath the chalk.

"The great Saurien reptile, and the tortoises of Maestricht, are found in the chalk formation, but these are both marine animals. The earliest appearance of fossil bones indicates that dry lands and fresh waters must have existed before the formation of the chalk strata. Yet neither at that early epoch, nor during the formation of the chalk strata, nor even for a long period afterwards, do we find any fossil remains of *mammiferous land* quadrupeds. We begin to find the bones of mammiferous sea animals, namely, of the manati and of seals, in the coarse shell limestone, which immediately covers the chalk strata in the neighbourhood of Paris. But no bones of mammiferous land quadrupeds are to be found in that formation, and notwithstanding the most careful investigations, we have never been able to discover the slightest traces of this class, excepting in the formations which lie over the coarse limestone strata; but on reaching these more recent for-

* As relates to the fossil mammifera, most of which were discovered by Cuvier, they form a series consisting of about seventy-nine species.—Nineteen of which have been found in the calcareous gypsum formation; twenty-one in other strata equally new; and none of which have been met with in formations anterior to the coarse shell limestone; thirty-nine present their remains in the most recent diluvial deposits, or nearly at the surface of the earth, and consequently appear the less ancient of those animals of which the species have become extinct. None of them belong to the orders bimana, and quadrumana; nor to the family cheiroptera; ten are related to the order carnivora, properly so called; one only belongs to the marsupial family; three are of the order *glires;* two of the edentata; fifty of the order pachydermata; ten of the ruminantia; and four at least belong to the cetacea. Those buried at the greatest depth, differ most widely from recent mammiferæ, and are sufficiently distinguished to form particular genera.

mations, the bones of land quadrupeds are discovered in great abundance. As it is reasonable to believe that shells and fish did not exist at the period of the formation of the primitive rocks, we are also led to conclude, that the oviparous quadrupeds began to exist along with the fishes, while the land quadrupeds did not begin to appear till long afterwards, and until the coarse shell limestone had been already deposited, which contains the greater part of our genera of shells, although of quite different species from those that are now found in a natural state. There is also a determinate order observable in the disposition of these bones with regard to each other, which indicates a very remarkable succession in the appearance of the different species. All the genera which are now extinct, as the palæotheria, anoplotheria, &c. with the localities of which we are thoroughly acquainted, are found in the most ancient of the formations of which we are now treating, or those which are placed directly over the coarse limestone strata. It is chiefly they which occupy the regular strata, which have been deposited from fresh waters or certain diluvial beds of very ancient formation, generally composed of sand and rounded pebbles.

"The most celebrated of the extinct species belonging to known genera, as the fossil elephant, rhinoceros, hippopotamus and mastodon, are never found with the more ancient genera, but are contained for the most part in diluvial formations.

"Lastly, the bones of species, which are apparently the same with those that still exist alive, are never found except in the very light and *alluvial* depositions, and probably are not, strictly speaking, *fossil remains.*"

Such is the statement of M. Cuvier, formed on long and accurate observation of organic remains in their original positions, aided by the first museum of detached specimens in the world. Now to all this, it has been intimated: First, that the asserters of this hypothesis are *infidels!*

and secondly, that the hypothesis itself is gratuitous and unnecessary. To the first of these charges, we shall only reply, that the puerile practice of calling names has long ceased to be considered a legitimate instrument in logic. When such individuals interfere in questions of science, it is always for the purpose of suppressing, not for *promoting* knowledge: truth is to the *moral*, what the sun is to the *physical* world; the glare of the former, indeed, to the *bigoted*, is as insupportable, as was the effulgence of the sun to Milton's *fallen hero;* whose address to the glorious luminary is equally applicable to either.

> "O thou, that with surpassing glory crowned,
> Look'st from thy sole dominion like the God
> Of this new world; at whose sight all the stars
> Hide their diminished heads; to thee I call,
> But with no friendly voice, and add thy name
> O Sun, to tell thee how I hate thy beams."—*Milton.*

To the second charge, we need only remark, that if an hypothesis is gratuitous and unnecessary, the phenomena to be accounted for may be explained without it: our opponents offer no explanation.

Critical Notices of various Organic Remains hitherto discovered in North America.

The author of the following observations has been led to the undertaking by the urgent requests of many of his scientific friends in Europe.

It will appear in the ensuing pages that many eminent American naturalists have occupied themselves in the successful prosecution of this most interesting department of human knowledge; and yet very recent inquiries have satisfied us, that but a small fraction of what has been published on this subject in this country is adequately known to foreign naturalists. With the exception of some few of our scientific journals, the limited circulation in foreign countries of our scientific publications, is a subject of just complaint among Europeans, who interest themselves in works of this nature. We have been honoured with the personal acquaintance of hundreds of transatlantic savans, to whom we are well assured the following pages, imperfect as they necessarily are, will prove an acceptable offering; a motive in itself more than sufficient to impose upon us a more difficult task; and the end satisfactorily attained, is more than adequate compensation for the labour bestowed.

CLASS MAMMALIA.

ORDER PACHYDERMATA.

Genus Mastodon, Cuv.

M. *giganteum* or *maximus* of Cuv.

Recherches sur les Ossemens Fossiles, Vol. I. 3d edition; S. L. Mitchill's edition of Cuvier's Theory of the Earth; Harlan's *Fauna Americana;* Cooper's Notice of Big-bone Lick, Am. Monthly Journal of Geology; Peale's Account of the Skeleton of the Mammoth, 4to.; Trans. Am. Philos. Soc.; Ann. of Lyc. Nat. Hist. N. York: Syn. Tetracaulodon, of Godman, Trans. Am. Philos. Soc. Vol. III. new series; Mammoth of the Anglo-Americans; "*Father of the Buffaloes,*" of the Indians; *Animal d'Ohio*, of the French.

Locality.—Confined to North America, principally in the valley of the Ohio, Big-bone Lick, Kentucky, but occurring in every state of the Union. Specimens of the teeth and bones in most cabinets of Natural History. A skeleton nearly complete, both in the Philadelphia and Baltimore museums.

Place in the Geological Series.—Not yet ascertained with sufficient accuracy. According to De la Beche, "Geolog. Manual," occurring not later than his "Erratic Block Group," which also includes the elephant or mammoth, and five other species of Mastodon, together with the genera Hippopotamus, Rhinoceros, Tapir, Cervus, Bos, Hyena, Ursus, Megalonyx, Megatherium, &c.

Mr. De la Beche remarks, p. 169:—"The relative age of the deposit in which the American Mastodons are found, cannot be considered as satisfactorily ascertained. Some geologists are of opinion that these animals have disappeared more recently than is commonly supposed; that is, previous to the commencement of the modern group."

In Europe the remains of the Mastodon and other large mammifera sometimes occur buried in more ancient strata than those noticed in the Erratic Block Group. There is a mixture of the remains of Mastodon and Palæotherium in the basin of the Loire, in the Touraine faluns, (Miocine.) According to M. Desnoyers, the bones are broken and worn, their substances black and hard, often siliceous, and altogether resembling, in these respects, the marine mammalia which accompany them. Some are covered with *serpulæ* and *flustræ,* showing that they have remained as bare bones for some time in the sea; the remains are those of the *Mastodon augustidens, Hippopotamus, Rhinoceros, Tapirus, Anthracotherium, Palæotherium, Equus, Rodentia, Lepus,* and *Cervus.* (Vide Desnoyer, Ann. des Sc. Nat. 1829.)

In most instances there is sufficient evidence that these animals died, and left their bones to become fossilized in the precise situations in which they are now found; and that they have not been brought from a distance or exposed to the action of running waters, which proves clearly that they have been destroyed subsequently to the action of those causes which formed the beds of gravel or diluvial detritus, in and upon which they are frequently found.

Not only are the teeth and bones of this animal unworn by the action of running waters, but the skeleton is not unfrequently discovered in a standing position, just as the animal has sunk into the marsh or mud, clay and sand. Such were those from Great Osage river. Cuv. An. Foss. Vol. I. p. 222; and in the skeleton noticed by Dekay and others. Ann. N. Y. Lyceum.

In some instances it would appear that the stomach itself, with its vegetable contents, has been preserved. In a letter addressed to Cuvier, by the late Professor B. S. Barton, there is an account of the discovery of the remains of a Mastodon, in Withe county, Virginia, five feet and a half beneath the soil, on a bank of limestone. "But what renders this discovery peculiarly curious," continues M. Cuvier, Anim. Foss. Vol. I. p. 219, "is that they collected from amidst these bones, a mass of semimasticated small branches, grasses, leaves, &c., among which it was thought a species of brier, still common in Virginia, was recognisable; the whole of this being enveloped in a kind of sack, which was regarded as the stomach of the animal, so as to leave little doubt that it consisted of the identical substances which the animal had devoured."

M. Cuvier further remarks, p. 222, "Indications of the sojourn, or passage of the sea over the remains of these animals appear to be more rare than in the case of the elephant bones; I have never seen any remains of shells or zoophites on the bones of the great Mastodon which I have examined."

During the exploration made by Lieut. Col. S. H. Long, at Big-bone-lick, in 1824, great quantities of the remains of the elk and bison, both recent and fossil, were disinterred along with the bones of the Mastodon.

From the facts and observations above detailed, together with others of a similar nature, that might be produced, we are led to the conclusion that the great Mastodon, and other similarly situated animals. must have ceased to exist, at a period much more recent than is generally supposed.

Much has been written of late by inexperienced individuals, containing romantic descriptions of the remains of monstrous extinct quadrupeds, disinterred in various parts of our country, and which are calculated to produce much confusion when they attract the attention of the uninitiated. Thus, in excavating the canal around the falls of the Ohio, the remains of portions of several individual skeletons of the Mastodon were exhumed from the river banks, several feet beneath the surface of the present soil. Several pairs of tusks were arranged in a circle, within which were the remains of a fire and Indian tools; various other bones of the same were scattered about this focus, which had no doubt at some distant day been so arranged by the native Indians. A writer in one of the Kentucky papers presumed that all the bones were the remains of a single individual, with its immense mouth filled with enormous teeth, and armed with several pairs of huge tusks, and the whole animal of course sufficiently large to swallow a forest at a meal.

Another account of a huge animal disinterred at Big-bone-lick, sixty feet long and twenty-five feet high! has gone the rounds, being first published in our western papers, republished in those of the Atlantic cities, and finally transferred to those of Europe.

Of a character somewhat analogous are the descriptions of similar organic remains published by individuals supposed to possess higher claims to science, in the Trans. of the Am. Philos. Soc. vols. iii. and iv. At page 478 of the volume first referred to, there is a description of the under jaw of a young Mastodon, with a figure. This relick was found in Orange county, New York, and is now in the New York museum.

The author of these remarks took an early opportunity to forward plaster casts of this jaw, to the Geological Society of London, and to the Garden of Plants at Paris; and on his recent visit to the Jardin des Plantes, he was somewhat surprised to observe that he had already been in some measure anticipated by a foreign naturalist. This museum already containing the plaster cast of a portion of the lower jaw of a Mastodon, sent from Germany to Baron Cuvier, soon after the completion of the last edition of his *Animaux Fossiles*. This specimen also contained the inferior tusk, about which so much has been subsequently written on this side of the Atlantic.* The circumstance, however, elicited very little attention from the French professors. Yet it is on the existence of this inferior tusk in the jaw of the young individual from Orange county,

* This specimen, presuming it to characterize a new species, M. Kaup of Germany denominates "*Mastodon longirostris*," the "Tetracaulodon" of Godman.

above referred to, that the author has attempted to found a new genus of fossil quadrupeds, under the name of "TETRACAULODON."

Admitting that the genus had been established on a solid basis, the name is not a proper distinction, as it is equally applicable to the camel, hog, horse, deer, hippopotamus, fossil tapir, &c., all of which possess "*four tusks,*" or tusks in each jaw.

It further displays inattention at least, if not ignorance of established usages among naturalists, to found a genus on the existence or absence of tusks in the lower jaw, independently of any other specific differences in the organization of other portions of the body. It is well known that the *males* of some species of animals possess tusks in one or both jaws, whilst the females of the same species are destitute of these teeth; just as some male animals possess *horns*, whose females are destitute of them.

On the first appearance of this pretended "tetracaulodon," the inferior tusks were considered by the best authorities on this subject, to characterize the young of the Mastodon; a subsequent examination, however, of numerous jaw bones of the Mastodon, in our various cabinets, soon demonstrated these inferior tusks to be mere sexual peculiarities; a goodly proportion of the jaws of the adult Mastodons being found to be thus characterized, but in no one single instance were specific differences observable in the jaw teeth, maxillary bones, or any other portions of the skeletons.

Volume iv. p. 317 of the Trans. Am. Philos. Soc. contains the lucubrations of a neophyte in these matters, whose laborious observations as historian of the pretended "Tetracaulodon," would lead us to believe that he had clearly elucidated this subject, and had ended the dispute in question. The author occupies twenty-three pages of this quarto volume in letter press, besides ten plates, (with numerous figures.) With a critical acumen and depth of research peculiarly his own, he has "actually discovered," from the same materials previously examined in vain by naturalists of less penetrating zeal, three new "species of Mastodon," and two or three new species of "Tetracaulodon!!"

We repeat, that with others upon whose judgment reliance is to be placed, we have repeatedly examined all the specimens of fossil bones noticed in the memoir above referred to, and have searched in vain for any *specific* differences, not to speak of *generic* distinction. The jaw bones, together with the various teeth connected with them, or separately existing, display no peculiarities or varieties of structure, but such as are found to exist in similar portions of the skeletons of any other species of animal recent or fossil, provided specimens are selected from individuals of different sexes, and different ages. No peculiarities or differences, in fine, worthy of notice, not fully described by Cuvier, in his Ossemens Fossiles, where he has given seventeen figures of the teeth and jaws of this species, and which are thus noticed in vol. i. p. 226, of his last edition:—"The differences of teeth of the '*Grand Mastodonte*,' consist principally in the number of their points, and in their length and breadth.

"I recognise three kinds of them: those nearly square, with three pairs of points.

"Rectangular, with four pairs of points. Others still longer, rather contracted posteriorly, with five pairs of points, and an odd spur.

"The first are generally found among those most used; I have observed many about half used, and several others worn down even to the neck of the tooth.

"The latter, on the contrary, are very rarely used, and are almost always, their posterior parts at least, entire.

"This circumstance at once indicates their relative position. The teeth with six points are anterior, and are the first to appear; those with eight and with ten points come after, and are situated behind. Direct observation has confirmed this induction."

Again, at page 227: "The disposition then of the jaw teeth in the adult animal is as follows—two with six points, and two with eight points above; and two with six points, and two with ten points below.

"But besides these eight molars which remain in the adult, there are others placed anteriorly to them in young individuals, which are shed successively.

"Thus the number of *effective jaw teeth*, which can be brought into action at one time, is eight in the young animal, and four only in the old.

"The *roots* of these teeth, like those of other animals, are not formed until after the *crown* is perfected. They are found complete only in such teeth as are already somewhat used.

After reading the above quotations from Cuvier's "Ossemens Fossiles," let any one attentively examine the *specific* characters of the "new genus and species" in the memoir above referred to, and judge for himself of their validity. But for such readers as may not have it in their power conveniently to refer to the memoir in the Transactions of the American Philosophical Society, we will now quote a paragraph in the author's own words, which affords a fair specimen of his notions of *specific* characters.

"The cabinet of *our* society [Am. Philos. Soc.] contains a portion of an inferior maxillary bone, which differs in its form from any of those hitherto described. This fragment consists of the chin, the right ramus, with the posterior molares, and a portion of the left ramus. The anterior molar has three denticules, with two points each; and a ridge posteriorly. The ramus of this jaw is *straighter* and more *cylindrical;* the *height* from the base to the edge of the alveolæ is less; the groove for the tongue *broader* and *shallower*, and the *direction* of the teeth less diverging than in the maxilla figured in plate XXIV.; the crowns of the teeth are also less elevated in the former than in the latter."—Vid. vol. iv. Trans. Am. Philos. Soc. p. 323.

"*Height, breadth, depth, direction!*" *&c.*

On comparing a number of human jaws together, scarcely two will be found to correspond exactly in these particulars.

The author of "Tetracaulodon" renown appears to pay no regard to the principles of classification, yet he ought to have been aware, that, whether "labouring for bread, or doing something for fame,"* writers on natural science are not permitted to swerve from established laws.

We shall now close our observations on the remains of the *Mastodon giganteum*, by one more quotation from an authority which our author appears to esteem as conclusive in such matters; we allude to Mr. William Cooper of New York, whom our author states "has been long engaged in the investigation of the history of the Mastodon; has visited Big-bone-lick, for the purpose of obtaining materials; and who, upwards of a year since, communicated to the Lyceum of Natural History of New York, some observations on the dentition of that animal."†

The conclusion to which Mr. Cooper arrived after the fullest and most complete investigation of the most extensive collections of the Mastodon bones, in this country, of the famous "Tetracaulodon" inclusive, will be found in the following paragraph, and needs no comment. "The '*Tetracaulodon*' of the late justly lamented Dr. Godman, appears to me, after a careful examination of his specimen, to be another young individual, also of the common Mas-

* Vid. "Tetracaulodon" Memoir. Trans. Am. Philos. Soc. vol. iv. p. 318.
† Ut supra. p. 336.

todon, but older than mine; I have stated my reasons for this opinion, in a paper on the dentary system of the Mastodon, which I read to the Lyceum of Natural History, in April 1830. It appears, however, from recent observations, that the lower tusks which I supposed all the species to have possessed in their youth, were in some instances permanent during the advanced age of the animal. But whether this was a sexual characteristic, or merely an individual case of anomaly, of which I have seen other curious examples, *I cannot recognise more than one species of Mastodon among the great quantity of their remains found in the United States, which have come under my observation, those just alluded to included.*" Vid. "Notices of Big-bone-lick, by William Cooper," Monthly Am. Journ. of Geology and Natural Science, conducted by G. W. Featherstonhaugh, vol. i. p. 158.

Finally, in the original memoir, descriptive of this supposed new genus, the author has himself expressed doubts of the validity of the characters on which it is proffered. He admits that the specimens he has described are the remains of a *young* individual, and that, "in every view, this animal so strongly resembles the Mastodon, but for the singular difference of organization presented by the lower jaw and its tusks, *we could not avoid concluding we had obtained a young animal of that species.*" As regards this jaw itself and *molar* teeth, they certainly do resemble those of the *Mastodon giganteum,* as closely as the same parts in any young animal resemble those of the adult individual.

Note.—Mastodon *angustidens*, Cuv. and M. *tapiroides*, Cuv. Indications of the existence of these species in North America, were given in the *Fauna Americana*, pp. 212, 213. Subsequent observations have not yet further confirmed this indication.

Genus Elephas.

E. *primogenius*, Blumenbach, and Cuvier,

Ossemens Fossiles, 2d edition, t. i. p. 75, pl. 2; Harlan's *Fauna Americana*, and Journal of the Philadelphia Academy of Natural Science; Mitchell's edition of Cuvier's Theory of the Earth.

Locality.—In Europe these remains abound in the northern countries, also in France, Germany, and Italy. They are scattered over a vast range of country in North and South America. The frozen bodies of these animals have been found enveloped in ice on the north-west coast of America, as well as in Siberia. (*Vid.* Kotzebue's Voyages, and Buckland's Description of the Remains of Elephants and other quadrupeds in the cliff of frozen mud, in Eschscholtz Bay, within Behring's Strait, and in other distant parts of the shores of the Arctic Seas. 1832.)

We have been indebted to H. Piddington, Esq., Foreign Secretary of the Horticultural Society of Calcutta, for the following intelligence, relative to the discovery of the remains of the fossil elephant in Central India, who states, in a letter dated October 5th, 1834, "There has recently been discovered near the head of Nerbudda river, at a place called Nersimpoor, a fossil elephant, the os femoris of which measures sixty-three inches in length! and has been perfectly identified with the Elephas primogenius, or Mammoth.

Near the same place was discovered the fossil skull of an ox, very closely resembling your *Bos bombifrons*, of Big-bone lick, U. S. of N. A."

The length of the thigh bone of the fossil elephant is about one-third the height of the animal; this calculation will give to the fossil elephant above noticed, the enormous height of more than fifteen feet.

Measurement of the Skeleton of the Siberian Elephant, in the Museum of St. Petersburgh, Russia, found imbedded in ice at the mouth of the river Lena, in 1799.

From the mouth to the root of the tail . .	21 ft.
Length of the tusks	10
Height over the withers	12
Width of the thorax	5
Width of the pelvis	4
Diameter of the hoof	1 4 in.
Length of the os femoris . . .	4
Length of the leg bones	3

Spine, including the joints of the tail, composed of 43 vertebræ

The ribs are imperfect.

Philos. Trans. Lond.

Place in the Geological Series.—The fossil bones of the elephant, although they are found to exist contemporaneously with those of the mastodon, rhinoceros, megalonyx, ox, deer, &c. would appear to have belonged also to a geological period more ancient than the last named animals; according to Cuvier, "the isolated bones which are met with everywhere, are often observed to have marine animals attached to them, which establishes, in an incontestable manner, that since their dispersion they have been covered by the ocean under which they have been buried a considerable time."

These remains are most generally discovered in the diluvial deposits which fill valleys, or on the borders of rivers.

It is probable that the immense mass of the fossil bones of the elephant scattered throughout the world, include the remains of several species; they are generally found in a state of decay, too imperfect for specific comparisons, the only perfect skeleton of this animal known, being that in the Museum of St. Petersburgh, Russia. From observations that we have made on the fossil elephant teeth, several years ago, and published in vol. iii. of the Journ. Acad. Nat. Sciences of Philad. there can be little doubt but that two distinct species at least once existed in North America.*

Specimens of the teeth and fragments of the skeleton of this species abound in our cabinets both public and private; more particularly in the Cabinet of the Academy of Natural Sciences of Philadelphia, of the Philosophical Society, &c. &c. The Geological Society of Pennsylvania, possesses an enormous fossil *Os femoris* of this animal, found near Moorestown, New Jersey.

I have observed several specimens of elephant teeth, with the enamel arranged like that of the African elephant, which appeared to be fossilized; two of these are in the Museum at Liverpool, one in my own collection; their origin is uncertain, and all such are considered as apocryphal by Baron Cuvier.

Genus Tapirus.

T. *mastodontoides*, Harlan,

Fauna Americana, page 224.

Locality—Big-bone-lick, state of Kentucky.

This fossil molar tooth displays considerable analogy to that of the "small fossil Tapir" of Cuvier, differing only in the obliquity of the transverse eminences of the crown, and in the form of the disks of these, produced by detrition; but as subsequent and more extensive observation on the Tapirs, in the Museum of the "Jardin des Plantes," at Paris, has convinced us that similar differences in the form and direction of the transverse eminences are displayed in the different teeth of the same individual, we

* Vide memoir in the following pages of this volume.

admit that little reliance is to be placed on them, when regarded as *specific* characters.

The molar teeth of the Tapirs, Kangaroo, and Manatus, bear considerable analogy with those of the Mastodon; they are covered in a similar manner with enamel, and furnished alike with transverse mamillary eminences in the young animal, which by detrition present disks, more or less resembling each other in the teeth of these different animals; thus, a superficial observer might readily confound our fossil tooth with that of a young Mastodon, was not its size at least one half smaller than the smallest of the milk molars of the Mastodon that have come under the observation of naturalists. Mr. Cooper has casually remarked (*vid.* Notices of Big-bone-lick, Am. Monthly Journal of Geology, p. 163, in a note,) "Among these [the molars of the Mastodon,] I include one similar to the tooth, also from Big-bone-lick, described by Dr. Harlan, as having belonged to an extinct species of Tapir. That it is a young Mastodon's tooth, is evident, I think, from the milk teeth still remaining in the head on which the supposed genus Tetracaulodon is founded, as well as from the small jaw above described."

It is difficult to conceive in what manner "the milk teeth remaining in the head" of this or that animal, could prove any thing concerning the nature of the tooth in question. Mr. C. probably means to say that he compared the tooth of my fossil Tapir with those in the jaws of young Mastodons; I also have made similar comparisons, and have carried comparisons still further. Taking the disputed tooth in question to Paris, I compared it in presence of naturalists skilled for their observation, with the teeth of the various Tapirs, preserved in Cuvier's collection of comparative anatomy. The tooth in question proves to have belonged to the anterior socket in the upper jaw of a Tapir. The size of the tooth and the form and structure of its roots, distinguish it from those of the Mastodon.

Place in the Geological Series—Contemporaneous with the fossil remains of the Rhinoceros, Elephant, Mastodon, and other Pachydermatous quadrupeds. Hitherto the fossil Tapirs have been found only in Europe, whilst the recent species inhabit only South America and Mexico, the peninsula of Malacca, and the isle of Sumatra.

Genus Equus.

E. *caballus*. The Horse.

The fossil remains of this quadruped are sparingly found both in North America and in Europe. The late Dr. S. L. Mitchell, in his edition of Cuvier's Theory of the Earth, alludes to the fossil teeth and vertebræ of the horse, found near Neversink hills, state of New Jersey.

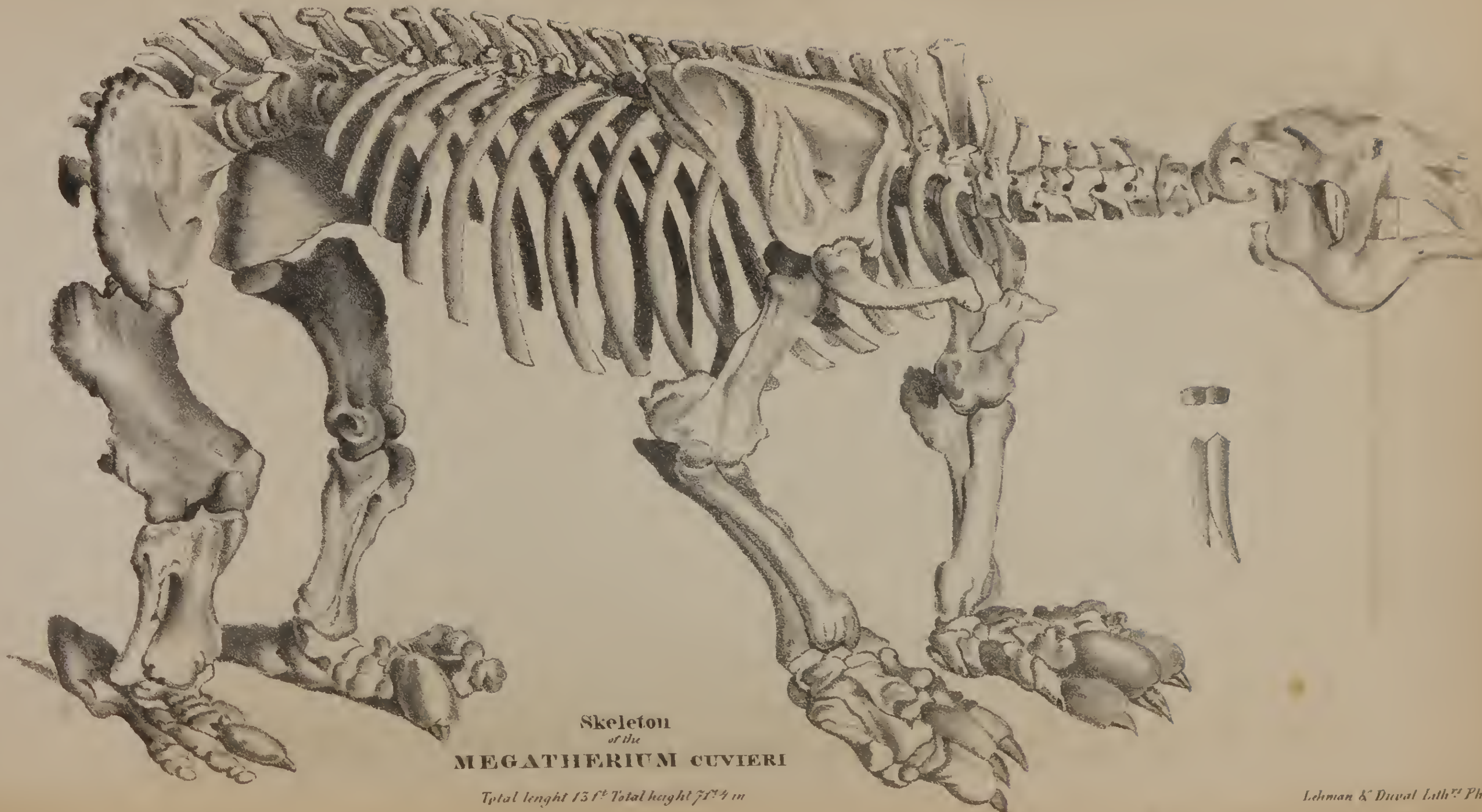
The cabinet of the Academy of Natural Sciences, Philadelphia, also contains specimens, from the valley of the Ohio or Mississippi, and we have to acknowledge the receipt of others from Col. I. J. Abert, of Washington, which were found in excavating for the Chesapeake and Ohio canal, near Georgetown, D. C., not far from the Potomac river. Mr. Richard C. Taylor has observed specimens from the gravel banks on the north branch of the Susquehanna river; and Mr. T. Conrad possesses specimens from the *Pliocine* on the river Neuse, 16 miles below Newbern, N. C. Professor Buckland has described the Astragalus, Metacarpus, and Metatarsus, of the fossil horse, from the cliffs on the south side of Eschscholtz bay near the Arctic circle.

Genus Rhinoceros.

Rhinoceroides *Alleghaniensis*.

Vide Am. Monthly Journal of Geology, &c. where under this name is figured and described a petrifaction which displays considerable resemblance to the bony snout of the Rhinoceros. The original specimen was sent to London, and the geologist who there examined it, considered it of too doubtful a character to be admitted as a fossil remnant.

For ourselves, we are disposed to wait for further discoveries of this nature, previous to admitting the present specimen as a part of our fossil fauna. The specimen is no less singular or interesting to geologists, as demonstrating the very close analogy of a mere *lusus naturæ* of the mineral kingdom, if it be nothing else, to a portion of the animal skeleton. One argument applied to this and other similar specimens, in order to prove that it could not be considered as an organic relic, viz.—the total absence of bony material, I conceive to be by no means conclusive; it being quite possible that the skeleton of an animal might be so circumstanced as to become completely mineralized, or changed from its original structure, just as we observe some vegetable structures to have changed. In ordinary instances, we are well aware the very reverse of this, as regards bones, is the fact; even the animal matter in fossil bones would appear to be, under some circumstances, as indestructible as the rock in which they are entombed, some of which are comparatively ancient, such as the saurian bones contained in the cuperose schists of Europe, and which were found on analysis to contain animal matter.



Skeleton
of the
MEGATHERIUM CUVIERI

Total lenght 13 f^t. Total height 7f^t. 4 in

Lehman & Duval Lith^rs. Phila

ORDER EDENTATA.

Genus Megatherium, Cuv.

M. *Cuvieri*, of authors.

Cuv. Ossemens Fossiles, 3d ed. Vol. V. part 1st, p. 174, pl. 16; *Megatherium*, S. L. Mitchell. Ann. of the Lyc. N. York, Vol. I. p. 58, pl. 6, and Wm. Cooper, ut supra, Vol. I. p. 114, pl. 7, and Vol. II. p. 267; Harlan's *Fauna Americana*, p. 200. Syn. *Animal du Paraguay; Animal incognita.*

Locality.—In South America, Paraguay, Lima, and in the vicinity of the river Luxan, three leagues south-west of Buenos Ayres, whence was obtained the skeleton nearly entire in the Madrid museum. In 1823, remains of this fossil animal were first discovered in North America. Specimens from Skidaway island, Georgia, in the cabinet of the New York Lyceum; a detailed account of which will be found in the volume of the Ann. of the Lyc. of N. York, above referred to, by the late Dr. Mitchell, and by Wm. Cooper, Esq.

Place in the Geological Series.—The entire skeleton in the Madrid museum was obtained on the borders of the river Luxan, South America, in 1789. The bank in which it occurred is only elevated about ten yards. These remains occur most commonly in the great plains of South America, particularly in the vicinity of Buenos Ayres; in that flat country, washed by the Panama and its tributaries, the bones being found sunk in the sand of the ancient alluvion, and sometimes, during very dry seasons, when the waters are low, they appear elevated above the surface; such was the position of those fine and valuable specimens of this fossil animal, recently brought to London, and presented to the Royal College of Surgeons, by Woodbine Parrish, Esq. The inhabitants of a remote district, we are informed, saw the pelvis of the animal appearing above the water, and throwing the lasso drew it on shore, carried it to the authorities of Buenos Ayres, from whom Mr. Parrish obtained it, and subsequently sent some hundred miles into the country, and with great exertions in dredging and turning off the water, succeeded in obtaining the greater portion of the skeleton, including the massive scaly cloak of the animal, with which it was covered, somewhat in the manner of the Chlamyphorus and armadillo, together with the caudal vertebræ, neither of which had ever been previously found. The os femoris is more than twice the thickness of that of the elephant. The bones of the feet are more than a yard long and twelve inches wide.

As regards the position of the remains of this animal discovered in North America, we are indebted for all the information we possess on the subject, to the observations of Mr. Wm. Cooper. *Vid.* Ann. of the Lyceum of New York, Vol. I. p. 124.

"My inquiries have not, as yet, enabled me to give any very precise information respecting the locality of these bones, or the character of the formation in which they were found; their appearance, however, indicate that they have been overflowed by the sea; and they appear to have had one side imbedded in the earth or mud, while the other was washed by the salt water. They are thinly incrusted in some places with *Flustræ* and other zoophites, and have recent shells of the genus Balanus and Ostrea adhering to them. All are remarkably hard and heavy, and of a deep black colour; they do not retain any of their animal matter."

It is further stated: "These bones are still to be procured in great quantity, by some labour and expense, at the same place. Bones of the same kind may be obtained at two other places; one called *White bluff*, also on the sea coast of Georgia, the other at some distance up the Savannah river."

We have only to remark, that the relative position of the bones above referred to, as regards the waters of the ocean, appears to be due to accident, or recent exposure; the fractured surfaces of the bones still retain their angles, and in other respects display sufficient evidence that they have not been exposed to the action of running water; they apparently occupy the situation in which they were originally deposited.

Genus Megalonyx, Jefferson.

Megalonyx *Jeffersonii*, Harlan, Fauna Americana, p. 201.

Megatherium *Jeffersonii*, Desm. Mammalogie, p. 336.

Megalonyx, Jefferson,—Trans. of the Am. Philos. Soc. Vol. IV., old series, p. 246, and Wistar, same vol. p. 526, pl. 1 and 2; Cuvier, Ossemens Fossiles, Vol. V. part 1, p. 160, pl. 15, 3d edition.

The characters of the genus, being founded on a single molar, the only one known when Cuvier wrote his notice of this animal, will require revision.

Locality.—As yet only three localities for the remains of this interesting fossil are known—all in North America, viz:—Greenbriar county, state of Virginia, Big-bone-lick, Kentucky, and Big bone cave, Tennessee.

Place in the Geological Series.—The first notice we have of the existence of this fossil genus, is due to the late Mr. Thomas Jefferson, former President of the United States of North America, who made them the subject of a memoir published in the Transactions of the Am. Philos. Soc. of Philad. Vol. IV. p. 246.

Mr. Jefferson compared these fossils with similar parts of the lion, to which he considered his animal congeneric. Plaster casts of these bones were sent to Baron Cuvier, who was thus enabled to estimate them at their true value, and to arrange them as pertaining to an animal of the tardigrade family, and as allied to the Megatherium.

The bones forwarded by Mr. Jefferson to the American Philosophical Society, consist of "a small fragment of the femur, os humeris, a complete radius, a cubitus complete, broken in two, three claws, and a half dozen other bones, belonging to the foot or hand." A tooth and some other small fragments were subsequently obtained by Palisot de Beauvois, from the same cave.

Similar caverns to that in which these bones were found, exist in great numbers throughout the western part of Virginia, Kentucky, Tennessee, and other portions of the great valley of the Mississippi river, in the cavernous limestone, which here constitutes the surface rock for hundreds of miles. Some of these caverns, such as the mammoth cave of Kentucky, are several leagues in extent, and appear to have once been the channels of subterranean rivers, a circumstance which may possibly explain the comparative rare occurrence of organic remains within them.

Nitre, or saltpetre, is not unfrequently found adhering to the surfaces, and in the soil of clay, mud, or stalagmite formed at the bottom. The cave in Greenbriar county, Virginia, in which the Megalonyx bones of Jefferson were found, is thus situated, and was formerly extensively worked for saltpetre; the bones were buried two or three feet beneath the surface of the floor of the cave; they are completely fossilized, very dense and heavy, of a white colour, and are still very well preserved.

MEGALONYX *laqueatus*. Harlan.

Journal of the Academy of Natural Sciences of Philadelphia, vol. vi. p. 269. pl. 12, 13, 14. Also, in the American Monthly Journal of Geology and Natural Sciences, 1831 and 1832, "Description of the jaws, teeth, and clavicle of the MEGALONYX *laqueatus*," By R. HARLAN, M. D. vol. i. p. 74. Pl. 3. And in the Trans. Geol. Soc. of Pa. vol. i. part 2nd. 1835.

Locality—"Big-bone-cave," Tennessee, and "Big-bone-lick," Kentucky.

Specimens of this highly important organic remain are at present the property of John Price Wetherill, Esq., and have been by him liberally deposited in the Cabinet of the Academy of Natural Sciences of Philadelphia. They consist of the following portions of the skeleton, viz. two claws of the fore feet; a radius; humerus; scapula; one rib, and several remnants of ribs, os calcis, tibia, portion of the femur; four dorsal and one lumbar vertebræ; a portion of a molar tooth; together with several epiphyses, the bones being mostly portions of the skeleton of a young animal, all occasionally imperfect at their extremities.

Recent bones of the bison, the deer, the bear, and a metacarpal bone of the human finger, accompanied the specimens, and were stated to have occurred in the same cave with those of the Megalonyx; the latter, strictly speaking, are not fossilized; they retain a very considerable portion of their animal matter, are much more brittle and lighter than recent bones; most of the articulating surface are still covered, more or less, with cartilage, tinged of a yellow colour. One of the unguial phalanges still retains the horny covering or nail, also tinged of a yellow ochreous colour. These bones are stated to have been found on the surface of the floor of the cave, uncovered by earth or stalagmite. Not only the teeth, but other portions of the skeleton, were found, on comparison with similar parts of the Jefferson Megalonyx, to present differences estimated of sufficient importance to constitute distinctive specific characters.

In the same collection there are, a humerus, nearly perfect, nineteen inches long, and a metacarpal bone of an adult animal of the same species, subsequently disinterred at Big-bone-lick; these are of a deep black colour, of a dense and solid structure, like the soundest of the Mastodon bones.

Still more recently, a large collection of fossil bones obtained from Big-bone-lick, have been exhibited in the city of New York; among them were observed, the jaw, teeth, clavicle, and a tibia of the right leg of the MEGALONYX *laqueatus*, the same that we described and figured in the American Monthly Journal of Geology and Natural Science, of Philadelphia.

Place in the Geological series.—Contemporaneous with the Big-bone-lick fossils, and probably also, with bones of the caverns of Germany, England, France, &c.; but judging from the appearance of the Megalonyx bones from Big-bone-cave, Tennessee, they are still more recent than those of any extinct fossil species hitherto discovered, with the probable exception of the "Elk of Ireland." I have seen, in the Museum of the Dublin Society of Natural History, the lower portion of the fore leg of a cervine animal, with the skin, hair, and hoof, simply desiccated, found in the peat bogs of Ireland, along with the bones of the fossil elk, of which animal it was supposed to form a part; it bears the closest analogy to the same part of the North American moose deer, (CERVUS *alces*, Linn.)

Most of the original specimens of the fossil bones of this extinct species are in the cabinet of Mr. J. P. Wetherill, deposited in the Hall of the Academy of Natural Sciences, Philadelphia. Plaster casts have been taken, and the specimens thus multiplied, are contained in many European cabinets; among others, we have furnished the "Jardin des Plantes," Paris, and the Geological Society of London.

ORDER RUMINANTIA.

Genus Cervus.

C. *Americanus*, Harlan,

Fauna Americana, p. 245; Wistar, Trans. Am. Philos. Soc. vol. i. new series, p. 375, pl. 10, fig. 4. *Fossil Elk* of the United States of North America.

The present fossil species was first established on a mutilated skull in the cabinet of the American Philosophical Society, presented by the late President Jefferson; the species appears to be nearest related to the common elk of North America, (Cervus *Canadensis*, Briss.) although it displays several characters which distinguish it from all other species, living or fossil, hitherto introduced into the systems. Judging from the skull, the animal was larger than our common elk.

Locality.—The bones of this fossil elk are not unfrequently found in the celebrated morass near the Ohio river, Big-bone-lick, in company with the bones of the Mastodon. Some fossil bones were observed by Dr. Bigsby in Canada, which from designs in his possession are judged to have belonged to the fossil Elk.

Place in the Geological Series.—Such as indicated by the above mentioned locality. Professor Buckland has described the fossil bones of the deer from the cliffs on the south side of Eschscholtz bay, near the Arctic circle.

Genus Bos.

B. *bombifrons*, Harlan,

Fauna Americana, p. 271; Skull of a fossil Ox, Wistar, Trans. Am. Philos. Soc. vol. i. new series, p. 379, pl. xi. figs. 11 and 12.*

This fossil species displays considerable analogies in

* Vid. p. 263, for notice of fossil ox found in Central India.

such portions of the skeleton as are known, to the Bison (Bos *Americanus*,) or common Buffalo of the United States, but the form of the skull, and peculiar disposition of the horns in the fossil, distinguish it as a nondescript species.

Locality.—Big-bone-lick and other similar morasses. The fossil teeth of this species are very common.

B. *latifrons*, Harlan,

Fauna Americana, p. 273; Cuv. Anim. Foss. 1st ed. vol. iv. pl. 3, fig. 3. or 3d ed. vol. iv. pl. 12. fig. 2. *Broad-headed Fossil Ox.*

This specimen, a mutilated skull of large dimensions, is in the cabinet of the Am. Philos. Soc. Philad., presented by the late C. W. Peale. It resembles in many respects the skull of the *Auroch*, (Bos *urus*, Cuv.) The horn is twenty-eight inches in circumference at its base.

Locality.—State of Kentucky. According to Cuvier, similar fossil skulls have been found in Europe, on the borders of the Rhine, near to Cracovie in Bohemia, &c.*

B. *pallasii*, Dekay,

Ann. of the Lyc. of Nat. Hist. N. York, vol. ii. p. 280, pl. 6.

Among a large collection of fossils presented to the Lyc. of Nat. Hist. of N. York, by the late Dr. Mitchell, is a bovine skull, which Dr. Dekay has minutely described as above referred to, and compares it with the skull of the Bos *moschatus*, which it most nearly resembles.

Similar fossils have been occasionally found in Siberia, which it is supposed were probably carried there in ice

* Professor Buckland, in his memoir "On the occurrence of the remains of Elephants, and other quadrupeds, in the cliffs of frozen mud in Eschscholtz Bay, within Behring's Strait, and in other distant parts of the shores of the Arctic Seas," pl. 3. fig. 1, represents the mutilated skull of an Ox, under the name of *Bos urus*, Cuv. On comparison of this specimen with our *Bos latifrons*, we were unable to detect any specific differences.

from the American continent. Vid. Cuv. Anim. Foss. vol. iv. pl. 3, fig. 9 and 10; also, Ozeretskovsky, Memoirs of the Royal Academy of St. Petersburg, 1809—10.

Locality.—" New Madrid, on the banks of the Mississippi river, ejected by the earthquake of 1812." "The weight of this fragment is twelve pounds; its texture is evidently altered, and although not mineralized, is exceedingly dense and heavy."

ORDER CARNASSIERS, Cuv.

Genus Trichecus, Lin. The Walrus.

T. *rosmarus*, Lin.,

Cuv. Recherches sur les Ossemens Fossiles, tom. v. Cooper, Ann. Lyc. Nat. Hist. of N. York, vol. ii. p. 271.

Only slight indications of the existence of a fossil Morse or Walrus have been hitherto observed in any country; a few molar teeth, and some fragments of bone found in France, have been referred to this species. In the work above alluded to, Mr. Cooper has given a lucid account of a mutilated fossil skull in the cabinet of the Lyceum, which, without doubt, belonged to the Walrus; the skull is remarkably hard and heavy—the tusks having become almost agatized. On comparison with similar portions of the T. *rosmarus*, of Linn., it displayed strong specific affinity.

Locality.—Accomac county, Virginia.

Place in the Geological series.—Atlantic tertiary? along with the fossil bones of Cetacea.

Captain Beechey brought home with him in 1828 from the north-west coast of America, fossil vertebræ of an unknown extinct mammalia; on comparing the plaster casts of these vertebræ with the amphibious tribe of Carnassiers in the museum of the Garden of Plants, the fossil appeared to us readily referrible to an extinct genus of this tribe.*

ORDER CETACEA.

Genus Manatus.

The fossil ribs and vertebræ of a large species of Manatus, are contained in the cabinet of the Academy of Natural Sciences of Philad. Vid. Journ. Acad. Nat. Sciences of Philad. vol. iv. p. 32, "Notice of Plesiosaurus, &c. by R. Harlan, M. D.

Locality.—Eastern coast of the United States, Atlantic Tertiary, Georgia, New Jersey, western shore of Maryland, &c.

The cabinets of the Academy of Natural Sciences of Philadelphia, and the Lyceum of Nat. Hist. of N. York, contain ribs and vertebræ, &c., of fossil whales, or

Cetacea *proper*.

Such remains are by no means of rare occurrence in the Atlantic tertiary.

In the estuary of the Mississippi river, numerous remains of recent Whales are daily discovered, the bones being observed projecting from the mud. The skull, jaws and teeth, of a very large spermaceti whale, were thus obtained by the fishermen some few years since, and carried

* In his description of the fossils obtained by Captain Beechey, Dr. Buckland has figured one of the cervical vertebræ above mentioned, accompanied with the following observations:—"Pl. 3. fig. 17, cervical vertebra of an unknown animal. It has been compared with all the skeletons in the collection at Paris, by Mr. Pentland, without finding any to which it can be referred: he thinks the nature of the articulation more resembles that in the sloth and ant-eaters than in any other animal; but the bone differs from them in other respects, and approaches to the character of the Pachydermata. The animal, whatever it was, seems to have differed essentially from any that now inhabit the Polar Regions of the Northern Hemisphere." Vid. Buckland's Description of the remains of Elephants, &c., in the cliffs of frozen mud, in Eschscholtz Bay, &c.

to New Orleans, where they were palmed on the public as the fossil remains of some enormous nondescript monster. Numerous theories and ingenious speculations arose on the subject, and were gazetted from one end of our country to the other. The bones were purchased at considerable expense, and exhibited through the United States. The late Dr. Godman produced a memoir on the occasion, and announced to the American Philosophical Society "the discovery of the remains of the largest '*saurian* fossil' ever heard of," and proposed to designate it by the name "MEGISTOSAURUS," which stands at the present day registered on the minutes of the society. The animal was represented as possessing a long horn several feet in length, projecting from the side of its head. The fame of this wonderful monster found its way even into the European newspapers—when lo! and behold! on the first examination of these remains by a naturalist, they were immediately perceived to form a portion of the skeleton of an immense recent spermaceti whale; the pretended horn being nothing more than one of the intermaxillary bones sawed off, and fitted on the jugal bone of the right side.

Thus the remains at last met with an honourable burial, on the eve of departure for England, where they would no doubt have astonished the natives, both as to the gigantic fossil productions of the new world, and as specimens of the critical acumen of our scientific observers.

The articulating surface plates, or epiphyses of the vertebræ of whales, are not unfrequently found separate, both fossil and recent; they have occasionally given rise to false notions, and to the dissemination of error. The "New Fossil Genus," of Rafinesque, named "*Nephrosteon*," (*Vide* Atlantic Journal,) and the bone on which the genus is constructed, and which this author considers as a portion of the head-plate of a fossil saurian, has no other foundation than one of these epiphyses from the remains of a recent spermaceti whale.

CLASS AVES.

The fossil remains of birds are of rare occurrence in any country, but particularly so in America; only one specimen clearly ascertained has fallen under our immediate inspection. This consisted in a femur, imperfect at its upper extremity, of an individual allied to the genus *Scolopax*, presented to the author by the late S. W. Conrad. The bone appears to be perfectly mineralized. Cab. of the Acad. Nat. Sciences, Philad.

Locality.—From a "marl-pit," in New Jersey.

CLASS REPTILIA.

ORDER CHELONIA.

Fossil bones and breast-plates of tortoises are not unfrequently discovered in the Jersey "marl-pits," but are too imperfect to admit of any satisfactory arrangement into genera or species; they occur principally in the Atlantic secondary. Specimens preserved in the Cab. of A. N. S. and Lyc. Nat. Hist. N. York.

ORDER SAURIA.

Genus Crocodilus, Cuv.,

C. *macrorhyncus*, Harlan,

Journ. of the Acad. Nat. Sciences, Philada. Vol. IV. p. 15, pl. i.

Several fine specimens of the jaw, teeth, vertebræ, &c. of an extinct fossil species of crocodile from the New

Jersey marl-pits,* are contained in the Cab. of Ac. Nat. Sciences; the most perfect of these is described and figured as above referred to. It consists of the dental bone of the right side, in a good state of preservation, perfectly fossilized, or impregnated with iron, so abundant in the marl-pits of New Jersey; it contains the sockets of eleven teeth in a space of twelve inches.

The most striking peculiarity of this remnant is its great thickness in proportion to its length, compared with the same part in recent crocodiles, with which circumstance the structure and appearance of the teeth perfectly correspond, being exceedingly thick, short, and blunt.—Length of one of these teeth, two inches, diameter at base one inch; only one-half an inch projecting beyond the alveole.

We have seen a portion of the jaw of a very distinct species of fossil crocodile, in possession of Dr. J. E. Dekay, who is about to describe it in the Annals of the Lyceum of Natural History; this fossil is also from the Atlantic secondary in New Jersey; it displays considerable analogy with the Crocodilus *gangeticus* of Cuvier.

Genus Plesiosaurus, of Conybeare.

The fossil vertebræ of a Plesiosaurien reptile, from the New Jersey "marl," is contained in the Cab. of Ac. Nat. Sciences, which we have described in the Journal of the Academy, Vol. IV. p. 232, pl. xiv. Although the general character of this vertebra associates it with the plesiosaurus, yet the comparative great length of the axis of the bone will distinguish it from any species of that genus hitherto noticed.

* Marl-pits occur both in the secondary and tertiary of the Atlantic coast.

Genus Basilosaurus, Harlan.

A name we have used to distinguish the remains of an immense fossil saurian recently discovered on the banks of the Washita, or "Ouachita," river, state of Louisiana, and described in the Trans. Am. Philos. Soc. Vol. IV. new series, p. 297, pl. xx. 1834.

The principal fossil which forms the subject of this paper, consists of a vertebra of enormous dimensions, possessing characters which enable us to refer it to an extinct genus of the order "Enalio Sauri," of Conybeare. The animal of which the present remnant constituted a portion, existed in a period more recent than that of any of its congeners hitherto discovered.

On comparison of this vertebra with those of its congeners, it appears to be generically distinct from them all, but bears a closer approximation to the Plesiosaurien vertebræ than to any other. The length of the axis of the bone is twice its diameter, being fourteen inches long and seven inches broad. Its sides are slightly concave in the middle, and the weight of the vertebra is forty-four pounds: allowing the individual to possess as many vertebræ as the Plesiosaurus, that is to say, sixty-six, independent of those of the tail, the weight of the whole fossil skeleton may be fairly estimated as exceeding two tons; even supposing each vertebra to weigh only thirty pounds instead of forty-four, and calculating the weight of the extremities, pelvis, and tail, to be collectively but a little heavier than the spine alone.

Judging from the position and descending obliquity of the transverse apophyses, and the small size of the canal for the spinal marrow, this vertebra must be referred to the posterior part of the column, and most probably to the lumbar region: this opinion is strengthened by the coalition of the two foramina or fossæ, which characterize the *inferior* aspect of the vertebræ of the *posterior* part of the column in the spiral bones of the *Plesiosaurus,* in which respect these portions of the two fossils closely resemble each other; they are also similar in the form of the *planes* of the articulating surfaces of the bodies of the vertebræ. But our fossil differs totally from the same portion of the Plesiosaurus in its *proportions,* the vertebræ of the latter being broader than long. All the superior apophyses of the Plesiosaurus are attached by suture to their bodies, but there are no marks of such a structure in our fossil.

Judging from relative proportions, the Megalosaurus did not attain to more than thirty or forty feet in length; the Iguanodon of Mr. Mantell did not exceed sixty-feet; but the individual now indicated could not have been less than from eighty to a hundred feet. According to the statement of Judge Bry, to whom the society is indebted for the specimens, there were four hundred feet in extent, nearly in a curvilinear direction, marked by these fossils in the soil, which we must presume included the remains of several individuals. If future discoveries of remaining portions of this skeleton, should confirm the indications above pointed out, we may suppose the genus to which it belonged may take the name, not inappropriately, of *Basilosaurus.*

Locality.—Banks of the Washita, Louisiana.

Place in the Geological series.—Atlantic tertiary.* The piece of "sea-marl" which accompanied the specimen, is a conglomerate mass of small marine shells, principally of an extinct species of *Corbula,* similar to those observed in the same formation in Alabama. Most of these shells are comminuted; a few, however, remain perfect. On the upper surface of the mass, there remains a stratum of clay half an inch in thickness, enclosing pieces of chrystallized carbonate of lime.

* Vide a subsequent memoir on the Basilosaurus, in the following pages of this volume.

Genus Ichthyosaurus?, Conybeare.

I. *Missouriensis*, Harlan, ut supra, p. 405.

The fossil fragments which indicate the existence of the above named species, consist of the anterior portions of the upper and lower jaws. The form and structure of these fragments, as well as of the portions of teeth remaining in the sockets, bear a close analogy to those of the Ichthyosaurus, but the extreme length and breadth of the intermaxillary bone, which projects beyond the extremities of the superior maxillaries, will distinguish it from all other species of this genus hitherto described.

The portions of maxillary bones attached, contain three teeth on each side, all equally broken off at the sockets; the intermaxillary bone contains four teeth, two on each side, also broken; thus displaying in all ten teeth, in a space of alveolar processes four inches long, the length of the fragment. The mode of growth and reproduction of the teeth is well displayed in the fractured portions which remain; the animal is allied to the Ichthyosaurus in these particulars. For further minutiæ we must refer to a subsequent memoir in this volume.

Locality.—In the vicinity of the Yellow-stone and Missouri rivers. Missouri territory.

Place in the Geological series.—Secondary limestone of the sub-cretaceous group.

We are indebted to Major N. A. Ware for the specimens, who obtained them at St. Louis, from a fur trader or trapper, who, "on his return home from the Rocky Mountains, observed in a rock the skeleton of an alligator animal, about seventy feet in length; he broke off the point of the jaw as it projected. He said that the head part appeared about three or four feet long."*

* Baron Braunsberg, Maximilian Prince de Wied, during his recent visit to Philadelphia, on his return from the Rocky Mountains, informed me that he had

Genus Mosasaurus, Conybeare.

Maestricht *monitor*, Cuv.,

Ossemens Fossiles, vol. v. part 2, ed. 3d. p. 310; Harlan, Journ. Acad. Nat. Sciences of Philad. vol. iv. pl. xiv.; Silliman's Journal, vol. xvii.; Dekay, Ann. of the Lyc. of New York, vol. iii. pl. xiii. p. 134.

Locality.—From a "marl pit" near Woodbury, Monmouth county, New Jersey.

Specimens of the teeth, and probably of the femur, in the cabinet of the Academy of Natural Sciences, and the jaw teeth in the cabinet of the Lyc. Nat. Hist. N. York.

These remains are completely fossilized and impregnated with iron, dense and heavy, and of a deep dark colour. The teeth of the second series, whilst they yet remain in the sockets, are serrated on the edges.

Place in the Geological series.—Atlantic secondary, of New Jersey. A well marked caudal vertebra of the Mosasaurus, found by Col. Long, from the vicinity of Black-warrior river, Green county, Alabama; Nov. 1834, "penes me."

Genus Geosaurus. Cuv.

Lacerta *gigantea*, Soemerring.
G. *Mitchelli*, Dekay;

Ann. of the Lyc. Nat. Hist. of New York, vol. iii. p. 138, pl. iii. fig. 3, 4.

Dr. Dekay has established the existence of this genus in the United States, upon a fossil tooth, with a small portion of jaw attached.

"From various considerations we should be disposed to place this tooth among the most anterior of the lower jaw.

obtained the fossil skeleton of a saurian animal, fifteen feet in length, from the "Great bend" of the Missouri river, which on comparison of its characters with those of the animal above noticed, he thinks belongs to the same species.

Its elevated position on its osseous support, places it in the group composed of Mosasaurus and Geosaurus, while its compressed shape removes it from the former. The tooth now described agrees with those of the Geosaurus in shape, attachment, and mode of dentition."

Judging from the size of the tooth, the American species must have been of much larger dimensions than the European, or Monheim species. (G. *Soemerringi*, Dekay.)

Locality.—Monmouth, New Jersey.

Place in the Geological Series.—New Jersey secondary.

Genus Saurocephalus, Harlan,

S. *lanciformis*, Harlan,

Journ. Acad. Nat. Sciences of Philad. vol. iii. p. 331, pl. xii. 1824.

This new fossil genus was originally established on the dental bone and teeth, discovered in 1804, by Lewis & Clark, in their "Expedition to Columbia river," by whom it was presented, on their return, to the American Philosophical Society, in whose cabinet it remained unknown and neglected, until about ten years since we published our description and figure in the work as above referred to.

Place in the Geological series.—Secondary limestone? Missouri, (subcretaceous group.)

This fossil genus has been further confirmed by the subsequent discovery by Mr. Lea of a distinct species of the same genus, in a "marl pit" of New Jersey, which was imperfectly described by Dr. Hays, as the

Saurocephalus *leanus*,

Trans. of the Am. Philos. Soc. new series, vol. iii. p. 471, pl. 16. 1830.

Locality.—In a "marl pit" near Moorestown, New Jersey.

Place in the Geological series.—Atlantic secondary, New Jersey.

Very soon after the memoir on the last named species was presented to the American Philosophical Society, we took occasion to read the following observations before that learned body.

Note on a paper entitled "Description of a fragment of a head of a new fossil animal, discovered in a marl-pit, near Moorestown, New Jersey."

This fossil relic, in the possession of Mr. Lea, is interesting, not only on account of its geological locality, but also as it serves further to establish a new fossil genus, the *Saurocephalus*, described by the author of these remarks, in the Journal of the Academy of Natural Sciences, Philada. vol. iii. part 2d, p. 331, 1824. Both these relics evidently belonged to animals allied to the genus *Ichthyosaurus*, of Conybeare; but which approach, in their organization, more nearly to the fish than to the lizard. The specimen described by Dr. Hays, in the Transactions of the American Philosophical Society, possesses the following characters in common with the SAUROCEPHALUS *lanciformis:* the bodies of the teeth are in close contact throughout, the nerves and vessels of the teeth passing on the inner side of the alveolar processes. The inferior series of teeth entering the cavities of the superior directly in the centre, in the process of shedding; the inferior series are completed before they enter the superior, the dental serrature of the superior and inferior jaws closing like incisors. In both also, there exists a longitudinal groove along the mesial aspect of the jaw bone, directly below the alveolar margins, though this groove is not so evident in the S. *Leanus;* but it must be remarked that this species was not more than one-half the size of the S. *lanciformis.*

In all these particulars of organization, both species differ from the Ichthyosaurus and Plesiosaurus, and from the Saurian order in general.

The S. *Leanus*, we find, on comparison, to be characterized as a distinct species from the S. *lanciformis*, by the greater acuteness of the teeth, by their greater *comparative* length, but particularly by their curvature; they are also slightly compressed at their inner face.

In both descriptions of these different specimens, it is stated that "the bodies of the teeth are placed close together;" which would seem to imply that there exists no "separate and distinct alveoli." But as the author of the paper on the S. *lanciformis* was not privileged to dissect the relic, he may have been mistaken in this point, a question which he is willing to cede as one of little importance in the present instance, as the statement was only made to convey an idea of the close approximation of the bodies of the teeth.

Dr. Hays would appear to entertain different opinions on this point, and although he states that distinct alveoli do exist in both specimens, yet has made a new genus for his animal under the name "SAURODON," which he subsequently altered to "SAUROCEPHALUS," and thus appropriated to himself the labours of another without acknowledgment, and dedicates the species to his friend Mr. Lea, in the first place in the feminine gender at page 476, "S. *Leaæ;*" but is notified of this amphibious compliment, whilst the paper is still in press, in time to rechristen the bantling, which finally, at page 477, figures as the S. *Leanus!* On the most critical examination, the animals will be found to agree *generically* in every point of the least importance. The *reasoning* in the following paragraph of Dr. Hays' description, we are unable to comprehend. "The *most important generic character* which was supposed to distinguish this animal from the one we described, [viz. the absence of distinct and *sepa-*

rate alveoli,] having no existence, it appears proper, in the present state of our knowledge, to place the two species in the same genus; and as the *genus Saurocephalus is founded on erroneous characters*, and will not admit our species, it becomes necessary to construct a new genus, which we shall accordingly do, and shall retain for it the name '*Saurodon!*'"

Nothing can be more incorrect than the statements here made, or more preposterous than the deductions drawn from them. In the account of the SAUROCEPHALUS *lanciformis*, in the Journ. of Acad. of Nat. Sciences, p. 336, vol. iii., are the following paragraphs in direct opposition to the above gratuitous assertions:

"The row of teeth on the inferior, appear to have passed within those of the superior jaw; this supposition is further strengthened by the worn appearance of the sides of the teeth. This arrangement of teeth, which would require a peculiar configuration of the jaw, together with the peculiar distribution of the maxillary nerve, appears to entitle this animal to rank as a new genus."

The distinct and separate alveoli, are not even alluded to in the characters of the genus *Saurocephalus*, which are thus designated in the account published several years ago,

"SAUROCEPHALUS *lanciformis*.

"*Generic characters.*—Bodies of the teeth approximated; those of the inferior and superior jaws closing like incisors. Inferior maxillary nerve passing along a groove on the mesial aspect of the dental bone." If it should be hereafter ascertained that the groove for the nerve does not exist in all the species which may be discovered, it will only be requisite to strike out the words "*a groove on*," to make the generic characters as originally established on a single fragment of jaw, apply correctly to all.

In the present state of our investigations, the following are the *specific* characters which distinguish the *species* already ascertained:

S. *lanciformis*. Projecting portions of the teeth smooth and obtusely lanciform.

S. *Leanus*. Teeth rather acute, slender, slightly compressed and aduncate.

Coprolites.

These curious organic fossils, so classically described by Dr. Buckland, and which occur so plentifully in the *Lias* of England, are occasionally met with in the New Jersey secondary.

A specimen of the *Saurocopros* genus is described and figured by Dr. Dekay, Ann. of the Lyc. Nat. Hist. N. York, vol. iii. p. 140, pl. iii. fig. 6.

We have only further to observe concerning the fossil Sauria of the United States, that we possess a curious fossil tooth from South Carolina, presented by Dr. W. Blanding, whose root displays a mode of articulation peculiarly its own, and which may be hereafter found to indicate the type of a new fossil genus of animals. The same may be inferred from numerous fossil vertebræ from the New Jersey secondary formations in my possession, which differ in their structure from any others hitherto described. We have seen in possession of Dr. Dekay, the inferior jaw bone of a nondescript fossil animal found in New Jersey, which bears some analogy with a jaw bone figured in Mr. Mantell's "Geology of the South East of England," p. 153, under the name of "Jaw of a Reptile." My friend Dr. Pickering refers this fossil to the jaw of a fish of the genus SPHYRÆNA, Bl.

CLASS PISCES.

Ichthyolites.

The fossil remains of fish are by no means of rare occurrence in many parts of the United States, but the observations of our men of science on this subject are not yet sufficiently numerous, or so completely digested, as to enable us to give a scientific classification of them. The largest and most noted of the fossil fish of this country belong to the division,

CHONDROPTERYGIA,

Or Cartilaginous Fishes.

The bones of one species of shark, upwards of forty feet in length, allied to the Carcharias, have occasionally been found in several localities. In Cuvier's "Theory of the Earth, by S. L. Mitchell," p. 400, it is stated:—"The skeleton of a huge animal was found on the bank of the Meherrin river, near Murfreesborough, N. C. It was dug out of a hill, distant sixty miles from the ocean. Capt. Neville, and Dr. Fowler, who visited the spot, gathered the scattered vertebræ which the negroes had thrown out, and laid them in a row thirty-six feet in length. If to this the head and tail be added, the animal must have been fifty feet or more in length. The former of these gentlemen enriched my collection with two of the teeth and a joint of the neck bone: the teeth weigh sixteen ounces each; they are covered with an ash-coloured enamel, except at the roots where they were fastened to the jaws; the sides of the triangles are six inches long, and the base is four inches and a half across. The single vertebra weighed twelve pounds and a half." These fossils are at present in the cabinet of the Lyceum of Nat. Hist. in

New York. We have recognised them as the remains of a gigantic species of shark. The proteiform varieties presented by the teeth of the individual sharks, render it almost impossible to classify the species from these organs, viewed separately, those of the upper and lower jaw being in most instances entirely different in form. The cabinet of the Academy of Natural Sciences, however, contains specimens of sharks' teeth from New Jersey "marl-pits," which resemble closely those of the Squalus *zygena*, S. *mustelus*, S. *squatina*, and S. *carcharias*, two specimens of the last measuring five inches in length and four broad at base; to which may be added, according to Professor Broun of Heidelberg, the S. *raphiodon*, and S. *pristodontes*, of Agassiz. Provided the same proportion exists between the fossil and recent *Carcharias*, the former must have been more than forty feet in length. Parkinson's Organic Remains, Vol. III. contains good figures of the teeth of most of the above named species; also, Mantell's Geology of the south-east of England, p. 132. For further observations on the fossil remains of sharks, *vide* "Journ. Acad. Nat. Science of Philad." Vol. IV. p. 232, pl. xiv. in an essay published by the author, entitled "Notice of the Plesiosaurus, and *other fossil reliquiæ*, from the state of New Jersey, 1824."*

Professor Hitchcock, in his "Report of the Geology, &c. of Massachusetts," p. 193, pl. xi. and xii., has given figures of fossil teeth and vertebræ, found in what he terms the plastic clay formation at Gay-head, Martha's Vineyard; the former are evidently the remains of sharks, similar to those found in the green sand of New Jersey; the latter are either not well figured, or resemble but indifferently the vertebræ of sharks; but possibly the state-

* This essay has been reprinted, with amendments, in the present volume. Still more recently Col. Long has presented to me specimens of fossil shark teeth, found in argillaceous or marly geodes, in the decomposed secondary limestone of Erie county, Alabama; in the vicinity of Black warrior river, along with the remains of the Morosaunus.

ment of the author, that "in general they (the bones) are much broken and often rolled," will explain their anomalous forms.

In addition to the genus Squalus, the isolated fragments of other cartilaginous fishes, as the Raia and Acipenser, are occasionally found in similar localities as the former.

Fishes *proper.*

The fossil bones of fishes hitherto discovered in the United States, belong principally to Cuvier's second division, or

Malacopterygia,

Including among others the carp and the gar. On the 24th of January, 1825, the author of these remarks had the pleasure to be present at the reading of an essay by Dr. Dekay, before the New York Lyceum of Nat. History, on the "Fossil fish of the U. States;" this essay we believe has never yet been published, but we were impressed at the time by the following statement of Dr. Dekay: "All the fossil fish which I have examined in the United States, are modelled after the *Esox osseus*, or bony-scaled pike of the Mississippi," which last species then, he thinks may stand, "as the representative of a former creation,—the Logans of their race." This curious fact was subsequently confirmed by the observations of Baron Cuvier—vide "Ossemens Fossiles."

ORDER ACANTHOPTERYGIA.

Genus Sphyræna.—Bl.

The fossil jaw from the N. Jersey secondary, referred to above, is in possession of Dr. Dekay, who has not yet published a description of it.

Many years ago we received from Mr. A. Jessup, a fine collection of fossil fish in the slate from Westfield, Connecticut.

Connected with the fossil fish of this locality, Professor Hitchcock, in his recent work, "Report on the Geology, &c. of Massachusetts," has given a very interesting chapter—we quote his observations for the benefit of our foreign readers, who may not conveniently refer to the original. "The remains of fish have been found on bituminous shale, and on bituminous marlite, in Middletown, Con., at Sunderland, Mass., and also in West Springfield and Deerfield. Sunderland, however, is the only spot where they can now be procured. The shale there forms the bank of the river several feet high: but the Ichthyolites are most abundant in the lower part of the bed, which corresponds nearly with low water mark. I have dug out hundreds of specimens at this spot, though perfect ones are very rarely to be obtained.

"On one layer of the rock, fifteen inches by three feet, seven distinct impressions are visible. Indeed, I have not unfrequently met with one fish lying across another, without the intervention of a layer of shale, and from these specimens, I can easily conceive how the mistake should have been made, that among the Monte Bolca ichthyolites, one fish was found in the act of swallowing the other.

"A thin layer of carbonaceous matter usually marks out the spot where the fish lay, except the head, whose outlines are rendered visible only by irregular ridges and furrows. In some cases, however, satin spar forms a thin layer over the carbonaceous matter, and being of a bright gray colour, it gives to the specimens an aspect extremely like that of fish just taken out of the water.

"We sometimes find the specimens a good deal mutilated; so much so indeed, that the form of the fish is entirely lost, and the tail and fins are scattered about promiscuously; and this, too, in the vicinity of other specimens that are entire. Hence we cannot impute this mutilation, as is usually done, to a disturbing force acting on the rock at the time in which the fish was enveloped, or afterwards. But if we suppose that the fish, as they died, were gradually enveloped by mud, it is easy to conceive how some of them might have putrified and fallen to pieces, before they were buried deep enough to be preserved; or it might be, that most of the fish was devoured by some other animal: and in either of these ways, we might expect to find only scattered relics enveloped in the rock. The great resemblance of these ichthyolites to those found on the bituminous slate of Mansfield, in Germany, has been already noticed. Probably all of them belong to the genus *Palæothrissum*, (Blainville.) I am inclined to believe that I have found four species." *Vid.* p. 236, pl. xiv. fig. 44, 45, 46, 48.*

As is generally the case, the fish appear to have lain on their sides when enveloped in the rock.

There are doubtless numerous localities of fossil fish in our widely extended country, which have not yet met the eye of a scientific naturalist. An intelligent friend has recently furnished us with a notice of a very interesting locality of this nature; he is the proprietor of a marble

* In an essay entitled "Geology of Connecticut." Am. Journ. of Sc. vol. vi. pp. 77 and 78, and p. 9. Professor H. has figured two or three fossil fishes from the coal fields of Westfield, Con., and Sunderland, Mass., which he refers to the genus Palæothrissus of Blainville. In the work of Agassiz, they are represented as the Palæoniscus fultus, and P. frieslcheni. The same author refers also to a species of eel, from the same locality. Mr. Agassiz remarks, "I do not know a single species of fossil fish which is found successively in two formations," they have occasionally a very extensive horizontal extent.

Again.—"Fossil fish traverse all formations," i. e. from the commencement of life. Vid. Lond. and Edin. Philos. Journ. for December, 1834. No. 30.

The fish of the Tertiary approach nearest to recent fish; he has found *none* identical with fish of our seas. More than two-thirds of the species found in chalk are referrible to extinct *genera*.

Below the chalk there is not a single genus which contains *recent* species. Below the lias the two orders which prevail in the present creation are found no more; those which are in small minority, in our days, appear suddenly in great numbers. Fish decidedly carnivorous do not appear before the carboniferous series, but are principally *omnivorous*, *i. e.* those of the secondary series before the chalk.

quarry situate in "Oval Limestone Valley," or "Nipnose Valley," on the west branch of the Susquehanna river, Pennsylvania. The marble is a greenish coloured conglomerate, somewhat resembling verd antique, and admits of a high polish, being fine grained and hard, interspersed with softer spots of an argillaceous nature. Some parts of this marble are represented as being replete with the remains of fossil fish, about the size of a herring or carp; some specimens retaining the impressions of the scales; others only of the bones. The stone was too brittle to permit the obtaining of any of the specimens whole.

CLASS CRUSTACEA.

ORDER DECAPODA. Cuv.

Genus Cancer. Linn.

The Atlantic secondary formation, particularly of New Jersey, is the richest locality for these kind of fossils.

Dr. Van Rensselaer has described and figured several specimens of cancer from the above named locality, in the Ann. of the Lyc. Nat. Hist. of N. York, vol. i. p. 195, pl. xiv. The cabinet of the Lyceum, and of the Academy of Natural Sciences of Philadelphia, contain various specimens. In most cases they are said to bear considerable analogy with the genus Pagurus, of modern authors.

Locality.—New Jersey; Chesapeake and Delaware canal, &c.

Place in the Geological series.—Cretaceous group. "Ferruginous conglomerate sand" of New Jersey, which Dr. V. refers to the tertiary, others to the secondary formations of the Atlantic.

In the cabinet of the Academy of Natural Sciences, Philadelphia, there is a fossil specimen of the genus Astacus, from the deep cut of the Chesapeake and Delaware canal; and also, a slab of carboniferous limestone filled with impressions of a crustaceous animal, about the size of a pea; the specimen is labelled "CANCER. Linn." They resemble as much the trilobite as cancer, perhaps they will prove to be an intermediate genus.

Locality.—Little Falls, New York.

ORDER BRANCHIOPODA.

GENUS EURYPTERUS. Dekay.

E. *remipes*. J. E. Dekay,

Annals of the Lyceum of Nat. Hist. vol. i. p. 375. pl. 29.

Character of the Genus.—"Caput a thorace non distinctum: os ignotum: oculi duo, sessiles, distantes, lunati: abdomen elongatum, posticam versus extremitatem sensim gracilus, segmentis transversis subimbricatis divisum. Pedes octo: duo utrinque antici branchiferi, duo utrinque postici maximi, omnes lamellosi."

Description.—"Head roundish, marked anteriorly by a deep indented line formed by the junction of the superior and inferior plates. *Eyes* distinctly lunated, much depressed, and marked by concentric striæ; *feet* four pair; the two anterior composed of four or more nearly equal articulations, of which the terminal one is the smallest and bluntly pointed, furnished with filaments, which from their size &c. are supposed to be branchiæ; the third pair are rather longer than the two preceding, and entirely destitute of filaments. The fourth or posterior pair are placed near the junction of the head with the abdomen, and are larger in proportion to the body than in any living genus of Crustacea. As nearly as can be determined from the faint and broken impressions of the upper part of these rotatory feet, five articulations are visible, of which the second is furnished on its anterior edge with two slight spines, and the last terminates in an oval plate, as in the genus Portunus. The abdomen consists of eleven distinct articulations tapering gradually to the tail, a small part of which only remains. The abdomen presents no trace of a division into longitudinal lobes."

Dr. Dekay has indicated the genera *Apus*, *Binoculus*, and *Lepidurus*, as most nearly allied to his new genus.

The highly interesting specimen which forms the subject of the above notice, is at present in the cabinet of the Lyceum of Nat. Hist. of N. York; it was originally described in the American Monthly Magazine, Vol. III. p. 291, by the late Dr. Mitchell, who considered it a fossil fish of the genus *Silurus*.

Locality—Westmoreland, Oneida county, New York.

Place in the Geological Series.—There is some doubt as to the precise nature of the rock in which this fossil occurs; in the memoir above noticed it is stated :—"The rock containing the impression, is called by the country people bastard limestone, and has been described under many different names: it is said to be clay-slate, by Dr. Mitchell; graywacke slate, calciferous sand rock, transition sand rock, &c., by others. It is of a bluish colour, with a conchoidal fracture, homogenous appearance and earthy smell; it effervesces slightly with acids, contains a few siliceous particles, and gives fire with steel."

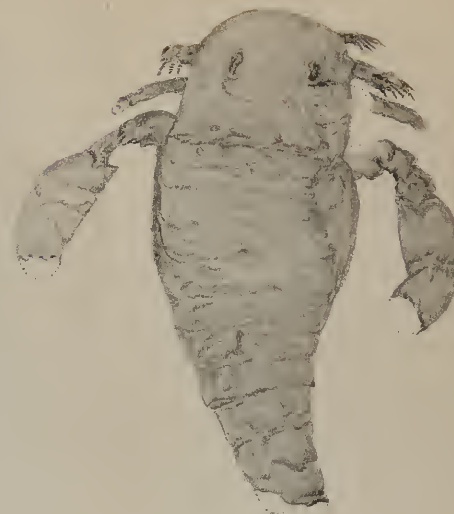
Eurypterus *lacustris*, Harlan.

By this name we intend to designate a well marked fossil species of this genus from the shore of Lake Erie, Penns. The specimen is preserved in the Museum at Buffalo, N. York, where we had an opportunity of inspecting it, and of making a drawing, in the autumn of 1829.

Fig 2d
Nat Size

E. LACUSTRIS.

Fig. 1st
Nat Size



EURYPTERUS REMIPES

Lith. Phila

The following are the comparative dimensions of the two species.

	E. *lacustris.*	E. *remipes.*
Total length, - - -	5 inches. - -	$3\frac{3}{4}$ inches.
Length of the head, - -	$1\frac{1}{4}$ " - -	1 "
Breadth, - - - -	$2\frac{1}{4}$ " - -	$1\frac{1}{2}$ "
Breadth of the body, - -	$2\frac{5}{8}$ " - -	$1\frac{5}{8}$ "
Distance between the eyes,	1 " - -	$0\frac{3}{8}$ "

But other differences exist besides those of size and proportions. The transverse bands or joints are proportionably wider in the *lacustris*, consequently there are fewer of them in a given space. These bands are nearly equal in the *remipes*, those of the former on the contrary are broadest above, and narrower near the tail—the first plate, nearest the head, being double the size of the others. The tail in the *remipes* was wanting in the specimen—a faint outline of this member existed in our specimen, in which it appears to have been depressed and expanded, but contracted above where it unites with the body.

Some portions of the present species are more perfectly preserved than in the remipes, from which it appears that all the feet consist of five articulations, of which the terminals of the three first feet are filamentous; by reference to fig. 2. of the accompanying plate, it seems not improbable that these filaments exist on the under surface of some of the other articulations, an appearance of which is observed in one of the left extremities.

A comparative view will display other distinctive characters. *Vide* pl. fig. i. E. *remipes;* fig. ii. E. *lacustris.*

Locality.—Williamsville, 7 miles below Buffalo, Penn.

Place in the Geological Series.—Grauwacke slate? Dr. Dekay, of N. York, has recently discovered a new species; and in the Trans. of the Royal Society of Edinburgh, for 1834, Dr. Hibbert has described gigantic species of the same genus. (*Vide* Memoir on the fresh-water limestone of Burdiehouse, near Edinburgh.)

For the following list of the genera of North American Trilobites, and synopsis of the species, the author acknowledges himself indebted to the politeness of Dr. Green, who has presented to geologists the only monograph on this subject, accompanied with plaster casts of each species, generally accurately executed.

Admitting the component rocks of the Grauwacke series to be the same as that proposed by De la Beche, all these crustaceous organic remains belong to this group. The following list includes the species of Trilobites hitherto discovered in this country.

Genus Calymene, Brongniart.

C. *Blumenbachii*, Al. Brongn.

Localities.—Lebanon, Ohio; Trenton Falls, New York; near Reading, Pennsylvania; and many other places. No Trilobite is so extensively diffused over the United States, as the C. *Blumenbachii*. See Green's Monograph; Eaton's Geology, p. 31; Monthly American Journal of Geology, p. 558.

C. *callicephala*, Green.

Locality.—Near Cincinnati, Ohio. Green's Monog. p. 30; Monthly Am. Journ. Geol. Vol. I. p. 558.

C. *selenecephala*, Green.

Locality.—New York. Green's Monograph, p. 32; Monthly American Journal of Geology, p. 558.

C. *Platys*, Green.

Locality.—Helderberg mountains, near Albany, New York. Green's Monog. p. 32; American Journal of Geology, p. 558.

C. *microps*, Green.

Locality.—Near Ripley, Ohio. Green's Monog. p. 34; American Journal of Geology, p. 558.

C. *anchiops*, Green.
C. *macrophthalma*, Brongn.

Locality.—Ulster county, New York. Green's Monograph, pp. 35, 36, 37; Monthly American Journal of Geology, p. 558.

C. *Diops*, Green.

Locality.—State of Ohio. Green's Monograph, pp. 37, 38, fig. 2; Monthly American Journal of Geology, p. 559, pl. xiv. fig. 2.

C. *macrophthalma*, Brongniart.

Locality.—Berkley, Virginia. Green's Monograph, pp. 39, 40, 41; Monthly Journal of Geology, p. 559.

C. *Bufo*, Green.
C. *macrophthalma*, Brongniart.
C. *rana*, Green, variety of Bufo.

Localities.—New Jersey, at Patterson; very extensively diffused in the slaty limestone throughout the United States. See Green's Monog. p. 41; Monthly American Journal of Geology, p. 559.

C. *odontocephala*, Green.

Locality.—New York, Ulster county? Silliman's Journal, vol. xxv. p. 334.

GENUS ASAPHUS, Brongniart.

A. *laticostatus*, Green.

Locality.—Ulster county, State of New York. See

Green's Monograph, p. 45; Monthly American Journal, p. 559.

A. *selenurus*, Eaton.

Localities.—Glenn's Falls and Buroft's Mountain, State of New York. See Geological Text Book, p. 31; Green's Monograph, p. 46.

A. *Limulurus*, Green.

Locality.—Lockport, New York. Green's Monograph, p. 48; Monthly American Journal, p. 559.

A. *caudatus*, Brunnich.

Localities.—Ripley, Ohio; Banks of Lake Superior. Green's Monograph, p. 50; Monthly American Journal, p. 59; Geological Text Book, p. 31.

A. *Hansmanni*, Brong.

Localities.—Helderberg, New York; Shore of Lake Erie. Geological Text Book, p. 11; Green's Monograph, p. 52.

A. *pleuroptyx*, Green.

Localities.—Helderberg and Genessee rivers, New York. Green's Monograph, p. 55; Monthly American Journal, p. 559.

A. *micrurus*, Green.

Locality.—Trenton Falls; New York. Green's Monograph, p. 56; Monthly American Journal, p. 559, pl. xiv. fig. 3.

A. *Wetherilli*, Green.

Locality.—Near Rochester, New York. Green's Monograph, p. 58; Monthly American Journal, p. 559.

A. *myrmecoides*, Green.

Locality.—Genessee county, New York. Silliman's Journal, vol. xxiii. p. 397.

A. *astrogalotes*, Green.

Locality.—Greenville canal, Upper Canada. Silliman's Journal, vol. xxv. p. 325.

A. *tetragonocephalus*, Green.

Locality.—Newport? New York. Silliman's Journal, vol. xxv. p. 336.

A. *crypturus*, Green.

Locality.—Nova Scotia. Transactions of the Geological Society of Pennsylvania, vol. i. p. 37, pl. vi.

Genus Paradoxides. Brongniart.

P. *Boltoni*, Bigsby.

Locality.—Lockport, New York. Journ. of Academy of Natural Sciences, vol. iv. p. 365, pl. 23; Green's Monog. p. 60; Monthly Amer. Journ. p. 360.

P. *Harlani*, Green.

Locality.—Trenton Falls? New York. Silliman's Journal, vol. xxv. p. 336.

Genus Isotelus, Dekay.

I. *gigas*, Dekay.

Localities.—Trenton Falls; New York; near Cincinnati, Ohio, &c., &c; St. Joseph's, Canada. Annals of New York Lyceum, vol. i. p. 185; Green's Monog. p. 57; Month. Amer. Journ. p. 560.

I. *Planus*, Dekay.

Localities.—Trenton Falls; New York; Newport, Kentucky. Annals of New York Lyceum, vol. i. p. 186; Green's Monog. p. 68; Monthly American Journal, p. 560.

I. *Cyclops*, Green.

Locality.—New York? Green's Monog. p. 69, fig. 7.

I. *megalops*, Green.

Locality.—Trenton Falls; New York. Green's Monog. p. 70.

I. *stegops*, Green.

Locality.—Newport, Kentucky. Green's Monog. p. 71.

GENUS CRYPTOLITHUS, Green.

C. *tessellatus*, Green.

Localities.—Glenn's Falls; Trenton Falls; New York. Green's Monog. p. 73, fig. iv.; Month. American Journal, p. 560.

C. *Bigsbii*, Green.

NUTTAINIA *Concentrica?* Eaton.

Localities.—Montreal; Trenton Falls; Champlain canal; New York. Green's Monog. p. 76.

GENUS DIPLEURA, Green.

D. *Dekayi*, Green.

Localities.—Lockport, New York, and several other places in the United States. Green's Monog. p. 79, figs. vii. and viii.; Monthly American Journal, p. 560.

Genus Trimerus, Green.

T. *delphinocephalus*, Green.

Locality.—Niagara county, N. Y. Green's Monog. p. 82, fig. i.; Monthly American Journal, p. 560.

Genus Ceraurus, Green.

C. *pleurexanthemus*, Green.

Localities.—Newport, New York. Green's Monog. p. 84, fig. x. Monthly American Journal, p. 560.

Genus Triarthrus, Green.*

T. *Beckii*, Green.

Locality.—Cahooes Falls, New York, and other places. Green's Monog. p. 37, fig. vi. Monthly American Journal, p. 560.

Genus Nuttainia, Eaton.

N. *sparsa*, Eaton.

Locality.—Near Albany, New York. Eaton's Geolog. Text Book, p. 33. Green's Monog. p. 80.

Genus Brongniartia, Eaton.

B. *platycephala*, Eaton.

Locality.—Lockport, New York. Eaton's Geolog. Text Book, p. 32. Green's Monog. p. 31.

* Vide memoir "On new species of Trilobites, from the State of New York, and Observations on the genus Triarthrus," in the following pages of this volume, in which this genus is obliterated.

PHYTOLITHITES.

In North America there is no lack of material in this department of our subject; but all the information we possess relative to the fossil plants of this country, is disseminated in the various works devoted to natural history. Our fossil vegetables are confined to no family in particular, but consist, as far as yet discovered, of the pine, oak, hickory, walnut, beech, palms, ferns, reeds, grasses, mosses, algæ, peat, and lignite in various stages of carbonization. Dicotyledonous lignite is of common occurrence in the deep cut of the Chesapeake and Delaware canal. Numerous popular accounts of submerged forests and petrified trees in scattered localities, will be found in the American Journal of Science and Arts, and occasional notices of similar phenomena in Hitchcock's Geology, and the Journal of the Academy of Natural Sciences, &c. &c.

The following remarkable account of a petrified forest, is extracted from a letter of G. H. Crossman, of the United States Army, published in the Illinois Magazine, during the summer of 1830:

"The enclosed specimen was broken off from one of the many large stumps and limbs of trees, found near Yellow Stone river, Missouri territory, and brought away by some of the officers attached to the Yellow Stone expedition in 1815.

"The most remarkable facts, perhaps, with regard to these petrifactions, of what was once a forest of thick timber, are their location and abundance. For a distance of twenty or thirty miles over an open high prairie, upon the west bank of the Missouri river, and a few miles below its junction with the Yellow Stone, near latitude 48°, these remains are most abundant.

"The topography of this section of the country is hilly, and much broken into deep ravines and hollows. On the sides and summits of the hills, at an elevation of several hundred feet above the present level of the river, and an estimated height of some thousand feet above the ocean, the surface of the earth is literally covered with stumps, roots, and limbs of petrified trees, broken and thrown down by some powerful convulsion of nature, and scattered in all directions in innumerable fragments.

"Some of the trees appear to have been broken off, in falling, close to the root; while others stand at an elevation of some feet above the surface. Many of the stumps are of large size; I measured one, in company with Dr. Gale of the United States Army, and found it to be upwards of fifteen feet in circumference."

The vegetable impressions observed in our coal measures are equally numerous and interesting as in any of a similar nature in Europe, and all are of the same general character with those obtained from the carboniferous and grauwacke series in Europe.

Many of the fossil vegetables of our coal measures are peculiar to America: such are, NEUROPTERIS *Cistii*, N. *macrophylla*, of Wilkesbarre, Pennsylvania; N. *Grangeri*, of Zanesville, Ohio; SIGILLARIA *Cistii*. S. *rugosa*, S. *Sillimani*, S. *obliqua*, S. *dubia*, all from Wilkesbarre, Pennsylvania; LYCOPODITES *Sillimani*, South Hadley, Mass.; LEPIDODENDRON *mamillare* and L. *Cistii*, Wilkesbarre; POACITES *lanceolata*, Zanesville, Ohio, and PECOPTERIS *punctulata*, Wilkesbarre.

Those common to both countries, as enumerated by De la Beche, (Geological Manual,) are:—"Calamites, three species; Neuropteris, three species; Pecopteris, four species; Sigillaria, one species; Sphenophyllum, one species; Lepidodendron, three species; Stigmaria, two species; Andularia, two species; Asterophyllites, one species.

Several eminent American authors have communicated important information in this department of geology, in that highly valuable repository of American intelligence, the American Journal of Science. Among others, we refer with much satisfaction to the labours of Professors Silliman, Hitchcock, and Eaton, and to Messrs. Grammer and Cist.*

We refer our readers also, with great confidence, to the memoir of Mr. R. C. Taylor, in the first volume of the Geol. Trans. of Pa., for valuable information respecting the geological position of a class of fossils, (Fuci,) which have recently elicited much attention in this country. Mr. T. has indicated several additional new species.

Up to the period of the publication of the invaluable work of M. Ad. Brongniart, ("Histoire des Vegetaux Fossiles," 1828,) very little had been accomplished towards the elucidation of this interesting portion of the fossil flora.

The opinions offered by this enlightened author relative to the geological relations of the fossil Fuci, of Europe, receive confirmation by all the facts hitherto obtained of the like fossils observed in America:

"Fossil Fuci are found even in the most ancient formations of the globe, in the transition rocks of the north of Europe and of America."

"Such are the Fucoides *dentatus*, F. *serra*, F. *antiquus*, and F. *circinatus*."

"The Fuci become more abundant in the strata which separate the limestone from the chalk, and some remarkable species occur here."

"In England, these fossils are of frequent occurrence in the green sand formation which separates the Lias and Oolitic series (calcaire jurassique) from the chalk."

"It has been demonstrated that the Marine, like terrestrial vegetation, approaches nearer to that of our own

* Vide Silliman's Journal, Oct. 1835, for numerous and interesting additions to the fossil flora of the Valley of the Ohio.

climates, in proportion as they occur in the more recent formations. They present, on the contrary, characters equally resembling those of the vegetation of equatorial climates, in proportion as they occur in more ancient formations." Hist. des veg. foss. tom. 1. pp. 41, 43, 45, 47.

The following list embraces all the determined species hitherto discovered in North America.

NATURAL ORDER ALGÆ.

FAMILY FUCOIDES. Sternb.

F. *dentatus*, Ad. Brongniart,

Hist des veg. foss. Vol. I. p. lxxx. pl. vi. fig. 9. 12.

Locality.—Point Levi, near Quebec, Canada.
Place in the Geological Series.—Transition limestone.

F. *serra.* Ad. Brongniart,

Hist. des veg. foss. p. lxxxi. pl. vi. fig. 7, 8.

Locality.—Point Levi, near Quebec.
Place in the Geological Series.—Transition limestone.

F. *Brongniartii.* Harlan,

Monthly Journal of Geology, &c. 1831. Figured in the present volume.

Locality.—Welland canal, Canada; western part of the state of New York; mountain ranges of western Pennsylvania and Virginia.

Place in the Geological Series.—Siliceous sandstone—Grauwacke slate, and old red sandstone.

For further observations on this, and analogous fossils, *vide* Mr. Taylor's memoir, above referred to.

In Hitchcock's Geology, pp. 233, 234. pl. xiii. fig. 38, 39—there occurs a description of a fossil vegetable, which on very doubtful authority, Professor H. refers to a fossil fucus, analogous to that above described. In the opinion of this "*authority*," the fossil in question "*evidently* belongs to the fossil genus fucoides, of which Dr. Harlan has described a species from the sandstone of Genessee, under the name of F. *Brongniartii*. If the specimens were weathered, their specific characters would be more obvious, and would probably prove identical with those from Genessee." *Vide* page 231, ut supra. We have no faith in opinions, on matters of science at least, delivered "ex cathedra," and in this instance, the mere glance of the eye of an intelligent observer at the description of the fossils in question, would convince him that they display no characters in common with each other—there is sufficient reason to doubt whether or not the specimens figured by Professor H. from Deersfield, really belonged to the natural order Algæ, much less to the genus or family fucoides—judging from the description, they would appear to possess much stronger analogy to the stems of dicotyledonous plants.

The following are some of the particulars in which this fossil differs from the fucoides, with which it has been confounded, viz: Stem attains to more than twice the diameter, and twice the length in the former—its surface is moreover uniform, without grooves or wrinkles. These stems are never branched in the Deerfield petrifaction, and the sandstone in which it occurs is rather fine, and quite soft, and easily disintegrates—the very opposite of all this characterizes the F. *Brongniartii;* but what distinguishes the former, or Deerfield fossil, from the fucoides above named, and from all the species of algæ that have come under our notice, is the peculiar vestige of organization observed in the stems figured by Professor H., who states, in his lucid and detailed description of his petrifaction, "by breaking the specimens transversely, a curious structure is revealed; it may be described, by saying that the cylinder is made up of convex layers of sandstone, piled upon one another." From the known fleshy organization of the aquatic cryptogamæ, it is difficult to conceive, how mere petrifaction, to say nothing of "weathering," could produce a structure similar to that noticed in the stems above alluded to.

Two years subsequently to the publication of the F. *Brongniartii*, Mr. Mantell described and figured a Fucus, by the same name, though of a very distinct species, (*vide* "Geology of the south-east of England," p. 95,) where this author states—"a fine species of Fucus has been noticed in chalk, which I have named, in honour of the distinguished author of the Vegetaux Fossiles, *Fucoides Brongniartii*." We leave it to future systematic writers to correct these trivial collisions in classification. We learn from Professor Brongniart, that it is his intention to favour the public with a complete synopsis of fossil vegetables, at the termination of his great work.

F. *Alleghaniensis*, Harlan,

Journal of the Academy of Natural Sciences of Philadelphia, Vol. VI. p. 289, pl. xv.; R. C. Taylor, Loudon's Magazine of Natural History, No. 37, for January, 1834, p. 27, fig. vi.

Locality.—Eastern ridges of the Alleghany mountains.*

Place in the Geological series.—Compact sandstone, subjacent to the coal measures.

* In common parlance, all that succession of mountain ridges spreading from the main Alleghany mountain, to within thirty miles east of their base, is denominated, the "*Alleghany Mountains.*" But in a geological sense, this term includes formations totally distinct from each other: in the vicinity of the Susquehanna river, and crossing the Juniata, these mountains are constituted of a series of grauwacke sandstones and limestones, in the former of which various species of *Fucoides* abound. The Alleghany proper, consists of a secondary series resting upon the old red sandstone.

We refer to the first volume of the Trans. of the Geol. Soc. of Penns. for a detailed account of these fucoid beds, by R. C. Taylor, Esq.

We subjoin the following extract from a letter we have recently received from Professor Troost, of Tennessee, on the Transition Fossils of the valley of the Mississippi, as it serves, in addition to what has already been published by American naturalists, to complete the catalogue of American fossils.

"I will commence with a list of the fossils which I found in the transition strata, including the mountain limestone of the English geologists. I must do so, because, in a zoological point of view, our carboniferous limestone is characterized by the same organic remains which in Europe are found in the grauwacke group—and our grauwacke is without fossils, except a few of the upper strata. The lowest fossil that I have found, is the Maclurites bicarinata, Lesueur. They occur in a stratum of black limestone near the Holston river; they are abundant near Kingsport, where they are associated with the Conotubularia Cuvieri. The next fossils are some Encrenites and Polypiferes, which are so much incorporated with the rock, that I was not able to distinguish them. The next series is the carboniferous, which I considered distinct from the coal measures. The lowest strata are characterized by a genus which I have christened Conotubularia, and we have C. Cuvierii, C. Brongniardii, C. Goldfussii. 2. Several species of Orthoceratites. 3. Isotelus planus. 4. Astrea tessellata, nobis. 5. Cyathophyllum ceratites, Goldf. 6. Cyathophyllum vermiculare, Goldf. 7. Stromatopora concentrata, Goldf. 8. Stromatopora verrucosa, nobis. 9. Coscinopora infundibuliformis, Goldf. 10. Catinipora mæandrina, nobis. 11. Calamopora maxima, nobis. 12. Columnaria divergens, nobis. 13. Columnaria sulcata, Goldf. 14. Manon Piziza, Goldf. 15. Eschara ovatopora, nobis. 16. Escaria reticulata, nobis. These 16 species are found in the lowest strata—the intermediate strata of the same group contain: 17. Astreas antiqua, nobis. 18. Hamites Haanii, nobis. 19. Turbinolia cuneata. 20.

Aulopora serpens, Goldf. 21. Scyphia Neesii, Goldf. 22. Scyphia stellata, nobis. 23. Sarcinula costata, Goldf. 24. Astrea alveolata, Goldf. 25. Calamopora spongites, Goldf. 26. Calamopora hemispherica, nobis. 27. Calamopora alveolaris, Goldf. 28. Calamopora basaltica. 29. Calamopora favosa, Goldf. 30. Calamopora gothlandica, Goldf. 31. Calamopora milleporacea, nobis. 32. Astrea porosa, Goldf. 33. Syringopora ramulosa, Goldf. 34. Catenipora escharoides, Lam. 35. Catenipora labyrintica, nobis. 36. Aulopora tubæformis, Goldf. 37. Achilleum cheirotonum, Goldf. 38. Madrapora complanata, nobis. 39. Cyathophyllum gracile, nobis. 40. Cyathophyllum secundum, Goldf. 41. Cyathophyllum plicatum, Goldf. 42. Cyathophyllum excentricum, Goldf. 43. Cyathophyllum helianthoides, Goldf. 44. Cyathophyllum plicatum, Goldf. 45. Linipora rotunda, nobis. 46. Turbinolia mitrata, Goldf. 47. Cnemidium remulosum, Goldf. 48. Achilleum fungiforme, Goldf. 49. Tragos sphæroides, Goldf. All the above mentioned remains are intermixed with several Crinoidea which I have not yet determined, and Trilobites of which I have called one Asaphagus megalopthalmus.

"The Molluscæ are very numerous, but before I have received the Mineral Conchology of Sowerby, I am not able to describe them. I know, for the present, Calceola sandalina, Turbo bicarinatus, Bellerophon hiulcus, Strophomene rugosa, Raf., Producti, Spirifer, Terebratula and others.

"The upper strata of the same group (always below the coal) are characterized by Pentremites. There are still many fossils which I can not enumerate as yet, not having determined them."

On the structure of the teeth in the "Edentata," fossil and recent.

Profiting by recent opportunities that have offered themselves, for the examination of the intimate nature of the structure of the teeth in several genera of the order Edentata, both fossil and recent, I have observed some peculiarities not hitherto noticed, and have been enabled to correct a few previous errors existing in relation to this subject.

The close relation of the results of these inquiries to comparative anatomy and fossil geology, may, in the opinion of my readers, render them worthy of publication.

To the "*Ossemens Fossiles*," of Baron Cuvier, and the "*Dents des Mammiferes*," of M. Fred. Cuvier, we must refer for the most recent information on the subject in question.

The following is a translated extract from the work of the former. Vol. v. part i. p. 84.

"In both species of sloth, there are four molar teeth above and three below on each side; all are conical during youth, but become cylindrical when the summit is worn off by detrition. The truncature of the summit produces a hollow in the osseous substance; the borders, which are of enamel, remain projecting, but unequally, sometimes more on one side, sometimes on the other; sometimes equally before and behind, leaving two lateral points, all depending on the manner in which the teeth meet and rub against each other. The teeth of the sloths are of the most simple structure imaginable. A cylinder of bone enveloped by enamel, and hollow at both ends, at the external end by detrition, at the internal, by default of ossification, and for the purpose of lodging the remains of the gelatinous pulp, which served them for a nidus—voila toute leur description."

"These animals do not possess, like the other herbivora, plates of enamel, which penetrate the tooth in various directions, and which render the crowns more fit for grinding vegetables; consequently *their mastication ought to be very imperfect.*"

"It is still further necessary to remark, that the plates which compose their osseous substance, are but imperfectly united to each other. In sawing a tooth longitudinally, these plates are observable, piled one on top of the other, like pieces of money in a tube, and this tubular case consists of enamel."

The observations which I have made on the structure of the teeth in the sloths, lead to different results, both as regards fact and inference. In the first place, the two species of the Linnæan genus BRADYPUS, (B. *tridactylus*, and B. *didactylus*, or the tree-toed and two-toed sloths,) differ considerably in their dental structure, and in the form of the head. In reference to the latter point, Illiger and F. Cuvier have arranged these tardigrade animals under two distinct genera, the former author applying the term CHOLÆPUS to the B. *didactylus;* and the latter author taking the B. *trydactylus* as the type of his genus ACHEUS.

The teeth of the three-toed sloth, although constructed on general principles like those of other phytivorous quadrupeds, display remarkable peculiarities in the arrangement of their various parts; they are composed of *bone, enamel,* and *cement,* or *pars petrosa;* but in place of being irregularly intermixed with each other, there exists, first, a central cylinder of bone which is surrounded by enamel, which itself is surrounded or enveloped by a regular layer of cement. The different densities of these constituent portions of the tooth, occasion its crown to present, by detrition, several irregular faces; the central pillar of bone being softest, wears away fastest and deepest, the central portion of the crown is consequently hollow, whilst the external surface of the tooth or the cement being softer than the enamel which it incloses, and harder than the bone proper, remains less worn than the bone, and more so than the enamel, and each portion projects proportionably, the circumference of the tooth presenting a bevelled edge.

This structure renders the masticatory apparatus of this species peculiarly appropriate for grinding vegetables; accordingly, in my dissection of an adult sloth (B. *tridactylus*,) which was killed soon after eating a hearty meal of green leaves, its customary food, I observed the stomach replete with vegetable matter, reduced to a fine pulpy consistence by mastication. (*Vid.* our memoir on the Anatomy of the Sloth, in the following pages of this volume.)

In the *two-toed sloth*, (B. *didactylus*, Linn. or *cholæpus*, Illig.) the form and structure of the teeth differ from those of the former species, besides possessing true canines, differing in form and size from the molars; the latter are nearly destitute of the external layer of cement, which consists only of a slight brush of this substance, of a black colour, probably stained by the vegetable juices on which the animal feeds; the crowns of the two middle molars display, by detrition, two irregular concave triangular faces, anteriorly and posteriorly. The central portion of the bony pillar is of a softer structure, and differs in colour from the rest of the bone.

In the genus Dasypus, or Armadillo, although the various subgenera and species, differ considerably in their dental formula from each other, I have observed nothing very remarkable in the structure of these organs, in the species which I have examined; they are generally subconical, apparently destitute of *cement*, surrounded by enamel, which, when worn off by friction, leaves the crown with a double concave semi-elliptical surface, with a central depression, there being, as in the B. *didactylus*, a central portion of bone, of a softer texture; like the teeth of most of the animals composing the order Edentata, those of the Armadillo are destitute of true roots or fangs, a structure which it is supposed enables them to continue through life, growing from the inferior extremity, as the crown is worn by friction, similar to the process observed in the incisors of the RODENTIA.

The structure of the teeth in the ORYCTEROPUS, or *Cape ant-eater*, is totally different from all the other animals of this order; they are destitute of fangs, and penetrated their whole length by an infinity of small parallel tubes, the superior orifices of which are visible on the crown when the enamel is worn off; and are still more visible at their bases. A magnified view of a similar arrangement is perceptible in the molars of the Sus africanus.

The "MERMECOPHAGA," or *ant-eaters* properly so called, are destitute of teeth of every description.

By referring to Cuvier's "Ossemens Fossiles," it would appear that the illustrious author had not enjoyed an opportunity of a detailed examination of the teeth of the *Megatherium*. It is merely stated, (at p. 179, vol. v.) "Another difference consists in the teeth of the Megatherium possessing two roots, which I do not find in my specimens of sloths."

If I am correctly informed, the teeth of the Megatherium had not been seen at the "Jardin des Plantes" during the lifetime of the Baron; specimens were, however, subsequently obtained. The museum of the Royal College of Surgeons of London, has recently been put in possession of choice specimens of the remains of this interesting fossil animal, through the liberality and public spirit of Mr. Woodbine Parrish. It was among these remains that I first enjoyed the opportunity of inspecting the skull and teeth of the megatherium, through the kind politeness of Mr. Clift, the Curator. In structure, they resemble those of the B. *tridactylus;* they differ in form and in the possession of two radical fangs.

The teeth of the *Megalonyx* also consist of three distinct substances; their general structure bears a close analogy to those of the Bradypus tridactylus; but complete series of the teeth of this species have not yet been obtained.

The molars which have been discovered differ from each other in size and form; their crowns assume by friction a form analogous to those of the B. tridactylus.

*Description of the Fossil Bones of the Megalonyx, recently discovered in the United States, N. A.**

MEGALONYX *laqueatus.*

FOR many years it was ascertained that the collection of fossils in the cabinet of the late Mr. Clifford of Kentucky, contained some of the remains of a Megalonyx. On the death of this gentleman, his whole collection passed into the hands of Mr. Dorfeuille, proprietor of the Cincinnati Museum,—who added a very extensive collection of fossils of almost every variety, principally from the Basin of the Mississippi. During the summer of 1829, this collection was offered for sale; when my estimable friend *John Price Wetherill,* Esq. with that distinguished liberality which he has so repeatedly displayed towards the sciences and those who cultivate them, authorized me, when on a visit to Cincinnati in the autumn of the same year, to purchase these invaluable relics, which, together with other admirable contributions in this department, he has caused to be arranged in the cabinet of the Academy of Natural Sciences of Philadelphia.

The fossil bones which form the immediate subject of the present dissertation, were labelled "White Cave," Kentucky; being one of those saltpetre caves so numerous in the limestone formation, in the states of Kentucky, Tennessee, and Virginia. One of them, named the "Mammoth Cave," Kentucky, is said to extend thirteen miles, running under Green River. During the late war the United States government was supplied with nitre from these caves, which salt, it is said, is not regenerated so

* According to the recent observations of Dr. Troost, these bones were derived from Big-bone-cave, Tennessee.

soon as usual in other countries; the atmosphere within them is exceedingly dry and antiseptic; Indian Mummies, which consist of human bodies simply desiccated, together with their ornaments, have been frequently discovered in a state of high preservation; and bones of the existing species of animals have occasionally been observed.*

Along with the remains of the Megalonyx, we have received portions of skeletons of the Bos, the Cervus, the Ursus, and a metacarpal bone of the human species. The remains of the Bear alone appear to be nearly as ancient as those of the Megalonyx. Strictly speaking, these bones are not fossilized; they retain a very considerable quantity of animal matter, but are much more brittle and lighter than recent bones; most of the articulating surfaces are still more or less covered with cartilage: they are mostly of a yellow ochreous colour: it is stated that they were found on the surface of the floor of the cave; whilst those of the Megalonyx Jeffersonii were buried two or three feet beneath the surface, and are completely fossilized; they are still in very good preservation in the cabinet of the American Philosophical Society.

* From a communication received from my intelligent friend Dr. Black, late of Kentucky, we copy the following extract relative to the *White Cave.*

"The Cave is located in Edmondson County, Kentucky, on the Southern bank of *Green River*—130 miles distant, following the course of the stream, and 50 miles, in a direct northern line, from the Ohio river—120 miles S. W. of Lexington. It penetrates the second or upper bank of the river nearly at its summit, about half a mile from the mouth of Mammoth cave. The entrance dips a little below the horizon, and is 8 or 10 feet deep, and is only sufficiently large to admit of the simultaneous ingress of one person, feet foremost. The first chamber is of an irregular elongated oval shape, with a low, flat, uneven roof, seldom allowing a grown person to stand erect. Water continually dropping from the ceiling keeps the floor very wet, this is irregular, and covered with a thin layer of alluvial soil—mud or clay and gravel. The second chamber differs from the first in having the ceiling covered with quill-like stalactites, and its floor more level, is intersected with small channels of running water, so transparent, as to be scarcely perceptible. The third chamber is more regular than either of the others, and is chiefly distinguished by an irregular pile of limestone, which has evidently fallen from above, and very probably closes the passage to other chambers. Saltpetre, so common in other caves, has not been detected in this."

The remains of the new Megalonyx, consist of two claws of the fore feet; a radius, humerus, scapula, one rib, and several remnants; os calcis, tibia, a portion of the femur; four dorsal, and one lumbar vertebræ; a portion of a molar tooth; together with several epiphyses: the bones being portions of the skeleton of a young animal, are occasionally imperfect at their extremities.

In the same collection there is a humerus nearly perfect, and a metacarpal bone of an adult animal of the same species, disinterred subsequently at that almost universal cemetery of fossil quadrupeds, "Big-bone-lick."

The bones of the fore arm and fore foot, together with a single tooth of the *Megalonyx Jeffersonii*, discovered in 1796 in a cavern in Greenbriar county, Virginia, (*vide* Cuvier, Anim. foss. Vol. V. part 1. ed. 3, p. 160,) are the only portions of the skeleton of this genus hitherto obtained. On comparison of the similar parts of the skeleton of the new animal, they will be found to display strong characters of specific distinctions.

In addition to the Megatherium and Megalonyx, so elaborately described by Baron Cuvier, in his "Ossemens fossiles," this author has furnished us with indications of the existence of two other fossil quadrupeds of the order Edentata; one of these he refers to the genus "Manis," but of immense magnitude, when compared to the largest of that genus now existing: if we may judge from the size of an ungueal phalanx, which was disinterred in the vicinity of Eppelsheim, canton of Alzey, on the Rhine, "this fossil quadruped may have been twenty-four feet long."* (*Vide* Cuv. Anim. foss. 3d ed. Vol. V. part 1. p. 195.)

The other fossil to which the Baron alludes, is an arma-

* M. Kaup, to whom we are indebted for the discovery of two species of his fossil genus Dinotherium, or great Tapiroid animal of Eppelsheim, has recently announced his conviction that the ungueal phalanx above alluded to, belongs to his Dinotherium. (N. Jahrt. f. Min. 1833, cap. 2. p. 172.) Quoted from the Bulletin de la Soc. Geologique de France, t. v. p. 444.

dillo, (Dasypus) more than ten feet in length, lately discovered in the alluvium of the "Rio del Sauce," in the vicinity of Montevideo; this animal was evidently covered with scales, and its femur, which weighed seven pounds, is said to resemble in every respect that of the armadillo.*

With these preliminary remarks, we proceed to the description of the bones in question, commencing with those which we are enabled to compare with similar bones of its kindred species: these latter being already minutely and accurately described in the Anim. foss., it is only necessary to note the points of dissimilitude.

1. The largest claw or ungueal phalanx, which appears to belong to the medius, in general contour resembles that of the M. Jeffersonii; but is much thicker and stronger, being one half as high as it is long, measured posteriorly; and is more curved at the point, and more abruptly arched above;—the inferior osseous plate or tubercle, is globular and protuberant, and in place of two foramina, as in M. J., the vessels entered a notch, at the posterior base of the tubercle, and run in a direction parallel to the axis of the bone, but the artery soon divides, one branch penetrating the substance of the bone, within the osseous sheath, another running upwards between the bone and nail; as is demonstrated by a groove and foramen. The osseous sheath, which rises upward and appears to have spread from the tubercle, is broken off from both sides. The articulating surface, and the whole aspect of the bone, denotes a much more powerful instrument than the same bone of the adult species to which it is allied. (*Vide* table of dimensions at the end of this paper, and pl. 12. fig. 1 and 2.)

2. The second claw, or that of the annular finger, is smaller, and proportionably more slender, and bears the same comparison as the first to the annular claw of the M.

* More recent observers have referred the above mentioned remains to the Megatherium.

Jeffersonii, but is a much more interesting specimen on account of the *preservation of the nail itself*, which is of a compact lamellated corneous structure, of a reddish ferruginous tint, and adheres closely to the bone beneath, and to the osseous sheath above, which is fractured and removed on the exterior side, and shows the nail passing upwards and backwards as far as the articulating epiphysis, pl. 12. fig. 3. The inferior or cutting edge of the claw or nail is canaliculate, as in the *Bradypus tridactylus*. At the inferior portion of the claw, the corneous substance is three-tenths of an inch in thickness.

On the interior surface the osseous sheath is perfect, and extends above the dorsum of the bone, *vide* pl. 12. f. 4. This phalanx is much more curved than that of the M. Jeff. and differs also in its relative proportions; its height is about one-third its length. (*Vide* table of dimensions.)

All the claws in this species, as well as in those of the M. Jeffersonii, were evidently furnished with osseous sheaths, but are broken in the specimens of the last named species; a fact which could not be so readily ascertained by examining the plaster casts of the bones alone; in which respect again the Megalonyx is more closely allied to the sloth.

3. The contour of the superior head of the *radius* is circular, as in the Megalonyx Jeffersonii; and in its general aspect this bone resembles that of the last named species, but is proportionably thinner, narrower, and longer;—cartilaginous matter remains adhering to the articulating surfaces. The epiphysis from the radio-carpal extremity is lost. (*Vide* pl. 12. fig. 5. anterior, and fig. 6. posterior view.)

4. The fractured *molar tooth* appears to have belonged to the inferior maxilla on the right side; the crown is destroyed; a part of the cavity of the root remains. The body is compressed transversely, and presents a double

curvature, which renders its anterior and exterior aspects slightly convex; the posterior and interior gently concave; these surfaces are all uniform, with the exception of the interior or mesial aspect, which presents a longitudinal rib or ridge, one-half the thickness of the long diameter of the tooth; with a broad, not profound, longitudinal groove or channel along each of its borders. It is from this resemblance to a portion of a fluted column, that the animal takes its specific appellation.

The crown would resemble an irregular ellipsis widest at the anterior portion. The tooth consists of a central pillar of bone surrounded with enamel, the former of a dead white, the latter of a ferruginous brown colour: the transverse diameter is more than two-thirds less than its length, whilst that of M. Jeffersonii is only one-third less —the antero-posterior diameter is one-half its length in the former, and two-thirds less in the latter. The proportions of this tooth are consequently totally at variance with that of its kindred species. (*Vide* pl. 12. fig. 7, 8, 9.—*a.* exterior, *b.* interior, *c.* crown.)

5. *Os humeri.*—The portions of the skeletons of this genus, which remain to be described, being heretofore unknown, our means of comparative observation as regards its kindred species are at an end; among its congeners, however, there exists ample means of comparison. In the *form* of the humerus of the *Orycteropus,* for example, we find the almost exact counterpart of that now under notice. (*Vide* Anim. foss. Vol. 5, part 1. pl. 12. fig. 2. Ed. 3.)

It has already been remarked that the individual whose bones are above described, was at death a young animal, perhaps one-third less than the adult size; consequently the epiphyses are generally separated, and in some instances lost: this is the case with the arm bone. Being in possession of a larger and much more perfect specimen of a fossil humerus of the same species, from Big-bone-lick, we shall draw our descriptions from this; merely remarking of the former, that it bears the same relative proportions to the radius, as is observed in the same parts in the *Orycteropus.* Myrmecophaga Capensis.—Pall. (Vide table of dimensions.)

The humerus from Big-bone-lick, is nineteen inches long, and is of the colour and consistence of the bones of the Mastodon from the same locality. Like the same bone in the Myrmecophaga and Orycteropus, it is distinguished by the extreme length of the internal condyle, in order to afford origin to the large muscles which move their enormous claws. This internal condyle is also distinguished by a large foramen, for the transmission of nerves and blood vessels, and to relieve them from the pressure to which they would be subjected by the action of the large muscles in their vicinity. This foramen is characteristic of all the species included in the order Edentata, with the exception of the *Sloth* and *Megatherium.* The shaft is strongly marked with longitudinal ridges and depressions; its superior head by a large external and internal protuberance; its lower head, together with the radio-humeral articulating surface, is broad and flat, with a depression or cavity on the posterior part, for the coronoid process of the ulna. The external condyle is partially fractured, but judging from the apparent curvature at its superior border, its outline is precisely the same as that of this condyle in the Orycteropus. (Vid. pl. 13. fig. 10. from Big-bone-lick. Fig. 11. Big-bone-cave, Tennessee.)

6. *Scapula.*—As a counterpart for this bone we might refer to its almost miniature likeness, the scapula of the *Myrmecophaga jubata,* to which it bears a closer resemblance than to that of any other animal. In both, the bone is nearly as high as broad; and both are perforated by a distinct foramen, in place of a notch, near the anterior and inferior angle; but they differ in the relative position

of the superior and posterior angle, in the relative lengths of the different borders, and in the relative length of the acromion process. The posterior border is nearly rectilinear in the present instance, and curved in the Ant-eater. The acromion process is nearly on a line with the anterior border of the glenoid cavity, in the former; whereas this process projects below, and before this border in the latter. In both, the acromion projects a considerable distance from the coracoid process, with which it has no connexion. The anterior border of the megalonyx scapula being broken, we have by dotted lines, attempted its restoration in the figure. The glenoid cavity is an ellipsis, nearly twice as long as it is broad. It is most probable that the new animal, unlike the Orycteropus, was furnished with a clavicle, in which respect it resembles the Megatherium, the little Ant-eater, and the Sloth. (Vid. Tab. of dimens. and pl. 13. fig. 12. which may be compared with the humerus of the Orycteropus, pl. 9. fig. 6. vol. 5. pl. 1. ed. 3. Anim. foss.)

7. A metacarpal bone, which probably belonged to the same animal from which we have derived the humerus, was lately obtained by Mr. Cooper from Big-bone-lick, for a cast of which we are indebted to Dr. Dekay;—it is proportionably shorter and thicker than the metacarpal bone of the index finger of the M. Jeffersonii, to which it bears a general resemblance; it differs also in the diagonal or oblique position of the articulating surface of its inferior head, and in the greater size of its tuberosities; from the marks on its superior or carpal head, it must have belonged to the right fore-foot, and is part of a skeleton of an animal much larger and more powerful than the M. Jeffersonii. (pl. 13. fig. 13. back view, fig. 14. anterior articulating surface.)

8. *Ribs.*—The first rib of the left side has its inferior extremity broken off;—it is characterized by the extreme width of its superior head; the largeness and proximity of

the two articulating surfaces; and the deep furrows for the lodgment of muscles.—pl. 13. fig. 15. The remaining rib is in a state of perfect preservation; it is much thicker in proportion to its length than that of the Rhinoceros; the superior extremity is marked, for a small distance, with a furrow for the intercostal arteries, on both the anterior and posterior borders:—the distal extremity is narrow; it appears to be one of the anterior false ribs, left side. (Tab. dimens.—and pl. 14. fig. 16.)

9. *Vertebræ.*—These consist of four dorsal and one lumbar; pl. 13. fig. 17. appears to be one of the posterior dorsal. The general resemblance is to that of the Megatherium; but the spinous process is not so long; all the processes have lost their epiphyses. The lumbar vertebra is larger and heavier, as usual. The bodies of all are perforated by one or two large foramina, running from the base to the spinal canal. (Vid. Tab. of Dimens. and pl. 13. fig. 18.)

10. *Femur.*—An epiphysis, comprising the inferior head, is the only portion of this bone preserved; this, however, is very important, as it enables us to construct the knee joint, which in this animal presents remarkable characters. When it is recollected that the whole order of the Edentata, like that of the Monotremata, are characterized by their abnormal physical developments, the peculiar structure observed in the new fossil animal will appear less surprising.

The internal condyle is very considerably larger and projects further downwards than usual; where it is received into a rather deep concavity of the tibia. The external condyle is smaller and represents a segment of a flattened sphere, the longest diameter of which is in the antero-posterior direction; the depressed surface looking obliquely inwards, toward the internal condyle, from which it is separate nearly two inches. The pulley-like surface for the accommodation of the rotula, is large, and strongly marked, though not deep. This portion belonged to the femur of the right side. (Vid. Tab. Dimens. and pl. 14. fig. 19.)

11. *Tibia.*—This bone is in a good state of preservation with the exception of the inferior head, which is deprived of its epiphysis. The depression on the superior head for the reception of the internal condyle, is nowise remarkable, except for its unusual depth; it would admit of extensive motion without liability to luxation. The central ridge which divides the head does not extend across the surface: the articulating surface is convex; and on its outer border, in place of the usual depression for the reception of the external condyle, there exists a segment of a *flattened sphere*, projecting upwards nearly on a level with the central ridge, and in a manner isolated from the other portions of the articulating surface, leaving a considerable portion of the anterior and exterior part of this surface, irregularly raised, not covered with cartilage, and bearing marks of tendinous insertions. This sphere is rather more depressed than the external condyle, on which it moves; and projects posteriorly, much beyond the border of the interior articulating cavity. On the exterior and rather posterior lateral portion of this sphere, there is a rough and honey-comb appearance, evidently intended for the attachment, by anchylosis, of the superior head of the fibula, which must have occupied a position nearly posterior as well as exterior to the tibia. The body of the tibia is uniform anteriorly and depressed; gradually narrowing and compressed towards the middle, and again enlarging at the inferior portion: posteriorly the body of the bone presents a broad ridge, causing a considerable projection at the upper part, and descending in a straight line from the sphere in the centre of the bone, and disappears before it reaches the middle of the tibia. By referring to the table of dimensions, and pl. 14, fig. 20 and 21, being an interior and posterior view—and to

fig. 22, being a view of the articulating surface, a more correct idea of this anomalous structure will be obtained, than can be given in a description. The tibia is of the left leg.

12. There is an articulating epiphysis, which appears to have been attached to the inferior head of a tibia; but is unlike any portion of bone of that kind that has come under my observation. It presents a large articulating surface, still covered with dark coloured cartilage; there is a short internal maleolus, separated from the articulating surface anteriorly by a deep groove for the passage of a strong tendon, and two other grooves, situated laterally and rather posteriorly; there is also a small articulating surface projecting obliquely upward and outward from the exterior border; the bone is convex anteriorly, and concave posteriorly. It appears too large to have formed a part of the tibia just described, pl. 14, fig. 23.

13. The Os calcis presents some analogy in general contour to that of the Badypus tridactylus, but is proportionably much shorter, as will be seen by referring to the table of dimensions; it presents three articulating surfaces for attachment to the astragalus; superior, inferior, and exterior. (Vid. pl. 14, fig. 24.) The inferior border is concave; the superior, probably, an oblique plane; (this portion being fractured.) The posterior and inferior extremity is inclined inwards. (Vid. pl. 14, fig. 25.)

14. The inferior maxilla of a Bear, found in "Big-bone-cave," is introduced here, as it displays appearances of an antiquity nearly equal to that of the bones of the Megalonyx. It appears to have belonged to the common black Bear, (Ursus Americanus,) pl. 14, fig. 26.

Our animal with the teeth constructed after the manner of the Sloth, presents in the remaining portions of the skeleton, a singular admixture of characters peculiar to the Ant-eater, the Armadillo, and the Orycteropus.

In size, the adult of the present species surpasses the

Megalonyx of Jefferson, being about one-third less than the Megatherium. It possesses peculiarities of organic structure, which certainly entitle it to rank as a distinct species; indeed a minute examination of the tooth and knee joint, render it not improbable, supposing the last named character to be peculiar to it, that if the whole frame should hereafter be discovered, it may even claim a generic distinction; in which case, either Aulaxodon, or Pleurodon, would not be an inappropriate name; referring to the ribbed or fluted form of the mesial aspect of the tooth, M. Desmarest's most prominent character of this genus, viz. "Molars cylindrical," will not apply to this animal. In every instance, when it could be accomplished with any degree of certainty, an attempt has been made to restore the fractured portions of bone, by introducing dotted lines.

The fossil humerus disinterred at Big-bone-lick, and which appears to have belonged to an adult individual of the present species, is nineteen inches in length; the same bone of the Megatherium is twenty-six inches and four-tenths; the height of the whole skeleton of the latter, according to Cuvier, being seven feet four inches and five-tenths; which would give to the new animal, a height of about five feet, supposing the existence of similar proportions. The radius of the new animal, (being part of the young skeleton found in "Big-bone-cave") is about one-sixth less than that of the M. Jeffersonii; and the individual to which it belonged, may have been about the size of the common ox, although it was not more than three-fourths grown, if we are permitted to judge from comparisons made on the size of the os humeri, and metacarpal bone of the fossil animal found at Big-bone-lick, with those from Big-bone-cave.

The laws of co-existence, when applied to estimate the relative proportions of animals, must of course be admitted with some limitation, these proportions being known to vary according to age, and other circumstances. Thus the legs of the colt are proportionably much longer than those of the horse; and were we to conclude from the extreme size of the internal condyle of the os humeri of the *Orycteropus*, that the claws of this animal are equally developed with some others of the same order, the conclusion would be erroneous. Further, the bones of the fore arm of the new Megalonyx, (young specimen) are actually smaller than those of the M. Jeffersonii, yet the claws of the former are absolutely larger and stronger. Indeed, as Cuvier has already remarked, there exist exceptions to all those general laws of co-existence, so admirably established by his boundless penetration. Thus, to the general law, "Ruminant animals furnished with sharp canines are destitute of horns," are opposed the examples found in the Cervus *moschatus*, and in the subgenus, RUSA. Again, "Ruminants alone are characterized by cloven hoofs"—the genus *Sus* furnishes an example directly at variance with this rule. Such exceptions however stand in relation to the whole system, as "spots in the sun;" the only surprise is, that they do not more frequently occur. In fine, the deeper we enter into the study of this most important and deeply interesting department of knowledge, based as it is, on the unerring principles of geometrical and mathematical science, the more cause we find to look up with admiration to that "Master Spirit," which diffusing itself through every department of animated nature, has conferred upon this, a dignity, order, and utility, equalled only by the science of astronomy; and which certainly cannot be surpassed by any pursuit that may occupy the mind of man.

TABLE OF DIMENSIONS.

LARGE CLAW.

	Inches.
Length of the largest Claw,	6. 8
Height, - - - -	3. 4
Length of articulating surface along the cord of the arch,	1. 6
Breadth of the same, - -	1. 6

SMALL CLAW.

Length, - - - - -	6. 0
Height, - - - - -	2. 0
Length of articulating surface along the cord of the arch,	1. 1
Breadth, - - - -	1. 1

RADIUS.

Length without inferior head,	12. 6
Greatest width, - - -	3. 1
Thickness, - - - - -	1. 0

MOLAR TOOTH.

Length of the fragment, -	2. 3
Antero-posterior diameter, -	1. 4
Transverse, - - - - -	0. 8

HUMERUS.

From Big-bone-lick.

Length, - - - - -	19. 0
Greatest diameter of its shaft,	3. 0
——— of superior head, -	5. 5
Breadth of inferior head, about	9. 0
Long diameter of the foramen in the internal condyle, -	2. 0
Short or transverse diameter,	1. 0
Diameter of superior articulating surface, - - - - -	4. 0
Length of articulating surface of inferior head, - - - -	6. 0
Distance of the extremity of the internal condyle from the centre of the shaft, - - -	6. 0

HUMERUS

From Big-bone-cave, without epiphyses.

Length, - - - - -	12. 8
Diameter of the shaft, - -	2. 0

METACARPAL BONE

From Big-bone-lick.

Length, - - - - -	5. 0
Long diameter of anterior head,	2. 5
Short diameter, - - -	1. 5

SCAPULA.

	Inches.
Length of the spinal border not following its curvature, about	13. 0
Posterior border, - - -	9. 0
Anterior border, - - -	9. 0
Height of scapula from the centre of the spinal border, to glenoid cavity, about - -	11. 0
Length of glenoid cavity, -	3. 5
Transverse diameter, - -	2. 0
Height of the spinous process,	3. 0
Length of the acromion process,	3. 0
Breadth, - - - - -	1. 5

RIB.

Breadth of the head of the first rib,	3. 8
——— of articulating surface,	2. 3
Length of the false rib following its curvature, - - -	29. 0
Breadth, - - - - -	1. 5

VERTEBRÆ.

Height of a dorsal vertebra from the base of the body to the apex of the spinous process, -	7. 0
Diameter of the body, - -	2. 5
——— of the spinal canal,	2. 0

FEMUR.

Greatest breadth of the inferior head,	8. 6
Diameter of the internal condyle,	3. 0
——— external, - -	2. 0
Breadth of the rotuline surface,	3. 3

TIBIA.

Length, about - - -	10. 0
Transverse diameter of the superior head, - - - - -	6. 4
Antero-posterior diameter across the external condyle, - -	5. 0
Transverse diameter of the middle of the bone, - - -	2. 7
Antero-posterior diameter, -	1. 7

TIBIAL EPIPHYSIS.

Transverse diameter, - -	5. 3
Antero-posterior diameter, -	2. 7

OS CALCIS.

Length, - - - - -	5. 5
Height of articulating surfaces,	4. 0
Breadth of the same, - -	3. 3
Height of the body of the bone,	3. 0

Plate XII

Plate XIV

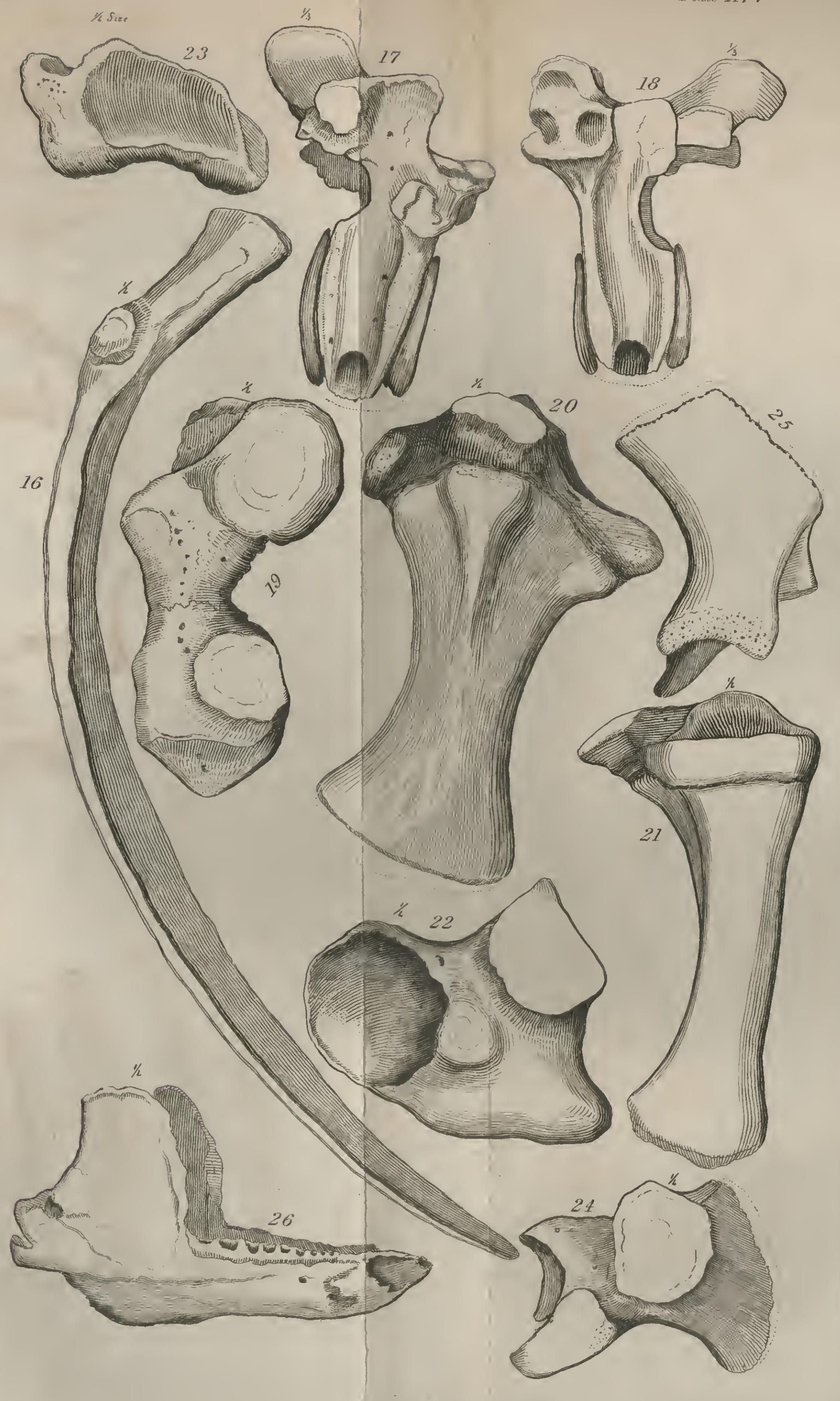


Plate XIII

Lehman & Duval Lith^rs Phila

Fig. 1 Clavicle of Megalonyx Fig. 2, 3 & 4 portion of the Jaw of the Megalonyx 5 6 & 7 a molar tooth

EXPLANATION OF THE PLATES.

PLATE XII. Fig. 1. Ungueal phalanx of the medius finger.
2. View of the inferior surface of the same.
3, and 4. Lateral views of the annular phalanx.
5. Radius, anterior view.
6. Radius, posterior view.
7. Molar tooth, external lateral view.
8. ————, internal lateral view.
9. Crown of the tooth.

PLATE XIII. 10. Humerus from Big-bone-lick.
11. Humerus from Big-bone-cave.
12. Scapula.
13. Metacarpal bone of the index finger, back view.
14. ———— anterior articulating surface.
15. First rib.

PLATE XIV. 16. False rib.
17. Posterior dorsal vertebra.
18. Lumbar vertebra.
19. Condyles of the Femur.
20. Tibia, posterior view.
21. Tibia, interior view.
22. Tibia, articulating surface.
23. Epiphysis from the inferior head of a Tibia.
24. Os calcis, articulating surface.
25. Os calcis, lateral view.
26. Inferior maxilla of a Bear.

PLATE XV. Jaws, teeth, and clavicle, of the Megalonyx laqueatus.

Description of the Jaws, Teeth, and Clavicle of the Megalonyx Laqueatus.

Desirous of examining the fossil bones, now in New York, in the possession of Mr. Graves, I proceeded there with my friend, Mr. Norris. Amongst others, I found a bone, which I had not seen before, and which is the first of the kind that has been described of this animal. I presume it to have been the clavicle of a Megalonyx laqueatus, lately described by me; as portions of this part of the skeleton of this species, were found at the same time and place. The individual of which the remains now described were a part, was older and larger than the one discovered at Big-bone-cave.

This clavicle* belonged to the left side, is long, flattened, and slender, curved somewhat like the human clavicle. The sternal extremity is thickened and hemispherical, where it forms the articulating surface: the scapular extremity is compressed, and furnished on the inner, or inferior surface, with strong tubercles for the attachment of ligaments. The anterior, or superior aspect of the sternal extremity, is marked by an arterial groove. The length of the clavicle is seventeen inches, the greatest circumference, four inches; the breadth one inch and eight-tenths; the greatest thickness, one inch.

The fragment† I am now about to describe, is a portion of the dexter lower jaw of the Megalonyx, containing four molar teeth; three of the crowns of these teeth are perfect, that of the anterior one is imperfect. These teeth

* Figure 7, plate 15.

† Plate 15, fig. 1, is a flat view of the Jaw, looking down. Fig. 2, the interior aspect. Fig. 3, the exterior aspect.

differ considerably from each other in shape, and increase in size from the front, the fourth and posterior tooth being double the size of the first, and more compressed laterally: it is also vertically concave on its external aspect, and vertically convex on its internal aspect; the interior, or mesial surface is strongly fluted, and it has a deep longitudinal furrow on the dermal aspect, in which respect it differs from the tooth of the M. Laqueatus, previously described by me,* of which the dermal aspect is uniform, but to which, in all other respects, it has a close resemblance. I suppose it therefore probable, that this last may have belonged to the upper jaw. The three anterior molars differ in shape and markings: they are vertically grooved, or fluted, on their interior and posterior aspects, a transverse section presenting an irregular cube. The length of the crown of the posterior molar is two inches; the breadth about five-tenths of an inch: the length of the tooth is three inches and six-tenths. The diameter of the penultimate molar is eight-tenths by seven-tenths of an inch. The length of this fragment of the jaw bone is eight inches and four-tenths; the height three inches and six-tenths: the length of the space occupied by the alveolar sockets, five inches and eight-tenths. The crown of the tooth presents no protuberances, but resembles that of the sloth; the roots are hollow.

There is also in Mr. Graves' collection, a tibia, nearly perfect, from the right leg: the segment of a flattened sphere, on which the external condyle of the femur moves, is rather more depressed, than in the specimen from Big-bone-cave. Other marks and peculiarities are observable on this bone, not found on that of the Megalonyx of Big-bone-cave, but they are probably due to a difference in the age of the individuals.

Of the remains of Mastodons in this collection, I shall

* No. 4, is the fluted surface; No. 5, the external, or dermal surface; and No. 6, the crown of that tooth.

only notice the recomposed cranium of an animal, not yet adult, but which appears nearly perfect. The tusks are of an enormous size, and there exists a very deep cavity immediately anterior and below the aperture for the anterior nares, for the lodgment or origin of the large muscles which moved the trunk. This cranium does not appear to differ specifically from that of a specimen in Peale's museum, New York, and which gave occasion to the too hasty proposal of a new genus, under the designation "Tetracaulodon," or "four tusked;" a name which would be more appropriately applied to the wild boar, the hippopotamus, and many other quadrupeds which are furnished with four tusks.

Os Ilium of the Megalonyx—from Big-bone-cave, White County, Tennessee.—Pl. XVI.

Among several portions of the skeleton of the Megalonyx, recently discovered in the above named locality, the only bone of this extinct animal, not heretofore obtained, is the *os ilium.*

Referring to the accompanying figure for a very accurate view of this bone, we need only remark, as a curious distinguishing feature, the acetabulum. This is divided into three distinct articulating facets, by a deep crucial groove, the superior facet being nearly double the size of the two inferior. These deep and strongly marked grooves denote the former attachment of very powerful round ligaments.

The observations of Dr. Troost on the locality of these fossils, render it quite probable, that all the bones of this animal, hitherto described as coming from *White Cave,* Kentucky, are in reality relics from *Big-bone-cave,* Tennessee.

Os illium of the Megalonyx.

Lehman & Duval Lith^rs Phila

Observations on the Fossil Bones found in the Tertiary Formation in the State of Louisiana. Originally communicated to the American Philosophical Society.

In conformity with a resolution recently passed by this Society, requesting me to describe the osteological fossil remains presented by Judge Bry, I have the honour to offer the following observations for publication in their Transactions. The fossils consist of several fragments of vertebræ, and one of immense size nearly perfect; together with specimens of the soil, and several osteological fragments too much mutilated to offer any descriptive characters.

For the local history of these fossils we are indebted to the following letter from the donor, addressed to our venerable President, Mr. Duponceau.

Philadelphia, July 12th, 1832.

Dear Sir,

I have the honour to present to you, for the Society over which you preside, some fossil bones, found on the Ouachita* river, in the state of Louisiana, at a distance

* As I spell the word Ouachita differently from the apparently adopted mode, it may not be amiss to explain why I think that my orthography should be retained. The etymology of the word is in one respect descriptive of the country. The word Ouachita is composed of two Choctaw words; to wit, *ouac*, a buffalo, a cow, horned cattle in general, and *chito*, large, pronounced *tchito*, bearing lightly on the initial *t*. It meant the country of large buffaloes, numerous herds of those animals having formerly covered the prairies of Ouachita. All the names, (now translated into French,) of *Riviere aux Bœufs*, *Bayou Bœuf*, have the same origin. These animals have disappeared before civilization, with the Indian tribes, whose principal support they formed. They never remain long within hearing of the repeated strokes of the axe, or of the voice of the white man. Nothing is left to remind us of them at *Ouachita*, but the sound of this name, which may serve to keep in remembrance the fact of their former undisturbed possession of the country. The common orthography, *Washita*, destroys this allusion, and means nothing in itself. By re-

(south) of about fifty miles by land, and one hundred and ten by water from the town of Monroe, in the parish of Ouachita, and in lat. 31° 46′ or 48′.

I regret that my very limited knowledge does not permit me to add to this offer such a dissertation on the subject as would be useful or even agreeable. A scientific memoir cannot be expected from one who has now spent the last thirty years of his existence literally in the remotest forests of Louisiana, whose life has during that long period been entirely devoted to agricultural pursuits, and who has consequently been deprived of all means of keeping pace with the progress of science; yet as I feel that it may be necessary to make you acquainted, as far as lies in my power, with the locality of these bones, I beg leave to submit the following observations.

It would be useless to offer more than a few casual remarks on the geology of Louisiana, which is better known to the Philosophical Society than to myself. That part of the state, beginning at the foot of the highlands of Baton Rouge, on the eastern side of the Mississippi, and at the hills in the parish of Cataouta to the sea, is evidently soil of comparatively recent formation. You are probably acquainted with the character of the different strata on which rests the lower part of Louisiana. A description of them has been published as they occur on the Bayou*

taining the mode of spelling which I have adopted, it may serve to show how languages the most remote may receive the phraseology of one another.

The first settlers at Ouachita were French hunters, who adopted, with that facility peculiar to their nation, not only the Indian mode of living, but, in some instances, their expressions. Thus they found the country named *Big Buffalo*, and they marked the different epochs of their lives by such expressions as these:—*l'année de la grande eau*, (1798); and *l'année de la grande ourse*, (1810), when thousands of bears crossed the country, emigrating towards the west.

* As the most important point in making ourselves well understood, is to attach to words a permanent meaning, conveying at once and correctly the ideas we wish to express, I beg leave to observe that I understand the word *bayou* to mean a stream which has little or no current; such as the *Bayou de Siard*, the *Bayou de la Mâchoire a l'Ours*, which are hardly any thing more than natural drains to the adjacent low lands. A *creek* I conceive to be a small stream running through the

St. John, near the city of New Orleans, where an enterprising gentleman (Mr. Elkins) undertook to bore for good water. He reached to the depth of two hundred and twelve feet, but endeavoured in vain to bore deeper. At that depth the soil appears to be of the same nature as the deposit now made by the Mississippi, the intermediate strata being various; but no shells were discovered except fragments of some *bivalves*, exactly similar to those now found in the Bayou St. John. Part of a crab was brought up by the augur, at a depth of one hundred and sixty feet; and, if my memory serves me aright, a piece of a buck's horn was also found.

The hills, beginning at Cataouta, extend north to the Arkansas river, and west to Red river, whence they spread to the Sabine. Through that tract of country are interspersed overflowed lands, varying in extent according to the magnitude of the creeks, of which they form the banks at low water, and which flow over them at high water. In these hills very few ores are found except those of iron, which are abundant in two different places; but no measures have yet been taken to ascertain their value. The highest of the hills do not exceed eight hundred feet above high water mark; and in many places they dwindle into gently rolling ground. These hills appear to be of a much more ancient formation than the lower section of Louisiana. No rocks, however, enter into their composition; but a few sandy stones and pebbles, nearly all *siliceous*, are occasionally seen scattered on their summits, or in the beds of the numerous creeks fed by springs issuing from them.

Sea shells are discovered in several places; I found them on the highest ridge which divides the waters running into Red river from the tributary streams of the

hills and highlands with a brisk and continued current, and emptying itself into the bayous, rivers, or overflowed lands. These two expressions are thus generally used in the upper parts of Louisiana.

Ouachita. The tract, by far the richest in calcareous substances, is the one within the limits where fossil bones have been found, extending about fifteen miles from north to south, and probably ten or twelve from east to west. Several years ago, while rambling among these hills, I met with a small creek, the banks of which are in some places thirty feet high, in which I found many different species of sea shells, among others, *pectenites*, *belemnites*, &c. At the same time, my attention was attracted by a quantity of *cornua ammonis*, the largest of which did not exceed an inch and a half in diameter, while many were much smaller.

The hill, in which the bones herewith presented were found, is within the limits above described, at a distance of not more than two hundred yards from the Ouachita river. About three years ago, after the occurrence of a long spell of rainy weather, a part of the hill slid down near to the water's edge, and thereby exposed twenty-eight of these bones, which had been until then covered by an incumbent mass of earth about forty feet thick. They were imbedded in a bank of sea marl, a specimen of which is added to the bones, as well as of the calcareous spar and *talc* also found in the same hill. I followed a horizontal vein of this marl, five or six inches thick, which I traced to a distance of about forty feet, when it sinks into the valley under an angle of from twenty-five to thirty degrees. It appeared to have effloresced where it had been long exposed to the influence of the atmosphere.

When these bones were first seen, they extended in a line, which, from what the person living near the place showed me, comprised a curve, measuring upwards of four hundred feet in length, with intervals which were vacant. The person referred to destroyed many of the bones by employing them instead of andirons in his fire-place, and I saved what remained from the same fate. I think, however, that a great many more bones belonging to the same animal are yet covered, and will gradually appear, as the soil and marl shall be washed off by the rain.

If I might presume to express an opinion as to the animal to which these bones belong, I should venture to say that they were part of a sea monster. The piece having the appearance of a tooth, which I gathered myself on the spot, may assist in determining that point. To you, Mr. President, and to your learned colleagues, who are so fully adequate to the task, I cheerfully relinquish the solution of this problem, as well as the determination of the epoch of our globe when the animal existed. Accept, my dear sir, the expression of my great regard for yourself, and of my sincere wishes for the prosperity of the useful institution over which you preside.

Your friend and obedient servant,

H. BRY.

P. S. Duponceau, Esq.

President of the Philosophical Society, Philada.

The geological formation in which these bones occur is evidently tertiary, similar to that extensive belt which characterizes our Atlantic borders. The piece of "sea-marl" alluded to in the above letter, is a conglomerate mass of small marine shells, consisting principally of an extinct species of Corbula, about to be described by Mr. T. Conrad, who has met with a similar formation, including the same shells, in Alabama. Most of these shells are comminuted; a few however are perfect. On the upper surface of the mass, there remains a stratum of clay, half an inch in thickness, inclosing pieces of crystallized carbonate of lime. The portion noticed by Mr. Bry as displaying the appearance of a tooth, does in reality possess considerable resemblance in size and form to the teeth of some of the fossil Saurians; but, on closer inspection, it is recognisable as a portion of the cast of a Pinna, with some of the shell still remaining attached to its base.

The principal fossil which forms the subject of this paper, consists of a vertebra of enormous dimensions, possessing characters which enable us to refer it to an extinct genus of the order "Enalio-Sauri" of Conybeare, which includes numerous extinct genera of marine lizards or crocodiles, generally possessing gigantic proportions, which have hitherto been found only in the sub-cretaceous series, from the *lias* up to the weald clay inclusive, in England, France, and Germany, and in the supposed equivalent formations in North America. The animal to which the present remnant belonged, existed at a period more recent than that of any of its congeners hitherto discovered; the formation in which it occurs being generally referrible to a geological epoch more recent than any of the oolitic series.

We have compared our fossil with the following genera: —Mosasaurus, Geosaurus, Megalosaurus, Iguanadon, Ichthyosaurus, and Plesiosaurus; from all of which it appears to be generically distinct; though it bears a closer analogy to the vertebræ of the last named species than to any other. The length of the axis of the bone is twice its diameter, being fourteen inches long and seven inches broad. Its sides are slightly concave in the middle, and the weight of the single vertebra is forty-four pounds. Allowing this individual to possess as many vertebræ as the Plesiosaurus, that is sixty-six, without those of the tail, the weight of the whole fossil skeleton may be fairly estimated as exceeding two tons; even supposing each vertebra to weigh only thirty pounds instead of forty-four, and calculating the weight of the head, extremities, pelvis, and tail to be collectively but a little heavier than the spine alone.

Judging from the position and descending obliquity of the transverse apophyses, and the small size of the canal for the spinal marrow, this vertebra must be referred to the posterior part of the column, most probably to the lumbar region. This opinion is strengthened by the coalition of the two foramina or fossæ, which characterize the *inferior* aspect of the vertebræ of the *posterior* part of the column in the spinal bones of the *Plesiosaurus*;* in which respect these portions of the two fossils closely resemble each other. They are also similar in the *planes* of the articulating surfaces of the bodies of the vertebræ; but our fossil differs totally from the same portion of the Plesiosaurus in its proportions, the vertebræ of the latter being broader than long, whereas the present specimen is twice as long as it is broad. All the superior apophyses of the Plesiosaurus are attached by suture to their bodies; but there are no marks of such a structure in our fossil. In the Plesiosaurus, the ribs are articulated with the distal extremities of the transverse processes by a single tubercle. Reasoning analogically, the same arrangement may be referred to the species under consideration, the size of which is immensely superior to that of any of the Saurian or Cetaceous tribe whatever. Judging from relative proportions, the Megalosaurus did not attain to more than forty feet in length; the Iguanadon of Mr. Mantell did not exceed sixty feet; but the individual now produced could not have been less than from eighty to one hundred feet long. According to the statement of judge Bry, there were four hundred feet in extent, nearly in a linear direction, marked by these fossils in the soil, which undoubtedly include the remains of several individuals. If future discoveries of the extremities (paddles) and of the jaws and teeth of this reptile, should confirm the indications I have pointed out, we may suppose that the genus to which it belonged, will take the name, by acclamation, of "BASILOSAURUS."

* All the vertebræ of the Plesiosaurus are characterized by two foramina on their inner aspect, which approach each other as we descend the column, until at last they form but one hole with a septum.

Description of the Ichthyosaurian Remains recently discovered in the State of Missouri.

For the interesting specimen which forms the subject of the present memoir, I am indebted to the politeness of Major N. A. Ware, who obtained it from a trader, with the information contained in the following attached label:—"'A trader from the Rocky Mountains, on his return, near the Yellow-stone knobs, or hills, observed, in a rock, the skeleton of an alligator-animal, about seventy feet in length; he broke off the point of the jaw as it projected, and gave it to me. He said that the head part appeared to be about three or four feet long."

The fossil fragments consist of anterior portions of the upper and lower jaws. The form of the intermaxillary bone, the structure of the teeth, and the mode of dentition, characterize the animal to which these bones belonged as a species allied to the extinct genus Ichthyosaurus; and afford us the first indication of the existence of this genus of lost animals on the continent of America.

Future discoveries will no doubt demonstrate that our country, already rich in fossil reliquiæ, possesses numerous species of fossil Saurians, those extraordinary inhabitants of a former state of our planet, which sported on the bosom of the ocean, or enlivened the shores of primordial waters, ere yet the "lord of the eagle eye" had scanned the creation, or waved his magic sceptre over the beasts of the earth. Strange, indeed, are the forms, structures, and habits of those beings with which geological researches are making us acquainted: in the beautiful and sublime at least, the pre-adamitic *Fauna* and *Flora* are as yet unsurpassed by those of the present day. Cuvier remarks,—the Ichthyosaurus has the snout of a dolphin, the teeth of a crocodile, the head and sternum of a lizard, the extremities of a whale, and the vertebræ of a fish; whilst the Plesiosaurus has, with the same cetaceous extremities, the head of a lizard, and a neck resembling the body of a serpent.

The remains of four or five species of the Ichthyosaurus have hitherto been discovered in England, France, and Germany. In England their remains have been found from the new red-sandstone even up to the green sand, which is immediately subjacent to the chalk. They consequently belonged to almost all that epoch of secondary formations, commonly known by the name of Jura formation; but it is to the blue-gray limestone, called *lias* by the British geologists, that we are to look for the greatest abundance of these organic remains. In the fragments from Missouri, consisting of the snout, or anterior portion of the upper jaw, the intermaxillary bone is strongly marked by sutures which separate it from portions of the maxillary bones, beyond which it extends nearly two inches anteriorly. The nostrils in this genus being placed near the eyes, the intermaxillary is consequently without perforations for nostrils, and displays a remarkably dense structure; its greatest breadth is two inches. It is perforated by several rather large foramina for the transmission of blood-vessels, and contains four incisor teeth, two on each side, broken off on a level with their sockets. The portions of maxillary bones attached, contain three teeth on each side, all equally broken off at the socket; thus making in all ten teeth in a space of alveolar processes four inches long—the total length of the fragment. The alveoles are perfectly distinct, and consist of circular osseous elevations, in the cavities of which the teeth are firmly fixed. The enamel is thick, brittle, and of a jet black colour; the cavities of the teeth are for the most part filled with spath and quartz. The truncated surface of the posterior portion of the fragment displays the mode of dentition, where the young tooth, also hollow, is observed to project its point on the inner side of the root of the old tooth; the root of which it destroys by pressure during growth, and which falling, allows the young tooth to take its place, the point of the young tooth always cutting the gum on the inner and posterior part of the old tooth. On the inner and posterior part of the anterior left incisor, is observed the conical point of a young tooth, projecting in such a manner as to render a new socket necessary for its future accommodation.

All the natural vacuities of these bones are filled with the matrix or rock in which they occurred, which consists of a dense blue-black argillaceous limestone, effervescing with weak acids, and not unlike the matrix containing the bones of the Ichthyosauri from the lias of England. Beautiful and rich specimens of these fossils are contained in the cabinet of Mr. G. W. Featherstonhaugh of this city. This fragment of jaw is four inches long, two inches eight-tenths broad, and two inches in depth at its truncated part. It remains to notice the fragment of lower jaw of the left side, of equal length with the upper portions, and one inch two-tenths in thickness, containing the remains of five teeth, broken, and partially covered with the matrix. The exterior surface of the bone is finely scabrous, or marked by the attachments of the skin, and displays numerous foramina for the transmission of nerves and blood-vessels. Near the base of the inner surface is a deep longitudinal canal, which probably extended the whole length of the jaw. From an experiment made by placing a portion of these fossils in a dilute solution of muriatic acid, the whole mass would appear to be soluble; thus denoting the loss of the animal constituent of the bones.

The above considerations enable us to pronounce with certainty on a fact, in itself interesting to the geologist, viz. the existence of the remains of an Ichthyosaurian genus in the secondary deposits on the banks of the Missouri river. In the present stage of the investigation it is probably premature to pronounce with equal certainty on specific distinctions; yet the magnitude of this skeleton, being thrice the size of the largest of the species yet described, and the geographical position of the fossil, seem to indicate such distinction. On comparison of the teeth of the present species with those of a fine specimen of the head of the largest species, the *I. communis*, in Mr. Featherstonhaugh's collection, peculiarities were observable.—It is highly probable that future discovery will throw more light on this interesting subject, as the present skeleton would appear to be not the only one exposed to view in the valley of the Missouri; and, judging from the zeal, ardour, and scientific acumen with which such researches are prosecuted at the present day in all quarters, we may hope that the era of their resuscitation is not remote. To the Mosasaurus, Geosaurus, Saurocephalus, and fossil crocodiles, the Ichthyosaurian and typifications at least of the Plesiosaurian genus may now be added to this department of the fossil Fauna of North America.

It is not improbable that Lewis and Clarke, in their Expedition up the Missouri, allude to the remains of a similar animal in the following extracts. "Monday, September 10th, 1804, we reached an island (not far from the grand detour, between Shannon creek and Poncarrar river,) extending for two miles in the middle of the river, covered with red cedar, from which it takes the name of *Cedar Island;* just below this island, on a hill, to the south, is *the back-bone of a fish forty-five feet long, tapering towards the tail, and in a perfect state of petrifaction,* fragments of which were collected and sent to Washington. On both sides of the river, are high, dark-coloured cliffs"—Vide Lewis and Clarke's Exp. ed. 1814, vol. i. p. 69. Again, on descending the Yellow Stone river:—"The north side of the river, for some distance, is diversified by jutting romantic cliffs; these are succeeded by rugged hills, beyond which the plains are again open and extensive. After enjoying the prospect from this rock, to which captain Clarke gave the name of *Pompey's Pillar,* he descended and continued his course; at the distance of six or seven miles he stopped, and while on shore, he saw in the face of the cliff on the left, about twenty feet above the water, a *fragment of the rib of a fish, three feet long, and nearly three inches in circumference, incrusted in the rock itself.*"—Ibid. vol. ii. p. 358.

It has already been stated, that the fossils which we have described were obtained near the junction of the Yellow Stone and Missouri rivers. Should the fossils noticed in the above extracts, prove to be of a similar nature, the fact will display a formation extending from three to five hundred miles in a direction east and west, and north and south.*

The subject of the present memoir was originally described in the Trans. Am. Philos. Soc. under the name of Ichthyosaurus Missouriensis.

* Since writing the foregoing essay, the author has enjoyed a more extensive field of observation, in the examination of the numerous and magnificent collections in every department of natural science, both in Great Britain and in France. He has satisfied himself that the Missouri fossil (I. Missouriensis) must be arranged as an extinct genus altogether new, characterized, more particularly, in the fragment in question, by the extreme length, breadth, and projection of the intermaxillary bone, in which it presents a marked difference from any species of the genus Ichthyosaurus, and approaches, in a slight degree, animals of the Batrachian order.

EXPLANATION OF THE PLATE.

Fig. 1.—View of the superior surface of the anterior extremity of the snout of the "*Ichthyosaurus Missouriensis.*"
Fig. 2.—The fractured surface of the same.
Fig. 3.—Palatine surface of the same.
Fig. 4.—Lateral view of the same, external surface.
Fig. 5.—Internal lateral view of the anterior extremity of the inferior maxilla.
Fig. 6.—Fractured extremity of the same.


Fig 1
Fig 2
Fig 5
Fig 3
Fig 4
Fig 6

Description of the remains of the "Basilosaurus," a large fossil marine animal, recently discovered in the horizontal limestone of Alabama.

In the Transactions of the American Philosophical Society for 1834, will be found the description of an enormous fossil vertebra, presented to the Society by Judge Bree, from the "marly" banks of the Washita river, Arkansa territory. We there ventured to refer this bone to the vertebra of a large extinct Saurian, of a nondescript genus, and proposed to name the animal provisionally "Basilosaurus."

Accompanying this vertebra, was a mass of the matrix which enveloped the fossil, and contained fossil shells, which Mr. Conrad referred to the genus Corbula, and to a species found plentifully in the Alabama tertiary deposits. Regarding our opinion then expressed, as to the geological age of this marly deposit, our subsequent information furnishes no fact either to confirm or to disprove it.

In the course of last autumn, Mr. Conrad received specimens of fossil vertebræ, fragments of lower jaw, &c., from Alabama, about thirty miles north-west of Claiborne, which resemble, in all essential particulars, that previously described in the American Philosophical Transactions, as above noticed. These fossils occur on the plantation of the Hon. John G. Creagh, Esq., in a limestone rock, of so solid a structure as to render blasting requisite in order to obtain the bones, which are consequently much broken —scarcely a single specimen having been obtained perfect.

Soon after the receipt of these bones, above noticed, Mr. J. P. Wetherill joined me in the determination of investigating the new locality of this highly interesting fossil animal. We accordingly communicated our design to the Hon. Mr. Creagh, requesting that he would use every exertion to procure us during the winter season a collection of these curious remains; noticing, at the same time, that the jaw, the teeth and long bones were more peculiarly desirable. Mr. C. in the most liberal manner honoured our request in paying immediate attention to our demands, and this with the sole purpose of contributing to the advancement of science—the different parties being strangers to each other. We take this opportunity of offering that gentleman, in the name of all votaries of science, our warmest thanks.

The box received on this occasion contained the following named specimens: viz. A portion of the upper jaw of the right side, with several teeth, more or less perfect, all nearly buried in the matrix of limestone with which the bones are intimately incorporated (the rock is of a dull white colour, the bones of a brownish cast tinged with reddish); an os humeri, fractured transversely near the distal extremity, but in other respects nearly perfect (this bone is of a greyish-black colour); several immense vertebræ, with three or four of much smaller dimensions, and of different proportions; one isolated molar tooth, which was with difficulty separated from the mass; numerous pieces of ribs, both true and false; the inferior extremity of a tibia, and some fragments of solid bones, apparently portions of the shoulder and pelvis. From a similar rock in the vicinity of the bones were also obtained and forwarded, casts of a Nautilus, of a species peculiar to this formation (N. Alabamensis, Morton); a new species of Scutella (S. Rogersi, M.); and also the cast of a Modiolus, of a nondescript species, described and figured by Mr. Conrad in the first volume of the Transactions of the Geological Society of Pennsylvania; together with some fossil teeth of the Shark.

Further north in the same state, from a place called Erie, in a limestone somewhat similar, but of a formation which Mr. Conrad considers to underlie the above named rock, and of a less recent date, being equivalent to the green sands of New Jersey, I had previously received, through the politeness of Colonel Long, of the U. States Engineers, a fine specimen of the caudal vertebra of the Mosasaurus or Maestricht Monitor, together with numerous Shark's teeth, similar to those found in the New Jersey green sand.

All the bones are alike totally destitute of animal matter, and are entirely destroyed and reduced to muriate of lime by the addition of weak muriatic acid; they differ from the rock only in colour; the pores occasionally contain casts of small marine shells.

We take it for granted that all the bones obtained from the same spot, and almost in contact with each other, constitute portions of one species. The great disparity in their proportions and size, presents a remarkable feature in the structure of this animal; so much so, indeed, that we were at first inclined to refer the large and small vertebræ to different species: and bearing in view the form and structure of the teeth only, we should have been inclined to rank the animal among the marine carnivorous quadrupeds; but a careful examination of other portions of the skeleton, and especially of the lower jaw, which is *hollow*, forbids this arrangement, and appears to force it to take its station among the Saurian order, as a lost genus.

We understand from Mr. Conrad, that he was informed by Mr. Creagh, that on his first settlement in that portion of the country, a train of vertebræ belonging to this animal, was observed on the surface of this rock, extending in a line much over 100 feet in length. This statement agrees with that made by Judge Bree; 150 feet in length being attributed by the observers to the Arkansa skeleton. The comparative smallness of the bones of the extremities or fins, constrains us to look to the tail of the animal for the principal organ of locomotion of this huge mass.

Place in the geological series—most recent of the cretaceous group. Mr. Conrad considers this horizontal limestone rock of Alabama as more recent than the true chalk of Europe, and even as occupying a place anterior to the Maestricht beds. For the accurate and beautiful drawings illustrative of these fossils, we are indebted to the skill and kindness of our friend Richard C. Taylor, Esq. who liberally offered his services "con amore" when his time was most precious to him. Such accurate illustrations obviate in a great measure the necessity of minuteness in written details.

Superior maxilla. Pl. 26, fig. 1.

This fragment constitutes the most important portion of the new fossil animal hitherto brought to view; it consists of a considerable portion of the upper jaw of the right side, containing four teeth more or less fractured, together with the sockets of two others; these, like most of the bones, are of a light brown colour slightly tinged with red; they are so extremely brittle, and so intimately consolidated and incorporated with the rock, as to render their separation almost impracticable. That portion of the palate bone remaining is nearly on a level with the alveoles; the side of the jaw presents a doubly concave surface, that is, concave from above downwards, and from before backwards; the superior border is convex posteriorly, and slightly concave before: this bone is unusually thin, and at the alveoles barely sufficient to accommodate the roots of the teeth. Pl. 24, fig. 2, displays these portions: A, the palate bone; B, the thickness of the side of the maxilla.

The teeth present a remarkable structure, and as far as my observations go are peculiar to the present species:

No 1. Lateral view of the anterior portion of the Upper Jaw bone of the Basilosaurus No 2. Crown surface of one of the Molar teeth No 3. Lateral view of a Molar tooth. No 4. Lateral view of letter E. Fig. 1. No 5. Anterior view of a lumbar vertebra. No 6. Os humeri of the Basilosaurus

of the four remaining teeth in this jaw no two resemble each other. The first in the existing series, or third from the anterior portion of the jaw, is conical in form, and was covered with a thin layer of enamel, presenting a crenulated surface, a small portion of which still adheres on the anterior portion of the crown; pl. 26, fig. 1, *e*. Fig. 4 is a view of an isolated molar. All the teeth appear to have been similarly enveloped in enamel: the roots are also remarkable both in length, form, and curvature, descending two and a half inches into the socket, and projecting one inch above the alveoles before they are united by the body of the tooth. Pl. 26, fig. 1, *f*, this is also a double tooth, yet totally dissimilar in form to the last; the outer surface is fractured, but the posterior part of the crown retains its natural form. Not the least appearance of enamel is observed passing into the body of the tooth: that it was covered with enamel is evident from the examination of a similar isolated tooth from the opposite jaw, in a better state of preservation, and the crown of which being weather-worn, enables us to present an outline of the enamel near the crown of the tooth; pl. 22, fig. 2. The whole tooth is also represented at fig. 3. Posteriorly to this double tooth, in pl. 22, occur two single teeth with each one separate root; their original contour, especially towards their crowns, has been destroyed by fracture.

Anteriorly to the first or conical double tooth, the fossil jaw has been fractured transversely; it contains the socket for one double molar; pl. 26, *b* and *c*; and another anterior or canine tooth of considerable comparative size; pl. 26, *a*. Directly above this tooth, imbedded in the limestone which encloses the inner portions of this fragment, is observed a portion of bone, which most probably formed part of the intermaxillary bone. Letter *d* points to a vacancy occurring between the second and third teeth.

At pl. 26, fig. 3, there is an anterior view of this portion of jaw.

Dimensions of the various portions constituting this fragment:—

	Inches.
Total length of the fragment of upper jaw, . .	15
Greatest width posteriorly, from the base to the alveoles,	5
Which gradually tapers anteriorly, to . . .	2
Thickness of the side of the maxilla, . . .	2.5
Thickness of the palate bone, ...	0.7
Height of the largest double tooth, ...	2.6
Greatest width of do., ...	3
Height of the root projecting above the socket, . .	1
Single teeth, height, ...	3
Breadth of do., ...	1
Length of the socket which contained the canine, .	2.3
Breadth of do., ...	1.3
Height of conical double tooth, ...	2.3
Breadth of do., ...	2.7
Depth of root descending into socket, . . .	2.5

Inferior maxilla. Pl. 27, fig. 1.

General aspect of the lower jaw, compressed or subcylindrical, the shaft being hollow, and the cavity in the fossil filled with the matrix or limestone; the solid portions of the bone varying from a fourth to half an inch in thickness, with the exception of the alveolar portion, which is thicker. External or dermal aspect of the jaw slightly convex, in the direction of its axis, scabrous and weatherworn. The inner or mesial aspect displays the smooth and natural appearance of the bone, excepting a portion of the posterior extremity, which is scabrous and exfoliated; this surface is slightly concave in the direction of its axis, and marked with several foramina, for the transmission of vessels and nerves; basal surface, solid and rounded; dental aspect of the bone varying from one inch

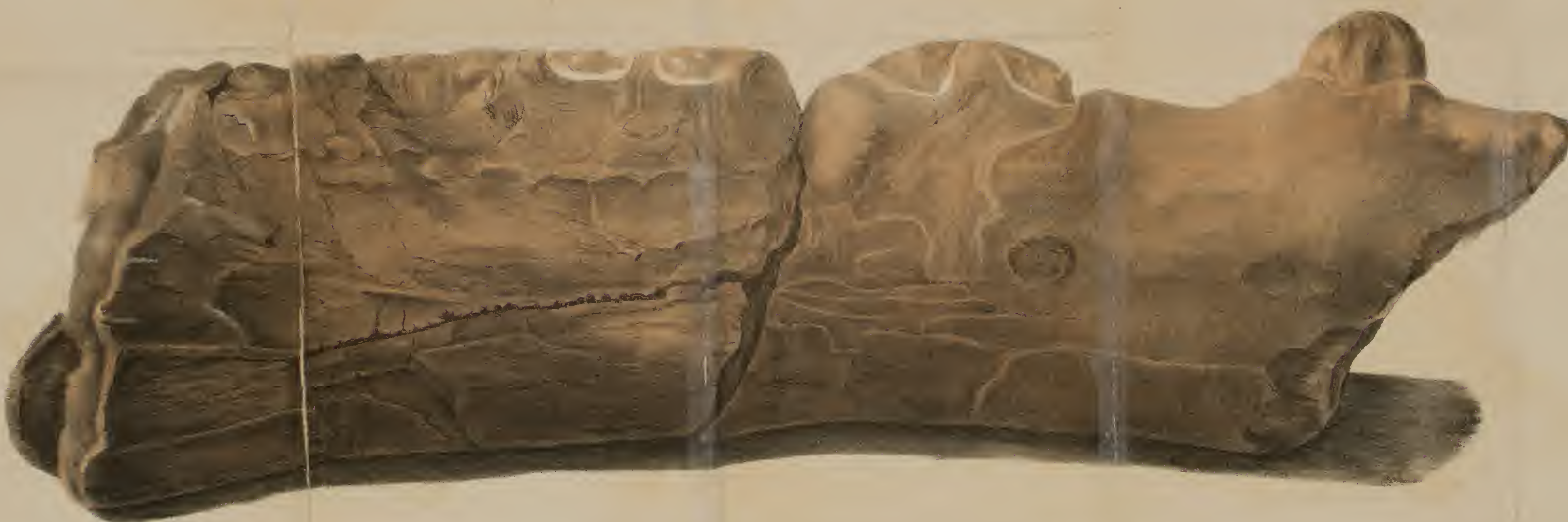
PL. XXVII.

Fig. 3

Fig. 2

Fig. 4

Fig. 1



No. 1. Lateral view of the anterior portion of the Lower jaw bone of the Basilosaurus. No. 2. Spinal extremity of a Rib. No. 3. lateral view of the inferior extremity of the Tibia. No. 4. Anterior view of one of the smaller vertebra of the Basilosaurus

[illegible] by R. C. Taylor

[illegible]man & Duval lith.

and a quarter, to one and six-eighths inches in thickness, marked with a longitudinal depression or groove, for the lodgment of vessels and nerves, exterior to the sockets; total length of this surface seventeen inches, containing four sockets, and part of a fifth, all with remains of teeth more or less fractured and destroyed; the four posteriorly situated are the remains of double molars, similar to that displayed in pl. 26, fig. 1, *f*. Anterior to the first molar, a vacant and depressed curved space occurs, and then a pyramidal rising of the alveole, which contains a canine tooth, pl. 27, fig. 1, which has been fractured on its exterior and superior aspect, and from the internal surface of which the enamel has scaled; another vacant space follows this tooth to the anterior fractured extremity of the bone; the portion of tusk remaining is one inch in height, and one and a half inches in breadth at base. The fragments of the molars vary from two and a half inches to two and six-eighths inches in length, and from half an inch to six-eighths of an inch in breadth on the fractured surfaces.

The bone being fractured both anteriorly and posteriorly, leaves us at a loss to estimate the total length of the jaw, and consequently, the total number of teeth.

Dimensions.—Total length of this fragment eighteen inches; height posteriorly, five inches—anteriorly, four inches; breadth posteriorly, two and a half inches—anteriorly, rather less than two inches.

Vertebræ.

These are from different parts of the column. Great discrepancy is observable in their relative proportions and size; and they are more or less imperfect; but all agree in having the transverse apophyses given off on a level (or nearly so) with the basil or inferior aspect of the body of the bone, and descending obliquely, so that the distal extremity of these processes is inferior to the base of the bone. All the vertebræ have the inferior aspect of the body marked with one or two blind foramina, according to the portions of the column to which they belonged—as in the vertebræ of the Plesiosaurus. Pl. 26. fig. 5, represents the transverse processes and a portion of the spinal canal, one half the size of nature. This specimen, like several others, has been fractured transversely in two places, so that one-third anteriorly, and one-third posteriorly, to the transverse process, have been lost. All the large vertebræ display a disposition to fracture at these parts, which arises, doubtless, from the existence of three several points of ossification, dividing the bone transversely, previous to ossification, into three separate portions. The present specimen is from the lumbar region, and measures eight inches by nine in diameter; width of the spinal canal, nearly three inches.

Pl. 28, fig. 1, represents another vertebra of the natural size, and as it presents no mark for the attachment of a rib, must also be referred to the lumbar region; it is nearly as long again as it is broad, being in total length twelve and a half inches, and not exceeding seven inches in diameter, and is nearly cylindrical, excepting in the vicinity of the processes. The blind foramen is almost obsolete. The spinous process has been elevated, contorted, and fractured, by the pressure of the rock, when forced in whilst in a semi-fluid state, and which now occupies the place of the spinal marrow.

Ribs. Pl. 27. fig. 2.

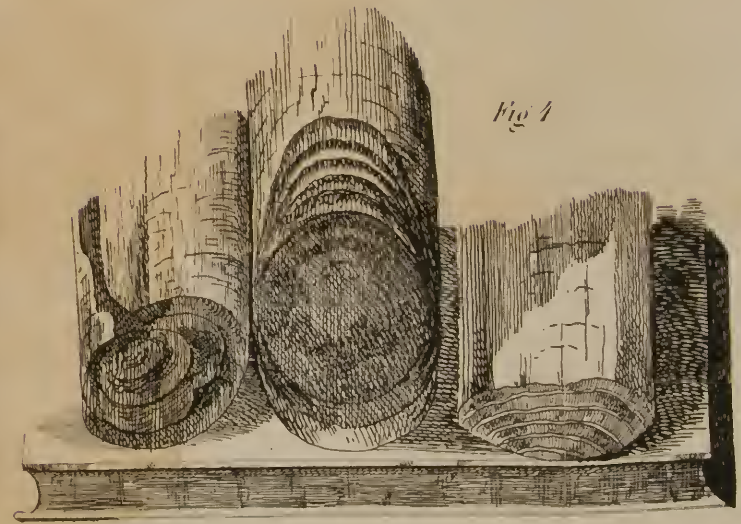
The most numerous portion of our collection consists in fragments of ribs, not one of which even approaches to perfection; the spinal extremities, or articulating surfaces, exist in very few of them; these serve, however, to demonstrate an attachment both to the bodies and transverse apophyses of the vertebræ.

Fig 1

Fig 2

Fig 3

Fig 4



N°1. Lumbar vertebra of the Basilosaurus N°2. Fractured extremities of A, the Palate, and B, the superior moxillare bones. N°3. Dental surface of the Anterior extremity of the superior moxillare bone. N°4. Fractured extremities of three ribs.

Drawn by R. C. Taylor

Lehman & Duval Lith^rs

These bones are more or less cylindrical, although occasionally considerably compressed, and like the ribs of most marine animals, are destitute of cellular structure. In some instances they appear to the naked eye quite compact and solid; but the variously fractured surfaces of others display a peculiar structure, the whole cylinder being composed of eccentric laminæ: this appearance is accurately represented, pl. 28, fig. 4. The diameter of the largest specimens does not exceed three inches.

There are a few spinal extremities of the false ribs; sometimes with single, at others with double articulating facets. The shafts of these are considerably curved.

Humerus. Pl. 26. *fig.* 6.

One arm bone, which constituted a portion of this skeleton, possesses unique characters. The complexion of this bone is of a much darker tint than the other bones, owing probably to its accidental position in the rock. The head, neck, and tubercles of this bone bear a striking analogy to those parts in the human skeleton. Its shaft is depressed, and particularly so as you depart from the proximate extremity, for two-thirds the length of the bone, where it is flattened, and produced outwards, to form a large depressed external condyle, when the bone becomes more cylindrical, and gradually attenuated laterally to the distal extremity, which terminates in a ginglymus articulation. The structure of this portion of bone leaves no doubt that the superior extremity of this animal assumed the form and functions of a fin or paddle; but a remarkable feature in this bone, is its extreme smallness in proportion to other portions of the skeleton, which renders it certain that the animal was incapable of progression on land, and refers to the tail as the chief means of locomotion.

Dimensions.—Total length, sixteen inches; circumference immediately below the neck, eleven and a half inches; depth at the same place, three inches; breadth, four inches; breadth taken at the external condyle, five and a half inches. The extreme accuracy with which this bone has been represented, renders further detail unnecessary.

Tibia. Pl. 27, *fig.* 1.

We have represented a portion of the long bones of the extremities, five inches in length, which can be referred to none other than the inferior extremity of the tibia: like the same bone in the human subject, it enlarges near its distal extremity, and is furnished with an internal and external malleolus. The tarsal articulating surface is small, and appears more adapted for the connexions of a foot than a paddle. This bone is of a solid structure, leaving but a small cavity in its centre for a medullary canal. Greatest circumference, seven and a half inches.

The collection in the cabinet of the A. N. S. includes a portion of the head of a femur, the circumference of which, in the antero-posterior direction, was, before fracture, twenty inches; transverse circumference, thirteen inches. A very small portion of the neck remains attached.*

* A letter has just been received from the Hon. Mr. Creagh, dated May 29th, 1835, announcing the discovery and partial disinterment of another skeleton of the Basilosaurus; and assuring us of his determination to forward a large collection of these remains during the ensuing winter.

Observations on the Fossil Elephant Teeth of North America.

Having been latterly employed in the examination of fossil Elephant teeth found in different parts of the United States, I trust the following observations will not be uninteresting to naturalists.

For a full description of the distinctive characters of fossil Elephant teeth, I must refer to Cuvier,* who has treated the subject in detail: I have here only to state, that this naturalist concludes that the fossil Elephant resembles the Asiatic more than the African, yet is specifically distinct from either, which is proved. 1. By the plates being thinner, and consequently more numerous in a similar space, in the fossil teeth. 2. The lines of enamel which separate the layers of the plates are thinner and less scolloped in fossil teeth than in others.

These, together with corresponding differences in the jaws and cranium, M. Cuvier thinks sufficient to establish the fossil as a distinct species. The only exception to these rules, he continues, is presented by a tooth disinterred near Porentrui, in the department of Upper Rhine, in which specimen the plates are still larger than in the other fossil teeth.

Thus far M. Cuvier's description corresponds pretty accurately with those fossil teeth of the United States, which I have observed, with the exception of a remarkable variety from the western part of the state of Pennsylvania, of which I shall speak more particularly hereafter. Of those I have examined, ten specimens belong to the Museum of the Philosophical Society; three to the

* Des Animaux Fossiles, tom. 2.

Philadelphia Museum; one to the Cabinet of the Academy of Natural Sciences, Philadelphia. The first are of various sizes, and of different ages, and were found in Kentucky, North and South Carolina, and Ohio. The second are old teeth, one of them from the Santee canal, S. C. Third, a young tooth from South Carolina.

Fig. 1st, is the tooth just mentioned as remarkable; it is an old tooth of the upper jaw, the grinding surface seven inches in length, is no wise scolloped, as is common; the layers of enamel and cement being very indistinct. A space of five inches of grinding surface, contains thirteen plates, and fourteen layers of cement. The greatest diagonal length of the tooth is eleven and a half inches.

Fig. 2d, is from Santee canal, S. C., a lower jaw tooth; grinding surface nine inches in length, five inches of which contains six plates, and seven layers of cement; greatest diagonal length, fourteen and a half inches.

One specimen in the Museum of the Philosophical Society, of the upper jaw, nearly resembles that represented by fig. 1st.

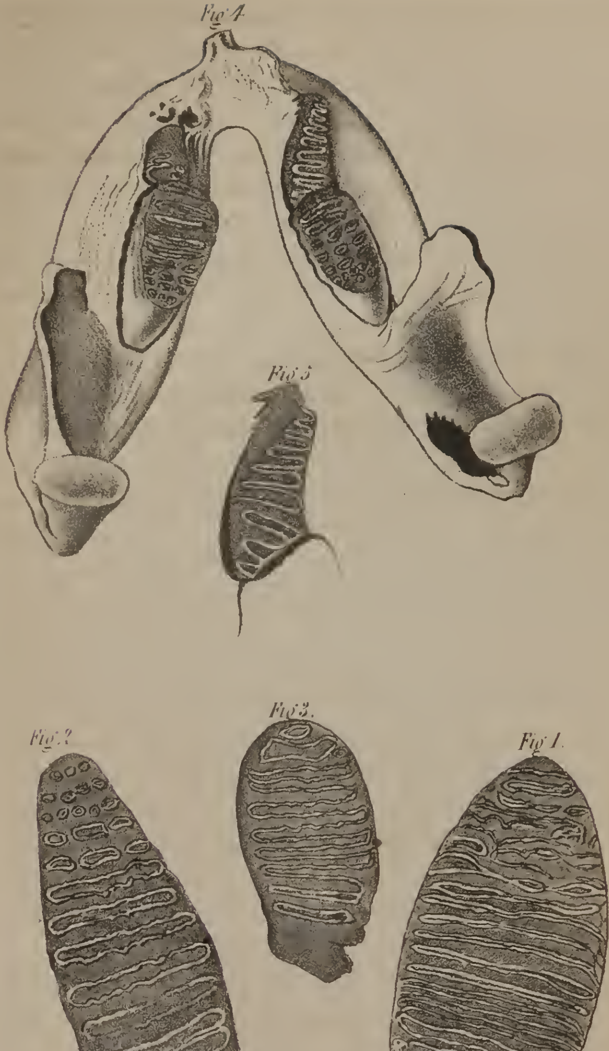
A fossil elephant tooth was lately presented to the Academy of Natural Sciences, with a portion of the cranium, from Santee canal, S. C., with an arrangement of enamel somewhat remarkable. The enamel, instead of being arranged in distinct plates, is continuous, passing from one plate to the other, at the inner margin; which can be better understood by referring to fig. 3.

A similar peculiarity is described by Parkinson* as occurring in three specimens of fossil teeth of elephants, which induced this oryctologist to refer them to a distinct species.

But that this peculiar arrangement of enamel is a mere deviation from the natural structure, and by no means characteristic of a distinct species, will at once be acknowledged by reference to fig. 4, where the same variety is

* Vide Vol. III. foss. organ. rem. p. 346.

Pl. 29



Fossil Elephant Teeth
of North America

Lehman & Duval Lith'rs

observed on the anterior tooth of the lower jaw of a *recent* Asiatic elephant; which is the portion of a whole skeleton belonging to the Philosophical Society's Museum.

I have thus endeavoured to make it appear probable that there is at present discovered in the United States, two distinct species of the fossil elephant; the one being chiefly characterized by the plates of enamel of the molars being thinner and more numerous than those of the recent elephants, the other in possessing broader and fewer plates.

The peculiar continuous arrangement of enamel which occasionally occurs in the fossil elephant teeth, is not characteristic of a distinct species, being only an accidental variety.

Mr. Titian Peale has kindly favoured me with the annexed drawings.

Description of a new Fossil Genus, of the order Enalio Sauri, (*of Conybeare.*)

Saurocephalus *lanciformis.*

About sixteen years ago, there was deposited, by Lewis and Clarke, in the cabinet of the American Philosophical Society, a fossil organic remain of some unknown marine animal. During the expedition of these gentlemen up the river Missouri, in the year 1804, this specimen was found in a cavern situate a few miles south of the river, near a creek named Soldier's River. The nature of the soil at this locality they do not mention, but there can be little doubt of its being secondary; a few miles down the river, at Council Bluff, there are hills of considerable size, composed almost entirely of fossil marine shells and other organic reliquiæ in a fossil state.

My attention was first directed to this specimen by Mr. T. Say, who, with his accustomed liberality, offered every assistance in deciphering the same. At first view, I recognised it as a portion of the dental bone of an animal allied to the Saurian reptiles; a closer inspection proved its approximation to the new fossil genus "Ichthyosaurus," an animal, as the name imports, uniting in its structure both the fish and the lizard; having the head of a Lacertian animal joined to the vertebræ of a fish, and extremities entirely sui generis. For a full description of this highly interesting animal, together with another new fossil genus, the Plesiosaurus, naturalists are particularly indebted to an able and elaborate essay, by the Rev. W. D. Conybeare, and Mr. De la Beche, (in the Trans. of the Geolog. Soc. 2d series, Vol. I. pl. 1st, and

Vol. V. pl. 5,) in which they have described four distinct species of the Ichthyosaurus.

By the most critical examination of the present specimen, it is found to possess characters which incontestibly render it at least specifically, if not generically, different from either.

Our specimen is rendered doubly interesting by its locality, being the first of the genus ever discovered on this continent. While we have to lament that so small a remnant of this animal has been snatched from oblivion, it still serves to display the utility as well as beauty of the doctrine of the laws of co-existence in the parts of animals, when employed with that caution which renders it a legitimate instrument of induction. A perfect knowledge of these laws enabled Cuvier to establish important species, on data far less certain than that now under consideration, not to mention many others; the ANOPLOTHERIUM *medium* was originally founded on a portion of the lower jaw.

From the data afforded by the account of the Ichthyosaurus above mentioned, the following would appear to be its *generic* characters. Teeth fixed in an open sulcus, instead of separate alveoli; consisting of two series only, one growing within the other; anterior nares opening near the root of the snout, immediately before the lachrymal bones. Bones of the head and face, in number and structure, nearly resembling the crocodile; bodies of the vertebræ concave both at their occipital and caudal surfaces; legs, four in number, terminating in a paddle, composed of a numerous series of polygonal bones, and attached immediately to the distal extremities of the humerus and femur; anterior extremities much larger than the posterior. Amphibious? Oviparous.

In order to demonstrate wherein the present differs from those species of the Ichthyosaurus already described, it will be necessary briefly to state their specific characters, which, as in most other instances, have been drawn principally from the teeth.

1. I. *communis.* Upper part of the tooth conical, not very acute, slightly aduncate, and thickly covered with prominent, longitudinal striæ.

2. I. *platyodon.* Upper part of the tooth smooth and flattened, so as to present sharpened edges.

3. I. *tenuirostris.* Teeth more slender than the preceding species, but is best marked by the extreme length and thinness of the snout.

4. I. *intermedius.* The upper part of the teeth much more acutely conical than in species first; and the striæ less prominent, yet less slender than in species third. These species vary in size: those of the first differ from five to fifteen feet, but the most gigantic belong to species second.

The animal to which our specimen belonged, may have been about six or eight feet in length. The remnant, from which these observations were drawn, is a portion of the dental bone of the right side; its greatest length four inches, greatest breadth two inches; alveolar surface three inches and a half long, three-tenths in thickness.

"The most important difference between the lower jaw of the Crocodile and Ichthyosaurus is, that the bones are not connected by *true* suture in the latter, but by squamous suture as in fishes."*

In which circumstance our specimen perfectly corresponds, as is demonstrated by fig. 4. (a.) The inferior and posterior edges being thinned and imbricated for articulation with the angular bone.

There are eighteen teeth in different states of preservation; the longest are seven-tenths of an inch, two-tenths only projecting above the bone; the projecting part enamelled, smooth and shining, lanciform; the edges very sharp; but this will be better understood by referring to fig.

* Conybeare.

1st. The bodies of the teeth are all hollow, and are firmly fixed in a longitudinal groove. The bodies of the teeth are mostly in *close contact throughout*, in which respect it differs from the Ichthyosaurus, the Plesiosaurus, and the other Saurian reptilia; it differs, further, from all these animals in the following respect—the body of the bone is not perforated by a canal for the inferior maxillary nerve; in place of which, is observed a groove running the whole length of the dental bone, immediately beneath the alveolar portion, on the mesial aspect of the bone; the bottom of this groove is perforated with foramina for the distribution of the nerves and blood-vessels, equal in number to the teeth, (i. e. 18,) in this fragment.

The process of dentition appears also to possess some peculiarities; being two series, one directly above the other, both hollow, (the cavities in some instances filled up with crystallized carbonate of lime;) the mode of shedding the teeth is similar, but the manner in which the inferior enters the superior, differs from the animals above referred to; the inferior entering the cavity of the superior directly at the centre, and not at the side of the body.

The inferior series are completed before they enter the upper. I could observe no appearance of a third series, except indeed the cavity in the second. The teeth of this species are neither conical nor striated, which is not the case in the other species, excepting the *tenuirostris*, in which the superior portion is smooth, curved, and conical; the lower half striated.

The extreme sharpness of the cutting edge of the teeth, and the juxta position of their bodies, precludes the possibility of supposing the teeth of the upper jaw to have passed between those of the lower jaw, when the mouth was closed, as is the case in all the animals we have referred to in this paper.

The row of teeth on the inferior appear to have passed within those of the superior jaw; this supposition is further strengthened by the worn appearance of the sides of the teeth.

This arrangement of the teeth, which would require a peculiar configuration of the jaw, together with the peculiar distribution of the inferior maxillary nerve mentioned above, appears to me to entitle this animal to rank as a new genus. In many respects it approaches very nearly the Ichthyosaurus, but is separated from this genus of animals by the peculiarities expressed above. We propose to distinguish this animal by the following name and characters.

SAUROCEPHALUS LANCIFORMIS.

Generic characters.—Bodies of the teeth approximated; those of the superior and inferior jaws closing like incisors. Inferior maxillary nerve passing along a groove on the mesial aspect of the dental bone.

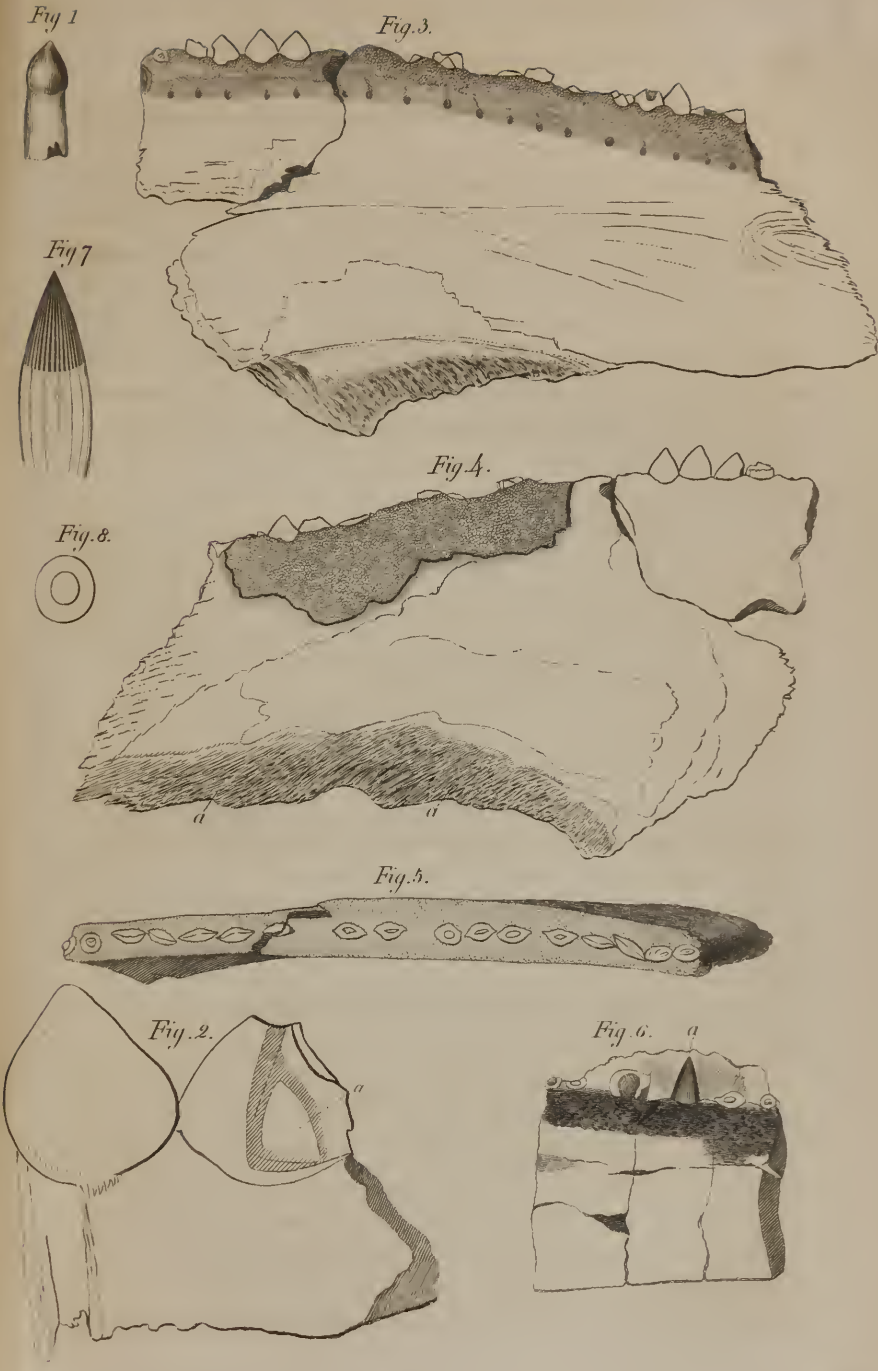
Specific characters.—Projecting portions of the teeth smooth and lanciform.*

* We are informed by Mr. Mantell of Brighton, England, that the Saurocephalus lanciformis and S. leanus, have also been found in the Sussex chalk. June 1835.

EXPLANATION OF THE PLATE.

Fig. 1. Tooth detached.
2. Teeth in their sockets, magnified.
a. The young tooth.
3. The dental bone, mesial aspect.
4. " " dermal aspect.
a. a. articulating surface.
5. Dental bone seen from above.

Pl. 30



Description of a new Fossil Species of an Ichthyosaurian Animal.

Soon after writing my last paper on the Saurocephalus, my attention was directed to a small fragment of petrified bone, deposited in the collection of British fossils in the Philadelphia Museum.

This specimen was originally from Bath or Bristol, and is easily recognised, at first view, for a portion of the dental bone of some Saurian reptile; though from the small size and crushed state of the specimen, and from its being, in some degree, imbedded in a matrix of Calp, it was at first difficult to ascertain to what genus it belonged.

Nevertheless, an attentive examination of this portion of dental bone, a little more than an inch in length, and containing six teeth, enabled me eventually to ascertain the following facts.

The remnant is six-tenths of an inch high, and five-tenths broad at the alveolar aspect. The largest teeth (for they vary in size) are .65 of an inch long, projecting three-tenths above the bone; the projecting portion being marked with closely arranged, longitudinal striæ; a few widely separated longitudinal lines mark the buried portion of the tooth, and the whole tooth is conoidal from the base to the apex.

In the mode of dentition, this animal resembles the crocodile, but it differs in having the teeth set in a continued groove, instead of separate alveoli. It varies from the Plesiosaurus in the same respect, and in the teeth, though conical, being not so long proportionably, nor in the same degree aduncate as in that animal. It should be remembered that the teeth of animals of this order vary in the latter respect even in the same jaw, as is particularly the case in the I. *intermedius*.

Our specimen totally differs from the Saurocephalus, in the relative size, form and proportion of the teeth and dental bone, and in the bodies of the teeth not being approximated or contiguous.

It resembles the Ichthyosaurus in the relative proportions of the teeth, in having them set in a groove, and in its mode of dentition. It approaches most nearly to the I. *communis* in the general appearance of the teeth, but differs from that species in their relative size and form; these bodies being more aduncate in the latter.

It differed from all the four species in the greater relative thickness of the dental bone. In fine, it no more resembles these species, than they respectively resemble each other. From these data I am led to believe the present specimen to have belonged to a species not before described, and propose to denominate it Ichthyosaurus *coniformis*.

EXPLANATION OF THE PLATE.

Fig. 6. (a) Tooth of the natural size in situ.
7. do. magnified.
8. do. transverse section do.

Description of an extinct Species of Crocodile, not before described; and some Observations on the Geology of West Jersey.

At various times there have been presented to the Academy specimens of fossil bones, principally from the state of New Jersey; which have not been hitherto described or noticed. I have undertaken to describe such as are most rare and interesting, and whose characters remain, in some degree, undefaced.

It will be necessary, in the first place, to offer a few remarks concerning the formation in which these fossils occur; in doing which, I shall content myself with the bare mention of the fossil *testaceæ*, some of which occur in immense numbers. For a knowledge of these, I am indebted to a gentleman eminently qualified to do the subject entire justice, and from whom we may anticipate, I hope, very shortly, a full and accurate description of these very interesting remains; it is almost unnecessary to state, the naturalist alluded to is Mr. T. Say, who together with Mr. T. Peale and myself, have lately returned from a short excursion to the Marl-pits of New Jersey.* We were much assisted in our investigations by Dr. Samuel L. Howell, of New Jersey, who politely offered to accompany us, and whose knowledge of the country was peculiarly serviceable.

All that part of the state, denominated West Jersey, and which is included between Trenton and the Delaware

* Since Mr. Say first commenced the description of the New Jersey fossils, numerous investigators have entered this field of science. The communications of Messrs. Vanuxem, Conrad, Lea, Morton, Van Rensellaer, Dekay, &c., in the Journal of the Acad. Nat. Sc. and N. York Lyc. of Nat. Hist. will be consulted with interest. The present essay was originally communicated to the Acad. Nat. Sc. Philad. in May, 1824.

Bay, on the North and South, and between the Atlantic ocean and Delaware river, on the East and West, is of oceanic or secondary formation, interspersed with patches of tertiary. The surface is composed chiefly of sand, occasionally of gravel, and very seldom of clay; not unfrequently of all three mixed.

This circumstance, in connexion with a knowledge of the nature of the substance improperly termed *Marl,* will explain the vague and contradictory opinions of the farmers, respecting the manuring qualities of this earth; some of whom informed me, they considered a load of this *Marl* equal to a load of *dung*. Others thought, that although the *Marl* enriched the land, and made it more productive the first year, it subsequently produced an impoverishing effect on the soil. Others again declared, that though they had frequently made the experiment, they always found the Marl absolutely injurious; and this depends, in fact, on the quality of Marl used.

The fact is, that this earth possesses no more claim to the title of *Marl,* than any other earth in which fossil testaceæ abound; generally speaking, it is little more than a ferruginous sand. Quantities of pyrites are also found to exist, almost universally; sometimes constituting the casts of shells, at others filling the cavities of bones; and to the prevalence of which may be attributed the imperfect state in which the organic remains are generally discovered, and the very great rapidity with which they decay on exposure to the atmosphere, unless they are varnished, or other means are used to prevent the access of the air.

It is, further, to the prevalence of pyrites we must refer the injurious effects of the "*Marl,*" when spread too thick upon the soil; when, on the other hand, if mixed sparingly with new soil, it destroys or reduces to earth the fibrous matter, and thus proves highly beneficial as a manure. Should the soil be composed almost entirely of loose sand, (as it frequently is) the clay, which is a principal constituent of some of the "*Marl-pits*," will give consistency to the soil, and enable the vegetables to take root; in which sense it may be said to act as a manure.

Not unfrequently whole strata or beds of this *Marl* will occur without a single fossil, of a loose friable structure and moist nature, more or less granulated, and of various colours, but most commonly of a dark slate-black or greenish colour; and has been by some supposed to consist chiefly of decomposed organic remains—but how erroneous is this opinion, will be clearly comprehended by the analysis of this earth, furnished some years ago by Mr. Henry Seybert of this city. (Vid. Cleaveland's Min. and Geol. 2d ed.)

Silex,	49.83
Alumine,	6.00
Magnesia,	1.83
Potash,	10.12
Water,	9.80
Protoxide of Iron,	21.53
Loss,	.89
	100.00

This specimen of "*green earth*" or the supposed Marl, was from Rancocus creek; the quantities of its constituent parts no doubt vary with the locality. It constitutes, in almost every instance, the matrix of the fossil reliquiæ, of which the Terebratula and Ostrea occur in the greatest profusion, sometimes commingled, at others in nearly distinct beds, as at Mullica hills and Blackwood town mills. At the county poor house we examined a creek, at the bottom of which were beds of fossil ostreæ, and a few *rolled* specimens of Favosite and Fistularia, together with broken Belemnites; occasionally we observed some of the beds composed of Ostreæ, Belemnites, Terebratula, &c. heaped together in every direction and position, conglomerated together by the green sand, and quartz pebbles, scarcely any of the remains preserved entire.*

I have been indebted to Mr. A. Seidler, an experienced operative chemist, for an accurate analysis of the fertilizing and non-fertilizing varieties of "Marl," the former of which is now extensively used in New Jersey as a manure.

Chemical Analysis of the green fertilizing Marl from New Jersey, dug from Lewellyn's Pit. By A. Seidler. November, 1835.

This mineral appears as a greyish-green granular mass, in which, by aid of the lens, small particles of a shining lustre are discernible. By exposure to a moderate red heat, it loses its greenish colour, together with a part of its weight, and the former is changed into a light brown intermixed with grey. With borax, before the blow-pipe it melts into a blackish slaggy globule of considerable hardness. It does not effervesce with acids; its specific gravity is 1.485.

Experiment, No. 1.

Five hundred grains of this mineral were carefully heated in a small glass retort until red hot; its colour changed as above stated, and after having cooled, its weight amounted to four hundred and eighty grains. During this process no gas (carbonic acid) was disengaged, but in the tube of the retort and the adopter a quantity of water was condensed whose weight nearly corresponded to the above loss. We may, therefore, consider this mineral as a hydrate or a compound of hydrates.

* The "Marl" from Rancocus creek has been ascertained to be of the non-fertilizing species; the fertilizing variety, or shell-marl, does not occur at that locality.

Experiment, No. 2.

The above four hundred and eighty grains, finely pulverized, were boiled in a matrass with a long neck for several hours, with nitro-muriatic acid, consisting of five parts muriatic acid of fifteen degrees Baumé, and one of nitric acid of thirty-five degrees.*

Again.—A considerable part of the mineral was dissolved, but the brown colour had not disappeared; the solution was set aside for twenty-four hours, and the yellowish solution decanted from the sediment and again treated for several hours with a new addition of nitro-muriatic acid. The colour of the mineral had disappeared considerably more, but was not altogether white: therefore, it was set aside again for twenty-four hours, and then decanted, a new portion of acid added, and treated again as above.

After one hour's boiling, the colour had completely changed, and appeared perfectly *white*. The matrass was removed from the fire, and the liquid allowed to subside; after having decanted the same, the residue was washed with distilled water until perfectly insipid; the residue, gathered on a filter and well dried, at 170 degrees, weighed 277½ *grains*, and proved to be Silex.

Experiment, No. 3.

All the clear decanted solutions of experiment No. 2, which were of a yellow wine colour, were heated gently in a matrass and then saturated with caustic ammonia: a copious and voluminous brown precipitate issued; which was brought on a filter and perfectly edulcorated with warm distilled water.

* These acids, as well as all other re-agents employed in this analysis, were chemically pure.

This precipitate (anticipating that it consisted of alumina and oxyd of iron) was boiled in a silver vessel with five hundred grains of potash, and afterwards gently evaporated to dryness and exposed to a moderate red heat, re-dissolved and filtered. The brown residue on the filter copiously washed with distilled water, and dried at 170 degrees of heat, weighed 134 grains, and proved to be pure oxyd of iron.

Experiment, No. 4.

The alkaline solution of the foregoing experiment was saturated minutely with muriatic acid, and a voluminous white precipitate was formed, which proved to be pure alumina; after washing it copiously and drying, it weighed 62 *grains*.

Experiment, No. 5.

The remaining solution precipitated with ammonia in experiment No. 3, was examined further, and by adding oxalate of ammonia, a precipitate was formed, which, after it had been well washed and dried, weighed 14 *grains*, and showed all the properties of *oxalate of lime*, which, after destroying the acid by exposure to heat, left 6 grains of pure lime, which corresponds exactly with the proportions of this salt given in the chemical works.

Experiment, No. 6.

As it is a known fact that magnesia forms a triple combination with muriate of ammonia, which cannot be decomposed by potash unless the ammonia is driven out in a higher temperature, the solution from which the oxalate of lime had been obtained, was mixed with a sufficient quantity of pure potash, heated and finally evaporated to dryness. The dry mass being now deprived of all the ammonia, was re-dissolved, but no precipitate made its appearance, even after standing over night: therefore it contained no magnesia.

Conclusion.

According to the foregoing experiments, this green marl is composed of

277.50	grains of	Silex.	Experiment No.	2.
134.	"	Oxyd of Iron.	"	3.
62.	"	Alumina.	"	4.
6.	"	Lime.	"	5.
20.	"	Water.	"	1.
.50	"	Loss.		
500				

Analysis of the non-fertilizing green Marl from New Jersey, by A. Seidler.

The external appearance of this mineral is of a dull olive green, granular, or rather consisting of crummy masses; which, by exposure to a slight red heat, loses its green colour, and part of its weight, becoming of a blackish-brown. It does not effervesce with acids: before the blow pipe it melts, with borax, into a slaggy globule. Specific gravity, 1.566.

Experiment, No. 1.

Five hundred grains of this mineral were heated in a small glass retort, long enough to change its colour entirely; a quantity of water was condensed in the tube of the retort and adopter; it lost by this process thirty-one grains, the loss corresponding with the evaporation. The remaining 469 grains were boiled repeatedly in a long-neck glass matrass with a mixture of five parts muriatic acid of 15°, and one part of nitric acid of 35°, Baumé, until its colour had entirely disappeared. The insoluble white residue, after copious washing with distilled water, and being well dried, weighed 277½ grains.

Experiment, No. 2.

All the acid solutions and washings obtained in the foregoing experiments, were mixed together and saturated with pure ammonia. A voluminous brown precipitate ensued, and after it had been separated by the filter and well washed, was boiled in a silver vessel with 500 grains of pure potash dissolved in a sufficient quantity of water, and afterwards evaporated to dryness, and exposed to a gentle red heat for half an hour, and then again boiled with water repeatedly in order to dissolve the alkaline mass; then filtered; the brown insoluble residue on the filter being well washed in hot water and dried, weighed 135 grains, and proved to consist solely of oxyd of iron.

Experiment, No. 3.

The neutral ammoniacal solution of No. 2, which remained after having separated the precipitate, was further examined, in order to detect lime, if any existed: a sufficient quantity of oxalate of ammonia was added and strongly agitated, and exposed to heat for half an hour; no precipitate was formed, even after repeated agitation, and twelve hours repose; the same result followed after adding phosphate of ammonia: consequently, lime formed no part of the mineral.

Experiment, No. 4.

The clear alkaline solution obtained in experiment No.

2, after the separation of oxyd of iron, was accurately neutralized by pure muriatic acid: a white gelatinous precipitate was formed, which, after separation by the filter, and being well washed and dryed, weighed 52½ grains, and proved to be pure alumine.

Experiment, No. 5.

To the remaining solution of experiment No. 3, after having tested it for lime, a sufficient quantity of pure potash was added, and the whole evaporated to dryness, by which process the ammonia was completely expelled. The remaining saline mass was re-dissolved in water, and appeared perfectly transparent; no trace of an insoluble substance could be discerned, even after twelve hours repose:—it consequently contained no magnesia.

Conclusion.

These experiments exhibit the following constituent parts of this non-fertilizing marl, viz.:

Experiment No. 1,	277.50	Silex.
2,	135.	Oxyd of Iron.
4,	55.50	Alumine.
	31.	Water.
	499	
Loss,	1	
	500	

Besides the fossil reliquiæ above named, we may further add Ammonites, Rostellaria, Turbinolia. Arca, Pyrula, Pecten, Donax, and numerous others, together with the bones or teeth of cetacea, sharks, crocodiles, turtles, mosasaurus, &c., lignite, amber, phytolithites, roots of trees encrusted with pyrites, &c.

This very extensive formation, of which we are now treating, lines the coast for several hundreds of miles, commencing at the northern extremity of Long Island, and extending as far as the Gulf of Mexico; and borders immediately the primitive rocks on its northern and eastern limits.

I shall now treat more particularly of the fossil bones brought from Jersey; and first, of a new extinct species of Crocodile, the dental bone of which was, some time past, found three miles from "White Hill," and presented to the Academy by Mr. Samuel Wetherill of Burlington, N. J., a corresponding member.

The fossil, under consideration, is the inferior maxillary bone of the right side, in a tolerable state of preservation, perfectly fossilized or impregnated with iron, containing the sockets for eleven teeth, in a space of twelve inches; three of the teeth only remain perfect, a portion of the bone is lost posteriorly and anteriorly; consequently, the total number of teeth cannot be ascertained with precision; though, from the great size of the inferior maxillary foramen immediately behind the last remaining tooth, there could not have existed more than one or two more at most. A portion of the angular bone was fortunately preserved, which will enable us to determine the form of the angle, and thus to reconstruct, with sufficient accuracy, the whole of the lower jaw.

The most striking peculiarity of this remnant is its great thickness in proportion to its length, compared with the same part in other crocodiles; with which circumstance the structure and appearance of the teeth perfectly correspond; being exceedingly short, thick, and blunt, except the very young tooth, which is sharper and more conical.

In the Crocodilus *acutus*, a portion of the dental bone, eight inches in length, contains ten teeth; the same measurement taken from the Crocodilus *lucius*, thirteen and a half feet long, affords space for thirteen teeth. In our fossil, on the contrary, there is only space allowed for seven teeth; in every instance commencing from the fourth tooth, and enumerating backwards.

In the C. *acutus*, the dental bone, immediately behind the fourth tooth, is one inch four-tenths in breadth. In the C. *lucius*, one inch seven-tenths. In the fossil, two inches four-tenths. Depth of the same portion of bone in the C. *acutus*, is one inch two-tenths; in the C. *lucius*, two inches; in the fossil, two inches five-tenths. By this measurement, the fossil bone is shown to be nearly cylindrical.

The teeth of the fossil, though very short and thick, are not much worn—the largest tooth of the lower jaw, in the C. *lucius*, thirteen feet long, is two inches four-tenths in circumference; the largest of the fossil teeth is three inches three-tenths. Of one of the loose fossil teeth, the length is two inches; diameter one inch; whilst the portion which projected above the bone, is only half an inch long. The caliber of the tooth at its base is half an inch in diameter. The bodies of the teeth are separated by a plate of bone only four or five-tenths in thickness.

The anterior or alveolar portion of the lower jaw, in all the crocodiles, excepting Cuvier's sub-genus C. *gangeticus*, presents a series of vertical curvatures; there are three in number in the fossil, in which respect it resembles the recent crocodiles and alligators; but which will alone separate it from the Gavials as well as all the *fossil* specimens hitherto discovered, which most nearly resemble the Gavials; in all of which this portion of the jaw is straight; but the present species is still further separated from all the sub-genera of Cuvier, by the greater relative thickness and less length of the dental bone, as well as in the peculiarities of the teeth above mentioned. The space between the fourth tooth and greatest elevation of the dental bone, in the fossil (a. b.), contains five teeth; in the C. *lucius*, nine; in the C. *acutus*, six.

The distance from the fourth tooth, (which is very large proportionably,) to the anterior margin of the symphysis in the fossil, is four inches two-tenths; in the C. *lucius*, two inches seven-tenths; in the *acutus*, two inches six-tenths. The symphysis of the lower jaw extends posteriorly to the fourth tooth in the C. *acutus;* it terminates two inches anteriorly in the fossil; its termination is nearly opposite the fourth tooth in the C. *lucius*. Directly posterior to the fourth tooth, there exists a considerable curvature inwards, in the fossil; directly the reverse is the case in the C. *lucius;* but a similar curvature exists in a very slight degree in the C. *acutus*.

The foramina for the transmission of nerves and blood-vessels are unusually large and numerous in the fossil. By referring to the figures, other differences will be noticed equally remarkable, though not so readily expressed; all of which, taken collectively, constitute, in my opinion, characters sufficient to require for this animal the establishment of a new sub-genus; which I propose to designate as the Crocodilus *macrorhyncus*.

Numerous vertebræ of crocodiles have been found in the same locality, none of which, however, are large enough to have belonged to this individual, but very different from any I have been able to compare them with; though very much broken, yet this difference is readily recognised by a very peculiar compression of the lateral and inferior portion of the bodies. As might be anticipated, the vertebræ already discovered denote a variety of species.

Pl. 31

Fig 1.

Fig 4.

Fig 8.

Fig. 2

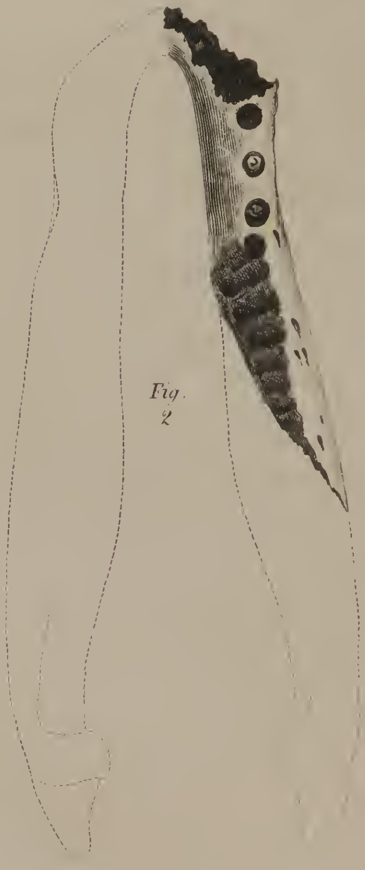


Fig 7.

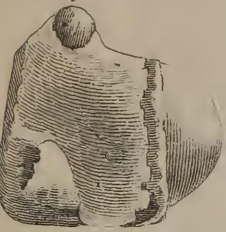


Fig. 5.

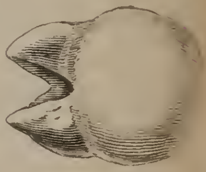


Fig 3.

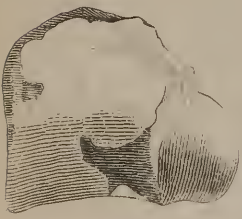
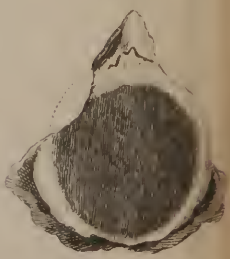


Fig 6.



T. Peale del.

F. Kearny sc.

EXPLANATION OF THE PLATE.

Fig. 1. Lateral view of the fossil bone.
2. Anterior view of the same.
3, 4, 5. Different views of a fossil vertebra.
6, 7. Two views of a vertebra from another part of the column.
8. Fossil tooth of natural size.

Notice of Plesiosaurian and other Fossil Reliquiæ, from the State of New Jersey.

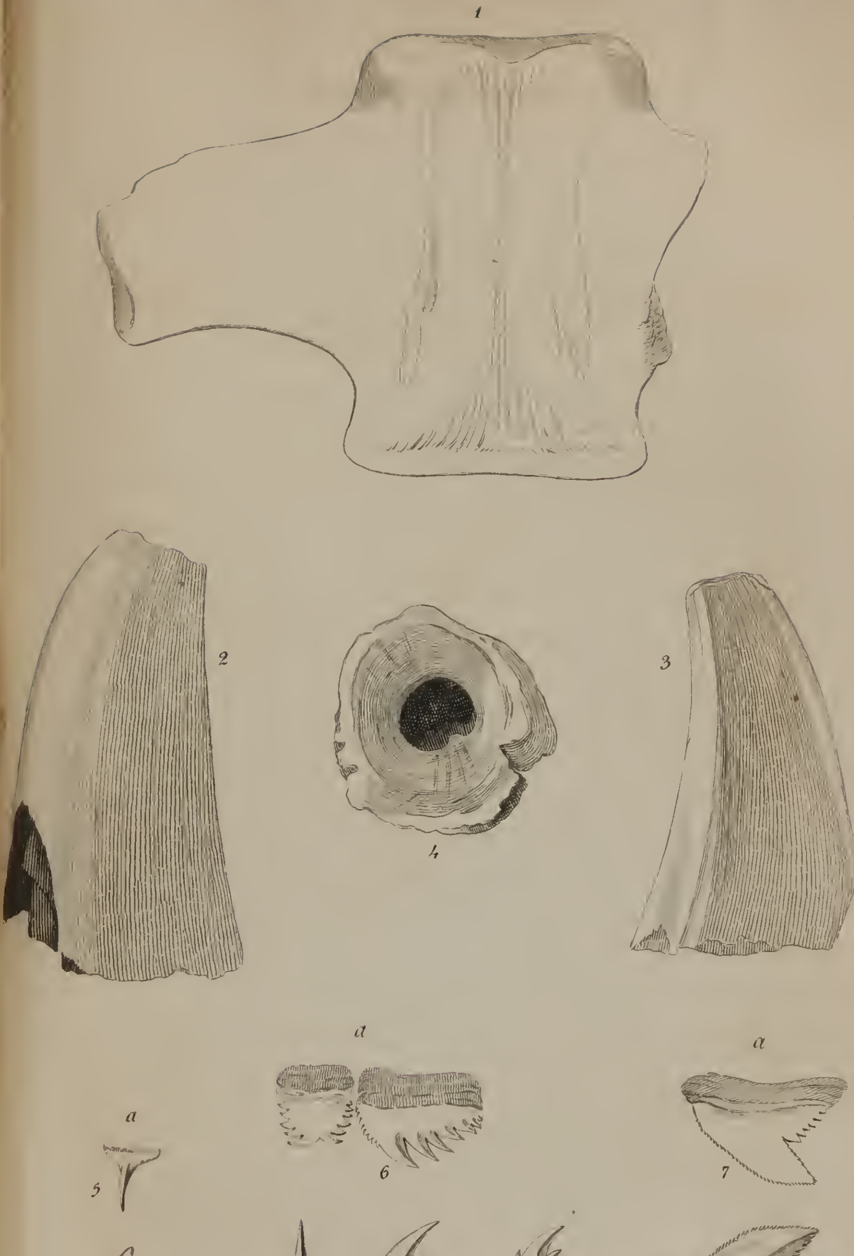
I HAVE lately received from Mr. I. Lukens, a collection of fossil teeth and bones, which were discovered at Mullica Hills, New Jersey; among which are three vertebræ belonging to some *saurian* reptile, unlike any hitherto described, and the *type* of which is not known to have existed in North America.

One only of these vertebræ retains sufficient characters to enable me to determine the extinct genus to which it belongs. This specimen, pl. fig. 1. is a dorsal vertebra completely petrified, or rather impregnated with iron; it is perfect, with the exception of the greater portion of the spinous process, which has been broken off since the petrifaction of the bone.

The following are its dimensions; transverse diameter of the body, one inch seven-tenths; vertical diameter of the same, 1.4; length of the side, 2.2; length of the transverse process, 1.4.

This vertebra is similar to those of the genus PLESIOSAURUS, in being slightly concave at both extremities, and again slightly swelled in a contrasted curve near the middle of the circular area. All the fossil *crocodiles* have this in the *posterior* part of the column.

It further corresponds with the PLESIOSAURIAN vertebræ in having the ribs articulated by a single tubercle, to the end of the transverse process, the articulating face of which is oblong horizontally; this structure is observed in the crocodiles in the three last vertebræ only. The specimen under examination, however, differs from any species of the Plesiosaurus hitherto described, both in



1
2
4
3
a
a
a
5
6
7
b
b
b

magnitude and *proportion*, as is demonstrated in the following measurements of the vertebræ of that animal, described by Messrs. Conybeare and De la Beche.

"The proportion of the diameter to the length of the side, is nearly as 5 to 4, in the cervicals; in the middle dorsal, a little greater, and in the caudal, nearly double.

"In the crocodile the diameter is always less than the side. A middle dorsal vertebra, from Col. Bird's specimen of Plesiosaurus, measured one inch and a half through the articulating surface; length of the side, one inch and one-eighth; though one specimen has been latterly discovered measuring three inches in diameter."*

The form of the occipital and caudal surfaces of the body of the *vertebra*, which is the subject of the present essay, distinguish it from the following animals, viz. the Maestricht animal, Crocodiles, Monitors, Iguanos, and in general the most part of the Saurians and Ophidiens, in which the bodies are concave before and convex behind. In the Cetacea the bodies are nearly plain, and in fishes they are concave conically on both surfaces.

Cuvier remarks,† "the dorsal vertebræ of the *Maestricht* animal have their transverse apophyses short, and terminated by an articulating surface enlarged vertically, which carries the rib, which is consequently attached by a single head: this characterizes the *Monitors* and most of the *Saurians*, *excepting only the Crocodiles*, in which particularly, this structure is absent, with the exception of the three last ribs."

To the crocodiles, as an exception, Cuvier should have added the Ichthyosaurus, Iguana, and Camelion, among the *Saurians*, together with the Crotalus and Coluber, among the *Ophidia;* in all of which the ribs are articulated with the bodies of the vertebræ by two tubercles,

* Vide Geological Transactions, Vol. V. Part II.

† Anim. Foss. Vol. IV.

but do not unite with the *transverse process as in the crocodile.*

Conceiving it highly important to the science of Oryctology to ascertain correctly the manner in which the ribs of the different genera of the Saurian family are articulated, I solicited and obtained permission from the Academy of Natural Sciences, to examine the very valuable collection of this branch of Zoology contained in their cabinet. As far as my examination extended, (with the exception of those genera above noticed, in which the ribs are articulated to the bodies,) the *transverse* processes (or a tubercle which supplies their places,) receive the head of the ribs, as in the following genera, viz. the PLESIOSAURUS, MAESTRICHT ANIMAL, CALOTES, MONITOR, AMEIVA, SCINCUS, GECKO, AGAMA, ANOLIS; also the SIREN, the TRITON, and the SALAMANDRA, among the BATRACHIA.

Figures 2, 3, and 4, represent different views of a *fossil mineralized tooth*, from the New Jersey "Marl-pits," three miles from Woodbury, belonging to the Cabinet of the Academy. This tooth, from the mode of dentition, evidently belonged to a *Saurian* reptile; it is figured of its natural size, two inches and four-tenths in length, though about one-fourth of an inch has been broken off the point. It is considerably curved inward, and slightly curved backward at its point; the dermal aspect is doubly convex, the mesial aspect presents a surface slightly concave, vertically; terminated by a sharp finely serrated edge anteriorly and posteriorly; the diameter of the base is one inch and four-tenths. This tooth resembles in every respect those teeth of the *Maestricht Monitor*, which lie buried in the maxillæ, and which are to take the place of the first series, when the latter are broken off or destroyed.*

* In the Cabinet of the Lyceum of N. York, we have observed a jaw with several teeth buried in the socket similar to the above.

The Cabinets of the Academy and Philadelphia Museum contain numerous specimens of Shark's teeth from New Jersey, most of which are impregnated with iron, and are in a perfect state of preservation. From the present imperfect state of our knowledge of this department of Zoology, and from the proteiform variety presented by the teeth of the same individual, it is almost impossible to refer them with certainty to the present existing genera; by referring to figures 5th, 6th, and 7th, the truth of this observation will be sufficiently obvious; they represent teeth taken from the upper and lower jaw of three existing species, the jaws of which are in the possession of Mr. C. A. Lesueur: however, specimens from New Jersey have been discovered, which resemble closely the following sharks, viz. *Squalus zygena, mustelus, cinereus, squatina,* and the *carcharias,* two specimens of which measure five inches long, and four broad at base. If the same proportions existed between the body and the teeth of the recent and fossil carcharias, the latter must have been more than forty feet in length. In vol. iii. of Parkinson's Organic Remains, are good figures of the teeth of most of the above named genera.

There is also deposited in the Cabinet of the Academy, from the western shore of Maryland, a cervical and a caudal vertebra of a gigantic species of fossil Manatus; the vertical diameter of the former is nine inches and a half; the transverse diameter eleven inches. A fossil rib of the Manatus, was also discovered by Mr. Finch, at the same locality.

Description of Fossil Vegetable Remains from the Bituminous Coal Measures of Pennsylvania.

PECOPTERIS OBSOLETA.

Geological position.—Shaly sandstone of the bituminous coal measures.

Locality.—Vicinity of Johnstown, Pennsylvania, western base of the Alleghany mountains.

Cab. of Geol. Soc. of Pennsylvania. Also, Cab. Acad. Nat. Sc. of Philadelphia, from the anthracite coal measures of Wilkesbarre, Pa.

This specimen forms part of the series of illustrative specimens which accompanies the valuable essay of Mr. E. Miller on the geology of the Alleghany mountain at the Portage Railway. In several respects, this species bears considerable analogy with the Pecopteris cistii, Ad. Brongniart, Hist. des Veg. Foss., pl. 106, with the following characters: "P. foliis lanceolatis bipinnatis; pennis elongatis obtusis, abrupte desinentibus, pinnula terminali brevissima elliptica vel subrotunda; pinnulis ellipticis vel suboblongis, basi connatis vel usque ad basin discretis, etiamve basi paululum contractis; pinnula infirma rachi pennarum inserta, vix alteris majori; nervo medio valde notato; nervulis arcuatis bis furcatis, distantibus, tenuissimis." With this description it will be only necessary to draw the *distinctive* characters of the present species, which consists of a single specimen four inches long in the stalk, and one and a half inches wide between the extremities of the leaves, each separate leaf being seven-eighths of an inch long by two-eighths broad—approximate, though separate, throughout their length: those of the P. cistii

Pl. 3

Fig. 1

Fig. 4.

Fig. 3

Fig. 2.

Fig. 1. Pecopteris Milleri _ Fig. 2 Pecopteris obsoleta Fig. 3 Leaf of Neuropteris Fig. 4._ Equisetum Stellifolium

Lehman & Duval Lith.

being occasionally united at base. The length of the leaves in the latter species is not quite double their breadth, whilst these organs are in length three times their breadth in the "obsoleta;" but what would appear to distinguish the P. obsoleta from all other species of this genus, is the interruption of the basil attachment of the upper half of the leaf, which appears unconnected with the stem in many instances. All vestige of nervures is totally obliterated from the leaves of the "obsoleta," which, in other respects, is a bold and well relieved specimen. Vide pl. fig. 2.

Pecopteris Milleri.

P. pinnulis obliquis, rectis, linearibus elongatis, vix distinctis; nervulis simplicibus, valde obliquis.

Geological position and locality the same as the preceding species. This most perfect specimen, which appears as if sculptured on the accompanying rock, consists of a fragment of a stem three and a half inches in length, displaying alternate curvatures, with four branches two inches long on either side, alternating with each other, each bearing from fifteen to twenty leaves half an inch long and two-eighths of an inch broad, separate from each other, obovate, linearly curved, and at their distal extremity pointed; with numerous simple oblique nervures.

This species is allied to the *Pecopteris Beaumontii* of Brongniart—Hist. des Veg. Foss. pl. 112—from the coal measures of the Alpine Lias, but is distinguishable by the simplicity of the nervures (those of the latter being dichotomous), also by the form of the leaf.

We have dedicated this species to our valuable associate Mr. Edward Miller, author of the geological memoir alluded to above, and to whom the Society has been recently indebted for an interesting illustrative series of fossil shells and vegetables. Vide pl. fig. 1.

Neuropteris.

Among the illustrative specimens above alluded to, are a number of vegetable fossils, numbered from thirty to thirty-nine; they include several masses of bituminous shale, inclosing numerous impressions of leaves, of which we have enumerated five distinct layers on the surface of a single piece, which displays also on the reverse side impressions of finely fibrous wood. These impressions of leaves are very distinct, and readily referrible to the genus Neuropteris, and are distinguished from all other species of this genus by the extreme minuteness of the nervures, being almost invisible without the aid of a glass, seen through which, the entire leaf appears to consist of nervures.

In other respects this species bears no remote resemblance to the Neuropteris macrophylla, and N. flexuosa, of Ad. Brongniart, Hist. des Veg. Foss. pl. 65.

We are informed by Mr. Miller, that these fossils occur on the top of the Alleghany mountains, lying immediately on the surface of a bed of bituminous coal, and that marine shells were found both above and below them.

The anthracite coal measures of the Lehigh and Schuylkill, Pennsylvania, are generally referred by geological observers to the grauwacke series; and the bituminous coal measures of Alleghany, Ohio, &c., to the secondary formations—the rocks would lead us to the former opinion, the fossils, in some instances to the latter, at least so far as they have been examined from both localities.

I have been indebted to our associate Dr. J. L. Martin, for an interesting collection of fossil plants, consisting principally of Lycopodiolites of Sternberg, Striaticulmus, &c., from his coal mine, in the western termination of the Schuylkill coal measures, situated on the western or right bank of the Susquehanna river in Perry county, Pennsylvania, together with a more remarkable specimen covered with the impressions of leaves, which appear to have fallen promiscuously from trees growing in the vicinity of muddy shale. Similar specimens, I have been informed, are very common in our transition coal measures. These impressions of leaves may be compared to those of the *Lycopodiolites dichotomus* of Sternberg. Vide "Essai d'un Exposé Geognostico-Botanique de la Monde Primitif, tab. 2." Vide pl. fig. 3.

Description of a new Fossil Plant from Pennsylvania, of the Genus Equisetum.

EQUISETUM STELLIFOLIUM. Fig. 4.

E. *Caule* erecto, simplici, lævi, cylindrico, diametro 1-8 poll., subæquali; *ramulis* 10, 12, ad articulationes caulis verticillitis, stelliformibus; *articulis* vix distinctis, versus basim distantibus, superne approximatis; *vaginis* indistinctis.

Geological position.—Coal measures, bituminous shale.

Locality.—Pennsylvania, Schuylkill anthracite coal mines. Cabinet of the Geological Society of Pennsylvania.

This beautiful and delicate little plant has left its image in a strong and vivid impression on a piece of densely foliated shale, five by three inches in size, and rather less than half an inch in thickness, displaying exceedingly minute and numerous particles of mica intimately incorporated.

So beautiful and symmetrical in appearance is this impression, that I conceived on first view the idea of an artificial production, but its true character is easily recognisable by observing similar impressions in the different laminæ throughout the specimen, some of which I have uncovered from the vicinity of both surfaces.

The principal and most perfect stalk of these impressions is about three inches in length, destitute of striæ, strongly but unequally divided into five separate but continuous pieces, by an equal number of knots or articulations, the pieces diminishing in length in ascending, the first being seven-eighths of an inch, the second five-and-a-half-eighths, the third four-and-a-half-eighths, the fourth four-eighths, &c. The stalk, originally cylindrical, has been subjected to forcible pressure; its present greatest diameter is one-eighth of an inch; from each articulation spring eight, ten, or twelve leaves, which radiate from the centre to the circumference, forming a pretty symmetrical star at each articulation, which diminishes in size as we approach the superior extremity of the stalk, the leaves varying from two-eighths to half an inch in length, and being one-sixteenth of an inch in breadth, the terminal star being reduced to a mere tuft. The articular sheaths which exist in all the recent species of this genus are barely visible in this fossil specimen; they may possibly have been destroyed by pressure; remnants of the sheath are however visible, more particularly at the antepenultimate joint of the upper portion of the principal stalk.

Species of the genus Equisetum have been discovered growing in all parts of the globe, with the exception of New Holland; yet very few fossil species have as yet been found, and hitherto none in America.

M. Ad. Brongniart, (vide Hist. des Veg. Foss., 2d livraison,) describes five species: one of these he states to have been found in the tertiary, two species from secondary formations, and a third, of rather a doubtful character, from the coal measures.

Our species bears some distant specific resemblance to the Equisetum Meriani, figured by Brongniart, pl. 12, fig. 13, which was found in the iridescent marl of Neuewelt, near Bale.

Martin figures three fossils, (vide Petrifacta Derbensia, pl. 20,) all of different genera, under the name Phytolithus plantites, (stellatus.) One of these, fig. 5, bears some analogy to the present species, but is sufficiently distinct. A fine specimen of this Derbyshire fossil exists in the Steinhauer collection of Mr. Wetherill, now deposited in the Acad. Nat. Sc. of Philadelphia. Fig. 4, of the plate above alluded to, is an *Asterophillites* of Brongniart, or *Annularia* of Sternberg.

There are other plants with stellate leaves, with which, perhaps, the fossil Equisetum might be confounded, as the Hippuris, Asperula, Galium, &c. But if the plant figured by Brongniart, pl. 12, fig. 13, be an Equisetum, there can be no doubt of our species.

Description of an extinct Species of Fossil Vegetable, of the Family Fucoides.

FUCOIDES *Alleghaniensis.*

Ord. Nat. ALGÆ. Cryptogamæ aquaticæ, plerumque marinæ; fronde inarticulata et carnosa; familias *Ulvacea* et *Fucacea* formant.

Fam. *Fucoides,** Sternb. *Algacites,* Schloth. "Frons continua, nunquam articulata, plerumque difformis, nec symmetrica; aut subcylindrica, simplex vel sæpius ramosa, nuda vel rarius folia sustinens; aut membranacea, integra seu magis minusve lobata, nervis nullis vel imperfecte notatis, vage ramosis nec unquam anastomosantibus percursa. Fructificatio, dum exstat, punctiformis vel vesiculas sessiles aut pedicillatus efformans."—(*Brongn.*)

Sect. *Cladorites.* Nob. Stipes ramosus; ramis subcylindraceis, transverse rugatis.

FUCOIDES *Alleghaniensis.* Nob. Fronde compressa, rugata; apice recurva, obtusa; ramis inequalibus, digitatis et fastigiatis, enervibus, nudatis.

Place in the Series.—Compact sandstone, subjacent to the coal formations.

Locality.—One of the eastern ridges of transition mountains crossing the Juniata river, near the Susquehanna, about 40° north latitude, and about 77° west longitude, from Greenwich; one hundred and fifty miles from Philadelphia; ten miles east of Lewistown, north side of the Juniata river, Mifflin county, state of Pennsylvania.

This fossil Fucus presents one of the richest specimens

* Including a general group of fossil ALGÆ.

of vegetable organic remains, that has hitherto come under my notice; not only is there a fragment of stone two and a half feet long by one and a half feet wide, with the surface completely crowded with the forms of this plant, but they lie upon each other three or four layers deep. They project in bold relief from the surface, with their distal extremities disposed in every direction; they appear to have been of different ages, and vary in size accordingly from two to five inches in length, the largest being eight-tenths of an inch in thickness. In breadth they vary from one to five-tenths of an inch: they are generally gently arched from the base towards the apex, and more or less recurved at top; in every instance the apex is curved downwards and sinks into the stone. The superior surface of both the stalk and branches is cylindrical, transversely wrinkled by irregular channels, and marked by a longitudinal depressed line.

In the most perfect and distinct specimens, the digitations of the stalk, and fasciculation of the branches, are displayed in a beautiful manner; they have grown in such profusion and are so crowded together, that the commencements or bases of the stalks are for the most part concealed; so that in a specimen, which is five inches long, the stalk of the plant, previous to the first digitation or branch, is only seven-tenths of an inch in length; the largest stalk exposed to view being one inch and eight-tenths.

The branches are all compressed laterally as well as the stalk, and are fasciculated or closely applied side by side at the commencement, and gradually diverge more or less towards their distal extremities, and in some instances are given off in the following order, commencing from the right,—one—two—three, &c., gradually increasing in size; descending again to the stalk, there is a much larger branch, which soon subdivides into four irregular branches of various sizes: but in this respect there exists no uniformity: in every case, however, the stalks very soon divide into two or more branches; the latter are more or less wrinkled apparently according to age, the rugæ being more or less obsolete in the largest,—profoundly developed in the smaller or younger specimens.

The plants are fractured in many places, and in various directions, but the fractured portions do not display any evidence of organization; nor is there any appearance of leaves, nervures, or fructification. The mass of the fragment of rock in which these fossils occur, is about half a foot in thickness, and weighs something less than two hundred pounds; it is of a very compact texture, and readily strikes fire under the hammer. When I first observed this geological specimen, on my return from an excursion to the Alleghany Mountains, in the month of August of the year 1829, it constituted part of a pavement before the door of a tavern: the landlord informed me, that the stone came rolling down the mountain, (which is here very precipitous) within a few yards of the house, and that viewing it as a very ornamental specimen, he had placed it in the earth before his door to attract public notice; and I confess that at the short distance in which I first viewed the specimen, it appeared to represent a beautiful piece of artificial sculpture. There exists a vertical fracture on one portion of the stone, which has evidently occurred subsequently to the petrifaction of the plants, and is filled at present with quartz, forming an irregular vein.

Brongniart has already determined with sufficient accuracy, the existence of thirty-six species of fossil Fuci, (Vid. Histoire des végétaux fossiles, ou Recherches Botaniques et Geologiques sur les végétaux renfermés dans les diverses couches du globe. Par M. Adolphe Brongniart.)

To this author, together with the work of Baron Sternberg, I have been indebted for details of great interest concerning these extinct vegetable species. M. B. confesses his inability to divide this family into distinct genera, inasmuch as the characters proper to define them accurately, occur too rarely to admit of a precise classification; but he has divided the general group of fossil Algæ, to which has been given the name "*Fucoides,*" into sections, founded on the form of the branches; which sections are found to correspond with sufficient accuracy to one or more genera of living ALGÆ.

Only two species of fossil Fuci, have been hitherto observed in North America, viz. F. *dentatus*, and F. *Serra*. M. B. describes these as occurring in the "Transition limestone of Canada," and as being very different from any of the existing species. Both in the north of America and of Europe these fossils have been discovered in some of the most ancient strata of the globe. In Europe, among the lower secondary formations (terrains de sediment inférieur,) the bituminous Schists of Mansfield, and the anthracite coal mines of Scania, are the only strata which contain impressions of Fuci. They become more common in the strata which separate the Jura limestone from the chalk, where some remarkable species have been discovered. According to M. Keferstein, the "Grauwacke" of the Apennines, which often contains Fuci, belongs to the transition formations, which, judging from its relations to the carboniferous limestone enclosing belemnites, probably corresponds to the Lais formations.

At Bignor, in England, these fossils are found in the *Ferruginous sand*, according to Mr. Greenough; and at Voisons, Switzerland, according to MM. Dufresnoy and Elie de Beaumont, they are found in the green sand formation, which separates the Jura limestone from the chalk.

M. Brongniart remarks, that if we admit these fossil Fuci to belong to an epoch nearly contemporaneous with the marine lignites underlying the chalk of the isle of Aix, the submarine flora which characterizes this period indicates a vegetation very different from that of the existing species on those coasts, and which approaches rather to those of the equatorial regions, than to those of the frigid zone.

In the chalk itself, only a single vestige of a plant of this family, the "F. *lyngbyanus*," has been discovered; this appears allied to a genus peculiar to the equatorial regions. In examining the fossil Algæ of the superior secondary regions, M. Brongniart arrives at a very different result: most of these species are from Monte-Bolca, and display great analogy to those genera at present existing on the Mediterranean coasts. Thus "marine vegetation, like the terrestrial, displays stronger affinity to that of our climate in proportion as the formations in which they occur are more recent. They present, on the contrary, characters more analogous to those of the vegetation of equatorial climates, in proportion as they belong to an epoch of more ancient formation."

In the course of the present investigation, I have been led further to admire the great harmony that is found to preside over all the laws which regulate organic life. It may be readily anticipated to what immense extent the study of fossil botany, added to that of fossil zoology, is calculated not only to enlighten us as regards the antediluvian climates, but to direct us finally to a certain knowledge of the comparative ages of the various strata which constitute the crust of the globe we inhabit.

Description of a new extinct Fossil Vegetable, of the Family Fucoides. Pl. fig. 2.

FUCOIDES *Brongniartii.*

Natural order, ALGÆ.—Linnæus. *Family,* FUCOIDES.—Sternberg and Brongniart. ALGACITES, Schlotheim. *Section,* CLADORYTES.—Harlan.

F. *Brongniartii.*—Fronde elongata, sub-quadrangularis, canaliculata, transverse rugosa; ramulis inequalis, sparsis, remotis, compressis, rugatis, recurvis, nudis.

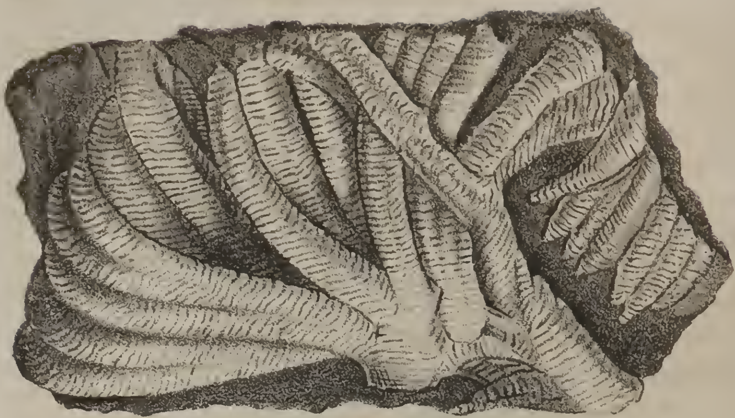
Place in the series.—Compact sand-stone, subjacent to the coal formation: occurring in slabs from one to three inches in thickness, the upper surface being tinged ferruginous.

Locality.—Western part of the state of New York: the fossil is also stated to abound on the Welland canal, Canada.

This fossil fucus is readily recognised as a species allied to the F. *alleghaniensis,* which I originally described in the Journal of the Academy of Natural Science, vol. vi., from which it differs principally in the elongation and uniformity of the stem, its sub-quadrangular form, in general, and in being more compressed and elevated on the surface of the stone. The branches of the present species are less fastigiated, and more remote from each other: in no instance are the tops of the branches exposed to view in the specimens which have come under my cognizance. The largest stem is one-third less in its greatest visible diameter in the present species, and they intercept, cross, or run into each other in various directions, so as occasionally to assume an appearance not unlike the asterias.

Pl. 34

Fig. 1.



Fucoides Alleghaniensis

Fig. 2.

Fucoides Brongniartii

Lith.

I have seen a very perfect specimen of this fossil, from the vicinity of Lockport, N. Y., in the possession of W. R. Johnson, Esq.; and Mr. Peale's museum of New York possesses a very large slab of these fossils. I am indebted to the politeness of P. A. Brown, Esq., for the opportunity of describing this species, who obtained it in the state of New York, during a geological excursion last summer. Specimens in the cabinet of the Academy of Natural Science, cabinet of Mr. P. A. Brown, &c.

In consideration of the great obligation under which Dr. Brongniart has placed all admirers of oryctology, by the publication of his invaluable *"Vegetaux fossiles,"* I have taken the liberty to designate this species by his name.

EXPLANATION OF THE PLATE.

Fig. 1st. Fucoides Alleghaniensis.
2d. Fucoides Brongniartii.

Notice of nondescript Trilobites, from the state of New York, with some observations on the Genus "Triarthrus," &c.

Having recently enjoyed an opportunity of inspecting several new species of Trilobites, in the cabinet of the Lyceum of Natural History of New York, which were obtained from Utica in that state, and which were supposed, at first view, to belong to the new genus Triarthrus, proposed by Dr. Green, in order to include a peculiar species; I have been enabled to correct the erroneous impressions on which this genus is constructed, and which were, perhaps, unavoidable from the imperfection of the fossil specimens of this kind which have hitherto come under the observations of authors. Among the numerous specimens above referred to, occurs one complete impression of the whole animal, from which it is clearly demonstrated that the only portion of this animal previously discovered, consisted of the *buckler* and not of the *body*. The latter having been composed of softer materials, has, in most instances, been obliterated; consequently the characters which were supposed to distinguish a peculiar genus, under the name of Triarthrus (vide Green's Monograph of N. A. Trilobites, p. 86,) having been drawn from the head or buckler of an individual under the erroneous impression that it constituted its abdomen and tail, cannot by any means be brought to practicable application, and the genus Triarthrus becomes obsolete.

But this is the less to be regretted in the present instance, inasmuch as by modifying and contracting the characters on which the genus Paradoxides of Brongniart, or Entomostracites of Wahlenberg, is constructed, it will readily include not only the present species of triarthritic reference, but also of the Paradoxides Boltoni, and P. scaraboides, which do not possess all the generic characters of Paradoxides as now extant. The above named species differ generically, in the form and proportions of the abdomen and tail, from each other and from those parts in the present species.

Generic characters, in order to be practically useful, should always be brief; in accordance with this rule, the following modification of the characters of Paradoxides is offered.

Genus Paradoxides.

Buckler, destitute of oculiform tubercles, anterior border semicircular, middle lobe marked with transverse furrows or bands.

Abdomen, composed of transverse bands or articulations continuous with those of the lateral lobes.

Under such modification we are prepared to introduce the new species before us.

1. Paradoxides triarthrus. (H.) Pl. fig. 5.

Buckler hemispherical, middle lobe nearly twice the width of the lateral lobes, and marked with three transverse lines, the two superior interrupted in the middle, lateral lobes plain, narrower above, subventricose. *Abdomen*, with at least four articulations, those of the middle being continuous with those of the lateral lobes, which diminish in descending order; *tail* continuous with the abdomen, inferior margin rounded.

The whole animal is rather broader than long; length of the body nearly equal that of the buckler; three or four small spines arranged transversely on the middle of the body; the specimen, like all such occurring in slate, is compressed and somewhat distorted.

Dimensions.—Total length of the impression rather less than five-eighths of an inch; greatest breadth rather less than six-eighths.

Locality.—Utica, state of New York.

Geological series.—Carboniferous slate.

Cabinet of the Lyceum of Nat. Hist., New York; plaster casts in the Cab. of Geol. Soc. of Pennsylvania.

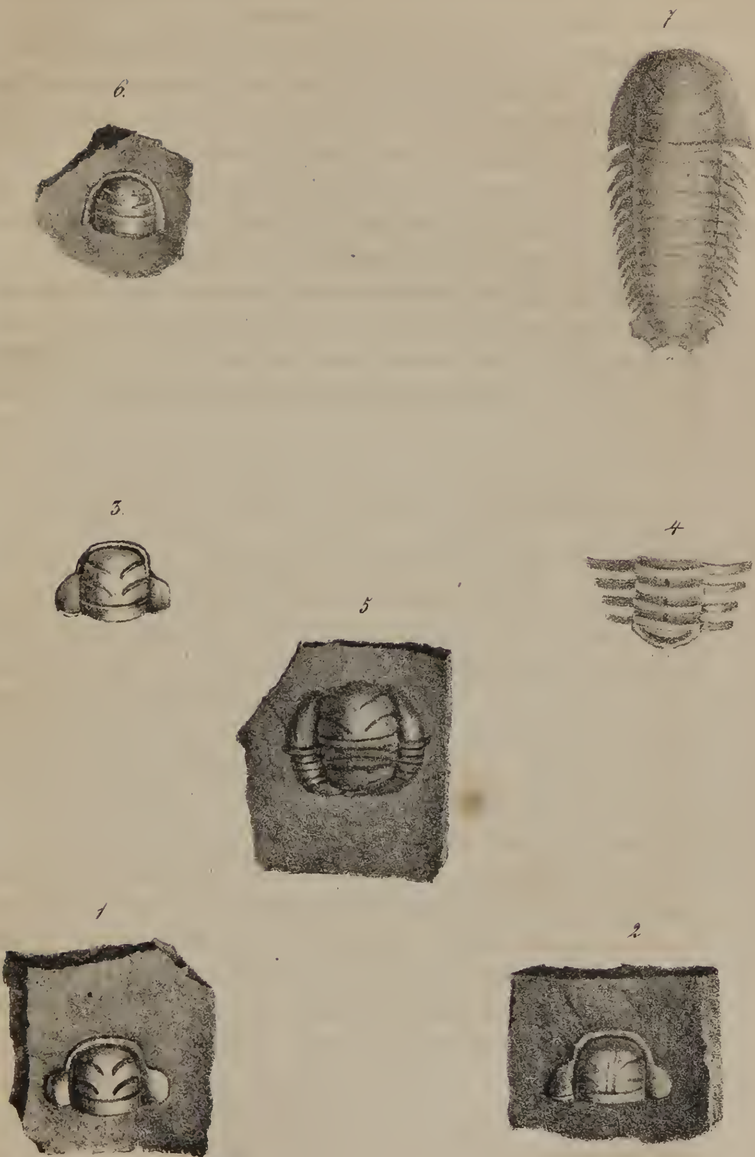
A second impression of the body without the head, occurs on the reverse surfaces of a schistose slab, more perfect and less compressed than the body with the head attached, and which is figured now for the first time. Vide pl. fig. 4.

2. Paradoxides arcuatus. (H.) Pl. fig. 1, 2, 3.

Several other triarthritic specimens accompanied the above from the same locality; they consist of the bucklers only, and bear some analogy with the "Triarthrus Beckii" of Green, (Vide Monograph, p. 87, fig. 6, cast No. 34.) The description of this species is herewith transcribed, with the necessary corrections to render it intelligible. "Cauda [capite] subrotunda, bipunctata; articulis abdominis [frontis] tribus, absque lobis lateralibus consuetis, sed lobo arcuato utrinque opposito."

The P. arcuatus, however, differs from his description and figure in the greater proportional size and form of the lateral lobes of the buckler, which are fully half the breadth of the middle lobe, ventricose, and prominently arcuated on their exterior borders, narrowing above and completely surrounding the middle lobe, of which it forms the anterior border: whilst these portions in the description of the T. Beckii, are represented by the author as "forming narrow cuneiform appendages to the sides." This description does not accurately correspond with, at least,

Pl. 35



New Species of Trilobites

N.º 1 2 3 Paradoxides arcuatus_ N.º 4 body of Paradoxides triarthrus. N.º 5. Paradoxides triarthrus
N.º 6 Triarthrus Beckii N.º Paradoxides Scarabaeoides.

some of the impressions of this species which are represented on the cast referred to.

The figure of T. Beckii (Vide pl. fig. 6,) is added, in order to show how closely it is allied with the buckler of the *Paradoxides scaraboides* of Brongniart and Desmarest, (Vide Histoire Naturel des Crust. Fossil., p. 34, pl. 3, fig. 5.) These authors quote as a synonyme, the Entomostracites scaraboides of Wahlenberg, who thus characterizes his species: "cæcus, capite hemispherico, antice rotundato; fronte subovata, antrorsum angustiore; cauda utrinque sinuato-tridentata." The author adds, "perfect or entire specimens are rarely found. From beds of fetid aluminous ampelite." Vide pl. fig. 7.

Tour to the Caves in Virginia, and Geological Sketch of the Route. Being a Letter to the Editor of the American Monthly Journal of Geology.

Washington, May 28th, 1831.

My Dear Sir,—In answer to your request, to have some details of our tour through part of the state of Virginia, I think I can do no better than send you a copy of my Journal, assured that you will make full allowance for the inadvertencies occasioned by the rapidity of our progress, and the very limited time at our disposal.

I left this city, with a friend, on the 17th inst.; the bridge across the Potomac having been destroyed by ice during the winter, we were obliged to cross at Georgetown in a flat-boat, and arrived at Fairfax Court-house at 9, P. M., on a dark night, and over a very bad road. The principal hotel here had recently been destroyed by fire; we succeeded, however, in getting tolerable lodgings. I was awoke during the night by the Caprimulgus Vociferus, (Whip-poor-will.) which perched for some time in the vicinity of my window. Thus far, this bird has appeared to us, more common in Virginia and Maryland, than in Pennsylvania: but the notes of the partridge we have not once heard; they appear all to have perished during the severe snow storm of last winter.*

Wednesday, 18th.—Started early, and arrived at Warrington, Fauquier County, to dinner. Dr. W. of this village, presented us with several interesting specimens of minerals and rocks, also a fossil molar tooth of an ele-

* We are afraid this will be found to have been very generally the case. Our favourite retreat, Brandywine springs, in Delaware, was last year the paradise of partridges; they were abundant, and having been but little disturbed, were very confiding. But we have received sad accounts, this season, from the farmers, of their skeletons being found under the fences.—Editor.

phant, found in this vicinity. Warrington is situated on an elevated plain, from whence the views are very beautiful. Nothing could be more kind than our reception here.

Thursday, 19*th*.—Left Warrington at day-break,—roads mountainous, and in Pennsylvania would be considered very bad. It gave us pain to see so many listless, idle persons, passing their days about the taverns. Men playing at marbles like boys, and exceedingly prone to cursing and swearing. In Pennsylvania, we are not happy without some useful occupation, and our people know how to help themselves. Here the climate, and the sad burden of negro slavery, which oppresses the white man still more, have made him dependant upon others; and if a gate is to be opened, or the slightest thing to be raised from the ground, Sambo, or Governor, or Major, or Colonel, or some pseudo dignitary of the African stock, is called from his work to do it.

In approaching the Blue mountains, the hills appear to be composed of the following strata; at least we crossed them in the following succession, our route lying in a direction south of west. 1. A red sandstone: our course lay for many miles parallel to this stratum; in these parts of Virginia, it constitutes the surface rock, the disintegration of which generally forms the common soil of the country, and gives the red appearance to the newly ploughed lands. The soil bears good grain and clover. 2. Talcose rock. 3. Greenstone. 4. Slate. 5. Decomposed greenstone, or red earth, as it is called. It is of a brick-dust colour, covered with loose fragments of quartz, and is apparently the same earth in which the gold is found in Carolina and Georgia. This extreme point of the gold region displays itself here on the main road, in the vicinity of a blacksmith's shop, ten miles north of Culpepper Court-house, about twenty miles in a parallel line from the gold region of Spotsylvania. It rained during the short time we could dedicate to this locality, in which some slight traces of the metal were observed. We dug through several feet of this hill, and beneath the loose quartz, we observed several veins of decomposed micacious rock, alternating with veins of quartz, both dipping at an angle of about 65°. The mica, in these glittering sands, is thought to be gold dust, by a great many of the country people.

The specimens we obtained in our researches, demonstrate that the gold region here resembles in every important particular, equivalent formations, both in S. America, and in Russia, on the east side of the Ural mountains. The true mineral structure of our gold formations, I first learned at the geological lectures you delivered in Philadelphia, this last spring.

Much rain fell, and we were exposed to a hurricane, accompanied with thunder, lightning, hail, and rain. The mountain torrents on these occasions, swell the streams, and soon render the fords impracticable. The country people not being accustomed to rely upon bridges, are careless in the directions they give to travellers, and fatal accidents frequently happen. We were upon one occasion of this kind benighted, and compelled to take refuge in the house of a respectable widow, but she received us cheerfully, and entertained us after the best manner she was able. Most of the slaves were poorly clad, whom we noticed in the fields; *some females were ploughing and harrowing;* they looked squalid and miserable.

Friday 20th.—Arrived early in the morning at Orange Court-house, where we breakfasted. We deviated a little from our route, in order to pay a visit to Mr. Madison, at his seat, Montpelier. On presenting a letter of introduction from General P., we were received with true Virginian hospitality, and with a cordiality that charmed us.

The farm of Montpelier is under excellent cultivation and repair. The clover and maize crops are thriving, but the wheat fields, like most of those we have seen, have suffered from the fly. The mansion-house is in a fine position, on an extensive and elevated plain, almost mountain-locked. The distant views are very grand. The venerable patriot, dressed in the garb of by-gone days, was an object of great interest to us; his conversation was that of a very high bred man, dignified and easy, and appearing to seek information, rather than to convey it. The slaves here wore a very different aspect, from those we had before seen. Pursuing our journey, we arrived at Charlottesville, at 7½ P. M., after a fatiguing day's journey of forty-five miles, over bad roads. After tea, we walked about a mile to the University, to pay our respects to some friends; here we met with a very pleasant society, consisting chiefly of the families of the professors.

Saturday, 21st.—Charlottesville is rather a superior place. It contains good buildings, and its society is refined. Everywhere we found hospitality. Desiring to make a short excursion on horseback, we discovered that all the Rosinantes were engaged by the students. Our wants, however, were no sooner known than supplied, by the polite and voluntary offers of private gentlemen. Immediately after breakfast we set out on a visit to Monticello, the seat of the late Mr. Jefferson, which is built on the summit of a high mountain, distant from Charlottesville about one mile; but in following the directions of the various windings, to graduate the ascent, it is about three miles; two mountains nearly join each other; the right hand one is called Carter's mountain, that on the left is MONTICELLO; when about two-thirds up the mountain, we dismounted in the woods, at the family grave-yard, enclosed by an ill-built stone wall, where lies, in obscure repose, the neglected remains of the patriot and philosopher; there are also the graves of several of the family. The whole scenery around this lonely spot, presents a gloomy and melancholy aspect. We were informed that Mr. Jefferson requested on his death-bed, (or left a note to that effect,) that all appearance of pageantry, and useless ceremony and display, should be scrupulously dispensed with, on the occasion of his funeral. He further requested, that no other memorial should be erected to his memory, than a plain, granite column, with a simple inscription, signifying his having been the author of the Declaration of Independence—founder of the Virginia University, &c. It appears to most strangers who visit this spot, the most unpardonable neglect, that this last request should not have been immediately attended to. We were informed at Charlottesville, that the mechanics in the vicinity, had offered to complete the work gratuitously, but as yet nothing has been effected, notwithstanding five years have elapsed since the death of Mr. J. The whole establishment of Monticello is rapidly verging toward ruin, and this splendid building, which originally cost, as we were informed, upwards of 50,000 dollars, has actually been offered for sale, together with 1,100 acres of land, for the trifling sum of 11,000 dollars. In the hall there still stands a column of verd antique, surmounted by a marble bust of Mr. Jefferson, by Ceracchi.

From the summit of this isolated eminence, the views are inimitably grand and imposing; the village to the north-west appears at the very foot of the mountain, and the university, which lies about one mile further west, is also plainly distinguishable; the views in these directions are then closed by the Blue mountains, forming a pleasing back ground to the picture: towards the east and south, the horizon is extended to an immense distance, and the eye is at length tired with tracing the faint outlines of the tops of receding hills and mountains. Towards the south, in Bedford county, Va., are observable two pyramids, at least eighty miles distant; they are known as "Otter's Peaks."

On our return to Charlottesville, we again visited the university. The numerous buildings attached to it are constructed of different orders of architecture, which, whilst they serve as useful specimens of the arts, give variety and interest to the scene. The library, situated in the rotunda, is constructed on a large scale, and already contains many very rare and valuable works, in the various departments of literature and science, principally selected by Mr. Jefferson. The cabinet contains but few objects in Natural History of much interest, with the exception of a finely preserved head of the *Argali*, or "BIG-HORN," from the Rocky Mountains, brought by Lewis and Clarke; also some bones of the Mastodon. The lower jaws of two of these have the remains of the inferior tusks, which characterize several individuals of this genus; they are precisely similar to those described from an individual skull in possession of Mr. Peale, of New York, and which has been erroneously supposed to have belonged to a distinct genus of extinct fossil quadrupeds.

At 4, P. M., we took leave of our kind friends, and pursued our way to Wyer's Cave, by the road to Port Republic, and slept the same night at Coxe's, a good tavern sixteen miles from Charlottesville, close to the Blue mountain.

Sunday, 22. Recommenced our journey at 7, A. M., and soon reached the base of the Blue mountains, at Rockfish Gap, and gained the summit on foot, hammer in hand. The eastern slope of this mountain at the above named Gap, developes the following rocks: red sandstone; greenstone; old red sandstone; slate rock; and granite: some of these rocks run into each other, and occasion many peculiar varieties.

A fine clear view of the Alleghany mountains, is presented from the summit of this ridge. We arrived at Wanesborough at 10, A. M. This place is situated on the south branch of the Shenandoah, at the head of navigation, three miles distant from the CAVES—it was settled by soldiers of the revolution, who received the farms as bounty lands.

Monday, 23. After an early repast we proceeded to Wyer's Cave, situate on the south branch of the Shenandoah, approached by a road of difficult access; there is an iron forge a little below, and a tavern within eight hundred yards of the spot, kept by Mr. Bryant, who rents the farm on which the caves are found. The three slaves whom we had hired at Port Deposit, had preceded us, and awaited us at the entrance of the caves, furnished with tools for digging; the principal object of our visit being to ascertain if the caves contained fossil bones. The frequent descriptions I had read of this cave, had prepared me on the present occasion to experience disappointment. The entrance is difficult of access, and dirty—the floors are constantly interrupted by precipitous risings and depressions, and by large broken masses of the limestone in which the caves occur. In some of the chambers the floors are loaded with wet tenacious clay, and the stalactites are for the most part discoloured by the water which percolates the rock from the red sandstone above. We made the slaves dig in two places in the lowest part of two chambers the most likely to contain fossils. The floor is for the most part destitute of stalagmite, but abounds in many places with loose fragments; occasionally, indeed, with large rocks fallen from above. In the first chamber, which is sunk considerably beneath the adjacent rooms, the labourers dug five feet deep, at first through a clay soil, which became moister below, intermixed with numerous fragments of stalactite; they did not reach the bottom rock here. The next digging occurred at the extreme end of the first left branch of the cave, and after excavating three feet deep, they came to solid rock. We now ascended ladders, and crawled and scrambled through several chambers, most of which presented such a monotonous aspect, that we grew fatigued, and proposed to our guide to return. The original or natural entrance, consists of a mere fissure in the rock, of a size only sufficient for the passage of a fox ; a circumstance which diminishes the chance of finding fossil bones. It was to Mr. Wyer's following a ground-hog, (Arctomys Monax,) to a hole in this hill, that the discovery of the cave was owing, in February, 1806.

The disturbed and confused appearance of the interior of the cave, as well as of the huge masses of mountain rock which are found on the surface, can only be accounted for, by supposing powerful subterranean disturbances. On our return we visited MADISON'S cave, about two hundred yards nearer the hotel. Unlike the other, this cave has no artificial door at its entrance, to prevent the ingress of strangers ; the "*old cave*," as it is now called, being considered as beneath notice, since the discovery of the new one. The entrance of both is more than one hundred feet above the level of the river ; the ascent to either is very precipitous. The entrance to Madison's cave is capacious, the surface of the floor is less rugged, and is also, for the most part, destitute of stalagmite ; saltpetre has been obtained from the earth taken from the floor of this cave. From the appearance of things, we thought that the occurrence of fossil bones in this locality was not improbable, and we set our labourers to digging in two of the lowest positions of the two first chambers. In the deepest room, the floor consists of clay—then at three feet depth, of red earth, or decomposed red sandstone, one foot in thickness, which lies on the original floor of the cave, resembling a compact red sandstone. Whilst the digging was going on, we followed our guide along a narrow high gallery, by a continuous descent of some hundred feet, until further progress was interrupted by a body of crystal water, which is said to be of immeasurable depth, and beyond which no one has yet explored ; some terrible tale of silent suction existing in this water, has become prevalent in this neighbourhood, and effectually paralyzes the efforts of the exploring *Homo troglodytes.*

Our researches continued actively for five hours, when we returned to the hotel, fatigued, covered with mud, and disappointed in our expectations of obtaining fossil relics. We dined at 2, P. M., and immediately continued our journey, and after a ride of fourteen miles arrived at Harrisonburg, via Port Republic, over a road indescribably bad. The weather has been so cool since our arrival in these mountainous regions, especially subsequent to the thunder storm, which we encountered north of Charlottesville, that fires are kindled at all the hotels at which we halt, and cloaks are an agreeable appendage during the day. Contrary to theory, the season is less advanced on the south-west limestone region of these mountains, or what is known as the great valley of Virginia, than it is on the more northern exposure; the leaves on many of the trees have been destroyed by the frost of the 12th inst. At Harrisonburg, formerly called Rocktown, there resides a French family, emigrants from Strasburg, on the Rhine, who settled here three years ago with the intention of cultivating the grape vine. Their vineyard has been totally destroyed the present season, by the recent severe frost, just at the moment they expected to reap the fruits of their labours. The sudden vicissitudes of temperature to which this elevated situation, as we are informed, is constantly liable, will at all times render it unfriendly to the cultivation of the vine.

We left this village at half past seven A. M., and after a ride of ten miles, arrived at the "Big Spring," which should rather be called a river, so large is the body of water which rises suddenly from the foot of a limestone hill, and continues in a stream of some yards in breadth, and half a foot deep, with force sufficient to turn two large mills immediately below: this stream of water is exceedingly cool, and does not contain any fish; it is artesian, or ever flowing, and is always very pure, excepting, as a Dutch girl informed me, "just before it was going to rain," when, she said, it became turbid. It has only ceased to flow once, in the memory of the oldest settlers, when it remained dry three days, to the great terror of the farmers who hold mill seats immediately on it.

This stream is situate on the main valley route, Rockingham county, about five miles west of the Massonetto mountain, which ridge is parallel to the Blue mountains, and nearly fifty miles long. Continuing our route, three miles from the "Big spring," on a line with the mountain, we halted to dine at an inn, kept by *Mr. T. K. Fuller*, an emigrant from the State of New York, who says he has resided in Virginia nine years, and detests the slavery system, seeing that the Dunkards who reside in this vicinity, and who abjure slavery, possess farms in every respect superior to those of their neighbours. Mr. F. possesses a taste for natural curiosities, and has his bar room filled with what, in your geological lectures, you styled "N. K's." Mr. Fuller appeared concerned, to think that people will have it that he knows something of the science of mineralogy, of chemistry, &c., &c., but he frequently repeated, "it is all a mistake; *it is all natural.*"

We left this station, after having made an arrangement with Mr. F. for exchange of N. K's, on our return to Philadelphia—he possessed some fine specimens of Ammonites, and a Trilobite, from the Massonetto ridge, in the vicinity, which, under the names of "*fossil toad, and fossil snake,*" he hugged to his bossom with parental fondness; no reasonable sum would induce him to part with them; he at length consented to exchange them for "sea-shells, corals, &c., or any queer thing that comes from the great ocean." Having passed through New-Market, and crossed the north branch of the Shenandoah, at 7 P. M. halted for the night at Pitman's. We have travelled the whole day over roads cut or worn through limestone, uncovered by soil, and in the worst condition; the limestone is quite black, of the variety called Hydraulic, from the water cement which is made of it. This formation continues nearly the whole length of the Massonetto ridge, and has evidently been subjected to violent disturbing powers from below, and subsequently, water worn on its surface: the strata are occasionally a foot or two thick, and dip towards the mountain, SE. to the NE., at an angle of 45°; at other times the strata emerge vertically—again they appear in large irregular masses, sometimes almost comminuted, and frequently resembling slate so strikingly, as to be mistaken for it until more closely inspected, hammer in hand. In one place they form a narrow pass, over which the public road lies, and which is known here by the name of "the Narrows:" it is about twenty feet wide, and displays a perpendicular precipice on each side, nearly eighty feet high, with a small river on either side, unconnected at this place. This "*narrow passage*" is four miles south of Woodstock, ten miles north of Mount Jackson. On the great valley road, there is another remarkable display of this curious hydraulic limestone rock; this is a denuded hill, through part of which the public road passes; on the very summit of which there is yet a small sprinkle of red diluvium—but all the slope is naked, and the faces of the projecting strata are water-worn and smooth. The roots of pine trees, which once occupied this slope, are still seen wedged in the crevices of the rock; this denudation was occasioned, as the neighbours assured us, "by the bursting of a cloud," whose awful consequences they witnessed, to their great loss and terror.

I could refer their account to no natural phenomenon, unless it be to the bursting of a water spout. The disturbed strata of this limestone, are here well contrasted with it in its natural state. Arrived at Winchester, at 7 P. M.

Thursday 26th.—After breakfast set out for *Harper's Ferry*, distant thirty miles; passed through, and dined at Charleston; much rain had lately fallen in this vicinity, and the roads, bad at best, are almost impassable; two miles per hour we found to be rapid travelling in their present state. The black lime rock continued almost to Harper's Ferry. The view at this gap suddenly burst open before us in all its glory, as we gained the summit of a hill about a mile distant, and richly repaid us for all our fatigue and toil. The rocks which overhang the river, are composed of green slate, somewhat talcose, which disintegrates rather fast in exposed situations, and masses are continually falling. This slate rests on a fine-grained, solid granite, very appropriate for the great rail road, which is to pass here.

Friday 27th.—We left this enchanting scenery about 10 A. M., lodged the same evening at Leesburg, and arrived at Washington at 1 P. M. on Saturday 28th, one of the hottest days experienced the present season. The last four miles previous to entering Georgetown, the road leads along the Potomac canal, through gneiss and granite rocks: higher up the river, it is said that anthracite has been discovered.

An Inquiry into the Functions of the Brain in Man, and in the Lower Order of Animals. Delivered as a Lecture before the Academy of Natural Sciences of Philadelphia, 1824.

"If the science of life, and with it some of the most important departments of human knowledge, be destined to make any decided progress towards perfection; it must be by the road of experience, aided and enlightened by *general philosophy.* The way, indeed, is in some parts intricate, and its length indefinite, but whether we reach the end or not, our very efforts, and the active state of mind they maintain, will be a sufficient recompense; as the pleasure of the chase, and the healthy vigour it imparts, reward us even when the game escapes."—Lawrence.

"Γνωθι σεαυτον. Strive not God to scan,
The proper study of mankind, is man."

I propose, for this evening's lecture, the consideration of the Brain as the organ of intelligence; to treat of it, as of any other viscera, with the physical construction of which we are acquainted; for which purpose it is not sufficient to confine our observations to the human subject; it is absolutely necessary, in order to obtain any accuracy of information, to trace the faculties as they exist, through the whole of the order Vertebralia. To a want of such information, and to a neglect of this mode of proceeding, may be attributed those errors, absurdities, and false inductions, with which metaphysical and psychological works abound.

It forms no part of the author's intention to enter, on the present occasion, into any discussion relative to the nature of the soul, its mode of existence, connexion with the body, &c.; the almost universal belief of its immortality, being based on an evidence totally dissimilar from the facts and observations of which this essay is composed. Though we are as ignorant of the nature of the soul, as we are of the Deity! yet have we the same proofs of the existence of either. All nature in silent eloquence furnishes indisputable testimony. That it is a principle endowed with immortality, and capable of existing after death, in a state separate from the body, we learn from the *God of nature!* With such conviction we may well rest satisfied, and with suitable modesty direct our investigations to those palpable branches of this mysterious subject that lie within the grasp of reason: otherwise the splendid efforts of genius may in vain waste their strength in the unprofitable pursuit of theoretical speculations, and add little or nothing to the solid and accumulating mass of inductive observations. Ignorance or levity could alone instigate us to pronounce recklessly on a subject, which is so intimately associated with the present happiness, and future prospects, of millions of the human family; concerning matters of faith it is in vain to dispute; all that an individual need claim, as a rational, consistent, and dignified being, is the unqualified right to obey the dictates of his own conscience, and firmly and openly to maintain that belief which is the result of unbiassed feeling, reflection, and observation—this surely is an honest zeal, and, whether mistaken or not, should challenge the respect and admiration, and not the odium and persecution of our fellow men. But if the dread of popular prejudice, if the fear of detecting facts which may militate against our preconceived notions or antiquated opinions, can prevent us from freely discussing a physiological question so very interesting and important, where shall we seek for the boasted pre-eminence of human reason?

As light and knowledge are extended; as superstition and bigotry, which for ages have swayed their ebon sceptre over the intellectual faculties of man, yield to the empire of reason, and lights of science; the odious epithets of sceptic! infidel! and atheist! will no longer be heaped upon the blameless head of the inquirer after the functions of the brain; whose investigations have, in reality, no more connexion with the existence of the soul, than the researches of the anatomist, who treats of the physiology of the liver, the spleen, and the pancreas. He must have *base* and contracted ideas of the majesty of the Great Supreme! who supposes that an honest and sincere search after truth on any subject, can prove offensive to the canons of the Most High! The lively exertions of genius are the most exuberant sources of intellectual delight; the very pursuit of natural science is an exercise of virtue; and has a tendency to advance us, by improving our taste, to *higher* degrees of perfection.

The short space of time allotted to these lectures will oblige me to treat of this comprehensive subject in a very cursory manner. I shall not dwell on the physical construction of the brain. To those entirely ignorant of anatomy, it will be sufficient to know, that it is composed of medullary fibres, cellular membrane, and blood-vessels, —and that it is larger in man, in proportion to the nerves which go off from it, than in any other animal.

Two principal ideas have been entertained by philosophers, respecting the nature of the brain and its faculties. The arguments of the first go to prove, that the brain, the seat of the faculties of the mind, is an organ, essentially one and simple in its construction, and producing all its phenomena, by the various actions of the same part.

They compare the actions of the nervous fibre, to muscular motion; the hand, for instance, is moved by muscular fibres solely; yet how varied and extensive are the applications of this organ. Such analogies are founded in error, and are only calculated to mislead.

To me, nothing is more clearly demonstrated, than that the brain, the material organ of the understanding, is as complex in its composition, and made up of as many distinct and separate organs, as there are *special faculties* of the mind. This position is as clear, as that no two atoms can occupy the same space at the same time. Of the numerous facts upon which my conviction is founded, I beg leave to advance a few of the most prominent, which at the present moment offer themselves to my recollection.

And first, can we conceive of an organ *one* and *simple;* at the same time asleep and awake, or at the same time diseased and healthy? Yet who hath not occasionally experienced periods of *broken* slumber; when some of the mental faculties, no longer restrained by reason and judgment, (these for the time being suspended,) take their flight into the regions of fancy, and operate with unusual activity,—when "the queen of sleep, Imagination, roves in frantic sorrows, or delirious loves."

The fact is, that sleeping or awake, *all* the mental phenomena occurring in health or disease, prove that the mind is made up of separate faculties; and that these faculties have separate and distinct localities, numerous facts abundantly testify. How otherwise are we to explain the circumstance of several faculties being in operation at one and the same time? Can we not, at once, see, hear, taste, smell, feel, weep, and laugh?

The too frequent occurrence of mental alienation, furnishes us with melancholy proofs that the faculties of the mind, like the various organs of the body, are not only subject to disease, but that, like the functions of the body, one or more may be diseased, whilst the others enjoy their healthy operations: hence we have *partial* insanity, or monomania.

The hospitals are filled with these unfortunate beings, displaying the various grades of derangement, from simple absence of mind, to the total eclipse of the understanding; from the mere obfuscation of intellect, to the entire wreck of all that is noble or dignified in our nature!

Further: Accidental injuries of the brain, according to the part affected, have produced sometimes a debility, at others a total destruction of certain faculties; for instance, a blow on that portion of the orbit of the eye, within which is located the organ of memory for words or names, has been followed by complete forgetfulness of proper names, whilst the other faculties of the brain remained uninjured.

One of the most celebrated botanists of Europe, whose verbal memory knew no bounds, was afflicted with a stroke of apoplexy. He entirely recovered his intellect, with the exception of his memory for names; with the adjectives, the qualities and characters of plants, he remained familiar; but forever after was unable to name them.

Again, effusions of serum into the cavities of the brain, produce consequences which vary according to the manner in which the accident occurs; whether the effusion was slow or rapid: whether the pressure it occasions is partial or general.

Instances have occurred of effusion into the anterior ventricles of the brain, obliterating to a considerable degree all the superior order of faculties, whilst the propensity to procreate the species (or amativeness, as it is called,) continued more than usually active—which propensity being seated in the cerebellum, under the tentorium or horizontal process of the dura mater, did not suffer compression from the fluid accumulated in the cerebrum or brain proper.

In certain conditions of the *material* instrument of the mind, minor faculties which have for a long time lain dormant and supposed to have been lost, have been suddenly recalled. Dr. Rush used to mention an instance of one of his fellow students at Edinburgh, who had once possessed some knowledge of the French language, so as to speak it indifferently, but who for many years had entirely forgotten it; this gentleman becoming intoxicated in a frolic, spoke the French language with the greatest fluency, to the exclusion of the English; this state continued until he was carried to bed and fell asleep.

A circumstance somewhat similar fell under my own observation, in the case of a friend labouring under delirium.

I may here call your attention to a fact which was one of the earliest to impress my mind with the importance of Phrenology in explaining the *animal functions.*

It is a fact well established in Comparative Anatomy, that the vocal organs of all those birds arranged under the extensive order *Passeres*, are constructed precisely on the same principle; that is to say, all are furnished with a double glottis, a superior and inferior, the latter being furnished in every individual with six muscles, &c. Here then we witness a numerous host of individuals, all possessed of similar musical instruments: yet few, very few indeed, are capable of displaying a musical talent; not more than one out of fifty is capable of producing a tune; and even of those species which are possessed of the highest musical proficiency, the males alone are capable of exerting it, the females, for the most part, remaining mute. Examples of this are observed in the linnet, the mocking-bird, bull-finch, gross-beak, &c.

Cuvier, who has noticed this circumstance particularly in his "Leçons d'Anatomie Comparée," confessed his inability to afford any philosophical explanation on the common theories of the operation of the brain, and refers it to the operation of a *particular instinct:* thus acknowledging the existence of a special and distinct faculty; and demonstrating that the faculty of music resides in the brain, and not in the vocal organs.

We are led to draw the same conclusions when we extend our observations into the inexhaustible field of Comparative Anatomy. Time will only allow me to adduce one more example.

In our dissections of the anthropomorphous animals, we cannot but be struck with the fact, that the anatomical structure of the organs of voice, in some of these animals, is precisely similar to the same organs in man;—yet, who ever heard of a monkey possessed of the faculty of speech?

I am aware, that it was long ago asserted by Camper, that the throat of the simia satyris, or orang outang, is furnished with a sac, opening into the glottis, and which was supposed by this author for ever to "spoil him for speaking." But this explanation cannot stand; as most of the other simiæ have, as above stated, the vocal organs similarly constructed to those of man.

When we reflect on the intimate knowledge which existed relative to the physical structure of the monkey tribe; especially of one of the orangs, (simia troglodites,) a minute and laboured dissection of which was perfected one hundred and twenty-five years ago, by Dr. Edward Tyson; it is somewhat surprising that so much should have been said concerning the discovery by Camper of a sac communicating with the larynx of the *simia satyrus:* which was thought to offer a physical obstruction to the faculty of speech, in this class of animals.

The perfect similarity which obtains between the organs of voice, as they exist in *man*, and in the simiæ generally, was particularly noticed by Tyson; who remarks, "As to the larynx in our pygmie, unless I enumerate all the cartilages that go to form it, and the muscles which serve to give them their motion, and the vessels which run to and from it, and the membranes and glands; there is nothing that I can further add, but only say, that I found the whole structure of this part exactly as it is in man: and the same too I must say of the os hyoides. The reflection that the Parisians make on the observation of this, and its neighbouring parts, in the dissection of their monkeys, I think, is *very just* and valuable; and if there were any other advantage for the forming of speech, I cannot but think our pygmie had it: but upon the best inquiry, I was never informed that it attempted any thing in that way. Though birds have been taught to imitate the human voice, and to pronounce words and sentences, yet quadrupeds never; neither has this quadrumanus species of animals, that so nearly approaches the structure of mankind, abating the romances of antiquity concerning them.

"The Parisians therefore tell us, that the muscles of the os hyoides, tongue, larynx, and pharynx, which must serve to articulate a word, were wholly like those of man; and a great deal more than those of the hand, which, nevertheless, the ape, which speaks not, uses almost with as much perfection as a man; which demonstrate that speech is an action more peculiar to man; and which more distinguishes him from brutes, than the hand, which Anaxagoras, Aristotle, and Galen, have thought to be the organ which nature has given to man, as to the wisest of all animals, for want, perhaps, of this reflection.* For the ape is found provided by nature, with all those marvellous organs of speech, with so much exactness, that even the three small muscles, which take their rise from the apophyses styloides, are not wanting; although these apophyses are extremely small: this, particularly, does likewise show, that there is no reason to think, that agents do perform such and such actions, because they are found with organs proper thereunto: for according to these philosophers, apes should speak, seeing that they have the instruments necessary for speech."—*Tyson's Anat. of a Pygmy.*

There are some *birds*, on the contrary, whose organs of voice are altogether differently constructed, which are,

* Lord Byron says, the vulgar hand first betrays the plebeian blood in patrician families, and that this truly lordly feature may be often found in peasants' cottages.

nevertheless, gifted with the faculty of speech, such as the crow and parrot kind.

The question here arises, does the faculty of speech merit being ranked as a distinct organ, or is it only to be considered as a modification of the organ of music?

Many facts of similar import might be adduced, but I trust I have already advanced enough, in order to maintain the truth of our position, viz. that the faculties of the brain are not only distinct, and in a manner independent of each other, but that there do exist separate localities and special organs for the development or manifestations of such faculties, though their names and localities may not as yet be correctly or scientifically disposed.

As far as facts drawn from analogy can influence our opinions, we shall have the strongest reasons to conclude, that the instinctive operations, throughout their very extensive range, the *anima brutorum atque humanorum*, are directed by one universal principle, whether we view its operations in the honey-bee constructing the hexagonal cell, or the reputed lords of the creation elevating the majestic palace. The web spun by the active and cautious spider, and the elegant cocoons wove by many insects, will furnish no mean comparison, and even surpass in delicacy the richest articles of the kind produced by human art and skill; with thousands of other equally interesting phenomena, which testify in the most eloquent manner to the presence and omnipotence of the first Great Architect throughout all the works of the universe; and may serve to captivate and improve the affections, whilst they convince the understanding.

If this be true in theory, how is it in fact? Let us observe for a moment the operations of the brain, as we descend the scale of animated existence; do we not find all those instinctive faculties of the brute creation, which assimilate most to human understanding, to be located in that region of the skull marked out in man for the seat of the knowing faculties? We may also remark, that the latter faculties are wonderfully developed at the expense of the higher order or intellectual; this is the case, at least, with very few exceptions, and if we occasionally observe an elevation of the anterior and upper region of the skull, of either man or brute, without a corresponding pre-eminence of intellect, we can only refer it to the absence of a proper organization. Thus, in order to constitute a Newton, a Franklin, or a Shakspeare, it requires not only "an inch or two of brain in the right place," but "Il faut aussi qu'il soit bien organisée," as some French physiologist has aptly expressed it: at any rate, the difficulties which Phrenology has to encounter from such irregularities, are by no means greater than those which check the career of every metaphysician warm in the pursuit of any favourite system.

"*Deus est anima brutorum*" is the language of an eloquent author; but I may perhaps be allowed to remark, that the exclamation savours more of poetry, than of philosophy: if it were true that the Almighty fiat had, "ab origine," impressed his mandates upon his creatures, which were to impel them, independent of any sensible or material organization, as the means of acting:—the instinct of all animals of similar species, would, we should suppose, lead to similar results in all animals in every climate, independent of organization: but the contrary of this is the fact. Numerous instances might be produced to show that instinct alters, as the organization changes, and that it will even lead the animal to change its habits according to necessity or convenience. Thus instinct directs the Asiatic Ostrich to lay her eggs in the sand, and trust to the sun alone, and give herself no trouble about incubation; whilst the same bird, by the same instinct, is led to sit on her eggs day and night in southern Africa. Rabbits dig holes in the ground for warmth and protection, but after continuing long in a domestic state, that resource being unnecessary, they seldom employ this art.

It would appear that even an *oyster* is susceptible of profiting by experience. Diquemare long ago observed the singular fact, that "oysters, which are attached to rocks occasionally left dry by the retreat of the tide, always retain within their shells a quantity of water sufficient for respiration, and that they keep the valves closed till the return of the tide: whereas those oysters which are taken from greater depths, where the water never leaves them, and are afterwards removed to situations where they are exposed to these vicissitudes, of which they have had no previous experience, improvidently open their shells after the sea has left them, and by allowing the water to escape, soon perish."—*Vid. Journal de Physique*, xxviii., 244.

From an examination of the brain of quadrupeds, birds, and fishes, M. Cuvier draws the following conclusions, which mark the peculiar features of each of these classes:

"1st. The character which distinguishes the brain of Mammalia from that of the other red blooded animals consists,

"a. In the existence of the corpus callosum, the fornix, the cornua ammonis, and the pons varolii.

"b. In the tubercula quadrigenia being placed upon the aquæductus sylvii.

"c. In the absence of ventricles in the optic thalami, and in the position of these thalami within the hemispheres.

"d. In the alternate white and grey lines within the corpora striata.

"2. The character peculiar to the brain of birds consists,

"a. In the thin and radiated septum, which shuts each anterior ventricle on the internal side.

"3. The character of the brain of reptiles depends, "a. On the position of the thalami behind the hemispheres.

"4. The character belonging to the brain of fishes consists,

"a. In the tubercles of the olfactory nerves, and the tubercles situated behind the cerebellum.

"5. The three last classes have, in common, the following characters, by which they are distinguished from the first:

"a. Neither corpus callosum, nor fornix, nor their dependencies.

"b. Some tubercles more or less numerous, situated between the corpora striata, and the optic thalami.

"c. The thalami containing ventricles, and being distinct from the hemispheres.

"d. The absence of any tubercle between the thalami and the cerebellum, as well as the absence of the pons varolii.

"6. Fishes have certain characters in common with birds, which are not to be found in the other classes. These are,

"a. The position of the optic thalami under the base of the brain.

"b. The number of the tubercles placed before these thalami, which are commonly four.

"7. Fishes and reptiles have, for a common character, distinguishing them from the two first classes, the absence of the arbor vitæ in the cerebellum.

"8. All red-blooded animals have the following characters in common:

"a. The principal division into hemispheres, optic thalami, and cerebellum.

"b. The anterior ventricles double; the third and fourth single; the aquæductus Silvii: the infundibulum; and a communication between all their cavities.

"c. The corpora striata, and their appendices, in the form of a vault, called hemispheres.

"d. The anterior and posterior commissures, and the valve of the cerebrum.

"e. The bodies named pineal and pituitary glands.

"f. The union of the great single tubercle or cerebellum, by two transverse crura, with the rest of the brain, which gives origin to the two longitudinal crura of the medulla oblongata.

"9. It appears, also, that there exist certain relations between the faculties of animals, and the proportions of their common parts."

If the slightest degree of variation in locality, alteration of structure, or perfection of organization of the brain of different individuals of the same species leads to results of such high import, as we are led by observation to believe is really the case in man—need we be surprised that the perceptible gradation of cerebral structure observed in the inferior orders should be accompanied with a corresponding gradation of intellectual phenomena? need we wonder at the instinctive faculties of brutes, which lead some of them to the performance of actions, which set at defiance the intelligence of man, with all his boasted prerogatives? The instincts of some of the former may be inferior in number, being confined to such only as are immediately necessary to the preservation of the species; but they act in some instances with such inconceivable energy, as to extort from us the confession that they are really something *super-human!*

In a very short time after the brute animal has been ushered into an independent existence, we know that the physical structure has attained its acmè of organization; the brain partaking of this perfection, fits the animal for the performance, at this early period, of all those operations which are for ever after to characterize its species.

Whilst man, on the contrary, by that mysterious law of nature, which fixes the *duration* of existence, for the most part, in direct proportion to the length of time necessary for an animal to arrive at *maturity*, is condemned to a long, painful, and defenceless infancy! is sent into the world helpless and naked, the mere rudiment of his future greatness! his brain, in particular, a pulpy, inconsistent jelly, a "rudis indigestaque moles." The assimilating function alone enjoying full activity, is it to be wondered that this little parasite should be confined to the single instinct of filling its digestive tubes? its very earliest inclination is for the breast, the nipple is seized with avidity—a vacuum is formed, and the stomach filled; the infant sleeps, is soon awakened to embrace anew the fountain of life—and such is the early history of that animal, whose apprehension is ere long to emulate the God of the universe! As the organization advances, we observe the mind becoming slowly developed: as the former is perfected, so is the latter matured; advancing thus, faculty by faculty, function by function, he has now become capable of estimating the relations of cause and effect; the remotest transactions of history, far removed into the night of time, are in a moment called up, and arrayed before him, in all the colours of the painted landscape: surrendered to his imagination, the fancy is permitted to expatiate in a world of its own creation. He no longer confines his observations to the present and the past, but is occupied with the destinies of the future; seduced into the unfathomable abyss of infinity, he visits the luminaries of Heaven—and contemplates, detached from his senses, the immutable laws of the Universe. He weighs the planets,—measures their distances—and calculates with wonderful accuracy their most complex evolutions—now watching the flights of time—now grasping at eternity! Sensible of his august origin and immortal destiny, he raises his thoughts to the Deity, and struggles to unveil the mysteries of omnipotence. From the full blaze of intellectual energy he is soon recalled to mourn over the wreck of departed glory: already has the leaden veil of time obscured his vision; his senses successively decay; the fire of passion is extinguished by the frost of years; the sun of genius no longer dissipates the mists of mortality—he drinks largely of Lethe's stream, and is again the weak, defenceless infant, from which he sprung; he vegetates yet a little longer, then sleeps to wake no more! Here the destinies of the past, the present, and the future, unite in one point; guileless infancy and hoary age; the sceptred tyrant, and the fettered slave; the idolater and his God! find a common level, and mingle their ashes together. "*Sic transit gloria mundi!*"

This is no fancied picture, but a true copy from nature's grand original: it must have been evident to the repeated observations of you all, that the operations of mind and matter are inseparably connected.

I think it could be easily demonstrated that reason is not peculiar to *man;* and that instincts are *common* to all animals, differing only in the energy and number (with possibly some other modifications) respectively assigned to each.*

Although many animals have *some* of the senses more fully developed than man, Comparative Anatomy furnishes a demonstration that there is no animal in which they *all* exist in so great a degree of perfection. Hence we are led to conclude, that man is more intimately acquainted with the properties of the material world in general, than any of the inferior animals.

* For the facts which clearly demonstrate that brute animals are possessed of rational faculties, consult Spence and Kirby's beautiful work on Entomology, Dr. Fleming's Philosophy of Zoology, Dugald Stewart's Philosophy of the Human Mind, and Smellie's Philosophy of Natural History; to the last named author we have been indebted for many facts illustrating the intellect of brutes.

Of the Mind of Brutes, as Illustrated by their Mental Phenomena.

We shall divide these into two classes, the INTELLECTUAL and INSTINCTIVE.

1st. *Attention.*—In lower animals this faculty not only exists, but displays itself to our observation in various ways. What is it but the exercise of attention, when we see a cat watching for a mouse, or a kestrel hovering in the air? In both cases, the faculty now under consideration is exercising its control over the organs of sight. When we witness the fox-hound engaged in the chase, we see attention regulating the organs of smell; and, regardless of the other perfumes arising from the ground, permitting only the scent of the cunning fugitive to make a deep impression. The dog who has lost his master in a crowd, practises the same restraint upon his organs of smell, sometimes, also, on his sense of hearing, as he is able to detect his master by his voice, even when others are speaking at the same time.

Reasoning from analogy, we may conclude that the faculty of attention reaches as low in the scale of animal life as the organs of sensation. It is necessary, in the more perfect animals, for the regulation of every impression; hence it is probable that it exists wherever there are organs to receive an impression.

2. *Memory.*—The existence of the faculty of memory in the lower animals can scarcely be doubted, as instances daily occur of its display in our domestic quadrupeds, as the elephant, horse, and dog.* It is likewise exhibited

* In illustration of the extent of the memory of the elephant, Mr. Corse, in his valuable observations on the natural history of that animal, states the following circumstances, to which he was an eye witness:—"In June, 1787, Fâttra Mungul, a male elephant taken the year before, was travelling in company with other elephants towards Chittegong, laden with a tent and some baggage for our accommo-

by birds. We have evidence of a peregrine falcon, which was lost in the month of March, recognising its master, when retaken in the end of September. Indeed, in all those animals which are capable of being tamed, there must exist this faculty to enable them to recognise former sensations.

The memory, in the lower animals, likewise performs its operations in the same manner as with us, by the help of what is termed the *Association of Ideas*. Thus we have seen a spaniel exhibit all the ecstacy of joy when he observed his master put on any article of dress which he was accustomed to wear during the hours of sport. These things recall to him the enjoyments of the field, as distinctly as the sight of the gun. We see the same animal

dation on the journey. Having come upon a tiger's track, which elephants discover readily by the smell, he took fright, and ran off to the woods, in spite of the efforts of his driver. On entering the wood, the driver saved himself by springing from the elephant and clinging to the branch of a tree under which he was passing. When the elephant had got rid of his driver, he soon contrived to shake off his load. As soon as he ran away, a trained female was despatched after him, but could not get up in time to prevent his escape. She, however, brought back his driver and the load he had thrown off, and we proceeded, without any hope of ever seeing him again. Eighteen months after this, when a herd of elephants had been taken, and had remained several days in the enclosure, till they were enticed into the outlet, there tied, and led out in the usual manner, one of the drivers, viewing a male elephant very attentively, declared he resembled the one which had run away. This excited the curiosity of every one to go and look at him; but, when any person came near, the animal struck at him with his trunk, and, in every respect, appeared as wild and outrageous as any of the other elephants. At length, an old hunter coming up and examining him narrowly, declared he was the very elephant that had made his escape about eighteen months before. Confident of this, he boldly rode up to him on a tame elephant, and ordered him to lie down, pulling him by the ear at the same time. The animal seemed quite taken by surprise, and instantly obeyed the word of command with as much quickness as the ropes with which he was tied permitted, uttering at the same time a peculiar shrill squeak through his trunk, as he had formerly been known to do, by which he was immediately recognised by every person who had ever been acquainted with this peculiarity." Phil. Trans. 1799, p. 40. The same observer furnishes satisfactory evidence that another elephant, a female, taken in 1765, and which was turned loose in 1767, when retaken in 1782, recollected the customs of her former bondage, and lay down at the command of her driver. "He fed her from his seat, gave her his stick to hold, which she took with her trunk, and put into her mouth, kept and returned it as she was directed, and as she formerly had been accustomed to do." —Ibid.

practising an attempt at recollection by smelling at a stranger, and, at last, after many efforts, recognising him as an old friend. We have known a dog to recognise an acquaintance in the dark, after a long absence, by the tone of his voice.

3. *Imagination.*—In the lower animals the faculty of the imagination certainly exists, although, from the imperfect communication which subsists between us and them, its operations, as distinct from memory, cannot be traced with any degree of certainty. The pointer, who exhibits impatience to travel when his master takes his gun in his hand, recollects the pleasure of his former sports, and wishes to have them renewed. What is it but imagination that persuades him that they may return, and even points out the channel of their course? A dog howls when his master is absent, and will anxiously look for his return in particular directions. Here is anticipation of a future event, and action founded on the certainty of its occurrence. We have seen a dog, evidently entertaining suspicions that his master would prevent his being a companion in his journey, steal away unobserved, and wait on the road at a considerable distance from the house. Here we have the anticipation of the master's going from home: apprehension of being detained: the prospect of gratification from the journey: an expectation of his master's road, and the success which would crown the plan; all of these efforts of the imagination; in fine, it is indisputable that dogs are subject to *dream.* As we descend in the scale, these displays of the imagination can scarcely be perceived, unless in actions which suppose a succession of events similar to those which have occurred.

There is one very striking difference between this faculty as it exists in man and in the lower animals. With us, it is frequently exerted on speculative truths: in them, on present, or future sensations. With us, sometimes on things which we know will never happen: with them, on things which the probabilities of experience warrant.

PART SECOND.

Ideas of Reflection.

1. *Personality.*—Uncultivated minds have not very correct notions of these ideas of reflection: but, still they do arise even in such, and, in various ways, influence their future operations.

The inferior animals likewise possess similar ideas of reflection. It is true, that they appear to be equally acted upon by the impressions produced by the secondary as well as the primary qualities of matter: nor have we any evidence that they act upon distinction, but they know that there is a difference among the qualities. They are, to a variable extent, acquainted with them, and regulate their conduct by this knowledge which they possess. They readily perceive changes in the objects with which they are familiar. They are acquainted with individuals, or their identity, as the dog is acquainted with his master—with groups, as in the case of the shepherd's dog, who is capable of marking the individual of a flock pointed out to him by his master, and steadily pursuing it. Even the notion of number is not unknown, as appears from the wolf uniting in bands in the chase,—and, while afraid of attacking men in company, appearing fearless of the resistance of a straggler.

2. *Time.*—The inferior animals evidently have a knowledge of time. Those which leave a particular dwelling at stated intervals, measure the distance they ought to travel, and return with regularity to their home. The sun appears to be their great regulator, as they are influenced by the changes which take place with his light and heat. Fishes, and other animals which live in the sea, or search for food on its shores, appear to regulate themselves by the motions of the tide. The regularity of the

crowing of the cock has been long admired,—but it appears difficult to point out the measure of time by which it is governed.

3. *Power.*—That the lower animals possess some notions of power, and of cause and effect, may be inferred from various actions which they perform. "Thus, for example, we have seen the hooded-crow (corvus cornix,) in Zetland, when feeding on the testaceous mollusca, able to break some of the tenderer kinds by means of its bill, aided, in some cases, by beating them against a stone; but as some of the larger shells, such as the buckie, (Buccinum nudatum,) and the wilk, cannot be broken by such means, it employs another method, by which, in consequence of applying foreign power, it accomplishes its object. Seizing the shell with its claws, it mounts up into the air, and then loosing its hold, causes the shell to fall among stones, (in preference to the sand, the water, or the soil on the ground,) that it may be broken and give easier access to the contained animal. Should the first attempt fail, a second or a third are tried, with this difference, that the crow rises higher in the air in order to increase the power of the fall, and more effectually remove the barrier to the contained morsel. On such occasions, we have seen a stronger bird remain an apparently inattentive spectator of the process of breaking the shell, but coming to the spot with astonishing keenness, when the efforts of its neighbour had been successful, in order to share in the spoil.* Animals, in general, seem to have a tolerably correct notion of their own powers, as we do not often see them attempting to accomplish objects for which their strength is inadequate. Thus, we have seen a pointer, which, if a hare was wounded, would pursue with the utmost keenness, but if otherwise, would witness her escape without exertion. It is the knowledge of the variety of

* Pennant, Brit. Zool. iv. p. 114, mentions similar operations performed by crows on muscles.

power which sometimes makes a horse run away with a bad rider, when he would not make the attempt with a good one."

A wasp was observed to light on a gravel walk, and seize a large fly and endeavour to carry it off—a great inconvenience was experienced from the wind, which impeded the flight of the wasp: it accordingly alighted, cut off both wings of the fly, which offered the greatest obstruction, and renewed the attempt at flight; the load was still too heavy—the animal alighted a second time, and lopped off the head of the fly, and eventually regained the nest.*

In countries infested with monkeys, many birds, which in other climates build in bushes and clefts of trees, suspend their nest upon slender twigs, and, by this ingenious device, elude the rapacity of their enemies.

The nymphs of water-moths, commonly called codbait, cover themselves, by means of gluten, with pieces of wood, straw, small shells, or gravel. It is necessary that they should always be in equilibrium with the water in which they live. To accomplish this purpose, when their habitations are too heavy, they add a piece of wood; when too light, a bit of gravel.

A cat was known to frequent a closet, the door of which was fastened by a common iron latch; a window was situated near the door; when the door was shut she gave herself no uneasiness; as soon as she was tired of her confinement, she mounted on the sill of the window, and with her paw dexterously lifted the latch, and came out.

"A black-snake was seen climbing up a tree, evidently with the view of procuring the young birds in the nest of a Baltimore bird. This bird, it has already been observed, suspends its nest at the extremity of the branch of a tree. The branch to which the bird of which I am now speak-

* See the bee and the gravel stone. Virg. Georgics.

ing had affixed its nest, being very slender, the serpent found it impossible to come at the nest by crawling along it: he therefore took the advantage of another branch which hung above the nest, and twisting a small portion of his tail around it, he was enabled, by stretching the remainder of his body, to reach the nest, into which he insinuated his head, and thus glutted his appetite with the young birds."—*B. S. Barton's Tracts*, vol. 1st, p. 68.

"One of my friends possessed a very intelligent monkey; the animal being very fond of nuts, he used to amuse himself by placing them beyond the reach of his chain; after many useless efforts, which only served to stimulate invention, the monkey, seeing a servant passing by with a towel under his arm, seized the towel, and made use of it to bring the nut within his reach—after having thus obtained the nut, he used to crack it with a stone—one day after a hard rain, the earth being softened, the nut was driven in, so as to prevent him cracking it,—sensible of the cause, he placed a stone beneath, and thus readily obtained his ends." —*Discours et Memoires par l'auteur de l'Histoire de l'Astronomie.*

4. *Truth.*—The inferior animals possess a knowledge of truth, but in a more limited degree than man. They do not direct their organs of perception to so many objects, or examine the same object under such variety of aspects. But that they possess much knowledge derived from experience, all will be ready to admit, who have traced the operations of memory which they exhibit. Besides, we witness its display in the caution of an old horse, in comparison with a young one,—and of the older animals which we wish to ensnare, compared with the more ignorant ones, which more easily fall into our hands. The absence of experience enables us to deceive the latter, its presence in the former teaches them to avoid the error.

b. *Testimony.*—Among the inferior animals, there are some species which, during life, are solitary and fixed to the same spot, as the common oyster. These can derive no information from the testimony of others. Their knowledge of external objects must be limited to the results of their own sensations. But in the case of all monogamous or polygamous animals, whether gregarious or otherwise, a considerable dependence is placed on the testimony of others in a variety of circumstances. Thus, in the case of wild geese, or crows feeding in a field, the knowledge of approaching danger observed by one, is speedily communicated to the whole, who immediately act upon the information.

Errors in testimony, among the lower animals, are frequently committed, as the result of erroneous information or experience. Thus, a cock will often give warning of danger to the hens under his charge, if a pigeon flies rapidly over his head, mistaking it for a rapacious bird. In other cases, the sentinel may be deceived by false appearances, and, considering that there is no danger approaching, fail to do his duty.*

There are few instances of attempts to give false testimony among the inferior animals, which do not appear to arise from the impulse of the instinctive rather than the intellectual powers. The fox, however, in a tamed state, will often scatter food within the reach of his chain, and then remain motionless until an unwary chicken approach-

* Dr. Edmonston, in his "View of the Zetland Island," gives a very striking illustration of this neglect of the sentinel in his remarks on the shag. "Great numbers of this species of the cormorant are sometimes taken during the night while asleep on the rocks, and the mode of accomplishing it is very ingenious. Large flocks sit, during the night, on projecting rocks of easy access, but, before they commit themselves to sleep, one or two of the number are appointed to watch. Until these sentinels are secured, it is impossible to make a successful impression on the main body; and to surprise them, is therefore the first object. With this view, the leader of the expedition creeps cautiously and imperceptibly along the rock, until he gets within a short distance of the watch. He then dips a worsted glove in the sea, and gently throws water in the face of the guard. The unsuspecting bird, either disliking the impression, or fancying from what he conceives to be a disagreeable state of the weather, that all is quiet and safe, puts his head also under his wing, and soon falls asleep. His neck is then immediately broken, and the party despatch as many as they choose."—Vol. ii. p. 253.

es the cunning observer. This is an attempt to deceive, not so much by scattering about food, as by lulling asleep all suspicion by his quietness.

5. *Duty.*—Among the lower animals, we do not observe any instance of their acting contrary to their experience. In a domesticated state, where laws have been imposed upon them, they obey from various motives; the prospect of reward, the dread of punishment, and ultimately habit. They are aware of the conformity or disagreement of their actions, to the standard by which they are tried. Examples of this kind are daily exhibited in the ox, horse, and dog.

6. *Deity.*—There is no evidence to prove that the brutes have any idea of a Supreme Being. Our notions of a Deity are not referrible to any particular intellectual faculty; but are solely the result of a greater perfection of all the mental faculties; hence all our ideas of reflection are more perfect and extensive. If the facts which we have adduced in support of the statements be admitted, it follows that the intellectual powers of man differ, not so much in kind, as in degree, from those of brutes.

In the examination of the *active powers* or *instincts*, it has been demonstrated, that man and brutes possess appetites, desires, and affections, regulated by the same laws, and destined to accomplish the same objects in the animal economy, exhibiting, however, slight shades of difference, according to the species. The superiority of man over the brutes in reference to the *active powers* (except perhaps some of the desires) is so small, that doubts may be entertained respecting his claims of supremacy.

Man, therefore, is far exalted above the brutes by a superior degree of perfection in his intellectual faculties; by a greater power of restraint over his instincts; and by readier methods of combination, and of communicating his ideas and feelings, rather than by a difference in the nature of his mental constitution!

Experiments to ascertain the Operation of various Poisons on living Vegetables; performed in 1830 *and* 1831.

I COMPLETED last year the following series of experiments, in order to test the powers of vegetable life in resisting the effects of vegetable and mineral poisons. The positive nature of the results which were obtained, is calculated, in my opinion, to throw considerable light on the *physiology* of plants; a department of science, at the present time, too much neglected, even by the members of the medical profession; and by the practical horticulturists, for the most part, entirely overlooked.

The application of certain poisons to plants and flowers, in order to destroy noxious insects and larvæ, is not unfrequently recommended; and doubts have been expressed as to the injury that might occur to the plants themselves by such treatment: it has even been positively asserted that the destruction of the plant is the necessary consequence of the application of certain vegetable poisons in some instances.

In the progress of science, next in importance to the accumulation of true knowledge, is the necessity to disencumber ourselves of error. If the results of the present experiments possess no other merit, they will be esteemed interesting on this account alone. I have been led to the present investigation by perusing a notice of experiments of a similar nature, by M. Marcaire Princep, a professor of botany in Geneva, in the "Bulletin des Sciences Naturelles," for March, 1830, of which the following is an extract:

"The experiments detailed in this memoir, have for their object to prove that the juices or extracts of plants, poisonous to animals, are equally so to the vegetables from which they are obtained. Thus M. Marcaire Princep has succeeded in killing branches, and even entire individual plants, of the *datura stramonium*, *hyosciamus niger*, and *momordica elaterium*, by plunging them into distilled water, charged with the juices and extracts of these plants, or even by watering them with this narcotic water."

"M. Goeppert, of Breslau, has published in the annals of Poggendorff, an account of experiments from which he derived very different results." But neither of these authors extended their experiments to the introduction of poisons into the substance of the plants.

I first confined myself to a repetition of the experiments of M. Princep, but obtained results entirely at variance with his. I now determined to pursue the subject on a more extensive scale. In the garden of the Philadelphia Alms-house Infirmary, I selected a number of young and thriving plants, and assisted by the gardener, and several of the resident physicians, I applied the following named poisons, as hereafter specified, taking care to wound the *bark* of the *perennial*, and the *interior* parts of the *annual* plants, so that the poison should be directly applied to the wounded sap-vessels. The poisons used were, the extracts of stramonium, belladonna, and cicuta; the essential oil of *nicotiana tabacum*, diluted hydrocyanic acid, and powdered oxydum arsenici.

Experiment 1. September 18th, 1830. A strong, thick solution of the extract of belladonna and cicuta, (German manufactory,) was introduced into the bark and pith of different stems of the stramonium, at 12, meridian.

2. Extract of belladonna introduced into the stem of the palma christi.

3. Powdered white oxyd of arsenic was freely spread about the root of a young palma christi, and the plant watered.

4. Arsenic introduced into the stalks of two young tobacco plants, near the roots.

5. Two young stramonium plants were selected: arsenic was introduced into the stalks and stems of one, and spread about the root of the other, and the plant watered.

6. Dilute hydrocyanic acid introduced into an incision made into the stalk of a stramonium.

7. Dilute hydrocyanic acid poured on the root of *impatiens balsamina.* (Lady-slipper.)

8. Strong oil of tobacco introduced into the stalk of palma christi.

9. Idem, into the stalk of stramonium.

10. Idem, into the stalk of a young tobacco plant.

11. Idem, into a branch of *ficus carica.* (Fig-tree.)

12. Idem, placed freely round the root of a young pyrus, (pear-tree,) the earth being loosened and watered.

13. Idem, placed round the root of palma christi.

14. Idem, introduced into the stalk of euphorbia sericea.

15. Arsenic freely spread round the root of the *mimosa sensitiva*—exposed to the rain and dews.

It is not necessary to enter more minutely into details of these experiments, some of which were frequently repeated, with great care. The same result universally followed in every instance. Not one plant, shrub, or flower, displayed signs of the least injury from the varied applications of the different poisons; some, indeed, appeared to thrive better for the attentions which were rendered them.

I shall only add a list of plants, on which some of the experiments were subsequently repeated at my request, by Mr. John Carr, at Bartram's botanic garden.

1. *With extract of belladonna.—Zinea elegans, impatiens balsamina, vinea rosea,* and *kœlruteria paniculata.*

2. *With extract of cicuta.—Zinea elegans, tagites, vinea rosea,* and *salvia splendens.*

3. *With oil of tobacco.—Amaranthus* and *Zinea.*

These additional experiments, performed by a skilful practical botanist, confirm the observations previously made: hence, we are permitted to conclude, first, That the experiments detailed by Professor Princep, are erroneous. Second, That substances which act as lethal poisons to animal life, are not so to vegetables.

We cannot but admire the wisdom, order, and harmony of creation! fixed to the earth by immutable laws, plants and flowers would have soon ceased to exist, had their susceptibilities, like those of animals, rendered them liable to the agency of poisons, to contact with which they are so much exposed.

"We had the satisfaction of assisting, during the present month, together with Professor Del Rio, at a repetition of those curious experiments on vegetable substances, with vegetable and mineral poisons. They were conducted by Dr. Harlan, assisted by Dr. Moore, in the garden of the Philadelphia Alms-house Infirmary, and the results corresponded precisely with those obtained in September, 1830.

"The plants to which the poisons were applied, were palma christi, stramonium, nicotiana tabacum, balsamina impatiens, brassica, geranium, and carduum benedict.

"The poisons used in the experiments, were ol. tabaci, oxyd. arsenic, extr. stramonium, extr. cicuta, corros. sub. in sol., ol. terebinthi, and a strong solution of opium.

"Each of these poisons was separately introduced into the circulation of individual plants, by incisions made in the stems, under the leaves, and by similar, separate applications of them to their roots; by infusions, and by powder also, in the case of arsenic. In some instances the poisons were placed around the roots only, viz. corros. sublimate, arsenic, sp. turpentine, and oil of tobacco.

"In none of these instances was any of the plants poisoned. One of the young geraniums faded, after constant impregnation. for three days, of the earth about its roots, but this is evidently attributable to its soil being rendered unfit for the support of vegetable life.

"We must therefore adhere to the reasonable opinion, that plants have the property of segregating from the soil or atmosphere, those principles which are proper for their healthy state. and of rejecting those which are injurious to their organization. If plants yield to the deleterious influence of those principles which are injurious to other organized bodies, it is because—as in the case of the young geranium—they cannot appropriate those salutary principles, upon which their existence depends, and which enables them to exercise their natural functions, one of which is, to reject that which is injurious to them. We speak now of the circulation of plants, and not of mechanical application of poison to their parts. Oil of turpentine applied several days to the bark of many trees, and especially the linden tree, will soften, and eventually destroy the part; but the experiments tried with the balsamina, or lady-slipper, the palma christi, the cabbage, and tobacco plant, whose roots were liberally supplied with spirits of turpentine, prove that it did not affect them through their circulation. Dr. Harlan's attention to this subject, will be properly appreciated by those engaged in the study of the physiology of plants.

"G. W. FEATHERSTONHAUGH,

"*Editor of the Monthly Journal of Geology and Natural Science.*"

Experiments with Phosphorus on a Cat. A paper read before the American Philosophical Society, February 17, 1832.

No small degree of interest has recently been excited by the appearance among us of M. Chaubert, of Paris, who professes to have discovered antidotes for some of the most lethal poisons, and his powers of resisting their effects have been succesfully demonstrated for several years past, throughout the greater part of Europe. Since his arrival in this country, M. C. has repeated most of his experiments, both in this city and in New York,—particularly those with *prussic acid* and *phosphorus*, the former of which he exhibits to animals; the effects of the latter he generally tests upon his own system, swallowing with perfect indifference from twenty to forty grains. M. C. has favoured me with the following remarks relative to the operation of this poison on himself. It produces, in the first place, exhilarating effects, succeeded, sooner or later, by a transitory sense of depression or faintness. In the course of a few hours, however, the most powerful and painful aphrodisiacal effects are the consequence: if the dose has been very large, frequently repeated, and especially if he has permitted three or four hours to elapse previous to taking the antidote, his bones become affected with pain and soreness throughout the skeleton, so as to render the usual pressure almost insupportable: his complexion also changes to a bilious hue, and his bowels become costive. All that M. C. has informed me of, concerning the nature of his antidote for phosphorus, is, that it is of an *animal* nature.

Many conflicting opinions are entertained by medical men, in regard to the extent of the deleterious effects of this poison on the animal body; some have even pronounced the substance to be inert, when taken into the stomach in a solid state; and others are of opinion, that its mixture with oil renders it *less* noxious; while M. C. positively affirms, that oil renders it a hundred fold more virulent. Some writers affirm, that one quarter of a grain is sufficient, in some cases, to destroy the life of man; and by some German chemist it is stated, that the water in which he had washed phosphorus, being drank by chickens, proved fatal to them. I have heard lately of a patient in Paris, to whom one grain was administered twice daily, for impotency, with fatal effects.

Confused by these conflicting statements, I was desirous of obtaining some satisfactory results; for this purpose, I procured a full-grown female cat, and on Tuesday, February 15th, at 10 A. M. administered *eleven grains* of phosphorus, cut into small pieces, and mixed with a tablespoonful of milk and water. The animal experienced no uneasiness for the first eighteen hours, nor could I observe any symptoms, referrible to the poison; she however passed urine, during the evening, which emitted the smell of phosphorus, and some irritation existed about the external organs of generation. On Wednesday, she displayed considerable uneasiness; drooped, cried, and during the morning experienced a fit of epilepsy; these symptoms increased apace, and on Thursday night and Friday morning, she was, for the most part, senseless, and expired in spasms at 1 P. M. about three days after taking the poison.

The following pathological symptoms were observed on dissection:—The intestines, for the most part, empty, and much contracted; the liver and kidneys gorged with blood; the former covered with small bright punctuations of blood; the uterus contained three embryons about two weeks old; (the term of gestation in these animals being fifty-six days.) On opening the stomach, the mucous tunic was observed generally inflamed: particularly so about the great curvature, and pyloric portion, which also displayed numerous holes, or abrasions, some of them much larger than the pieces of phosphorus which she had swallowed; two or three spots were sphacelated, near the pylorus; the mucous coat was also *softened* in its structure; this coat was highly inflamed, and preternaturally softened throughout the duodenum; the same appearances extending the whole length of the intestinal canal, which was nearly empty, with the exception of the rectum, which was distended with hardened fæces, of which it does not appear that there had been any discharge after the administration of the poison: not the least appearance of phosphorus, in a solid state, could be detected in the stomach or intestines, nor even in the fæces when exposed to a high temperature; the poison was most probably all dissolved in the stomach, as the animal was not observed to vomit until the end of the second day of the experiment, and then food only was ejected. The heart and lungs were collapsed; the brain and spinal marrow more than usually dry and pale; several lumbrici were observed in the stomach and intestines, all dead, though the animal was still warm. From this experiment it results, that phosphorus, though not an active poison, is fatal to these animals, when taken into the stomach; that it excites violent inflammation in the mucous membrane, and ulceration of such portions as the solid phosphorus comes in contact with, occasionally attended with sphacelus; that the gastric liquor is capable of dissolving solid phosphorus; and that when it passes in a state of solution into the intestines, it occasions inflammation and softening of the mucous coat generally, contracting the bowels, and inducing constipation; and that the glandular, muscular, and osseous systems among those parts not immediately in contact, are principally affected by the operation of this poison.*

It does not appear that phosphorus exerts any very powerful operation on the uterus, as in this instance no symptoms of abortion were the consequence of so large a dose, notwithstanding the spasms which formed part of the symptoms.

* The London Medical and Physical Journal, conducted by T. Brady, M. D. R. Batty, M. D. and A. A. Noehden, M. D. Vol. I. page 85, has the following passage :—

"From a letter from Citizen S. lately published in the '*Annales de Chimie*,' it appears that no less than twenty-seven of his poultry, including a turkey-hen, all died in the course of a few days, in the most dreadful convulsions. Curiosity induced him to open them, when every thing appeared in a sound state, without any indication of the slightest malady; he perceived, however, that the internal membrane of the gizzard was somewhat tough and shrivelled, like most animal substances when exposed to the action of heat. In all the different subjects, the stomachs were luminous; the grains, not fully digested, glittered on falling down to the ground; and those which at first sight presented no light, almost instantly exhibited both light and the smell of phosphorus when heated. This convinced Citizen S. that there could be only one cause for all these effects, and that they were all produced by the circumstance of his having, four or five days before, thrown out some water through a casement into the poultry yard; which water had served to wash and purify several substances, on which operations of phosphorus had been performed. The phosphorus contained in these waters, in a state of nature, he considered as solely occasioning the death of such a number of domestic animals."

Experiments performed on Living Animals, to prove that the Circulation of the Blood, through the Lungs, is immediately and entirely suppressed during Expiration.

I HAVE been induced to offer the following experiments, with the hope that the original object of them may be considered of so much importance, as to induce some one, possessed of talent, industry, and leisure sufficient, to institute a course of experiments, in order to throw some light on a subject, of which, as yet, we are entirely ignorant.

I am perfectly aware that hypothesis, of whatsoever kind, ought not to be admitted into science without the most rigorous examination; and that doubt has a right to close the door of credence, until the passport of demonstration is produced, sealed by nature or experiment.

For the accuracy of my experiments I can vouch; it is for others to judge of the correctness of my deductions.

The fact that the arteries are empty and the veins filled with blood after death, (provided the death of the animal has not been sudden or violent, as from the effects of electricity, a blow on the stomach, the operation of certain gases, &c.) is well known to every one the least conversant in anatomy; but the *cause* of this phenomenon has hitherto escaped the attention of the anatomist: at least no satisfactory explanation has ever been offered. It was with a view to obtain some information on this subject, that I was encouraged to perform the operations I am now to relate; and although I was disappointed in the main object, other circumstances were brought into consideration during the experiment, equally interesting to the practical anatomist or speculative physiologist; and I flatter myself I have detected one error in physiology.

It was the opinion of many, and inculcated, for several years, in the lectures of our much lamented Professor of Anatomy, Dr. Wistar, that the circulation of the blood, through the lungs, was not prevented during expiration, or the collapsed state of those organs; and that death, in such instances, was caused by the deteriorated or deoxygenated venous blood finding its way into the left cavities of the heart, and thence into the coronary arteries. If my experiments be correct, this reasoning is certainly erroneous. It is true they differ widely in their results from those of Dr. Goodwin, but this subject was not immediately connected with the object of his experiments.

I am happy to state, that after having communicated my experiments to Dr. Wistar, he was induced to change, in part, his opinion. He informed me, that from Goodwin's experiments, he had been induced to believe the contrary for many years. Much interest was shown on his part; and, after frequent conversation with him on the subject, he was kind enough to urge me to pursue my experiments extensively, and publish them; since which time various circumstances have prevented my giving the subject further attention; and I am induced now to make them public with the hope that some one, more capable, will institute a course of experiments to determine the problem yet to be solved, "why, after death, the arteries are empty and the veins filled with blood."

Experiment 1st.

Having secured a full-grown, healthy cat, in a horizontal position, I passed a ligature around the trachea, taking care that the lungs were in a state of expiration; I immediately opened the thorax, and exposed the heart to view; when the following appearances presented themselves. Both the auricles and ventricles contracted separately and naturally at first, but in less than five minutes the left auricle ceased; in fifteen minutes the left ventricle also; and in twenty minutes after the operation, neither could be again made to contract by any stimuli whatever. But the right auricle and ventricle continued their systole and diastole, incessantly, for fifty minutes; the consequence of which was, the right cavities, together with the two cavæ, became exceedingly distended; for, long previous to the left cavities having ceased to contract, not a single drop of blood entered the left auricle, which was very flaccid and empty. The circulation through the lungs, was, in this instance, entirely suspended: here we may remark, if the lungs did admit of as free circulation during expiration as during inspiration, why, in the fœtal state, does so small a portion of blood find its way through them?

I am unable, in this experiment, to determine why the right cavities should continue their systole and diastole so much longer than the left; unless it is that they still continue to receive a portion of the vis vitæ from the blood by which they were distended; as they are both, cæteris paribus, possessed of the same powers of life, being animated from the same source.

I now thought that the phenomenon in question was explained, by supposing the blood continued to circulate in the veins, whilst no more was propelled into the aorta and arterial canals; the latter were, of course, emptied. But I was soon convinced, that though the principal objection was obviated, the experiment did not explain in what manner that portion of blood, forced into the aorta by the last contraction of the left ventricle, found its way, independent of any vis à tergo, through the whole extent of the arterial canals to the mouths of the veins. This constitutes the problem to be solved; and it was of this, in particular, that Dr. Wistar asserted he had never heard any satisfactory explanation offered; although he had availed himself of frequent opportunities of conversing with men of science upon the subject; some of whom argued, the pressure and action of the surrounding muscles as the cause; others the pressure of the external air; but he remarked, "the elasticity of the coats of the arteries would resist any such pressure, and prevent the obliteration of their calibers.*

On dissecting the heart, the left cavities were found nearly empty of blood; what remained was in consequence of their contractions being too feeble to force it out; the right cavities, on the contrary, were enormously distended; the lungs, when cut into, displayed a sanguineous, frothy appearance, similar to that observed in the lungs of drowned animals.

Experiment 2d.

Having procured another full-grown, healthy cat, in the presence of two medical gentlemen I passed a ligature around the trachea, the lungs being in a state of expiration, and proceeded to expose the heart to view; and here I had an opportunity of observing, that the pericardium is perfectly transparent, and, like the cornea of the eye, becomes dim only at the approach of death. In this experiment it was some time before we perceived I had not removed it, as it lay flaccid over the heart, whose motions were distinctly observed through that membrane.†

Although the *nature* of that principle, which animates the animal and vegetable kingdoms, may be too abstract for our investigation, yet its *effects* and its *laws* are of the utmost importance to the physiologist; and is a subject requiring our most serious consideration.

* Gravitation of the blood from the large to the smaller branches is most probably the cause of the emptiness of the former.

† This experiment was made in the year 1816.

Deprive the animal structure, for an instant, of this unknown, imponderable, and invisible principle, we cannot but be struck with the great change that immediately supervenes, previous to decomposition; the adnata, over the cornea, becomes dim; the pericardium loses its transparency; the bladder permits the urine to percolate through its coats; the stomach and the gall bladder lose, in a great measure, their adhesive affinity, and allow their contents to transude the pores, and become effused upon the intestines; the muscular fibre cannot now resist near the same force as during life. Which demonstrate that there exists a vital or animal, as well as a *chemical* affinity in the living body; so different are living from dead membranes; and hence the fallacy of any experiment performed on dead parts, with a view to determine their functions whilst in a living state.

I commenced operations at five minutes before nine o'clock, P. M. In less than five minutes after the trachea was tied, the left auricle ceased to contract, as in the former experiment; in fifteen minutes the left ventricle ceased its contractions; and here the circulation through the lungs was suppressed. In twenty minutes the right ventricle ceased to contract, but the right auricle continued its systole and diastole, not only fifty minutes, as in the former experiment, but for *seven hours*, four of which it continued its contractions distinctly, and independently of any other external stimulus than its contents, or the atmosphere to which it was exposed; whilst every other part of the body, the heart itself, except the right auricle, was cold, dry, and lifeless. The object of the experiment not being to determine the length of time the heart could contract after the cessation of respiration, but to prove that the circulation through the lungs was not only interrupted, but altogether suppressed, during a state of complete expiration, it was discontinued. My assistants left me, at the end of an hour, to continue my observations alone; being perfectly satisfied, from the great distention of the right cavities, the regurgitation of the blood in the cavæ, the violent efforts of the right cavities, and the flaccid state of the left side of the heart, that no more blood had passed through the lungs.

I still, however, felt an inclination to see how long the contractile power would remain in the *right* auricle, and observed it attentively from nine P. M. until four in the morning; most of which time it contracted of itself, and was highly susceptible of external stimuli. On touching it with the point of the scalpel it contracted briskly; towards the latter part its contractions became less frequent, with intervals of some seconds, which intervals increased until one o'clock, A. M., after which it no longer contracted independent of external stimuli. On dissection, the left cavities were found flaccid and empty; whilst the right cavities, the two cavæ, with the pulmonary artery, were distended. The blood, in the right cavities, did not coagulate so long as the power of contraction remained. This engorgement of the right cavities would not have taken place did the lungs allow as free circulation, when compressed by expiration, as when expanded by inspiration; and that it does not depend on the want of power in the right auricle, to force it onward, is shown by instituting artificial respiration, which continues the circulation; also by the resuscitation of animals, which have remained a long time under water.

Conclusion.

From these experiments I infer, that death or asphyxia, from drowning or hanging, is not induced from the deteriorated or venous blood finding its way to the coronary arteries of the heart, nor from pressure on the brain, and loss of nervous energy solely, as it is of no importance whether the animal be decapitated or not, provided artificial respiration be continued; the circulation goes on equally well for a time. But in every case of asphyxia there is a negation of oxygen, and consequent paralysis of the lungs; and the effect is the same, whether this negation proceed from the inhalation of mephitic air, from the exclusion of all gas, as in drowning, hanging, tying of the trachea, or from interrupting the nervous spirit, by passing a ligature around the eighth pair of nerves; they all induce a paralysis* of the lungs, and a consequent suspension of their action. This paralysis is, therefore, in every instance, the *immediate* cause of death; whether it proceed from the simple negation of oxygen, or destruction of nervous energy; the one may produce or occasion the other. For although by inflating the lungs after decapitation, the circulation may be made to continue, it does so no longer than the right cavities of the heart possess a power of contraction sufficient to propel the blood through the expanded lungs; and until the vital energy of these organs is expended; which must soon happen. For no sooner does the paralysis of the lungs take place, than that power, by which the life of animals is produced and continued, and which I suppose to be derived from the atmosphere, is put a stop to, and the blood, which animates all the solids, no longer receiving its supply, death, or the total extinction of the vital principle, is the consequence. On the other hand, if the lungs be left in a state of expiration, the circulation is immediately suppressed; as in this instance, besides the paralysis, the air cells, with the extremities of the arteries and veins, are compressed.

It will be recollected, that the length of time for which the hearts of the animals dissected continued their contractile power, differed widely; the one fifty minutes, the other seven hours. And as it is impossible to determine what length of time the human heart may retain its *vis*

* By paralysis of the lungs I mean a suspension of their vital action.

insita, after every other phenomenon of life may have ceased, from asphyxia, we should be encouraged to attempt resuscitation in cases otherwise desperate.

The frothy, sanguineous appearance, noticed in dissecting the lungs of the animals which were the subject of these experiments, has, by some authors, in their dissections of drowned persons, been mistaken for the water which they supposed to have passed into the lungs; but it is not peculiar to the lungs of drowned animals. It may be observed, more or less, in death from all kinds of asphyxia; it is occasioned by the halitus, or vapour, which escapes from the exhalents, not being carried off by the function of respiration, being condensed and collected in the cells, or from an effusion of *serum* into their cells.

As the deteriorated or venous blood never reaches the left side of the heart in these cases, it cannot occasion those morbid effects upon the brain, so frequently spoken of by Bichat and other writers. Admitting that venous blood was propelled into the left cavities, I believe it would not produce its deleterious effects so immediately as is generally supposed; as, in those cases of infants, and, perhaps, of pearl divers, where the communication of the two auricles is continued through the *foramen ovale*, and by which a mixture of venous, with arterial blood, in the left ventricle, is produced, death is by no means the immediate consequence.

The passage of water into the lungs has no share whatever in inducing death from submersion. I filled the lungs of a cat by injecting water into the trachea; it threw her into convulsions, and the water was immediately expelled. Those parts about the glottis are so exceedingly irritable, that whilst life remained, no water could pass into the trachea; and, in fact, it is not to be found in dissections after death, until putrefaction has taken place.

As the heart is the last muscle which loses its power of contraction, and as the circulation *cannot* be continued whilst the lungs are compressed; the first indication in our attempts to resuscitate should be, 1st. Mechanical inflation of the lungs; 2nd. To restore the temperature of the body by the warm bath, friction, &c.; 3rd. Stimuli, external and internal, as enemata of brandy, &c.; 4th. To evacuate the contents of the stomach.

Report of the Committee of the Academy of Medicine of Philadelphia, on the Means by which Absorption is effected.

The Committee of the Academy of Medicine of Philadelphia, appointed to investigate, by experiment, the question, "Whether the veins absorb, and whether positive evidence can be obtained that the lymphatics perform that function, or that the lacteals absorb any thing but chyle"—

Report—That they have spent considerable time upon the inquiry intrusted to their charge, and have performed a considerable number of experiments relating to this subject, but intending to prosecute it further, had not distributed their attention in due proportion to all the parts of which it is composed, when unavoidable engagements, on the part of all the members, and the sickness of one of them, rendered it impossible, at the present time, to proceed. Not being able to promise themselves a speedy renewal of their undertaking, or to assign, at present, the precise time when they can renew it at all, they have concluded to make a report, embracing the subject in its present unfinished state.

Some points, we trust, not without importance, will be found fully established, according to the ordinary operations of human reason;—others will want further confirmation and elucidation, and some have been only broached.

In our experiments, in which we employed forty-three animals, we used much precaution to ensure their accuracy. The whole of the Committee were present at the greater part of them, and all the important ones were so frequently repeated with similar results, that the members, occasionally absent, had opportunities of making up for loss. Several scientific gentlemen, among whom we may name Dr. Chapman, Dr. Brown, of the Transylvania University, Dr. Troost, and W. Keating, favoured us occasionally with their presence and assistance. We are particularly under obligations to Dr. Troost and W. Keating, for their very polite and prolonged assistance in our chemical examinations of the fluids.

It has sometimes been made an objection to physiological experiments, perhaps in too general terms, that so great violence is done to the system, that it must materially affect the results; and that phenomena arising from this source, may be mistaken for those, owing to the simple presence of the articles employed, and compatible with a state of life and health. Of the importance of this observation, and the necessity of guarding against such errors, we trust we have been fully aware; and it will be seen that this reflection has given rise to operations conducted for the purpose of comparison. But at the same time, we presume that this truth should not stand as a general objection to all inquiries of the kind, or to those in which the above caution has been held in view.

Other and particular precautions employed, will be mentioned as we proceed; and we have only to add, that we have reported experiments which have appeared fallacious, (noting, however, the fact,) for the sake of candour, in order that we might be sure of not withholding any thing tending to establish doubtful questions.

We commenced with repeating and varying some of the experiments of J. Hunter, on the absorption of coloured fluids by the lacteals. These we performed with different articles, on a goat, a male and a female of the sheep, a dog, and two cats, repeating the operation several times upon each individual, and always *without* success. We employed the following articles, viz. indigo mixed with starch, with milk, and with water; milk alone, and infusions of rhubarb, madder, alkanet, and cochineal, the latter, both simple and rendered purple by the addition of carbonate of potass. Our practice generally was, to select a portion of small or large intestine, secure it by a ligature at both ends, inject at or near the temperature of the animal, and then return the part into the abdomen, or attempt to retain its warmth by artificial means. Where the canal contained much fluid, it was removed, but the small quantity which is naturally found on the mucous membranes, was suffered to remain. In some instances the lining surface was rendered as clean as possible. In all these cases, after a short interval, the lacteals, if originally colourless, continued so, and if filled with white chyle, became colourless and transparent. In this result, we are compelled to differ from the recorded authority of Hunter, and to agree with the observations of Magendie, Flandrin, Tiedeman, and Gmelin.

An elective process with regard to colour, is well known to take place in the common healthy operations of digestion; as the alimentary tube is filled with substances of various original colours, and below the duodenum deeply stained with bile, and notwithstanding this, the chyle is always of the same pure and uniform white.

In his experiments to ascertain this point, Bichat was not more successful than ourselves, or than the above named authors. "J'ài répèté souvent cette experience," says this writer, "le fluide injecté, à été bientot absorbé, *mais non la matiêre qui le colorait;* en sorte que cette matiêre, plus condensée apres l'absorption, teignoit la surface sereuse; les lymphatiques etant transparens, comme à l'ordinaire."—*Anat. Gen. Vol. IV. p.* 519.

Mascagni was induced to believe the reverse of our conclusions, from the following observations. 1. The hydropic fluid varies in density and colour in different cavities, and it was always observed, that the neighbouring lymphatics contained a fluid exactly analogous. 2. In two bodies having an effusion of blood in the thorax, this author observed the absorbents of the lungs engorged with blood. 3. In a man who became emphysematous after having been poisoned, these vessels were distended with air.

These cases would appear at first sight sufficiently conclusive; but we believe they can be explained without the implication which he draws from them. It is stated by Mascagni himself, that water can be made to pass from the arterial system into the lymphatics; and that this mode was practised, for the purpose of rendering the latter vessels visible. If, therefore, the exhalents, which, in their natural state, transmit only the most extenuated halitus, are capable of so much dilatation as to allow these grosser fluids to pass through them, what is there to prevent the same deranged operation in those capillaries which connect the visible arteries with the lymphatics? It is also the fact, according to Bichat, that when the serous membranes are inflamed, the subjacent lymphatics may be seen distended, like the arterial capillaries, with red blood.

The strongest instance that we have met with upon this subject, is one furnished by Magendie, (Precis Elem. Vol. IV. p. 193,) in opposition to his own views. It is that in which the celebrated Dupuytren found the lymphatics of the upper part of the thigh filled with a fluid resembling pus, in a case where a large abscess existed, in the course of those vessels. To this case Magendie makes no answer, nor are we prepared to do so; as we can hardly consider the secretion of pus, in the same light as a mere exhalation, or suppose so elaborated a fluid to escape in the manner above described.

When differing from a high authority in our statements, it affords additional satisfaction, if we can assign a probable cause for the mistake which we attribute to him. The experiment on which Hunter appears principally to rely, in the doctrine of the absorption of coloured fluids, is that in which he describes indigo as having been visible to him, in the lacteals. We were at one period deceived, ourselves, and thought we had seen the blue colour in these vessels; but we quickly discovered that they were colourless; and that what we saw was only the faint bluishness which transparent substances assume when placed over dark cavities, and was probably reflected from the sky. On holding the mesentery, which we were examining, between our eyes and the light, they were seen to be entirely colourless.

In conducting these experiments, as well as some others, our attention was irresistibly drawn to the entire absence of pain, which the subjects of them enjoyed, while violence of various kinds was done to the intestines. We cut, tied, and pinched them, with the greatest freedom, in different parts; not only without extorting cries from the animals, but without discovering the least convulsive twitch or other mark of pain. We are not aware that this has been observed by authors. Bichat* asserts this fact of their outer surface, and ascribes it to serous membranes lining the cavities. The same has also been asserted of the heart and the brain.† If this exemption should extend to all those parts supplied by the ganglionic system of nerves, it would form an interesting point of knowledge.

F. Magendie, a savant whose name must frequently occur in the pages of all who treat this difficult subject, has predicated much of the force of the reasonings contained in his treatise on physiology, upon the smell of camphor

* Anat. Gen. p. 528, Vol. IV.

† Some years since, Dupuytren of Paris thought he had made a discovery, when extirpating some cancerous ribs he exposed the heart, and found it insensible to mechanical irritation.

The celebrated Harvey observed the same fact many years previously, in the son of Viscount Montgomery, of Ireland: an abscess had exposed his heart to view, when Harvey observed its systole and diastole, and experimented to prove its insensibility to mechanical irritation. (Vide Op. Omn. Lond. ed. 1761, p. 399.)

which he states he detected in the blood and *breath* of various animals exposed to the absorption of that substance, when at the same time it was not discoverable in the chyle. Aware of the existence of much difficulty and uncertainty in indications drawn from a sense so little cultivated, and so irreducible to exact mensuration and comparison as that of smell, we were particularly anxious to confirm this part of our inquiries, by removing causes of error, and by frequent repetition. Accordingly, we found, in several instances, that a vessel containing blood or other fluids, appeared to smell very evidently of camphor, when by removing it to a distant part of the room, and either changing the air of the vessel, or pouring its contents into another recipient, the odour was entirely removed; thus proving, that it was situated in the air the vessel contained.* With these precautions, camphor was inserted in a variety of ways, into the bodies of living animals, and with the following results, which we have arranged in a table, for the convenience of reference at a glance. Our experiments were, from a variety of causes, irregular in their extent; but it is impossible to judge of their effectual weight without embracing the whole.

* We found, however, that living blood possessed the power of concealing the smell of a small quantity of camphor, when mixed with it.

Animals.	Mode of exhibiting Camphor.	Lacteal fluid	Fluid of Thoracic duct.	Blood of gen. circu.	Blood of the portal cir.	Breath.
Ram.	Tincture into intestine tied.	18 min. clear. No smell.			31 min. from mesenteric vein. No smell.	
Kitten.	Idem.		58 min. no smell.	58 min. jugular vein. No smell.	32 min. mesenteric vein. No smell.	
Cat.	Half an ounce of tincture into large intestine, half an ounce into small, with half an ounce of mint water. Tied.				75 min. mesenteric vein. No smell.	
Terrier female.	Half an ounce of tincture into stomach, and half an ounce into rectum.		40 min. lymph and chyle mixed. No smell.		30 min. inferior mesenteric vein. No smell. Section of the liver. No smell.	
Cat.	Tincture per os et anum.	34 min. clear. No smell.	36 min. lymph and chyle mixed. No smell.		39 min. vena portarum. No smell. 40 min. sections of the liver. No smell.	
Dog.	Solid camphor into the cellular substance of the thigh. Tinc. per os et anum, and in abdomen.		Upwards of 56 min. lymph alone. No smell.	46 min. right auricle. No smell. 56. Idem.	Sections of liver, no smell, in upwards of 66 min.	No Smell.
Cat.	One ounce tincture into abdomen.		No smell.	25 min. Left pleura, did smell of camphor. Blood of the heart smelled less strongly.		
Young Dog.	Two ounces tincture into abdomen.		45 min. chyle. No. smell.	10 min. left jugular, 20 min. right jugular, 40 min. transverse vein of the neck, no smell. Pleura no smell. Brain no smell.		Smell of camphor in 10 min. more strongly in 20 min.

Of the two last animals, the only cases in which any camphor was observed to traverse the system, one became instantly insensible, and died, on opening the pleura and admitting air. The other was bled to death from the above mentioned veins. The rest of our subjects were killed at different periods from commencing the experiment. We have placed the examination of serous cavities under the head of the general circulation.

From this table it appears, in positive evidence, that camphor may and does pass through the system of blood-vessels; but it is impossible to found upon observations like these, any inference relative to the mode in which it enters them.

In two experiments with assafœtida, this substance pervaded the whole system in a short time. A third is supposed to have resulted differently, from not having received and retained a sufficient quantity of the drug. We have not, however, investigated its effects far enough to elucidate our questions by it. We remarked that the smell of assafœtida predominated in the mucous surfaces, and that of alcohol in the serous.

We shall now give another table of experiments, which we performed with the prussiate or ferrocyanate of potass.

Animals.	*Mode of application.*	*Fluid of duct. thoracicus.*	*Serum of Blood, &c.*	*Urine.*
Cat.	Swallowed one grain and a half of the salt in two ounces of water.		64 min. no blue produced in the serum.	
Cat.	Half a drachm of the salt and three ounces of water into abdomen.	More than 35 min. intensely deep blue.	More than 35 min. deep blue.	
*Cat.	Two and a half ounces solution into abdomen.	More than 35 min. intensely deep blue.	More than 35 min. deep blue.	
*Kitten.	1 1-2 ounce of solution into abdomen, (and a part into cellular texture.) Thoracic duct tied.	35 min. milky, gave a strong blue.	35 min. jugular vein gave a light blue.	
Cat.	Quantity not ascertained injected into stomach.	45 min. faintly, but certainly blue.	No indication.	Strong blue.
Cat.	Two ounces into abdomen, part expelled. Then sol. of sulphate of iron into jugular vein.	35 min. strong blue.	No indication.	
Half grown cat.	Swallowed an ounce of solution.	20 min. no blue.	20 min. no blue.	Clearly developed blue.

* These two experiments were repeated in the presence of Dr. Brown and Dr. Banks, and the particulars were neglected; but the results were similar.

Animals.	*Mode of Application*	*Fluid of ductus thoracicus.*	*Serum of Blood, &c.*	*Urine.*
Cat.	Swallowed near 2 oz. of solution, and all removed from the stomach except about 1 drachm.	35 min. no indication.	35 min. no indication.	35 min. no indication.
Cat.	Swallowed 2 oz. of solution.	45 min. no indication.	45 min. no indication.	45 min. no indication.
Young Cat.	2 1-2 oz. into peritoneum.	Not collected.	36 min. blue.	36 min. blue.
Cat.	Swallowed 2. oz. of solution.	145 min. faintly blue.	145 min. not evident.	145 min. blue.
Kitten.	2 oz. into abdomen.	More than 10 min. slightly, but distinctly	More than 10 min. not satisfactorily indicated.	More than 10 min. not discoverable.
Cat.	Swallowed 1 oz. 1 ounce into rectum.	Not collected.	60 min. heart, not indicated, mesenteric vein not indicated.	60 min. not indicated.
Cat.	1 ounce secured in rectum.	46 min. distinct greenish blue.	46 min. carotid and jugular green.	46 min. deep blue.
Cat.	1 1-2 oz. into cellular texture of each thigh.	80 min very strongly indicated.	80 min. slightly, liquor pericardii visibly.	80 min. very strongly indicated.
Kitten.	Placed in a bath of the ferrocyanate.	35 min. no indication.	35 min. no indication.	35 min. no indication.

It is impossible to look over the above tables, without being struck with the obvious manner in which they indicate the route by which the chemical substance experimented on, entered the circulation. In nearly every instance in which it was found in the blood, the contents of the thoracic duct, if examined, exhibited it in a much more obvious degree; while the kidneys appear as the faithful guardians of the purity of the vital fluid, ready to remove it on its first appearance, and accumulate it among the urine. At the same time, the singular anomalies in some of the cases, may afford a useful caution in such researches; where we might have been totally deceived, had two or three such been the only trials which we made. The slowness and difficulty with which this salt was absorbed from the stomach, is also remarkable; and the last fact gives another example of the non-existence of absorption, in the healthy skin of the animal.

One trial was made of the absorption of chromate of potass, tested with lead, but without discovering it in the system.

Much stress has been laid upon the celebrated experiments of Magendie, in which he placed a part of a living body in such a situation, as to be connected with the rest of the animated system only by a column of blood, and destroyed life by applying poison to the separated part. Of this very striking operation, we have been compelled to postpone the repetition, from causes assigned above; but, in the meanwhile, we will venture to state the following difficulties respecting it. Magendie himself states, that he could not produce death in a healthy dog, by directing a column of blood of another dog, supposed to be thus poisoned, into his veins; an anomaly for which we have heard no explanation. 2. We do not know by what precaution the poison was prevented from entering the veins, directly through the openings made in them by the wounds; a mode in which Fontana supposes the bites of serpents often to prove fatal. 3. Finally, this experiment has been repeated in this city, by Dr. Somerville, who found, in every instance, that the blood of the separated portion coagulated, and that the circulation was at an end, and of course the experiment was so too.

In two instances, we placed nux vomica in the intestines, after securing the vena portarum by a ligature around the capsule of Glisson. Death took place sooner than in a comparative experiment, where the same violence was committed, and with strongly characterized tetanus and other symptoms of the poison, which, it is hardly necessary to say, were wanting in the comparative cases. The intestines of a cat were soaked in this poison, but with impunity; notwithstanding the very active absorption which we found to go on in the peritoneal cavity. In another instance, about which, however, there is a shade of doubt, (§ 52,) death appeared to be accelerated by the presence of decoction of nux vomica, in the intestine, while the mesenteric veins were secured.

We consider ourselves as having established the fact, that this article acts upon the nerves of the part, and that absorption, if it really takes place with this substance at all, is not necessary to its full and complete effect.

The suddenness with which concentrated hydro-cyanic acid destroys life, renders it sufficiently obvious, that it does not act by means of absorption. Nevertheless, we thought proper to make a comparative trial of it, similar to that with nux vomica, and with the same result.

In a late number of the Journal de Physique, there is a paper by Magendie, in which he records experiments, going to prove, the much denied existence of *infiltration* or *percolation* in the living body. He teaches that ink, muriatic acid, and some other matters, may be made to transfer their sensible properties through various membranes of animals. The large strides which this gentleman takes in his inquiries, render it impossible to use any other method in many parts of physiology, than to follow his footsteps. We have tried ink in several ways, described at length, in the account of our experiments, and with the most careful dissection, but always without finding that it had infiltrated.

The experiment on muriatic acid, which this author mentions, appeared to us liable to a very serious objection. It is well known to surgeons, that a blood-vessel separated, for some length, from all its attachments, commonly loses its vitality, in some part of its extent. Our experimentalist placed the jugular vein of an animal exposed in this manner, in a solution of muriatic acid, and informs us, that he detected the acid taste within the vessel. We repeated this experiment, but taking the precaution to leave one half the circumference of the vein with its natural attachments. We retained the sanguineous contents between two ligatures, and then endeavoured to imitate his operations in other particulars. No acid taste was found on the inner side. The vegetable blue was so stained with blood, as not to answer our purpose.

With regard to odoriferous substances, we found that camphor and mint could be smelled through portions of the intestinal tube, in which the vital functions were still proceeding.

Neither camphor nor assafœtida, in two experiments made with them, could be smelled through the stomach.

We conceive that we have thus established the following facts, in a manner as positive as this kind of evidence admits. 1. That colouring matters are not absorbed by lacteals in the living body. 2. That camphor is absorbed with much irregularity, and in too small quantity to afford proofs of the route of absorption. 3. That assafœtida is more permeating. 4. That prussiate of potass enters by the lacteals and ductus thoracicus. 5. That nux vomica and prussic acid destroy life by their operation on the nerves, and probably in no other way. 6. That the assertion of Magendie, that ink will infiltrate in the living body, is incorrect. 7. That the odours of camphor, assafœtida and mint, infiltrate through the intestines. 8. That the chemical and odoriferous substances just enumerated, are transmitted into the system with much more delay and difficulty from the stomach, than from the intestinal tube, and with still less from the serous cavity of the abdomen.

We mentioned on a former occasion, the reasons why we have not prosecuted some of these inquiries further, and it is not necessary to repeat them. Should circumstances prove favourable, we intend to do so on some future occasion.

It can hardly be necessary, in the present state of science, to defend inquiries of this kind, with the mass of the profession, from the imputation of cruelty. But there are many, whose feelings induce them to wish that torture should never be inflicted upon animals, without being perfectly sure, that the inquiries to which they are sacrificed are likely to be productive of utility; and they distrust these investigations generally, as probably futile, and as wasting toil and suffering upon doctrines already demonstrated. To such we can reply, that it has always been our desire, previously to performing a painful experiment, to decide in our own minds, that the object was worthy of it; and with such a belief, we would not shed puling tears over sufferings that are every day freely produced, for the unnecessary amusements of hunting and fishing.

LIST OF EXPERIMENTS. First Course.

Upon Absorption simply.

A. *With Coloured Substances.*

§ 1. The abdomen of a healthy goat being opened, about five inches of the small intestine was filled with starch, deeply coloured with indigo, finely mixed. The lacteals were colourless, and apparently empty. After near two hours, no change was visible in them.

§ 2. The lacteals of a full grown cat were found finely distended with a white chyle. An ounce of a strong mixture of indigo and water, was thrown into a portion of small intestine, and secured there by ligatures. The lacteals immediately became colourless, and continued so for an hour and thirty-six minutes.

§ 3. About six inches of the small intestine of a large dog were examined, and the lacteals found colourless. It was then injected partly full of a strongly coloured mixture of milk and indigo, and secured by tying the gut. This precaution was employed, in all those instances in which the contrary is not specified. In one hour and fourteen minutes, one lacteal continued white, and all the rest were transparent. None of them exhibited any shade of colour.

§ 4. In the goat mentioned in § 1, about five inches of the great, and an equal portion of the small intestine, were filled with milk; the lacteals being of the same transparency as above described.

These vessels continued, for a considerable time, to present the same appearance, after the animal was killed.

§ 5. A sheep apparently healthy, was opened, and milk introduced into three different portions of intestine. In the upper parts of these, or those nearer the stomach, lacteal vessels containing chyle were seen, intermixed with others which were transparent.

A white fluid was in all instances seen to be contained in a few of the lacteals on the mesentery, and in several of those on the gut, for the space of a few minutes. It generally soon disappeared.

§ 6. In a full grown female cat, a quantity of milk was thrown into a portion of small intestine, of which the lacteals were colourless. They continued colourless.

§ 7. In a large dog, a portion of small intestine, near the stomach, was partly distended with warm milk. The lacteals were white and transparent, mixed. They all soon became clear, and continued so till the termination of the experiment, in fifty-three minutes.

§ 8. In a full grown female cat, the lacteals were found filled with white chyle. An ounce of an infusion of powdered rhubarb was thrown into a portion of the small intestine, together with the powder. The lacteals immediately became transparent, but colourless, and continued so till the end of the experiment, in one hour and forty-five minutes.

§ 9. In a female cat the lacteals were found somewhat distended with white chyle. A quantity of strongly coloured infusion of rhubarb was thrown into the small intestine, and the part tied and returned into the abdomen. In other instances the portions of intestine on which we operated, were sometimes returned into the cavity of the abdomen, sometimes covered with warm cloths, and sometimes not well protected from the cooling effect of the atmosphere. The experiments were generally tried at a time when the thermometer ranged 70° to 85°, Far.

The lacteals, in this case, became colourless and almost perfectly transparent. On puncturing them, they emitted abundance of a fluid resembling chyle and water.

§ 10. In a large dog, the lacteals of a portion of small intestine were found white and colourless, mixed. The animal continuing vigorous, strongly coloured infusion of rhubarb was thrown into the segment of intestine warm. The lacteals continued for some time apparently in the same state, and underwent no change of colour.

Some white vessels were visible in fifty-four minutes. In this instance, as in many others, the intestine was not emptied of its contents. This was done whenever the part appeared occupied with more fluid than necessarily adheres to it.

We believe that there was a sufficient quantity present in this case, to afford some chyle.

§ 11. In a female cat, the whole of whose lacteals were white and distended, highly-coloured infusion of alkanet and cochineal, to the amount of half an ounce, was thrown into a portion of small intestine. The part was then returned into the abdomen. After a considerable interval, (about an hour,) the lacteals were uniformly transparent and colourless, and afforded a clear fluid on puncture.

§ 12. In a large dog, the same employed in § 3, (and who had become faint and weak by previous experiments,) a quantity of infusion of cochineal, the colour of which had been rendered more intense, and converted to purple, by the admixture of pearl ash, was introduced into the small intestine. The animal made efforts to vomit. The lacteals, which in this instance were originally transparent, continued so, and did not assume the slightest colour.

§ 13. In a female cat, whose lacteals were uniformly white, and moderately distended with chyle, strongly-coloured infusion of madder was thrown into the small intestine, and the part returned into the abdomen. After a considerable interval, these vessels were found colourless, and afforded, on puncture, a considerable stream of watery fluid.

§ 14. The last experiment was repeated on a large dog, whose lacteals were colourless. They continued so.

§ 15. The same experiment was repeated on a ram, near his stomach. The lacteals were originally filled with white chyle. In nineteen minutes they were equally so. In fifty-six minutes some were transparent, others faintly white, but all free from colour.

B. *With Odoriferous Substances.*

The remaining experiments were all comparative, between the lacteals and blood-vessels.

§ 16. A portion of the small intestines of a ram, whose lacteals were generally filled with white chyle, was secured, and a quantity of alcoholic solution of camphor was thrown in. In five minutes, many more white lacteals became visible, and all appeared more distended than in the beginning of the experiment. In nine minutes the intestine was much less distended, much fluid having been removed. In eleven minutes all the lacteals gradually became nearly transparent. In eighteen minutes, lymph, of watery appearance, was obtained from lacteals, and no smell of camphor was afforded, although all the parts smelled strongly of it. Camphor in considerable quantity remained in the intestine. The parts subjected to this experiment assumed and retained a bright red colour, apparently from the stimulus employed. In thirty-one minutes from the injection of camphor, blood was obtained from a mesenteric vein, which had no smell of camphor.

§ 17. Tincture of camphor was carefully introduced into the small intestine of a kitten, and secured. In thirty-two minutes, blood from a large mesenteric vein of the part, had no smell of camphor. In fifty-eight minutes, blood from the jugular vein, and fluid from the thoracic duct had no smell of camphor.

§ 18. Tincture of camphor, and mint-water, to the amount of about half an ounce of each, had been thrown into the small intestines of a cat, in two places, and secured by tying the gut; also tincture of camphor into the great intestine of the same animal. In an hour and a quarter after the commencement of the experiment, the blood of a mesenteric vein had no smell of either article.

§ 19. In a terrier female, half an ounce of tincture of camphor, with as much water, were injected into the stomach. The effects of this article on the nervous system were immediately apparent in a high degree. From two and a half to three minutes, the animal was in violent convulsions; then vomited freely, and in thirteen minutes was pretty well recovered. Half an ounce of tincture of camphor was then injected per anum, mixed with an ounce of water. She soon discharged a considerable portion of the mixture; but in four minutes' time the effects of camphor on her nervous system, were very apparent. In twenty-seven and a half minutes she was killed by a blow on the occiput.

Tincture of camphor was found in the stomach, on opening it, after the conclusion of the experiments. In thirty minutes, blood from the inferior mesenteric vein did not smell of camphor. In forty minutes, lymph and chyle, mixed, from the thoracic duct, did not smell of camphor.

Sections of the liver did not smell of camphor, which would have been conveyed there, if absorbed by the veins.

§ 20. A cat had escaped, and lived three days in a place without food, owing to our not being able to discover her. Her lacteals were, of course, in a state of great exhaustion. Tincture of camphor, and water, mixed, were injected into the stomach, and within twenty-five minutes two clysters of the same were given. She was much intoxicated ; when in twenty-nine minutes she was killed by a blow on the occiput. In thirty-four minutes, a pellucid fluid, from a lacteal, did not smell of camphor. In thirty-six minutes, lymph, with some chyle, from thoracic duct, did not smell of camphor. In thirty-nine minutes, blood from the vena portarum did not smell of camphor. In forty minutes, sections of the liver did not afford the smell.

§ 21. Several pieces of camphor were introduced into the cellular substance of the thigh of a dog. Tincture of camphor, and water, were then injected into the abdominal cavity, into the stomach, and into the rectum, the latter being performed twice. In forty-one minutes the dog was killed by a blow on the occiput. In forty-six minutes, blood from the right auricle of the heart had no smell of camphor. In fifty-six minutes large quantities of blood had no such smell.

Lymph from the thoracic duct, and sections of the liver, had no smell of camphor. The smell had nearly disappeared in the abdominal cavity, where it had been injected. A very singular phenomenon, indeed, as this smell was not to be found in any part of the fluids or tissues of the animal.

The tincture was greatly diminished in the rectum, as considerably less was found there than had been retained. The breath was carefully smelled ; but no camphorated scent discoverable.

In order to ascertain whether our senses were in a proper state for this investigation, we mixed a small quantity of tincture of camphor with some blood, separately from the animal, and smelled it—no difficulty was found in distinguishing the usual sensations.

§ 22. An ounce of tincture of camphor, diluted with water, was introduced into the abdomen of a cat, which became instantly insensible.

In twenty-five minutes the left cavity of the pleura exhaled a smell of camphor.

The blood of the heart smelled of the drug, but less strongly.

The fluid of the thoracic duct afforded no camphorated smell.

§ 23. In a dog between two and three months old, about two ounces of strong camphorated spirits were injected into the cavity of the abdomen, and the wound sewed. In five minutes the effect of the drug existed in a high degree, and the animal became insensible. In ten minutes the mouth and breath smelled of camphor, and in twenty minutes strongly so. Blood was obtained in ten minutes from the right jugular vein; in twenty minutes from the left jugular, and in forty minutes from the transverse vein of the neck; but in none of these instances was the least camphorated or spirituous smell discoverable.

The cavity of the pleura was next opened, and afforded no smell of the substances injected.

In forty-five minutes, one-fourth of a drachm of chyle was collected, but it afforded no smell.

The ventricles of the brain afforded no camphorated, nor spirituous smell.

The thoracic duct became strongly distended again, after being evacuated in part, not less than twenty-five minutes after the death of the animal functions.

§ 24. An ounce of tincture of assafœtida, with an equal quantity of water, was injected into the abdomen of a cat. The breath smelled very strongly of assafœtida in three minutes. The animal was intoxicated within the same time.

In ten minutes blood was obtained by cutting the animal's throat; and slightly, but distinctly emitted a peculiar smell, which we compared to assafœtida, but which was modified.

The serous cavities smelled of both assafœtida and spirits, but principally of the latter.

The mucus, on the contrary, smelled of both, but principally of the former.

The chyle in the thoracic duct emitted the same peculiar smell with the blood. The muscles gave no smell of the drug. The urine a powerful one.

§ 25. A small dog was compelled to swallow half an ounce of tincture of assafœtida, diluted with water.

The animal soon became evidently affected by the drug. Blood was obtained from a vein of the stomach, in little more than thirty-two minutes, and had no smell of assafœtida.

The cavities of the pleura and pericardium were found devoid of the fetid smell.

In fifty-six minutes chyle and lymph from the thoracic duct did not smell of the drug.

Blood from the carotid artery did not afford the smell, in fifty minutes.

The breath, here, of course, was imbued with the odour in the mouth and œsophagus. It is proper to remark, that this animal vomited at twenty-eight minutes, but that much of the article used was found in his stomach after death.

§ 26. An ounce of tincture of assafœtida was thrown into the rectum of a large cat, mixed with an ounce of strong solution of prussiate of potass. The rectum was then secured with a ligature.

In four minutes the smell of alcohol was perceived in the breath, and in twenty-three minutes a smell of assafœtida had gradually followed.

In thirty-three minutes, blood from the carotid artery and jugular vein, mixed, smelled of assafœtida and alcohol.

In forty-four minutes the abdominal cavity smelled distinctly of both these articles.

In forty-six minutes the urine did not smell of them. The phenomena afforded by the presence of prussiate of potass fall under another head.

C. *With Chemical Substances.*

§ 27. A cat was compelled to swallow one and a half grains of prussiate or ferrocyanate of potass, dissolved in two ounces of water; a solution, of which half a drop, mixed with two fresh ounces of water, struck a deep blue, on the addition of sulphate of iron.

The animal was killed in twenty-seven minutes, by a blow on the occiput.

Blood was obtained from the heart, and tested with sulphate of iron. No appearance of the prussiate was discoverable in sixty-four minutes.

An infusion of sections of the kidneys, was tested in the same manner, but without discovering the prussiate.

No fluids could, in this instance, be obtained from the thoracic duct, or from the bladder.

§ 28. A large, healthy cat was procured, the abdomen opened, and three ounces of solution of prussiate of potass, containing half a drachm of the salt, were injected and secured.

In thirty-five minutes it was killed by a blow on the occiput, and blood procured from the jugular vein and heart, as soon as possible after securing the thoracic duct. The ligature included the transverse vein of the neck.

The serum of the blood from the heart afforded a light blue, when tested with sulphate of iron and water.

That from the jugular vein was tested in the same way, when, if it changed to blue, it was scarcely evident.

Half a drachm of the semi-transparent contents of the thoracic duct was mixed wtih a drachm of water; when one drop of a solution of sulphate of iron being added to it, afforded a beautiful blue colour.

After an interval, these experiments were repeated without the addition of water, and while the chyle, freshly obtained for the purpose, was still fluid.

The colour obtained both from the contents of the jugular vein and heart, was deep, and from the chyle, intensely so.

§ 29. A large, healthy cat was opened, and two ounces and a half of the solution of prussiate of potass injected into the abdomen. The serum of the blood and the chyle, afforded results exactly similar to those in the last experiment. The fluids were arrested in their vessels, for the purpose of being extracted, at thirty-five minutes.

§ 30. The same experiment was repeated on a half-grown kitten, after previously tying the ductus thoracicus. An ounce and a half of solution was injected. But here it is proper to state, that a considerable quantity of the solution was effused into the cellular structure of the abdominal integuments.

The kitten was killed in thirty-five minutes, and blood obtained from the jugular vein. This afforded a light blue, on application of the test.

The milky fluid from the thoracic duct afforded a strong blue.

The urine afforded a light blue.

§ 31. In order to satisfy ourselves that these phenomena arose from the presence of the extraneous body in the vessels, serum of blood, and lymph and chyle from the thoracic duct, were produced under similar circumstances from a cat, and tested with the sulphate of iron. No change however was produced; thus evincing that the test was not fallacious.

§ 32. An ounce of solution of sulphate of iron was injected into the peritoneum of a kitten. No indication of this substance was afforded, in thirty-two minutes, by the test of prussiate of potass, applied to the serum.

This was repeated by one of our number, with the effect of producing a greenish tinge approaching to blue, probably resulting from the colour of the sulphate itself;

which, however, soon subsided into a thick, mucous sediment, leaving the supernatant fluid clear.

§ 33. The experiments described in § 29 and § 30, were repeated, with results so precisely similar, that it was not thought necessary to describe them more minutely.

§ 34. A quantity, not precisely determined, of solution of prussiate of potass, was injected into the stomach of a large cat, by the mouth. In forty-five minutes, the test faintly, but certainly, indicated the presence of the prussiate, in the chylous fluid of the ductus thoracicus. The urine indicated it strongly, but the clear serum of the blood gave no appearance of it at all. It is right to mention, that in this instance, the œsophagus being cut, it is within the bounds of possibility that a small particle of dissolved prussiate may have thus found its way into the vessel that collected the chyle, although we believe it was not so.

The stomach was found perfectly empty.

§35. Two ounces of solution of prussiate of potass were injected into the abdomen of a cat; and in about twenty-five minutes afterwards about one drachm of the solution of sulphate of iron was thrown into the right jugular vein. In two or three minutes the animal was convulsed violently, and part of the solution expelled from the abdomen.

In thirty-five minutes from the first injection the ferrocyanate was detected in the contents of the thoracic duct.

The serum of the blood was transparent, and did not indicate the ferrocyanate.

§ 36. A half-grown cat was made to swallow an ounce of the solution of Prussian alkali.

In twenty minutes she was bled to death, and the prussiate clearly indicated in the urine, but not in the least visible degree in either the chyle or the serum of the blood.

§ 37. A large male cat was forced to swallow near two ounces of solution of prussiate of potass.

In thirty-five minutes, urine, serum of blood, and fluid from the thoracic duct, were collected; neither of which indicated the presence of the salt in question, in the slightest degree. Notwithstanding this, a great portion of the solution had been removed from the stomach, by animal processes, as not more than a drachm remained in that viscus after death.

§ 38. Another large cat was made to swallow two ounces of the prussic solution, and in forty-five minutes, the fluids were tested in the usual manner, but without discovering any absorption of this chemical agent.

§ 39. Two ounces and a half of the solution were injected into the peritoneal cavity of a young cat. In thirty-six minutes it was detected in the urine, and in the serum of the blood. No chyle was collected.

§ 40. A middle sized cat was forced to swallow about two ounces of prussiate of potass. She first became very sick, then recovered, after having a fluid stool, and afterwards slept, but still was unable to walk steadily. In two hours twenty-five minutes she was killed.

The urine indicated the salt. The chyle did so, but faintly. It was not evident, to satisfaction, in the serum of the blood.

§ 41. Two ounces of the prussiate solution were injected into the abdomen of a kitten, which was killed in ten minutes, and the fluids collected as soon as possible. On applying the test, the urine did not contain a discoverable quantity of the prussian alkali, and the serum of the blood, not so as to be evident in a satisfactory manner, while the fluid of the thoracic duct exhibited it slightly, but distinctly.

§ 42. A small cat was made to swallow an ounce of the solution, and ten minutes after, another ounce was thrown into the rectum. In an hour, the cat was killed. No sign of the prussiate was found in the serum of blood, from either the heart, or the mesenteric vein, or in the urine. The chyle was lost.

§ 43. A large cat, mentioned in 26th section, was compelled to retain an ounce of the prussiate solution, mixed with an ounce of the tincture of assafœtida, by means of a ligature on the anus.

In thirty-three minutes, the animal was killed, and the fluids prepared for examination within thirteen minutes after.

Prussiated potass was found in the urine, forming deep blue, with sulphate of iron, acidulated with nitric and muriatic acids.

Chylous fluid from the thoracic duct, afforded a distinct greenish blue, with sulphate of iron and nitric acid.

Serum of blood, both arterial and venous, from the neck, separately, afforded a green, with sulphate of iron and nitric acid.

To discover how much of the colour in the serum was owing to iron, which the muriatic acid contained, this fluid was tried, first with nitric acid, which gave a white albuminous precipitate; secondly, with muriatic acid in addition, which gave a slight green; when, thirdly, sulphate of iron was added, which gave a more intense green, tending to blue.

§ 44. An ounce and one-half of solution of the prussiate was injected, with much pains, into each thigh of a large cat, and the wound stitched. At one hour and twenty minutes afterwards he was killed.

The urine and chyle very strongly indicated the presence of the salt. The serum of the blood exhibited it slightly.

It was discovered in the liquor pericardii.

§ 45. A small kitten was placed in a bath composed of the prussian solution above mentioned, and after thirty-five minutes, it was removed and killed. No indication of the salt could be obtained, though examined in the usual manner.

§ 46. Two ounces of a solution of *chromate of potass* were injected into the peritoneal cavity of a large cat.

In thirty-five minutes she was killed, and the fluids tested as soon as compatible with accuracy, by means of the subacetate of lead. In neither urine, fluid of the thoracic duct, nor serum of the blood, was the chromate detected.

D. *With Poisonous Substances.*

§ 47. In a kitten two months old, the capsule of Glisson was included within a tight ligature, so as to put an end to all circulation in the blood-vessels which traversed it.

Two-thirds of an ounce of nux vomica had been infused in eight ounces of boiling water, and with this several inches of small intestine were distended.

The animal soon began quick respirations, with protrusions of the tongue, which continued nearly till her death.

In fourteen minutes violent spasms took place.

In seventeen more, violent spasms, distinctly tetanic, with opisthotonos.

In twenty-three minutes the animal expired, after repeated tetanic spasms.

§ 50. A kitten about one month old, was opened, and the capsule of Glisson tied in the same manner as in the last experiment, in order to ascertain how far this violence affected the results above described.

More frequent breathing took place, together with protrusion of the tongue. In seventeen minutes appeared to breathe tolerably. In twenty-two minutes—has been for some time dying, with slow respiration, progressively declining. In thirty minutes ceased to struggle.

No tetanic symptoms, and no spasms whatever, were observed in this animal. The heart, which was first examined in this case, continued to palpitate for nearly an hour after death, and was easily excited again to action after it had ceased, by puncturing it with a needle.

§ 51. A full grown terrier female, that had had young, and appeared to be in good health, was procured. The lacteals were distended with chyle.

The capsule of Glisson was tied, with all its contents, and an ounce of the above mentioned infusion of nux vomica injected into the small intestine and secured.

The animal died in twenty-eight minutes, with the pupils of the eyes dilated, the cornea glassy, and with well characterized tetanus.

§ 52. As a few drops of the decoction were spilled, in both instances, and came in contact with the peritoneum; we made the following trial of the effect of this substance on that membrane. The intestines of a cat, weakened by several preceding experiments, were wet, on their peritoneal coat, with the infusion abovementioned. No effect was produced in seventeen minutes. The animal lived a longer time than could have been expected from the violence done her, and died without tetanus or other symptoms of the poison.

§ 53. A cat on which several of the abovementioned experiments with coloured substances had been tried, still retained considerable vigour; when the mesenteric veins of a portion of intestine, four or five inches long, were secured, and the gut distended with the decoction of nux vomica. Death ensued in eleven minutes, although the animal had borne other experiments for an hour and twelve minutes. We are, however, not prepared to say, that this experiment was entirely satisfactory, as its results depended on circumstances which could only be estimated by our judgment, and could not be brought under the test of precise mensuration.

§ 54. A portion of small intestine, about two inches in length, in a kitten, was separated from the remainder, by cutting it off; the arteries and veins which were visible, were then secured, including a small vessel which appeared in about two minutes after the commencement of the experiment. Half an ounce of tincture of nux vomica was then injected.

In seventeen minutes no effect was produced.

This experiment, although mentioned here for the sake of candour, was far from being circumstanced so as to produce reliance upon deductions drawn from it, as several lacteals, and most, if not all of the nerves, were evidently included within our ligatures, and the part was, very probably, early deprived of vitality.

Not having it in our power to obtain either of the species of upas, we thought it proper to make some trials with prussic acid, although we acknowledge that, to our minds, the supposition appears absurd, that an agent whose effect is sometimes so instantaneous, could require for its operation the circuitous route of absorption.

The prussic acid which we employed, was the alcoholic solution recommended by Dr. Thomas Cooper, much weakened, and was tried in the following manner. One drop was placed first on the eye, and then on the tongue of a young kitten, with impunity. Half a tea-spoonful was then injected into the stomach, and death, with the usual symptoms, followed in one minute. As the acid had been kept for some time previously to this trial, and was carefully put away, and used within three days, it is presumed no very great alteration in its strength took place.

§ 55. The thoracic duct and vena portarum of a kitten, two months old, were tied. The lacteals were white, and very conspicuous. About one fourth of a drachm of the prussic solution was introduced into the small intestine, and the orifice tied. The kitten died in seven minutes, with screaming and struggles, but with no tetanic symptoms. In twenty-four minutes the heart was examined, and found perfectly motionless, and not susceptible of excitement by puncturing. On opening the intestine operated on, the mucus which had come in contact with the poison, was stained reddish brown. The first inch of the bowel was opake and deprived of its peristaltic motion, although the rest manifested it in a high degree.

§ 56. The vena portarum of a half grown kitten was tied, and nearly a drachm of alcoholic solution of prussic acid was injected into the small intestine and secured by a ligature above and below. This experiment is inserted for the sake of candour, although we consider the prussic acid much weakened. The lacteals, which were completely distended with chyle, became empty as if paralyzed.

In fourteen minutes a rigid spasm was observed. In fifteen and a quarter minutes the animal, which had been lying quiet, with the last mentioned exception, and apparently gradually losing strength, expired.

SECOND COURSE OF EXPERIMENTS.

On the question, whether infiltration can take place through living tissues, in direction transverse to their texture.

A. *With Coloured and Chemical Substances.*

§ 57. Ink was confined upon two parts of the mesentery of a living cat. After a considerable interval, the opposite side of this membrane was examined with care, and no mark of infiltration was found.

§ 58. More than a drachm of ink was poured into the right pleura of a living female cat, and suffered to remain there nine minutes including seven of apparent death, but during which, the organic life must have continued in the part.

The membrane was then carefully dissected from considerable surfaces, both of the lungs and the thoracic parietes; but no coloured infiltration was discovered.

§ 59. Two ounces of ink were injected into the peritoneum of a cat. In thirty-five minutes the animal was discovered to be dead. After previously examining another part, the urine was obtained and the bladder examined. The bladder, whose outer surface was entirely black, from having had nearly the whole of the ink in contact with it, owing to the position of the animal, did not show the least mark of infiltration on its inner surface; nor did the urine either evince its admixture, or the presence of iron alone, as exhibited by the addition of ferrocyanate of potass. No other part was in this instance examined for infiltration.

§ 60. An inch and a half of the right internal jugular vein of a ram, were uncovered on the side which lay uppermost, and for one half of its circumference; leaving, however, the natural attachments of the remaining half of the vein, in order to avoid risking the destruction of the vitality of the part. Muriatic acid, mixed with water in the proportion of two drachms to eight ounces, was kept constantly applied to the part. In a few minutes the part exposed became quite black, and in ten minutes the whole section of vein, included, as it had been, from the beginning of the experiment, between two ligatures, was removed and washed. The cavity was then exposed, and the blood and inner surface of the vein applied to our tongues, without the perception of any acid taste.

B. *With Odoriferous Substances.*

§ 61. A ligature was made round the small intestine of a kitten, near the stomach, and tincture of camphor introduced. The orifice was then tied, and all the parts which had been in contact with the injecting instrument carefully cut off, so that not the least smell of the drug was any longer perceived. In one minute a smell was perceived, but we could not distinctly characterize it as that of camphor.

In fourteen minutes, camphor was distinctly smelled from the outside of the intestine.

In fifty-eight minutes this smell was stronger. The circulation had gone on for all this time, and clear lymph had continued to traverse the lacteals.

§ 62. A small vial of tincture of camphor, corked, and externally totally devoid of smell, was introduced into the large intestine of a cat. The gut was then carefully tied, and the cork pressed out of the neck of the vial, without disturbing the ligature.

In fifteen minutes no smell was perceived, but after some time, that of camphor was very obvious.

§ 63. Tincture of camphor was then introduced into the small intestine of the same cat, and secured between two ligatures; no vial being obtained sufficiently small to enter this part.

The intestine had at first a faint smell of camphor, which disappeared in three minutes. In three quarters of an hour, a slight smell of this drug was discovered, and in one hour and twenty minutes, it became quite distinct and evident; the part during all this time retaining its life and vital actions.

§ 64. A terrier female had half an ounce of tincture of camphor, mixed with as much water, injected into the stomach.

In twenty-seven and a half minutes she was killed, and other observations having been made on her, which occupied the time as far as forty-two minutes, the stomach was examined. It did not smell of camphor, although this substance was immediately afterwards found in the cavity.

§ 65. Mint water was thrown into the small intestine of the cat employed in the last mentioned experiment but one, and secured so that no smell was perceptible.

In about fifteen minutes the smell of mint was perceived, and in forty-four minutes it was very apparent, although the actions of the part continued during the interval.

§ 66. A small dog was compelled to swallow half an ounce of tincture of assafœtida.

In twenty-eight minutes the animal vomited, being at the same time much under the influence of the drug. No smell could be perceived on the outside of the stomach.

In fifty minutes, the carotid artery was divided.

In seventy-seven minutes the smell could not be perceived on the outer surface of the stomach.

In four hours, twenty minutes, it was very indistinct, although the stomach was separated from the body, and partially dried. On opening this viscus, however, the smell was very strong.

The above is a correct account of the experiments, carefully compared with the journal of the Committee, from which it was compiled.*

RICHARD HARLAN,
J. B. LAWRENCE,
B. H. COATES.

* The Academy of Medicine of Philadelphia, having resolved to investigate the function of Absorption, appointed, in the year 1821, Dr. Harlan chairman of a committee, with authority to name two assistants, for the purpose of instituting a series of experiments on living animals.

Experiments with the Poison of the Rattle Snake; in which the powers of the Hieraceum Venosum, *as a Specific, were tested; together with some Anatomical Observations on this Animal. Communicated to the American Philosophical Society, March 7th,* 1828.

In offering the following observations, it is not my intention or desire to add another specific to the numerous antidotes to the poison of the rattlesnake, already before the public. Most of these remedies have proved, on trial, to be either destitute of active properties, or altogether unworthy of serious consideration. I shall therefore briefly notice a few of the most celebrated.

The most ancient, at least, if not the most renowned, is the *volatile alkali*, a remedy prescribed by European practitioners more than a century ago, not only as an antidote for the poison of the viper, but against the effects of the bite of venomous animals in general.* The Abbé Fontana, about the middle of last century, published a work on the poison of the viper, to which we may refer for many curious experiments on the nature of this poison.†

There are few authorities of the present day inclined to place much faith in the volatile alkali as an antidote for the specific effects of the bite of the viper; but as the constitutional symptoms, produced by the bite of venom-

* Vide Dict. des Sciences Medicales, Vol. XXXIV. p. 309; article Morsure.

† The following, among other conclusions, are offered by Fontana; the viper alluded to is the "Coluber berus," of Linn. "1. The bite of the viper is not poisonous to its own body, or to that of its own species. 2. The venom is not equally destructive to all animals. 3. The poison is neither acid, alkaline, nor saltish. 4. It has no positive taste, and taken into the mouth does not cause the tongue to swell. 5. It is not inflammable. 6. Mixed with water it sinks to the bottom; when shaken it renders the water turbid and whitish." Vide Fontana, "Ricerché fisichè sopra il veleno della vipera."

ous reptiles, are generally adynamic in their nature, this remedy, together with other diffusible stimulants, is calculated to counteract this state of the system, and may prove very serviceable in supporting the vital powers, and thus suspend the fatal operation of the poison. To this conclusion I have been led by experiment.

The next remedy for accidents of this nature worthy of notice, is the "*Prenanthis serpentaria*," of Pursh. This plant is held in high esteem by the inhabitants of Virginia, as a remedy for the bite of the rattlesnake, and is known to them by the familiar name of "*Lionsfoot.*" Pursh states that he had an opportunity of being a witness to the efficacy of this plant. A man living in Cove mountains, near the Sweet-springs, was bit in the foot by a mockeson, [Cenchris mockeson? Daudin.] a species of snake considered the most dangerous. An inflammation and swelling of the whole leg took place immediately; but by taking the milky juice of this plant, boiled in milk, inwardly, and applying to the wound the steeped leaves, which were frequently changed, he was cured in a few days. The plant is frequently confounded with another species of the same genus, from which it is important to distinguish it; this last the inhabitants name "*false Lionsfoot.*" Gronovius, in his Flora, page 113, mentions Dr. Witt's *snake-root*, under *P. autumnalis*, or Wildenow's "*rubicunda*," as a remedy for the bite of the rattlesnake, which shows that he had information of the use made of this plant, though he did not know the genuine species.—Vide Pursh's "Flora Americæ Septentrionalis," p. 499.

The remedy which next claims our attention, has been considered as of sufficient importance to demand legislative enactment. It appears, that some years ago, the State Assembly of South Carolina purchased from a negro, for an annuity of one hundred pounds for life and his freedom, the secret of his cure for the bite of the rattlesnake. This proved to be the "*Alisma plantago*," or water-plantain.

Many of the members are said to have witnessed the efficacy of the remedy in the person of the negro, who stripped himself naked and jumped into a tub, containing many of these venomous snakes, and received numerous wounds. He cured himself by swallowing one tablespoonful of the expressed juice of the Alisma plantago, and repeated the dose at intervals, until the effects of the poison were counteracted. An essay was published on this subject in the sixth volume of the Technical Repository, of 1824, by C. Whitlaw, Esq.,* who states that the common plantain has been used by mistake, to which error he attributes all the reputed failures.

My friend Major N. A. Ware informs me, that in Florida and Alabama, a species of *Pedicularia*, or "Louse-plant," is of considerable repute as an antidote to poisons of this nature. Sweet oil has also been famous as a specific in similar cases. A number of experiments were performed by a viper catcher before the Royal Society of London, in order to prove its efficacy; some account of which was published in the early numbers of the New York Medical Repository.†

But passing over this remedy and many others of a similar nature, we come to the consideration of the plant which was the immediate object of my own experiments.

* The following extract from Mr. Whitlaw's Essay, is probably sufficient to destroy his authority altogether among medical men,—though the above statement concerning the experiments I believe to be historical fact.

"The specific action of the poison appears to be chiefly confined to the muscles: after the infliction of the bite, powerful muscular contractions take place over the whole body, the muscles are highly inflamed, a coldness and corrugation of the skin surround the part which was bitten, and violent spasms resembling tetanus supervene, followed by mortification. A friend of mine at Savannah, died in consequence of being bitten by a snake in the hand: when they took hold of his arm to place him in the coffin, *the arm came off at the shoulder joint*."—Vide Technical Repos. Vol. IV. p. 258.

† In Dr. Duncan's observations on the cure of the bites of venomous serpents, he recommends, as an antidote, the *Nux vomica;* and as used by the East Indian "Bite-curers," the leaves of the *Ophioxylon serpentinum*, to which, Dr. D. remarks, he witnessed the Ichneumon resort, when bitten in a conflict with a cobra de capello. Vide Lond. Lancet, Vol. I. p. 707.

It must be here repeated, that the *Hieraceum venosum* is not offered as a specific cure for the bite of the rattlesnake: much further observation is requisite to establish its claims to such high virtues. It is proposed to continue the experiments on the commencement of the approaching season, but in the mean while it was thought advisable to publish the present account as the first of a series, inasmuch as several facts have been elicited, which are considered very important by those who witnessed the experiments.

November 2d, 1827.—In company with a number of professional gentlemen, I visited the collection of living rattlesnakes* exhibiting by Messrs. Elnsworth and Murray. The reptiles, to the number of one hundred and fifty, were all taken by the proprietors in their native county of Susquehanna, Pennsylvania, during the current months of August and September. The proprietors profess to be in possession of an infallible remedy for the cure of the symptoms resulting from the bite of the rattlesnake; they display the utmost confidence, and are on terms of intimate familiarity with every individual of the collection; they take them in their hands and fold them around their necks,—open the mouth of the snake, and expose his fangs to the view of the visiters, &c. In order to satisfy ourselves that there existed no trick or deception in the case, and to prove that the bite of these animals, in their present state of subjection, is really mortal, two living animals were exposed to be bitten, both of whom died within the space of eight minutes. The first received a severe wound on the breast, the snake fastening his fangs in the flesh; immediately the eyes of the animal (a young cat) were observed to change their expression, lacking lustre, and appearing like the eyes of an intoxicated person. In three minutes after the infliction of the wound,

* Crotalus durissus, Linn.

involuntary discharges per anum occurred ; in six minutes urine was also discharged. The pupils of the eyes were dilated, and in eight minutes convulsions and death supervened.

A narcotic or sedative effect of the poison was an early symptom, and this soon degenerated into insensibility.

In the second experiment, the kitten was introduced into the box among the snakes, and received wounds from several; one of the proprietors, Mr. Elnsworth, having introduced his hand into the box among the reptiles, with a view of irritating them, received two distinct wounds on the back of the hand, and which were observed to be inflicted by different individual snakes; the wounds bled slightly. Mr. E. displayed no uneasiness, but loitered about the room and continued the exhibition for some time, and then took an opportunity to retire for a few minutes, and returned entirely out of danger ; two small punctured wounds alone remained visible ; the bleeding had ceased, and the slight tumefaction which had commenced around the wound had entirely disappeared. No marks of suction were discovered, nor were any precautions taken, in presence of the visiters, after the infliction of the wound, with the exception of the application of a ligature around the wrist.

In fine, that the proprietors are actually convinced that they possess some means to render the poison of the rattlesnake innocuous, would seem to be proved by the experiments above stated, as well as by the perfect composure and unlimited confidence of the man, when fairly wounded by the poisonous animals, which at the same time were inflicting mortal wounds on the subjects of the experiments.

They stated to the company that the specific was of Indian renown, that a decoction of the plant was administered internally, and that, for a moderate compensation, the secret would be disclosed.

Accordingly, on the 15th of December, 1827, a number of gentlemen,* including several eminent individuals of the medical profession, convened at my office for the purpose of witnessing experiments made with the poison of the *rattlesnake*, (*Crotalus durissus*, Linn.) Some days previous, a number of the most lively and vicious among them were separated, and permitted to drink; abstinence both from food and water having been strictly enjoined previously, during the period of their confinement, from an idea of the proprietors, that abstinence, particularly as respects water, is calculated to render the poison less destructive.

Experiment 1.

It was decided that Mr. Elnsworth, who had offered himself as the subject of the experiment, should be first bitten, and afterwards that the same snake should be made to demonstrate its poisonous powers upon a puppy.

A large active female snake was taken from the box and placed upon a table in a warm room. At 11 h. 20 m. A. M. the man received a bite from the irritated snake on the index finger of the left hand, about half an inch from the metacarpal bone; the wound resembled a minute incision, or briar scratch about one-fifth of an inch in length; one fang only appears to have been projected, the animal striking with one or both fangs at pleasure; a little blood exuded. Pulse, just before the bite was received, 104 per minute; but it was observed to vary during the experiments to such a degree as to prevent any correct inference to be expected from that source.

* The following is a list of the names of those gentlemen who liberally contributed towards paying the amount demanded by the proprietors for the disclosure of their "Secret," most of whom, with several others, were present at the experiments:—

Drs. Chapman, Harris, Meigs, Emerson, Mitchell, Wetherill, J. R. Barton, Pennock, Mease, Captain Basil Hall, R. N., Messrs. S. Wetherill, J. P. Wetherill, and W. Hembel. Notes were taken by several of the gentlemen, and the present statements result from a comparison of them all.

11 h. 40 m. He says the wound smarts a little, but no signs of a poisonous wound are as yet exhibited.

After the lapse of nearly an hour from the commencement of the experiment, no symptom denoting the action of the poison occurring, Elnsworth exposed the same hand to a large active male snake. As in the first instance, considerable irritation of the animal was requisite to force him to strike, and at

12 h. 15 m. He received a second wound from a single fang on the back of his hand, directly over a prominent venous branch. A large drop of transparent, yellowish, and glairy fluid was spread over and around the wound, which was doubtless ejected from the poison sack. A little very dark blood slowly exuded from the wound.

12 h. 31 m. Slight swelling is observable immediately around the second bite.

12 h. 48 m. Elnsworth again exposed his hand to the female snake, and received two additional punctures simultaneously, one from each fang, on the lower extremity of the metacarpal bone of the ring-finger. As in the first instance, neither of these wounds displayed symptoms of the specific effects of the poison; the *second bite* therefore, or that received from the male snake, will alone be the subject of further observations in this experiment.

1 o'clock, P. M. The swelling around the second bite has increased considerably, the tumefaction extending up and down along the course of the vein, about an inch and a half in length, and half that size in breadth, the greatest length of the tumefaction being below the wound. The man now complained of pain and numbness along the course of the lymphatic vessels on the inner part of the fore-arm.

1 h. 25 m. Pulse natural, symptoms last described somewhat increased; swelling unattended with symptoms of inflammation.

1 h. 30 m. Although the man is perfectly willing to

permit the symptoms to proceed further, several of the witnesses expressed their unwillingness to bear the responsibility of the consequences; he was therefore permitted to have recourse to his remedy, and he immediately swallowed a few ounces of the decoction of the root, and appeared indifferent about the external application of the same to the wound. He stated that the original stock of the vegetable being exhausted, and the season too far advanced to enable him to obtain more at present, he would be under the necessity of applying portions of the flesh of one of the reptiles (just decapitated for the purpose of another experiment) to the wound.

2 h. 30 m. He has held the bloody portion of the snake to his wound incessantly, from which all the swelling has subsided, together with all uneasy sensations, from his hand and arm.

4 o'clock, P. M. The man Elnsworth has remained constantly in the room under my inspection. His dinner was offered to him, but he had little disposition for food; says his stomach is a little sick, probably the effects of the medicine. No tumefaction or other symptoms remain; the wounds resemble slight scratches, without any appearance of inflammation. The vein in which the bite took effect presents a peculiar appearance, being for the distance of an inch between the valves above and below the wound quite empty. Directly above the valve the vein is unusually prominent, and the pressure, from the application of the flesh, has been removed for more than an hour. It is scarcely necessary to remark, that the application of portions of the snake to the wound, which the man appeared to think very important, could exert no other influence than might have been obtained from the application of the recent flesh of any other animal.

The root and leaf of the "specific" were produced and exposed to the inspection of an able botanist, Dr. Charles Pickering, who identified it with the *Hieraceum venosum*, or Hawk-weed, Adder's-tongue, Poor Robin's plantain, Rattlesnake weed, &c., a common weed in the dry open woodlands.* The same plant is noticed by Schœpf as a remedy for the bite of the rattlesnake.

Experiment 2.

11 h. 31 m. A pup, about three or four weeks old, was bitten by the same female snake which had previously bitten Elnsworth in the first experiment: both fangs took effect, and the two wounds were about an inch and a quarter apart.

11 h. 34 m. Pup urinates.

11 h. 36 m. Cries and staggers.

11 h. 37 m. Belly tense in the vicinity of the wound, and apparently painful; the wound presents an ecchymosis, being tumid and of a dark colour.

11 h. 39 m. Pup lies on his side, and continues his plaintive cries, also emits some froth from the mouth. The ecchymosis increases rapidly, and a pale bloody humour exudes from the wounds.

11 h. 51 m. The animal is quiet and fainting.

12 o'clock, merid. Appears vertiginous, turning round and resting on his extended fore feet; staggering and resting on his side, and turning upon his back. These symptoms continued with little alteration until

4 o'clock, When the animal died, having previously exhibited some stertorous breathing, but without the occurrence of convulsions.

Dissection.

I examined the body fifteen minutes after death in presence of Drs. Morton, Meigs, Emerson, &c. On raising the skin of the abdomen we observed an extensive extra-

* Vide Florula Cestrica, by W. Darlington, M. D., p. 84.

vasation of blood, not coagulated, in the cellular tissue over the whole front of the belly. The colour of the parts exposed to the specific action of the poison was a dark red, and the whole appearance in the vicinity of the wound might be aptly compared to that occasioned by an extensive and violent contusion.

The abdomen being laid open, displayed the abdominal reflections of the peritoneum nearly in the same condition, being very red, and appearing as if soaked in blood. A similar appearance, to a considerable extent, prevailed in the peritoneal coat of the stomach and intestines, the veins of which were congested. The internal coats of the stomach and intestines were natural in appearance. Urinary bladder was empty. No coagulated blood was observed in any of the vessels throughout the system. Thorax presented no remarkable deviation from a natural state.

Cranium.—On raising the skull and dura mater, an extensive dark patch, formed apparently by extravasation or congestion, was observed under the arachnoid membrane lying over the cerebral lobes, and extending down in a slight degree between the convolutions. The substance of the brain and spinal marrow appeared natural. The muscular system was rather pale.

It will probably be remarked, that the specific action of the poison appears to have expended its deleterious influence on the *cellular* tissue in this animal: the usual phenomena which characterize death from poisons, such as non-coagulation of the blood, extravasations, &c., were remarkably well developed.

Experiment 3.

A full-grown cock, having the feathers removed from over the pectoral muscles, was exposed to be bitten by a rattlesnake, and at

12 o'clock, merid. Received two slight wounds from both fangs at the same time; each wound was covered with drops of a transparent fluid ejected from the poison bag.

12 h. 3 m. The bitten part assumed the appearance of a dark purple ecchymosis, and the skin in the immediate vicinity of the punctures was puckered or corrugated.

12 h. 45 m. The parts over the wounds are slightly tumid, and present a black or gangrenous appearance, and are moistened by a yellowish ichor which exudes from the wounds.

The animal finally recovered, without having experienced any constitutional affection. It should be here remarked, however, that the punctures did not appear to have penetrated the skin thoroughly.

Experiment 4.

A black puppy, a few weeks old, received three bites between 12 h. 18 m. and 12 h. 23 m. The last and most severe bite was over the left eye.

12 h. 27 m. Apparently drowsy.

12 h. 40 m. Symptoms progressing slowly. At

4 o'clock, P. M. the swelling over the eye, vertigo, and general uneasiness, appear to have attained their height. On the day following the animal had recovered without the interference of art.

Experiment 5.

4 o'clock, P. M. A stout pup was inoculated with the poison, expressed from the poison bag of a living snake, on the left side of the abdomen.

4 h. 15 m. Local symptoms are evident, and constitutional effects are beginning to be manifested.

5 o'clock, P. M. Symptoms much increased: the animal cries with pain and uneasiness; changes its posture

frequently; moves with a tottering and irregular gait, sometimes lying on its breast with the fore feet extended: these symptoms were occasionally interrupted with drowsiness, and finally the animal went into a deep sleep.

9 o'clock, P. M. The pup commenced licking his wound, the swelling of which, from the ecchymosis, had so increased as to hang down like a large hernia.

The succeeding day this animal also recovered, no symptom remaining except a slight tenderness in the part where the inoculation had been performed. Had the "*specific*" been administered in this case, the cure would doubtless have been attributed to its operation.

Experiment 6.

Poison was squeezed out of the sack of a living snake, and being placed on a piece of meat, was given to a pup to eat: it produced no effect, local or constitutional, upon the animal.

Anatomical Observations, &c.

In all venomous snakes there is an opening of considerable size situate between the eye and nostril, which penetrates in the direction of the poison apparatus, at the base of the fang; the use of this opening in the economy of the animal, as far as I can learn, has never been discovered; it has no direct communication with the cavity containing the poison, but is connected with the lachrymal passages, so successfully investigated by Jules Cloquet.* On a careful examination of this portion of the anatomy of the Crotalus, I have invariably found at the bottom of this cavity an exceedingly delicate transparent membrane, extending over the osseous cavity in the bone at the base of

* Vide Memoire sur l'Existence et la Disposition des Voies Lachrymales dans les Serpens.

the fang. This membrane, whilst it intercepts any direct communication between the sack and external canal, might at the same time permit the action of the atmosphere on the fluid contained in the sack, to take place through it, and thus to change its chemical properties. This sack communicates with the oculo-palpebral cavity, formed between the eyelid and conjunctiva. The poison of the living Crotalus, tested in numerous instances with litmus paper, &c., invariably displayed acid properties.*

General Remarks.

In conclusion it appears, that of the number of reptiles exhibited, some possessed the venomous faculty to a considerable degree, in others the poison was less active, and in some it had entirely disappeared, and in the latter, the poison sack was found, on dissection, entirely empty.

These circumstances are readily explained when we are aware that the reptiles have remained in captivity without food for more than three months, during a cold season of the year, and, until within a few days of the experiments, deprived of water. It is more than probable that very little poison would be secreted during a state of perfect abstinence, and that of less activity than when produced under ordinary circumstances. Hence, the same reptiles whose bite occasioned the death of an animal in eight minutes, when the experiments were performed in September, required five hours in order to produce fatal results at the present period. The operation of the poison

* Similar observations relative to the acidity of this poison were long ago made by Dr. Brickell, of Savannah, who, speaking of the external application of the solution of caustic ley to the bite of the rattlesnake, states, "I was led to this by a chemical examination of the poison of the *Crotalus horridus*, which showed an acid to be one of its constituents."—Vide New York Medical Repository, Vol. VIII. p. 441.

on the animal system also varied. In September, when the animals died early after the infliction of the wound, death was preceded by convulsions, which was not the case in the present instance; but the animal appeared to suffer more pain, and finally fell into a state of stupidity, which continued for several hours, when death was produced by the slow operation of the poison on the system. On dissection, the usual appearances produced by such poisons on the organic structure, were manifest; congestions, exudation of blood throughout the system, together with the non-coagulation of this fluid, were among the more obvious results. The cavities of the heart were empty, and fluid blood was observed in the large veins.

Two of the Rattlesnakes were decapitated, and the heads being placed with the jaws expanded against the abdomen of a living rabbit, they were observed to bite repeatedly with the desperation of expiring nature, forcing their fangs into the flesh their whole length; but in these the poison bag appeared to have been emptied previously, by repeated efforts of the animal to bite, and on dissection were found nearly void. After decapitation it was curious to observe the motions of the body, which were continued from association; the cut extremity of the trunk, when an injury was inflicted near the tail, was thrown towards the offending body, as if with the intention of inflicting a wound; this experiment was repeated frequently. The heart torn from the body continued its contractions for ten or twelve hours.

Of all the animals bitten in these experiments, one only died, though all were more or less affected by the poison. Although the wound which was inflicted on Mr. Elnsworth was attended with the usual *local* effects, there is no proof that the poison would have proved mortal without the use of the remedy, inasmuch as obvious local effects were observed in some of the animals that finally recovered without the interference of art. Though at the same time it will be remembered that the first animal experimented on died from the poison of the same snake which had previously inflicted a wound on the man.

As regards any moral influence being exerted over these animals by the proprietors, which enables them to handle the snakes without the fear of being wounded,—one of the proprietors, Mr. Murray, subsequently confessed that no such influence existed; but that their knowledge of the habits of the Rattlesnake enabled them to handle them with impunity. Thus they are aware that the snake can strike only after certain preparation of the body; they assume an offensive attitude previously to striking a blow, and they seldom or never make an effort to strike when once secured by the hand.

The Abbé Fontana has remarked that the poison of the viper is not fatal to its own body, or to that of its own species when bitten; the contrary of this position is stated on respectable authority to be the case as regards the Crotalus—a result that might have been anticipated from the well known fact that Rattlesnakes, congregated together in any number, never inflict a wound on each other.

Among the most remarkable peculiarities observed in the economy of this animal is its power of abstinence. An individual lived more than two years in the Philadelphia Museum, totally deprived of food. Others in the same institution have been observed united for a considerable time in the act of coition, and subsequently to bring forth young in a living state. In one instance I have witnessed a female with fourteen young at one birth, which is far from being to the same degree prolific as some of the oviparous Colubers.

In the present stage of the investigation, had I occasion to treat a wound inflicted by a poisonous reptile, my faith in the *Hieraceum venosum*, as a cure, is not such as to induce me to resort to its employment, to the exclusion of the less equivocal means of suction, pressure, or ligature, together with constitutional treatment. Some very interesting experiments, which establish the superiority of the last mentioned methods, have recently been made by C. W. Pennock, M. D., and are published in the American Journal of the Medical Sciences for May 1828.

Some further Experiments with the Poison of the Rattlesnake.

Agreeably to a promise made, to continue the experiments on the poison of the Rattlesnake, in which the root of the *Hieraceum venosum* as an antidote was tested, I now offer a few additional observations.

It will be observed that though the experiments detailed below afforded different results, in no instance was it found successful, as an antidote, when administered to quadrupeds. In a few instances the medicine did certainly appear to mitigate the effects of the poison on the system in a slight degree, yet in others not the least benefit was derived from it. The reptiles were fresh healthy animals recently received from the country.

Experiment 1.

June 5th, 1828.—Two kittens were exposed to be bitten by a young male Rattlesnake; several wounds were inflicted on both without any poisonous symptoms following.

A large female snake was next produced; the bite of this animal was speedily followed by the usual symptoms of similar poisoned wounds in both animals.

A decoction of the root of the Hieraceum venosum was freely administered to the animal first bitten, with the apparent effect of rendering the poison less narcotic, and probably of retarding the death of the subject of the experiment, and it survived the animal subsequently bitten more than an hour.

Experiment 2.

At 4 h. 21 m. a small black pup was bitten by an active male snake.

At 4 h. 34 m. a brown dog was bitten by the same snake severely in the foot; the wound bled freely.

At 4 h. 37 m. the black dog was again bitten in the foot, the wound being severe.

At 4 h. 40 m. black dog was drowsy, and unable to stand.

At 4 h. 45 m. brown dog evacuated per anum.

At 4 h. 46 m. black dog evacuated per anum.

At 4 h. 47 m. administered a quarter of a pint of the decoction to the black dog.

At 4 h. 55 m. gave the same dog more of the decoction, say half a pint in all; he is certainly not more drowsy, while the brown dog appears very sick and restless; the black dog swelled a great deal, but shows signs of more liveliness.

At 5 h. 25 m. gave the black dog half a wine glassful more; he trembles very much, and the leg is greatly swelled, but he swallows his medicine easily.

5 h. 45 m. black dog drinks of the decoction voluntarily, and at 6 h. 30 m. went to sleep. The brown dog has become more lively, and limps about the room; the parts in the vicinity of the wounds of both are much tumefied. About this period both became considerably revived; bloody serum was squeezed out of the black pup's wound, and the swelling thus diminished. On the following morning the black dog was found dead, whilst the brown dog recovered completely.

Experiment 3.

4 h. 10 m. a pup was bitten over the inner canthus of the right eye.

At 4 h. 15 m. the effects of the poison were visible, and at 4 h. 20 m. involuntary discharges of fæces occurred.

At 4 h. 35 m. the subject was very sick, the parts much swelled and painful.

At 4 h. 30 m. six ounces of the decoction have been taken at intervals of six or eight minutes.

5 h. P. M. two ounces more were swallowed; the swelling is excessive about the eye; in other respects the symptoms have mitigated.

4 h. 40 m. a kitten received a wound from the same snake; several wounds were received in all, and the animal died with the usual symptoms in a few hours.

The constitutional symptoms in the pup appeared to mitigate an hour after the wound, but the swelling extended over the whole face. The blood, percolating from the vessels in the vicinity of the wound, became diffused through the cellular tissue, and did not coagulate. Next morning the pup was found dead, having swallowed the last portion of the decoction at 10 P. M.

On the Generation of Animal Heat. Communicated to the Philadelphia Academy of Medicine, in the year 1821.

"Opinionum commenta delet dies, Naturæ judicia confirmat."—Cicero.

Early convinced of the inefficacy of those physiological theories founded upon the doctrines of *chemical life*, which have a natural tendency to debase man from his dignified and compound condition of soul and body, to a mere complex chemical machine, I was led to examine with care the laws of vitality, and the *phenomena* resulting therefrom—not the least interesting of which is the *generation of animal heat*, or that function, by means of which the body, during health, maintains a similar and equable temperature throughout all parts of the globe.

Clothed in the seductive garb of high toned eloquence, or subtle disquisition, error appears to have been inseparably connected with those dogmas which allege that the multiplicity of changes, synthetical and analytical, occurring in our elementary particles, are produced by means of chemical or mechanical agency! Numerous examples might be adduced in illustration of this, though I shall rest satisfied with the following well attested fact.

While one physiologist estimated the force of the heart, as equal to one hundred and eighty pounds, another reduced it to eight ounces, and both these conclusions are deduced from reasonings presented in all the imposing forms of the exact sciences! It has well been said, that our ignorance may be concealed, but cannot be removed, by the vain parade of a *science foreign to medicine*.

In the following pages I shall have frequent occasion to make use of the terms *organization*, *vital properties*, *functions*, and *life*. My time, and the limited space allowed in the pages of a journal, will not permit me to enter into the discussion of that already hacknied subject, *vitality*. But it is necessary here briefly to state, that I consider the above expressions intimately related to each other—*vital property* is the *acting power*—*organization*, the *instrument acted upon*—*function*, the *mode of action*, and the *phenomena* of life the *result*.

To the pride of man it is not a little mortifying, boasting as a mark of pre-eminence the *progressive knowledge* of his species, that we are obliged to retrace our steps, through the difficult and arduous paths of elementary science, back to the days of the immortal Hippocrates, a period upwards of two thousand years, for a *theory* of animal heat—which, after the successive labours of the innumerable hosts of chemists who have flourished since, until the appearance of Hunter and Bichat, (whose ideas on this subject we shall see differ very little from the father of medicine,) possesses more of the semblance of truth, and is more in consonance with the immutable laws of life, than is offered by any author with whom I am acquainted.

The generation of animal heat, was thought by Hippocrates, to depend upon the action of a "*vital principle* on *organized matter*," and hence, that the function is not confined to any particular organ or part of the body.

About the period in which Boerhaave flourished, the science of physiology was subjected to a revolution equalled only by the ebullitions produced by Des Cartes in natural philosophy. The vigorous mind of Boerhaave was not exempt from the infatuation which seized upon the writers of the age, who resolved all the vital phenomena into attraction and repulsion. To the attrition of the fluids upon the solids of the body: to the friction of the particles of blood against the sides of the vessels: and to fermentation and putrefaction, was successively ascribed the temperature of animal bodies.

To the first, it was objected, that no perceptible heat has ever been excited by the attrition or agitation of water or oil, quicksilver or other fluids, unless they have undergone at the same time some chemical change, as in agitating milk or wine till they become sour.

The two latter causes, or fermentation and putrefaction, would not be maintained, at the present day, by the least informed chemist.

It was thus that hypothesis succeeded to hypothesis, without any thing satisfactory having been offered, till Dr. Black gave to the world his celebrated theory of latent heat. Comparatively ignorant of physiology, he was led to draw false deductions from the most clear premises, though his main principle, that latent heat is converted into free caloric, will be found to stand. Nevertheless, he erroneously confined the calorific function to the pulmonary organs, alleging, that in consequence of a reciprocal action of the blood in the lungs and of the atmosphere, a portion of the latent heat of the latter was absorbed.

Nearly allied to the preceding is Dr. Crawford's theory, the essence of which is, that the capacity of arterial, for heat, is greater than that of venous blood—that there is no difference of temperature between the two ventricles of the heart—and, in fact, that the heat of all parts is nearly the same.

"Animal heat is, in like manner, referrible to a process bearing no remote analogy to a slow combustion, by which a portion of *carbon*, an inflammable principle existing in the blood, is united with the oxygen of the air, in respiration, and thus carried off from the system."—*J. F. W. Herschel, Discourse on the Study of Natural Philosophy*, p. 234.

This apparently sound, and certainly beautiful theory, gained many advocates, and was admirably calculated to enlist such as are inattentive to the peculiar laws of life, or warm in the pursuit of a favourite science. But I hold it to be entirely untenable, as at variance with the fundamental laws of the animated being. "Whatever healthy mutations, whether of the solids or fluids, take place in that admirable workmanship, the human body, are the result, not of *chemical* but *vital* agency—an agency independent of organization."

Dulong has lately repeated the well-known experiments of Lavoisier and Delaplace, chiefly with the view of ascertaining whether the quantity of caloric developed by the oxygen, which disappears in respiration, is equivalent to the quantity given out by the body.

He employed for that purpose a modification of Count Rumford's Water Calorimeter. The result was, that the quantity of caloric disengaged, by the conversion of the oxygen into carbonic acid, is equal, in carnivorous animals, to between forty-nine and fifty-five parts in a hundred (100—) of the heat disengaged by the whole body, during the same interval of time, and in frugivorous animals, to betwixt sixty-five and seventy-five parts; and that the whole quantity of caloric disengaged, by the formation of carbonic acid and water together, is equivalent to between sixty-nine and eighty parts only. He thence concludes, that the animal heat is greater than can be accounted for by the fixing of oxygen during respiration, and that, therefore, some other source of calorification must exist.—*Journal de Physiol.*

Next, I proceed to state my objections to this pulmonic theory, which has become so fixed and riveted on the minds of many of the older, or electro-chemical physiologists, as scarcely to be shaken.

The lungs I shall at present consider as grand emunctories, whose principal function consists, in eliminating an excrementitious matter out of the mass of blood. I readily admit, that the oxygen respired, partly disappears, and that carburetted hydrogen is formed: it also seems probable, that the air respired may assume a more condensed form, or enter into combinations, producing new materials, possessing less capacity for heat. But it has never been proved, that the capacity of arterial blood for heat, is greater than venous blood, though it is reasonable to suppose, that the materials to be discharged from the lungs must assume a more fluid *form*, and thus *absorb* heat. The sensible temperature of the blood in both ventricles is granted to be the same. Nevertheless, nearly all the phenomena of health and disease militate against the chemical views of the origin of animal heat—some of the more striking of which I shall notice.

We frequently observe a local increase of temperature, as in the act of blushing—in topical inflammation—in chronic hepatitis, which causes a burning of the cheeks, of the palms of the hands, soles of the feet, &c. which cannot be explained by any of the theories of the oxydation of the blood.

Heat, moreover, continues to be evolved from the body some time after *apparent death* from acute diseases. I have dissected bodies warm twelve hours after death, while others which died of a lingering disease, though otherwise under similar circumstances, have cooled in two or three hours.

The pulse in certain stages of fever is diminished in force and velocity, the system nearly exhausted, and the lungs in particular, scarcely able to perform their office—and still, we find the temperature of the body morbidly increased.

In phthisis, asthma, apoplexy, &c. the same phenomena present themselves.

A remarkable instance of the latter disease came under the observation of Mr. Hunter: "a gentleman was seized with an apoplectic fit, and while he lay insensible in bed, covered with blankets, I found," says he, "that his whole body would in one instant become extremely cold in every part, continuing so for some time, and as suddenly become extremely hot; while this was going on, alternately, there was no sensible alteration in his pulse for several hours."*

That the heat of the body does not depend upon respiration, or the state of the circulation, has, indeed, been noticed by many writers. It is remarked by Dr. Rush,† that "during the fever of 1794, he found, that the burning heat of the skin, called by the ancients, 'calor mordens,' and from which this disease, in some countries, had derived the name *causus*, was more common this year than the last; it was sometimes local, sometimes general; it had no connexion with the state of the pulse, or circulation, for it was most intense at a time when the patient had no pulse."

We are told by Dr. Chisholm that he "found the skin to be warm, whilst the pulse was at fifty-two degrees; and that it was sometimes disagreeably cold, when the pulse was as quick as in ordinary fever."

Exactly the same was observed by Senac in intermittents, "I have often seen," says he, "the lower extremities extremely cold, and the upper ones parched with heat."‡

By some experiments of Mr. Hunter, it is proved, that the egg, during incubation, has the power of generating heat, in which case, pulmonary influence is out of the question.

"Having taken," he observes, "some eggs from under a hen, when the chick was about three-fourths formed, I broke a hole in the shell, and introducing the ball of the thermometer, found that the quicksilver rose to ninety-nine and a half degrees. In some that were addled, I found the heat not so high by two degrees, so that the

* Animal Œcon. p. 91. † Med. Inq. p. 212. ‡ Senac, p. 25.

life in the sound egg, assisted in some degree to support its own heat."*

He entertains the opinion that this power of generating heat is peculiar to an animal while alive: it is a power only of opposition and resistance, since it is not found to exert itself spontaneously, but must always be excited by the energy of some frigorific agent or disease.

"It does not depend upon the motion of the blood, as some have supposed; because it likewise belongs to animals who have no *circulation*, and the nose of a dog, which is always nearly of the same heat, in all temperatures of the air, is well supplied with blood. Neither can it be said to depend upon the nervous system, for it is found in animals that have no brain or nerves; it is then most probable, that it arises from some other principle, a principle so connected with life, that it can, and does exist, and act independently of circulation, sensation, and volition, and it is that power, which preserves and regulates the internal machine. This power of generating heat is in the highest perfection, when the body is in health; and in many deviations from that state, we find that its actions are extremely irregular."†

Much has been said by the advocates of the pulmonic theory, concerning the temperature of the blood in the left side of the heart, being higher than that in the right. Experiments to ascertain this point, differ very much in result. It is asserted by Drs. Crawford and Davy, that there is no difference of temperature, while some, on the other hand, have maintained that the temperature was highest in the right ventricle.

If any difference exists between the arterial and venous blood, in the cavities of the heart, as respects their specific caloric, excepting what arises from the difference of specific gravity,‡ it can only be accounted for by the su-

* Animal Œconomy, p. 103. † Idem.

‡ The specific gravity of venous blood, without its fibrine, is 1050, that of arterial 1047.

perior power of the left ventricle, its parietes being composed of much more numerous muscular fibres, its actions much stronger, and the formation of animal heat in the part might be greater.

The temperature of parts differs according to the degree of vital action present. Mr. Davy found in his experiments, that in the stomach of an ox, the pyloric compartment was of a higher temperature than the left ventricle itself. Thus when the latter immediately after death was 103, the former full of food was 104.5, from the stimulus of its contents and increase of vital action.

This enables us to explain the fact, that the temperature of young animals in whom all the vital actions are most energetic, is higher than in adult animals, and much greater than in old persons—which was remarked by Hippocrates, "*qui crescunt, plurimum habent calidi innati, senibus autem paucus calor.*"

In confirmation of this remark, we have the experiments of Davy,* who found in one instance, the heat under the axilla of a child just born, 98.5, after twelve hours, 99 degrees, and after three days the same—during the whole of which time, it appeared in perfect health. On five other children of the same age, similar observations were made: in two instances of weak infants, the temperature one hour after birth did not exceed 96 degrees, which is two degrees below the standard heat of a man in perfect health—probably from the *general debility* of the subject of the experiment.

Of late, we have a theory, which attributes the production of animal temperature to the influence of the nervous system. The work of Dr. Wilson Phillip on this subject, has attracted no inconsiderable share of attention. He supposes it to be generated by the action of the nervous

* Eclectic Repertory, 1816.

influence on the blood, by which the formation of secreted fluids is effected, and consequently that heat is a secretion.

An hypothesis like this, could only have been framed on limited views of the animal economy. We are very liable to error, by drawing hasty conclusions from a few isolated facts, as they occur in the higher grade of animals, without availing ourselves of those convincing evidences which are to be collected, by observing the phenomena presented in similar functions, in a more extensive survey of animal existence. Thus in the theories of animal heat, we have confined ourselves generally to the phenomenon as it exists in the vertebral animals.

Had Dr. Phillip carried his observations on the animal economy a few steps further, he would have saved himself the necessity of retracting opinions which cannot be supported by a more comprehensive view of the subject.

In relation to the lowest class of animals and vegetables, in which no nervous system has been discovered, Mr. Hunter found that the most imperfect are capable of an evolution of caloric. It seems to me that it is by no means established, that secretion is materially dependent on the nervous influence: on the contrary, many facts are opposed to the supposition.

Man is emphatically from the beginning, a secreted animal. In the fœtus in utero, assimilation probably is the only active function existing, at least, the whole glandular system, in the human fœtus, is quiescent: it is not till the blood has received the influence of the atmosphere, that we have urine, bile, saliva, &c.

The nervous influence being essential to the evolution of heat, how is it that the chick in ovo is capable of evolving it? in which the heart may be seen performing its functions, when no appearance of brain, or spinal marrow, can be traced. If the sanguiferous and nervous systems were co-existent, the formation of the animal must begin at more than one point, which is contrary to the simplicity observed in the established laws of nature.

Were the nerves at all concerned in the formation of animal heat in the human subject, the influence must reside in those of organic sensibility solely, since we not unfrequently witness a total loss of nervous energy, while the power of evolving heat remains.

We have a case detailed by Dr. Parry, in which there was an extinction of pulse in one arm, with a coldness, though complete power of motion existed in it, while the other arm was warm, and had a perfectly good pulse, without, however, the power of voluntary motion.*

I witnessed a case some years ago, in the Pennsylvania hospital, which tended to prove that neither respiration nor nervous energy has much connexion with the function under review. It was a patient with a fracture of the dorsal vertebræ, and consequent pressure of the spinal marrow. The inferior extremities were totally deprived of nervous influence: and yet, the portions of the body above the injury were of a natural temperature, while all the parts below the fracture indicated by the thermometer a morbidly increased temperature. It is as needless as it would be easy to multiply facts of this nature.

In our speculations on animal temperature, we must at present be content with the knowledge of facts. To refer it to some general principle, belongs probably to the destiny of future ages. I cannot forbear, however, to cherish the suspicion, that heat is caused by a distinct and peculiar action of living matter. If it be called a secretion, it is a peculiar one, though like the secretions in general, it is modified, increased, or diminished, by the operation of the passions and other states of mind, &c.

Considered as a secretion, animal heat most probably enters the system with the chyle, in a latent form, and is

* Parry on the Pulse, p. 139.

set free by the action of the vessels upon their contents. What else produces those changes in the blood denominated secretions? Every one now seems convinced by direct experiments, that vessels so modify their contents, that the liquids and substances which the absorbents take up, become lymph, a fluid resembling blood, in their transit through the vessels, and that the chyle imbibed from the bowels is undergoing continual modifications, as it proceeds through its channels to the sanguiferous system.*

There are secretions which not only are modified, but entirely wanting as we descend in the scale of beings. Birds, for example, have no salivary glands, and precisely the same occurs respecting the formation of animal heat, in that class denominated cold-blooded animals, as frogs, toads, lizards, snakes, &c., which "have no power of generating heat within themselves,"† notwithstanding they breathe with lungs.

What effect low diet or starvation has, in diminishing the power of forming animal heat, is generally known. Do we not often meet with persons, who have been accustomed to abstemious living and otherwise temperate habits, with hands continually as cold as a lizard?

Warm-blooded animals, inhabiting the ocean, perhaps from this circumstance alone, require a greater power of economizing food, as the very action of keeping up animal heat may require an additional supply of nourishment.

In searching Bichat for his authority, I was glad to find that I did not very essentially differ from so distinguished a physiologist. "Le dégagement du calorique," says this author,‡ "est donc une phénomène exactement analogue à ceux dont le système capillaire général est le siége."

* B. Franklin's theory of animal heat, 1784, or half a century ago, is not improbable. "Is not the natural heat of animals thus produced, by separating in digestion the parts of food, and setting their fire at liberty?" Vide Franklin's Essays, Boston, 1825, p. 300, "Loose Thoughts on the Universal Fluid," &c.

† Home's Comp. Anat.

‡ Anat. General, Vol. II. 523 and 524.

Again, "Le calorique arrive donc au système capillaire combiné avec la matière des sécrétions, avec celle des exhalations et celle de la nutrition. Le sang est le fluide commun qui résulte des toutes ces combinaisons. Dans le système capillaire général, chaque partie se sépare, *le calorique pour se répandre dans tout le corps et sortir ensuite au dehors;* les fluides, des sécrétions pour sortir par les glandes; ceux des exhalations s'échapper par leur surfaces respectives; les nutritifs pour sejourner dans les organes."

Further, "Chaque système a son mode particulier de chaleur. Certainment il se sépare moins de calorique dans les cheveux, les ongles, l'épiderme, que dans tout autre système. Les organes blancs, comme les tendons, les aponévroses, les ligamens, les cartilages, etc., en fournissent aussi moins probablement que les muscles. Examinez les pates des oiseaux; ou il n'y a que ces parties blanches; elles sont bien moins chaudes que le reste du corps."

He, however, admits that some latent heat may pass into the system through the medium of the lungs, and attempts to explain in this manner the connexion between the size of the lungs and the quantity of heat disengaged. But it is not unlikely we shall find on examination, that the degree of heat evolved, is in proportion also to the quantity of ingesta.

Not long ago I heard it argued by a distinguished chemist, that animal temperature is produced by the assimilating functions, on the principle that fluids converted into solids give out heat. But it was objected, that it is an acknowledged fact, that the absorbents are as active in converting the solids of the body into fluids. Each of these theories are, I think, to be discarded for the same reason, namely, that the ultimate particles of all bodies are similar, whether solid or fluid.

It may be added, that the temperature of a part is not increased proportionately to the assimilating function in energy, and conversely, as instanced particularly in the case of paralysis cited above.

I have thus endeavoured to show, chiefly by a train of negative reasoning, and I hope not unsatisfactorily, that the generation of animal heat, and the function of respiration, have very little if any connexion with each other, and in some animals, none at all. Believing ignorance to be preferable to error, no small point is surely gained, if former theories are proved to be fallacious, or at least inadequate to explain the phenomena of the case. It is not to be expected that this subject will be divested of obscurity, till we become much better acquainted with the laws of life, the importance of which, to physiology, and to the theory and practice of medicine, cannot be too highly estimated, though such inquiries have been by many condemned as purely speculative. We do not hesitate to calculate the fall of an apple from the tree—the projection of a ball from the mouth of a cannon—or the revolution of the moon in her orbit; knowing as little of gravitation, attraction, and projection, as we do of the cause of muscular motion, animal temperature, or any of the vital operations.*

* More than ten years have elapsed since this essay on animal heat was first published in the Medical and Physical Journal of Philadelphia, then edited by Professor Chapman; during this interval many similar essays have appeared, both at home and abroad, in none of which have we been able to detect any additional facts; whilst many of the most important data here detailed, have been, for the most part, entirely overlooked.

Remarks on the Variety of Complexion, and National Peculiarity of Feature. (Lecture delivered before the Academy of Natural Sciences, A. D. 1822.)

"The intellectual worth and dignity of man, are measured, not by the truth which he possesses, or fancies that he possesses, but by the sincere and honest pains he has taken to discover truth."—Treviranus.

Transported into the midst of a busy metropolis of India, where men, from various portions of our globe, pass, as it were, in review before the spectator, the very first circumstance, perhaps, that would strike the eye of the most superficial observer, would be the variety of tints, or shades of colour, and peculiarity of feature, which characterize the mixed multitude.

The causes of the variety of complexion have, at all times, occupied the attention of physiologists: but, as is frequently the case with men of genius, they have treated it too abstractedly. Led away by their powers of ratiocination, they have drawn their conclusions from *analogies* rather than from *facts;* and though we may be often delighted—sometimes even conquered by their logical powers, yet but little light has been thrown upon the subject in dispute; and the cause of national physiognomy and complexion remains as much a subject of discussion as ever.

Considering the field still open to a fair and candid investigation, I have ventured to enter the lists—endeavoured to collect and arrange some facts—performed some experiments, and made a few observations, which it is now my intention to communicate.

I shall not in this investigation stop to inquire whether all mankind are to be considered as of one natural species or not; that is, whether the physical diversities which so curiously distinguish the several races of men, are *specific* differences, or only varieties. That one pair at least of every living species must at first have been created, and that one single pair was sufficient for the population of our globe, in a period of no considerable length, is evident, from the frequent calculations of political arithmeticians. "The author of nature," says Sir William Jones,* "created but one pair of our species, yet had it not been among other reasons, for the devastations, which history has recorded, of water and fire—famine and pestilence, the earth would not now have had room for its multiplied inhabitants."

Notwithstanding the learned and elaborate dissertations of many naturalists and philosophers to the contrary,† it is now satisfactorily proved by modern zoologists, that all the diversities of mankind are but *varieties of one original stock.*

Indeed, agreeably to the zoological definition of the term *species*, it could not be otherwise.

"A fixed external form belongs to each animal, and is continued by generation: certain forms, the same as those existing in the world at the present moment, have existed from time immemorial; such at least is the result of the separate and combined proofs furnished, by our own observation and experience, respecting the laws of the animal kingdom, by the voice of tradition and of history, by the remains of antiquity, and by every kind of collateral evidence.

"All animals belonging to one of these forms, constitute what zoologists call a *species*. This resemblance must not be understood in a rigorous sense, for every being has its individual characters of size, figure, colour, proportions;

* Vide Families of Nations.

† Among whom we may mention Voltaire, Buffon, Blumenbach, Lord Kaimes, and many English authors.

in this sense, the character of variety is stamped on all nature's works. She has made it a fundamental law, that no two of her productions shall be exactly alike, and this law is invariably observed through the whole creation. Each tree, each flower, each leaf, exemplifies it—every animal has its individual character: each human being has something distinguishing in form, proportions, countenance, gesture, voice—in feelings, thought, and temper—in mental as well as corporeal physiognomy. This variety is the source of every thing beautiful and interesting in the external world—the foundation of the whole moral fabric of the universe."*

But to return. Three *principal* agents have been mentioned as the cause of *complexion*, namely, 1st, *Climate;* 2nd, *Solar heat* and *light;* and lastly, *Civilization;* each of which has been maintained by equally respectable authority.†

The following facts induce me to believe that the first cause, or climate alone, exerts very little influence in this respect. 1st, Is colour more influenced by *climate* or by the *blood* of the *parents?* The colour of the skin of an infant just born of the blackest parents amidst the burning sands of Africa, is so light, as scarcely to be distinguished from the European infant; from which fact, some naturalists might argue in favour of climate slowly inducing the change; but if the opinion I entertain of the formation and seat of the pigmentum nigrum be correct, it must be explained upon opposite principles. The colouring matter of the skin is generally admitted to be a glandular secretion; and as that which ascends the calibre of the hair, imparting colour thereto, is secreted in the bulb of the root of each respective hair, that lying beneath the cuticle, is also *secreted,* and probably contained in capillary tubes, of which tubes, the rete mucosum may consist.

* Lawrence's Lectures.

† "Climate, nourishment, and mode of life." Buffon, Vol. XX. p. 240.

Thus it is remarkable that the several hues of the different varieties, bear a close and nearly uniform relation to that of the hair and iris, as well as to the whole temperament of the individual.

The colouring matter being a secretion, it consequently is not found in the human fœtus in utero, as, in common with nearly the whole glandular system, those glands which secrete the pigment are as yet in a state of inactivity. Do we not observe the same in that large and important viscus, the liver, which in the fœtus affords no bile? in the kidneys, which form no urine? in the exhalents, which throw out no perspiration? &c., &c.

It would appear that atmospherical influence was absolutely necessary to the true secretory function, which may act by producing such changes in the blood as adapt it to the formation of the various matters of secretion. In the fœtus in utero, the blood circulating in the arteries and veins, has but one colour; it is, (according to Bichat's experiments) incapable of coagulation;* unctuous to the touch, and wants (according to Fourcroy) some of the saline principles contained in adult blood. Immediately after the commencement of respiration, the fœtal blood assumes the red colour, is capable of coagulation, &c., &c.

The functions of the fœtus in utero are consequently very limited, assimilation being the only one which enjoys *full activity;* and here, probably, the liver performs a vicarious action for the stomach. I confine my remarks, in the present instance, to the *human* fœtus only, being well aware, that in the lower orders of the animal creation, the fœtus at birth is by far more perfected; in these

* *Bichat's Anat. General*, vol. ii. As far as the human fœtus is concerned, I have had frequent opportunities of verifying this important fact; but in performing some living dissections upon the pregnant cat, I have repeatedly observed the fœtal blood of that animal to coagulate as perfectly as adult blood, the only difference being, that the blood of the kittens, as it left the vessels, was exposed to the air in a living state. Blood from the human fœtus will coagulate partially after very few inspirations.

the glandular system has already commenced operations; hence the necessity in some for the *allantois* to contain the urine. In such animals we must not be surprised to observe the colours of the skin also more or less stamped.

Although it is with great difficulty that we are able to demonstrate the rete mucosum in the European race, nevertheless, "*that some colouring matter exists beneath the skin, there can be no question, otherwise how can we account for the difference between the fair and the swarthy, or the more remarkable peculiarity of the albino:*"*—the freckles of the skin, the large blotches or stains which not unfrequently occur in the face and other parts of pregnant women, and the discoloration of the skin from the internal use of nitrate of silver?

The existence of the rete mucosum in the white race, so frequently denied by authors, has, however, been demonstrated occasionally in the European by skilful anatomists: a specimen of this kind remains to the present day in the Hunterian museum.† The difficulty of demonstrating it in the European depends upon the delicacy of its texture, being entirely destroyed by heat, maceration, or putrefaction, the usual agents for demonstrating the same but more consistent membrane in the Ethiopian. If not deceived, I have discovered it several times in the European on the living subject, by raising the epidermis with a blister, especially upon the back of the hands and neck.

In the *albino* the rete mucosum is most probably absent, as is the pigmentum of the choroid coat of the eye. The same phenomenon occurs also in the cicatrices of the negro, which sometimes remain fifteen or twenty years, or for life, of a dead-white colour, unless the new-formed

* Lawrence's Lectures, p. 278. In Brewster's New Edinburgh Philosophical Magazine, it is stated, that "that able physiologist, Mr. Lawrence, denies the existence of the rete mucosum in the European."

† We had occasion to examine this specimen in 1833.

part should regain its pristine vascularity, and strength of organization.*

From some observations I made a few years past upon a portion of skin taken from the buttock of a piebald negress who died in this city, I was convinced, that in all such cases, the metamorphosis from black to white, which we observe occasionally to take place in the negro, is dependent upon the total absorption of the rete mucosum, and a destruction of the glandular system, which originally secreted it. The cutis vera also in this case is far less vascular, which occasions the *dead-white* colour displayed through the translucent epidermis.†

But to return to our objections against climate as an important agent in producing variety of colour: and 2dly, "Diversities of manners, religion, and language, and mutual animosities which may have originated from long subjection to hostile governments, and may have been transmitted from distant times, produce aversions between the inhabitants of neighbouring countries, and prevent intercourse and intermarriages. The difference gradually increases, the effect accumulating while the cause continues; the people diverge in the characters of person; and national physiognomy becomes established. (*Vide Prichard. Phys. Hist. of Man.*)

The inhabitants of some parts of India, Calcutta for example, present all the intermediate shades from ebony black, to orange yellow, and that independent of climate, as they all enjoy a similarity of climate and mode of life; particularly as it occurs in the Brahmin caste, whose religious tenets oblige them to follow strictly a peculiar mode

* It has been doubted by some whether the cutis vera once destroyed is ever after re-formed. Professor Lawrence, of London, is very explicit on this subject;—"*Cicatrization*, which is the elongation of the sound skin over the ulcer, and which never takes place except from the sides of the wound." (Vide Lawrence's Lectures on Surgery.)

† Mr. Hunter found the rete mucosum in the cicatrices of negroes. (Vide Abernethy's Lectures on Surgery, p. 61.)

of life. "The different castes of people in Hindostan, who are settled in the same country, or who wander over it, have been prevented by the strict prohibitions of their religion from intermarriages with each other for many ages; the result of this long continued experiment is illustrative of the foregoing remark—each of these castes has acquired (though all of them are subject to the same local causes) a distinct set of features; all easily recognised by those who are conversant with them."

The characteristic physiognomy of the inhabitants of the different states or provinces of Italy; the difference of feature which we remark between the English and Scotch, and between the French and Italians; together with that remarkable characteristic physiognomy of the Jews, though scattered among the nations of the earth, must have arisen from the same cause.

The following anecdote from Dr. Gregory's lectures, will afford a good exemplification of the subject. The professor had made a long journey from the capital of North Britain to a remote village, to visit the principal inhabitant of the hamlet. The latter was a lady far advanced in life, who resided in an old baronial castle. On entering the hall his attention was attracted by a picture of a former lord of the place, who had at a former period been chancellor of Scotland. It held a conspicuous place among the family portraits, and was remarkable for a protuberant aquiline nose, and for a very peculiar set of features. But what excited the notice of the professor more strongly, was a singular resemblance, which he could not fail to observe, between the countenance represented in the picture, and that of the lady whom he was about to visit; the latter was descended in a direct line from the prototype of the portrait; the picture had held the place in which it was fixed for at least a century and a half. Going afterwards to other houses in the village, our author was surprised to find the same cast of features prevalent in several other families; and on inquiring, was informed that the old chancellor had been the father of several illegitimate children, who had disseminated thus widely the visage of their common progenitor.

We cannot imagine diversity of origin, or any considerable effect arising from difference of soil and climate in either of these instances, and perhaps the distinct physiognomy which characterizes the several nations, may in great part be accounted for on the same principles.

Variety in food, and the hereditary tendency of peculiar corporeal structure in the *brute species*, produce still more remarkable varieties; it is thus that we have the white, the black, the broad-tail, the hornless, and the many-horned sheep, together with every variety in the quality of the wool, induced from one or other of these causes; the same remarks may be extended to any of our domestic cattle. Human art alone can do but little in modifying the individual; but by diligently taking advantage of the natural tendency, to transmit any qualities which happen to arise, a very considerable influence is exercised over the race; we have only to select carefully those individuals which happen to be possessed in a more remarkable degree of the property or quality which it is desirable to perpetuate, and reserve them for the future propagation of the stock. The effect continually increasing, a particular figure, colour, proportion of limbs, or any other attainable quality, is established in the race, and the conformity is afterwards maintained by removing from the breed any new variety which may casually spring up in it. The utility and extensive application of this law of the animal economy, is well understood by the skilful and scientific agriculturist. Some authors are of opinion, that all the varieties which occur among the nations of the earth, were originally the result of accident, rendered permanent by procreation, examples of which in brutes, we have in white *rabbits* and *ferrets*.

3dly. Sheep in Iceland are covered with a kind of long and stiff hair, whilst the same animal is subjected to a similar change in the hot countries of India.

4thly. If the *wool* of the negro be caused by the *heat* of the *climate*, as authors have asserted, it is very singular that the *wool* of sheep is converted into *hair* by a similar cause! The fact is, that *climate*, solar heat and light, atmospheric influence, passions of the mind, and substances taken into the stomach, which act sympathetically or otherwise upon the superficial capillaries, can have no more influence upon the colouring matter *already secreted* in the rete mucosum, than they can have on the urine in the bladder, or any other secreted fluid: it is true, that exposure to the rays of the sun and to the atmosphere in any climate darkens the complexion; and in fair skins produces indelible freckles; yet such changes, together with others induced by the causes above enumerated, act primarily upon the *organs* which *secrete* the colouring matter, and consequently are constitutional causes; and probably of all such causes, the action of *mind* upon *matter*, will be found the most *general*, most permanent, and the most powerful.

Passions of the mind are capable of inducing a change of colour both in the hair and skin. A woman of this city (some years ago) had the hair of her head completely changed in colour during the course of one night: her case was that of difficult parturition; though her corporeal pain did not probably equal the anxiety and distress of mind. (Vide *Coxe's Med. Museum, vol.* 3*d, p.* 219—where several similar instances are related.) Cases somewhat analogous are not unfrequently met with.

The passions act also upon the kidneys, inducing change of colour, and altering the chemical properties of the urine; they act also more or less powerfully upon the whole glandular system; indeed the influence of mental affections does not stop here, but is extended even to the embryon or fœtus in utero, modifying not only the osseous fabric, but changing the colour of a part, or of the whole of the body. Innumerable cases of this kind must have come within the knowledge of every physiologist. It is curious that this phenomenon was known even to some of the *ancients*, and the means of which *Jacob* availed himself, in order to increase the number of spotted goats and sheep, must be familiar to all. (1739, *A. C.*)

V. 37. "And Jacob took him rods of green poplar, and of the hazel and chesnut tree; and peeled white streaks in them, and made the white appear which was in the rods.

V. 38. "And he set the rods which he had peeled before the flocks in the gutters, in the watering troughs, when the flocks came to drink; that they should conceive when they came to drink.

V. 39. "And the flocks conceived before the rods, and brought forth cattle, ringstreaked, speckled and spotted." (*Vide Genesis, Chap.* 30.)

The effects of fright upon the fœtus in utero are sometimes incredible; I have seen one case, and heard of others from respectable authority, wherein disorganization appeared to have been induced by this affection. A woman pregnant, was admitted into the Pennsylvania hospital with a severe burn which extended nearly over one side of the body: abortion soon took place; when the fœtus was observed to have one side of the body displaying the usual appearance, as of a part which had been exposed to boiling water, the skin was highly reddened and the cuticle in part abraded. A similar case occurred about the same time under the care of Dr. Atlee of this city.

"*Mr. John Hunter*, in his lectures, recites instances of children who have never seen their parents, resembling them exactly in form, manners, and in peculiar whimsical habits. He also mentions the fact that children have acquired the same diseases at the same period of their life, to which the parent had also been subject at the same age. Such instances are not only curious as demonstrative of the powers and progress of the vital actions, but they also deserve general consideration."

"Nature has implanted in the breast of every man, a love for youth, health, and beauty of form; she has made us to delight in amiable disposition, and to admire various kinds of intellectual excellence. She has given us propensities which tend to perfectionate the human race." (*Vide Abernethy, Zool. Lect.*)

But alas! how little the moral restraint, how perverted the sense, how morbid the taste of men; whilst the most fostering care and unremitted exertions are extended to the breed of our horses, sheep, cattle, and other domestic animals; the improvement of our own species by the same adequate means is utterly neglected or denied: and for the consideration of mere lucre, or the allurements of vanity, we are wedded to malignity, folly, or insanity, and consigned to disease, deformity, and death premature;

> "Quid non mortalia pretora
> Cogis; auri sacra fames;"

but if, like *Prometheus,* we presume to give life in opposition to the laws of Heaven, we shall receive the same punishment; for our children will become the vultures which prey upon our vitals.

5thly. Negro slaves imported into our country, undergo considerable changes in colour and osseous fabric, under peculiar circumstances apparently independent of climate.

Take, for instance, two pair of negroes,—allow one pair to bė exposed to all the influence of climate by hard labour on the plantation; the other pair are to be *educated* as house servants, and not exposed to the rigours of climate. The progeny of the former will, from generation to generation, retain the full characters of the negro form,—

namely, retreating forehead, anterior prominence of the malar bones, expanded nasal apertures, flat ossa nasi, prominence of the maxillary bones, obliquity of the incisor teeth, want of mental prominence, gibbous and crooked tibiæ, projecting os calcis, and flat foot; whilst the latter pair, or house servants, even in the first generation, will have approached considerably to the European form, simply by being in, and enjoying the atmosphere of *civilization*.

Dr. S. S. Smith was one of the first to remark, that "the field slaves live on the plantations, and retain pretty nearly the rude manners of their African progenitors. The third generation, in consequence, preserve much of their original structure; though their features are not so strongly marked as those of imported slaves. But the domestic servants of the same race are treated with lenity, and their condition is little different from that of the lower class of white people. The effect is, that in the third generation, they have the nose raised, the mouth and lips of moderate size, the eyes lively and sparkling, and often the whole composition of features extremely agreeable. The hair grows sensibly longer in each succeeding race—it extends to three, four, and sometimes to six or eight inches."* It has been asserted by persons resident in the West Indies, that a similar change is very visible among the negro slaves of the third and fourth generation in those Islands, and that even the first generation differs considerably from the natives of Africa.

If climate did exert such an active influence in producing, and in continuing those important differences of which we are treating, the change of complexion would have kept pace with the changes of climate; but this we are convinced is not the case. No one will call in question the

* Vide Smith on the cause of the variety in the complexion and feature of the human species.

fact, that the climate of Europe has undergone immense changes within the memory of man; and coeval to the earliest records of his history, we are informed by the sacred historian of the occurrence of ice in the Mediterranean sea, as hard as the rocks. (*Vide Book of Job.*) *Ovid*, complaining of the hardships of his banishment, refers to the severity of the cold, the Black sea being frozen sufficiently hard to bear the cattle.

Philadelphia and Lisbon are nearly on the same parallel of latitude: in the latter situation, the fall of snow is looked upon as a very rare occurrence, and the formation of ice is scarcely ever known; whilst the Delaware is almost annually congealed. Many facts might be produced in proof of the amelioration of our own climate.

That America, from the great lakes to the gulph of Mexico on the one hand, and from the sea-coast to the Rocky mountains on the other, includes almost every *variety of climate*, will scarcely be denied; and that there exists a great uniformity of complexion in the savage inhabitants throughout this immense region is equally certain; yet the customs, habits of life, and mode of thinking, are nearly the same. I consider these strong facts, which, at the same time that they discard climate as an active agent, give additional strength to the theory which attributes the diversity of complexion to the *state of society*.

During the fall of the *Roman* empire, the barbarians who involved it in ruin, crossed the *Volga* with their heavy wagons upon the ice. We are well aware that the congelation of water is a rare occurrence at the present time in like latitudes. Besides these historical facts, some of which are corroborated by *Gibbon*, (Decline and Fall of the Roman Empire,) we have others equally convincing, derived from the aid of *natural science*. *Cuvier* has discovered the osseous remains of the Lapland reindeer in countries south of the Mediterranean; those animals do not now inhabit south of the Baltic sea. It would be foreign to the subject of the present essay to enter into an investigation of the *causes* which have produced these slow but stupendous revolutions; and we have only to remark again, that the change of climate *has not been attended with a corresponding change of complexion.*

Having, I trust, made it evident that climate alone can exert very little direct influence upon complexion, we have next to show that *solar heat and light* are equally inadequate to produce the various changes.

1st. Those parts entirely out of the influence of solar heat and light, are constantly of a deeper black than any other part of the body, (ut vulva feminæ et raphe scroti maris,) and the streak of black along the spine will serve to detect the African origin, even to the fourth and fifth generations:

2d. African animals with the skin partly marked, as the monkeys, are not blackened by the sun; there are even white animals in the hottest parts of Africa: but a white woman has never been known to produce a black child without connexion with a black.*

3d. The black colour is not peculiar to the torrid zone. South America, even in the most scorching latitudes, does not produce real negroes; and those transported to North America, have preserved for many years their original complexion. The Portuguese established upon the burning coasts of Africa, have not changed their characters, unless by intermarriage. We find, in fact, a race of negroes in *Van Dieman's land,* under a climate colder than France or England.

We come now to the last agent mentioned, viz. *Civilization.* Animals, in a state of nature, obstinately retain their original colour, even when transported to a foreign climate. Thus the English rabbits bred in this country,

* Dr. Pearson, in Philos. Trans. Vol. LV, relates several instances of white women bringing forth children wholly black, by connexion with a black.

have not approached in the least to the colour of the American rabbit.

That matchless philosopher in his own department, *Cuvier,** remarks, that the most superficial characters are the most variable; colour depends very much upon the light; the thickness of the skin upon the heat; the size upon the abundance of nourishment: but in a savage animal, these varieties even are very limited by the nature of the animal, which does not abandon voluntarily those places where it is enabled most conveniently to obtain all that is necessary to the maintenance of its species, and which extends itself no farther than it can find the reunion of such conditions. Thus, although the wolf and the fox inhabit from the torrid to the frozen zone, scarcely do they display, in this immense interval, any other variety than a little more or a little less beauty of pelage. On comparing the cranium of the fox of the north and the fox of Egypt with those of France, no other than individual difference is observable.

Savage animals confined to closer limits vary still less; particularly the *carnivora;* a larger mane is the only difference between the hyena of Persia and that of Morocco. Wild *herbivorous* animals experience a little more evidently the influence of climate, because there is joined thereto a variety of *nourishment,* which differs as much in quantity as quality; thus elephants are larger in some forests than others; they have the tusks a little longer in those places where the nourishment is more favourable to the formation of ivory. It is the same as relates to the horns of the reindeer or the stag. But compare together two elephants of the same species the most dissimilar, and no difference is observed in the number or articulations of bones; in the teeth, &c.

Again, the *herbivora,* in a savage state, appear to be more restricted than the carnivora in their dispersion, as

* Vide Foss. Organ. Rem. Discours Prelim. p. 77.

nourishment is here joined to temperament to arrest them. Nature has also taken care to prevent the confusion of species which might have resulted from their mixture, by the mutual aversion with which she has endowed them.

But the empire of *Man* alters this order: he developes all the variations of which the type of each species is susceptible, and obtains results which the species, left to themselves, would never have produced. Even here, the degree of deviation is proportioned to the intensity of the cause, which is *domestication* or *slavery*.

These facts alone argue the importance of *civilization* or *domestication* in producing the various changes under consideration. View for a moment the immense chasm separating the civilized from savage man. We see the former surrounded by a vast extent of country cultivated by the labour of his hands; by whose industry the forest is levelled to the ground, and the wilderness is made to smile with the thousands of mixed vegetables which are scattered over the soil; each of which absorbing and exhaling, or vegetating after its own manner, must exert considerable influence in modifying the air we breathe.

From the cultivation of the soil naturally arises a great variety in our articles of food; add to which the studied arts of cookery, and the acknowledged effect of many articles of food upon the organic functions, even upon the *operations of intellect*, the distance between the untutored savage and civilized man is highly magnified; the gross sensuality of the one, unrestrained by the laws, and unsubjected to the abuses of civilized life, pursuing only the inclinations of his appetites; and the conscious dignity, the expressive features, and the intellectual resources of the other, are truly striking.

The operations of intellect alone, would go a great way to explain some of the most marked peculiarities which distinguish the *features* of the various nations of the earth, though I cannot concur with that able and eloquent author* who endeavours to show that our primogenial parents were black, and that their progeny were gradually bleached by intellectual cultivation and civilization. After demonstrating that the changes of colour in all kinds of animals is from the darker to the lighter tints; that there are many examples in the human species of the light varieties appearing in dark races, and that the dark races are best adapted by their organization to the condition of rude and uncivilized nations, (which he conceives to have been the primitive state of man;) this writer continues,

"If there be any truth in the above remarks, it must be concluded that the process of nature in the human species is the transmutation of the characters of the negro into those of the European, or the evolution of white varieties in black races of men.

"We have seen that there are causes existing which are capable of producing such an alteration, but we have no facts which induce us to suppose that the reverse of this change could in any circumstances be effected. This leads us to the inference, that *the primitive stock of men were negroes*, which has every appearance of truth; since, however, it is a conclusion which may be questioned, it will be proper to state more at length the arguments which offer themselves in its support," &c., &c.

It has been observed by men whose opportunities for observation rendered them best qualified to judge, that a happy married pair whose union has been a union of souls, who tread the path of life together, mutually partaking of its sorrows and its joys, who move by one sentiment, and constantly sympathize with each other's feelings; I say, such a pair have been remarked to assume in the course of time, a similarity of features, though at first of very opposite characters.

2d. In our daily intercourse with man, do we not ob-

* Dr. Prichard. De generis humani varietate, dissert. inaug. p. 233.

serve on the one hand, features "sicklied o'er by the pale cast of thought," and wrinkled, not with age, but with disappointment and sorrow?

On the other hand, we observe individuals far advanced in years, with features unruffled by the cares of life, whose affections have not been chilled, or whose hopes have not been blasted, who tread the earth with light hearts, and retain ruddy complexions. Compare the hale and rustic features of the clown with the supple and delicate lineaments of the citizen; or the wily finesse of the courtier with the frank and military air of the soldier; the calm and reflecting aspect of the man of study, to the fiery phiz of the drunkard, or the haggard and sinister traits of the villain. The state of the purse impresses as striking a character upon the face of the rich and the poor, as do vanity and abjection upon the powerful and the weak.

3d. Observe the retreating and narrow forehead, the contracted brow and vacant glare of ignorance, and compare them with the bold and expansive front, the lofty brow, the penetrating eye and determined lips of the hero, born to command; set each feature in motion, and behold the *fire of expression;* a single glance is sufficient to penetrate the breast, and strike terror into the hearts of his inferiors.

So much for *individual* differences of expression; all induced by external causes. But independent of these minuter differences, there remains a *national* peculiarity to be accounted for.

Men are by nature gregarious, social, and dependent beings, and when united together in great numbers for the purposes of support in some common cause, or for the various purposes of existence, they constitute *nations*—and contract a peculiar cast of thought, mode of expression, and habits of life; at least in such points as are considered of national importance. In this they would of course be influenced by the circumstances under which they happened to be placed, as regards climate, temperature, food, mode of life; or in other words, by the progress they had made in *civilization.*

That a number of human beings should thus contract *national characteristic features,* is to me no more surprising, than that there should exist a national peculiarity of thought, and other collateral causes, that may aid in modifying the solids.

Observations on the neglect of supplying Vessels with Medical Assistance, in long Voyages. Communicated to the American Medical Recorder, 1817.

The following observations are of a nature so highly important to the interests of humanity, that I take the earliest opportunity of making them public; hoping they may reach the notice of our common guardians, now assembled in congress; and trusting that they may be deemed fully sufficient to incline them to consider the subject noticed, with a view to the removal of a neglect so truly disgraceful to our country.—Ed.

Philadelphia, November 21, 1817.

Dear Sir,

It is with pleasure I embrace this early opportunity of communicating to you the result of my experience, on a subject which ought to command the attention of every one who feels himself interested in the cause of humanity. I allude to those abuses, under which a useful, though thoughtless part of the community, labour, by being deprived, on long voyages, of the benefit of medical assistance.

As the safety of the ship and passengers depends upon the exertions of the sailors, the health of the crew, one would suppose, should command the first attention of ship-owners; their neglect, however, in this particular, is too frequent not to have attracted the notice of many. Having but just returned from a voyage of this nature, the circumstances which gave rise to the following observations, and the numerous evils arising from that neglect, remain strongly impressed upon my memory.

On the first day of November, 1816, the ship to which I was attached, left the capes of Delaware. After a passage of 127 days we found ourselves in the port of Calcutta. On our arrival, we were surprised to find so many American sail moored in the river. This season proved unhealthy; and scarcely one of our crew escaped sickness. Being the only American surgeon in port, I had an opportunity of observing that we were not, in this respect, singular. Out of seventeen sail from the United States, that lay, at one time, in this port, *not one,* except that to which I was attached, held a surgeon in their employ, although few, if any, had escaped disease at sea: most of them had either lost men at sea, or sent some sick to the hospital on their arrival; some had lost their captain at sea; others were obliged to put into some port, and leave their commander sick: all these vessels were from ports to the eastward of Philadelphia; many of them had a scarcity of medicines on board, and those of a bad quality; this, however, is of little importance, when we consider that the best of medicines, in the hands of unskilful and ignorant practitioners, are no better than dangerous weapons in the hands of a madman. I have been witness to the melancholy effects of their improper treatment; diseases originally mild in their nature, pampered into disorders the most virulent and complicated; I have seen the best of constitutions irrevocably lost—features deformed, and limbs distorted, by diseases, from which, by timely and judicious administration of proper remedies, the unhappy sufferers might have been restored, with unimpaired constitutions, as useful members of the community. I might even say, (if rightly informed,) that death itself has followed the injudicious administration of medicines, or neglecting the proper time for administering them. Suppose, (as not unfrequently happens,) a mortal epidemic should take place among the crew soon after leaving the unhealthy shores of India, where they are generally exposed to every cause of fever, in working a ship out of rivers the most difficult to navigate. What confusion! what misery! no physician to alleviate the pains, or to administer consolation; far removed from all relief, they are left to the horrors of a putrid disease, or miserable death; under these circumstances, should the weather prove boisterous, not only the safety of the ship, but the lives of all on board, are endangered. Another inconvenience arising from the avarice of some ship-owners, and which, eventually, falls upon the thoughtless sailor, I have witnessed; a new and healthy crew, arriving in these unhealthy climates, the sailor is daily exposed, in his customary occupations on ship-board, (and, of course, for the interest of his owners,) to that most general cause of disease, the sun; being taken sick, and having no physician attached to the ship, one is immediately employed; the bill, not unfrequently, amounts to a considerable sum, which is to be exacted from the small pittance due him as wages. Should the poor fellow return home in the same employ, he will frequently find himself little bettered, perhaps worse, than when he left it; frequently, to avoid this exaction, they forsake their employ, and seek a passage home in other vessels.

I had frequent occasion to be called on board of ships, bound home, in order to give a last advice to those indisposed, and who were about to expose themselves to the mercy and inclemency of the sea; it was then, in particular, I observed the unprepared and dangerous situation in which some were about to withdraw themselves from all medical relief. Some I have observed labouring under the pain of that most detestable and nauseous disease, to which seafaring men are particularly liable, and which in its ravages exceeds even that pest of mariners, the scurvy. The bad effects of exposing themselves, in this situation, to the mal-treatment of inexperienced men, and the importance and truth of this observation, are sufficiently obvious, from the loss of a nose, perpetual ulcers, disfiguration of features, &c. to which such patients are subjected, and who, in this state, are consigned to the hospital. Others, at this critical period, are labouring under dysentery; the distressing, and oftentimes fatal effects, from neglecting this disease, are too obvious to need comment.

In fine, I never should end, were I to attempt to enumerate the many evils arising from the sordid avarice of some ship-owners, who, from the fear of a trifling expense, expose the lives and constitutions of so useful a part of society to such imminent danger.

I feel highly gratified in having it in my power to state, that the merchants of Philadelphia have shown a liberality and interest, in this respect, worthy to be imitated by every philanthropist. To show that persons at sea are as liable to sickness as those on shore, I insert the following list of diseases, &c., with which the crew of the ship William Savery were afflicted, on our passage to and from India, viz. dysentery, diarrhœa, hernia, fracture, luxation, hemorrhoids, wounds, furunculus, bilious fever, sarcocele, hepatitis, dropsy, enteritis, rheumatism, paralysis, ulcers, lues venerea.—I have thus, in a concise and hasty manner, thrown together the few facts I have witnessed, and should you think any of them worthy to be made public, I shall be happy, through you, in being serviceable in a cause that should interest us all.

RICHARD HARLAN.

Dr. Coxe.

Observations on the Anatomy of the Sloth.

BRADYPUS *tridactylus,* Linn.

I HAVE been indebted to the Academy of Natural Sciences of Philadelphia, for the long desired opportunity of making a dissection of this most curious animal. The specimen was preserved in spirits, and was sent along with many other interesting quadrupeds, by Dr. Hering, from South America. The specimen is one of the common variety of the Bradypus tridactylus, of Linnæus, and proved to be pregnant with a fœtus nearly matured. For the knowledge which we already possess of the anatomy of this animal, we are principally indebted to the observations of Daubenton and Cuvier;—my own dissection has resulted in the discovery of several additional facts, as well as the detection of some errors.

As regards the habits of this animal, in a state of nature, the accounts of travellers are at variance with each other, and the subject still remains obscured in fable. The sloth has generally been described as one of the most miserable, helpless, and dejected of beings, the effect of a physical organization altogether extraordinary and imperfect. A recent English traveller, however, Mr. Waterton, who has observed these animals in a state of nature, represents them as sufficiently active in their proper element, *on trees,* and asserts that they pass from bough to bough, and from tree to tree, with a rapidity which soon enables them to lose themselves in the depths of the forests. However this may be, there can exist little doubt but that most of the errors in the description of their habits, and the false inferences drawn from what appears at first view a vicious organization, are to be attributed to the erroneous notions which prevail, relative to the true position of this animal in the scheme of nature, and the part which it was intended to perform.

Considered as a creature destined to pass nine-tenths of its existence on the trees of the deep-foliaged and endless forests of tropical climates, where it lives, breeds, moves, and has its being; we venture to assert, that no other animal is so perfectly adapted, by its peculiar organization, to such a mode of life. But, on the other hand, viewed as a quadruped, formed for progression on the ground, or on a flat surface, it must be confessed, that the construction of its osseous frame, presents us with an anomaly in nature unequalled; an enigma insusceptible of solution; a machine, monstrous in all its proportions, without apparent form, utility, or intention. But of such an anomaly, the whole creation does not furnish us with a single example to interrupt that series of animated beings, where so much beauty and order of arrangement are displayed, from the "worm that revels in the dead man's socket," to the "lord of the lion heart and eagle eye." All are equally perfected, and wonderfully adapted to fulfil the purposes of their existence.

To commence with the skeleton of the individual before us, it is necessary to premise, that though it was nearly full grown, all the parts are not completely ossified; hence it may be inferred, that such portions as are completely solid in this subject, will always be found so in all adult individuals, and some other portions that are here cartilaginous, would have become ossified by age. Referring to Baron Cuvier's description of the several skeletons of the sloth which he has examined, it will be perceived that the same species differed among themselves in several important particulars. One of his specimens possessed sixteen ribs, of which seven are false. Another, a younger subject, possessed fourteen ribs, of which five are false.

(Vide Ossem. Foss. Vol. V. pt. I. p. 81.) Our specimen possesses fifteen ribs, six of which are false. The Baron represents the *Ai* with three lumbar vertebræ; ours possesses four: the former has eleven caudal vertebræ; the latter ten: the former six false vertebræ of the sacrum; the latter five.

These discrepancies will appear more evident, being placed in a tabular form. In the first column we have arranged Cuvier's adult specimen, in the second our own.

	Cuvier.	
Cervical vertebræ, -	9	9*
Dorsal, - - -	16	15
Lumbar, - - -	3	4
Sacral, - - -	6	5
Caudal, - - -	11	10
	45	43

The transverse processes of the first caudal vertebra, are elongated, and flattened or depressed, and are united to the os ischium by cartilaginous suture, which tends very much to enlarge the capacity of the pelvis, the outlet of which is disproportionably large: the posterior, or sacral region, presents a very broad, nearly flat, and solid surface, for the pregnant uterus to rest upon, as well as to accommodate the enormous rectum, in the usual position of the animal; that is, suspended from the lower surface of the limbs of trees, the back towards the earth: by this form of the pelvis, the cotyloid cavities, and conse-

* In the *Bradypus tridactylus*, the two inferior cervical vertebræ, like the same parts in some of the Saurians, are furnished with rudimentary ribs attached to the transverse processes; hence some zoologists have considered these vertebræ so circumstanced as constituting *dorsal* vertebræ; but inasmuch as these ribs are only rudiments, and the vertebræ are complete, we should rather denominate these rudiments "cervical ribs;" when we shall still agree with Cuvier in attributing *nine* cervical vertebræ to the three-toed sloth.

quently the thigh bones are widely separated, rendering an approximation of the knees difficult; an arrangement, which though exceedingly inconvenient to a quadruped walking on the ground, is, at the same time, an admirable structure for an animal always embracing a trunk, limb, or some foreign body, between his thighs. The ossa pubis are separated more than an inch, by an intervening cartilage in the present instance, which was ossified in Cuvier's specimen; whilst the sacro-ischiatic ligaments, uniting the sacrum to the ischium at the suture between the tuber ischii and transverse processes of the first caudal vertebra, are already ossified. The sternum is composed of nine distinct pieces; its nine cartilages are all ossified, and united to the true ribs and sternum by cartilaginous suture: the ninth cervical vertebra supported at the extremity of the transverse process, an osseous rudiment of a rib, to which it is joined by cartilage: the unusually long neck of this animal was exceedingly flexible, particularly so in the anterior direction, forming very readily a complete circle, with the snout resting on the ninth vertebra. This long and flexible neck, bending in every direction, must offer considerable conveniences to an animal which feeds on the leaves of trees in its immediate vicinity, and would also enable the animal to direct his visual organs to any position, without changing that of its body.

But the most remarkable peculiarity in the skeleton of this species, and which alone distinguishes it from that of all others, and admirably adapts it for its characteristic mode of locomotion, is to be observed in the form, structure, and articulation of its posterior extremities. We have already alluded to the widely separated state of the thighs at the acetabulum, which enables it the more readily to embrace any foreign object; the knee-joint is large, strong, and flexible; the femur is long, stout, and depressed, with a considerable concavity on its inner edge;

the bones of the legs are both convex externally, all admitting of the attachment of powerful muscles; and the joints, though supplied with firm ligaments, are unusually flexible. Baron Cuvier has already dwelt with great interest, on the very extraordinary and unique manner in which the foot is articulated with the tibia and fibula; the astragalus, in addition to the pulley-like surface, by which it moves on the end of the tibia, presents, on its exterior and upper surface, a deep conical pit, which receives a corresponding projecting bone of the inferior head of the fibula, admitting the greatest latitude of rotary motion, together with the usual ginglymus motion of the ankle, at the same time rendering dislocation impossible; but the powerful lateral ligaments prevent lateral motion at this joint; this, however, is more than compensated, by the unusual degree of motion existing between the calcis and astragalus, or rather of the latter *on* the former bone; producing a rocking motion from side to side, two distinct transverse pulley-like surfaces on the inferior aspect of the astragalus; being received into two corresponding cavities in the upper surface of the calcis, and to render the joint more secure, the anterior articulating surface of the astragalus, presents a deep conical pit which receives a pyramidal process, projecting from the usual articulating surface of the cuboid bone: a complication of structure, attended with equally complicated motions, witnessed in no other quadruped, and utterly useless and inconvenient to an animal moving on a plane surface; yet admirably adapted to the habits of the sloth, as it enables the animal, in any position of the body, to apply the soles of its feet to the sides, or even opposite surface of the limb or trunk of the tree, on which it is climbing; its long claws and powerful muscles, harmonizing with this arrangement, enable this animal to remain thus suspended, for hours and days, without fatigue, and even to sleep, in a position so awkward and painful to other animals.

The organs of mastication, the peculiar construction of the shoulder, with many other interesting details, have been already fully commented upon by Cuvier, in his "*Ossemens Fossiles*:" in the present instance, the rudimentary clavicles and coraco-acromion pieces were cartilaginous. We have only further to remark, as entering into the composition of the knee-joint, the existence of a large sesamoid bone at the exterior portion of the head of the fibula; and that, in two crania which we possess of this animal, all the canine teeth are worn on their *posterior* surfaces.

The size of this species has been variously estimated, at from fourteen to twenty-eight inches in length; the skeleton of our specimen is twenty-two inches in a straight line from the tip of the snout to the extremity of the tail.

The following represent the measurements in detail:—

	Inches.	Tenths.
Length of the Head, -	2	6
Neck, -	4	6
Body, -	9	0
Sacrum,	2	4
Tail, -	3	4
	—	—
	22	00

Length of the arm seven inches two-tenths: length of the fore arm six inches: length of the hand, including the wrist, five inches: greatest circumference of the body thirteen inches.

The crowns of the molars appear peculiarly adapted to the mastication of leaves. The *fœtus in utero* possessed the same number of teeth, similarly arranged, and with the exception of being more conical towards the crown, presented perfect miniatures of those of the adult animal;

and from the state of their development, no doubt can exist of the capacity of these animals to masticate from the period of their birth. The fœtus was clothed with a profusion of hair, marked in every respect like that of the adult; the eyes appeared to be perfectly developed: compared with other animals, the fœtus was unusually large; yet its protrusion is easily effected by means of the extremely large outlet of the pelvis, and the peculiar structure of the generative organs. The uterus is musculo-membranous, and contained two distinct lobulated placenta, one on either side of the fundus, receiving an equal number of branches from the umbilical vessels.

The reproductive organs of this animal are singularly anomalous. Vagina ab recto sejuncta est, ambo tamen uno ore aperiaduntur, sphinctere communi circumdato; in ipso cujus introitu, inferiorem spiraculi partem apparent nymphæ bene patefactæ, et clitoris triangularis foliaceaque. Circiter mensuram unciæ intra vaginam, meatus urinarius se aperit. Inter vaginam et os sacrum latum, rectum ingens positum est, impletum induratis fæcibus, similibus excrementis ovis.

The Sloths, then, have been erroneously represented as possessing a cloaca like that of birds, inasmuch as there does not occur any mixture of the contents of the bladder and rectum, as is the case in true cloacæ. The vagina and rectum, or cloaca, are distinct from each other; there being no large intestines, properly so called, the rectum performs the functions of the cœcum. Although the animal is strictly phytivorous, the bowels resemble those of the carnivora, being small and short; the inferior portions are somewhat succulated, like the colon; but the fæces do not assume their characteristic form, until they have reached the rectum. The stomach consists of a large paunch, in no way furnished with compartments like that of the ruminantia, as is asserted by Buffon, who also errs in attributing ruminating faculties to these animals; but this organ presents a structure differing from that of any other animal with which we are familiar, being furnished with numerous long, conical cul-de-sacs, some of which are divided longitudinally into two compartments; these, in the present instance, were filled with masticated leaves, of a pulpy consistence. The liver is small, without a gall bladder, or any unusual enlargements of the ductus communis. The kidneys are rather small and conglobate: the urinary bladder is very large. The heart was very small, and contracted by the spirits, as were all the blood vessels. The account given by Mr. Carlisle, of the peculiar distribution of the humeral and femoral arteries in these animals, (vide Philos. Trans. London, 1800,) had excited our curiosity, and prepared us for disappointment; for after the most careful examination of the arteries, we were unable to detect any resemblance to this *rete mirabile* structure, which was thought to explain the cause of the tardigrade movements of the Sloths; after considerable difficulty in distinguishing the nerves from the arteries, (the action of the spirits had rendered them similar in appearance,) we only succeeded in detecting and passing probes into the cavities of the humeral profundal, and the radial, ulnar, and interosseal branches at the elbow; but as the present specimen had been preserved in spirits, and Mr. Carlisle injected the arteries of his specimen, we are not authorized to question the observations of so accurate an observer, from the results of a single dissection. We wish, however, to direct the attention of comparative anatomists who may possess an opportunity, to a re-examination of this arterial arrangement.

It will be apparent, from what we have said, that the term Tardigrade, derived from the supposed extreme slowness of this animal, does not express its principal character; that the peculiar organization of the Bradypus, and its prodigiously compressed and crooked nails, cause its locomotion upon the surface of the ground, to be very slow, is true; but if one animal existing under this negative condition, is to be called Tardigrade, we conceive that all animals under like restraint, and not belonging to the Edentata, may, with equal propriety, be put among the Tardigrades.

The mud-fish of the genus Hydrargira of Lacepede, are often, by the retreat of the tide, left on the shore. These animals have the faculty of springing up and changing their place; they will thus advance over a considerable space, until they regain the water, which is their proper element. In like manner, the Bradypus, by an imperfect motion when on the surface, gains the trees, where it lives, feeds, and sleeps. It rarely leaves the tree it is on until it has stripped it of every leaf, so painful is the effort to change its situation, by dragging itself on its elbows from one tree to another when they stand far apart. The nails of this animal, when at rest, are always bent towards the palm of the hand; and it is thus it sleeps, grasping the branches, and suspended with its back towards the ground. We think the term Pendentia would be even more appropriate than Tardigrada, for these mammalia.

Observations on the Dissection of a Horse, whose death was occasioned by the Perforation of the Aorta by Worms. Strongylus armatus, Cuv. Communicated for the Agricultural Society of Philadelphia.

Philadelphia, March 25th, 1822.

GENTLEMEN,

I THIS day received through the politeness of my friend, R. Haines, of Germantown, the body of a colt one year old, which died suddenly on the morning of the 24th inst.

I proceeded immediately to the dissection, assisted by Dr. Lawrence. We first examined the brain, which we found healthy, though there was serous effusion within the sheath of the *Medulla Spinalis.*

On opening the abdomen, we were surprised by the effusion of at least two buckets full of fluid black blood: this excited my attention, as I had before met with a similar case, where the cause of the mischief had not been investigated.

Continuing the dissection, we came to an immense tumour, lying over the right kidney, occupying the whole of the right lumbar and iliac regions, and which was filled with grumous, coagulated blood. On removing this, we found the sack confusedly connected to the mesentery, the aorta, and surrounding parts. We next dissected away the aorta abdominalis, above and below the sack, and on opening the artery, we observed the internal coat near that portion, which gives off the mesenteric artery, much diseased, and considerably enlarged;—the superior mesenteric artery was particularly enlarged; the internal coat, both of the mesenteric and of the aorta, for several inches, being nearly destroyed, and of a black colour. On examining more minutely the portion of the aorta below the tumour, we discovered the cause of the whole mischief, viz. *a great number of small worms*, from a quarter to three-quarters of an inch in length, attached to the internal coat of this portion of the artery—giving it truly a *worm-eaten* appearance. The worms, on examination, by Mr. Thomas Say, proved to be an intestinal species, common in the horse: they must therefore have eaten their way, from the small intestines of the animal, into the mesenteric artery, from whence they continued their course to the aorta, destroying, as they proceeded, the internal coat. As their presence in this unnatural situation produced inflammation, coagulated lymph was thrown out between them and the current of blood, by which they became in a manner incisted.

The artery became enlarged by their irritation, and formed a species of aneurism; particularly of the mesenteric artery, which eventually burst suddenly, after the animal had eaten a full meal, and produced immediate death, the usual termination of such cases.

I beg the Society to accept of the specimens of the parasitical animals accompanying this communication. The artery is dissected and prepared (to be placed in my Museum) in which many of the worms are left in their situation on the interior of the aorta.

The following description of the worm is extracted from *Cuvier*. Regne animal, vol. IV. p. 34.

Description.

Le strongle du Cheval. Strongylus armatus. (Rudolphi.)

7.—15.* long du deux pouces, à tête sphérique dure,

* Two inches long; an hard spherical head; its mouth furnished all round with little soft prickles; the pouch of the male separated into three leaves or folds.

This is the most common of the horse-worms. It penetrates the arteries, where it occasions aneurisms. We find it also in the ass and the mule.

à bouche garnie tout autour de petites épines molles; la bourse du male devisée en trois feuillets.

C'est le plus commun des vers du cheval, il pènètre jusque dans les artères, ou il occasionne des aneurismes. —On le trouve aussi dans l'ane, et le mulet.

Books of Farriery do not state whether cattle of any description are liable to this disease.

I am, very respectfully,

RICHARD HARLAN, M. D., &c.

Remarks by the Hon. Judge Peters, President of the Philadelphia Society for Promoting Agriculture.

"In a note, page 83 of our 3d volume, I suggested that doubtful and unknown diseases in animals (man included) should be treated as originating from *worms*. If other remedies be used, vermifuges, in addition, should also be administered. Before and since this suggestion, I have been confirmed in this opinion. It has been my habit, (and so it should be with every farmer) to cause to be dissected every animal dying with disease on my farm. In the greatest number of these victims, worms have been discovered of various descriptions. Some of them like those mentioned by Dr. Harlan. It would seem that every region of the intestines had some peculiar foe. This, and a thousand other misfortunes occurring to our domestic animals, loudly impress the indispensable usefulness of veterinary knowledge. Whilst we are laudably endeavouring to improve the breed of our stock, it is lamentable indeed, that so little has been done to save them from destruction. Among the most respectable professional men in Europe, comparative anatomy, and all veterinary knowledge, is highly creditable. But with us, the diseases of our animals are left to ignorant pretenders, for their cure or prevention. Many years have passed away since our Society, and myself individually, have warmly and feelingly recommended a veterinary institution, and that it should be part of the education of medical men, to know how to treat the diseases of the animals composing our stock. Let this part of the acquirements necessary for those who practice in the country, be rescued from the low state in which it now is, by being made essential to the education of medical men, and countless advantages will accrue to our farmers and breeders of stock. It is vain to raise valuable animals, without ensuring (so far as human means can accomplish it,) their safety, when attacked by diseases, or injured by accidents too frequently occurring, and often fatal, through the want of skill in their treatment."

Notice of an Anatomical Peculiarity observed in the Stomach of the Condor of the Andes.

VULTUR *gryphus*, Linn.

DURING the past year, two fine specimens, male and female, of the Condor from Peru, died in this city. I caused their skins to be prepared, and they now constitute a valuable addition to the Cabinet of the Academy of Natural Sciences of Philadelphia.

On dissection, the stomach presented a peculiarity of organization, which appears to be characteristic of this species.

The crop or ingluvies is very large, and was in this instance filled with macerated raw meat. The stomach, which was nearly empty (with the exception of some thick pieces of glass, anthracite coal, gravel, &c.) is oblong in form; the cardiac portion being marked with longitudinal folds; the middle portion displays two oval protuberances composed of gastric glands, which is again succeeded by a membranous or saccular portion, on the interior surface of which are numerous and nearly contiguous, longitudinal bands or ridges, of a cartilaginous structure, serrated or spiny on the surface towards the cavity of the stomach, covering the pyloric or lowermost two-thirds of the stomach. This cartilaginous production, like the inner lining of the gizzard of the fowl, is easily detached. *It must have considerable effect in facilitating the process of digestion, by tearing and separating the fibres of the meat with which these birds habitually gorge themselves, so as to be disabled, for a time, for flight. The liver is very large; the gall bladder was much distended with bile.*

Observations on Meckel's Treatise on Comparative Anatomy, with notices of the Ornithorynchus Paradoxus, &c.

Traité Général d'Anatomie Comparée. Par J. F. Meckel. *Traduit de l'Allemand et augmenté de Notes, par* MM. Riester, *et* Alphonse Sanson, *Docteur en Chirurgie de la Faculté de Paris. Précédé d'une Lettre de l'Auteur. Tome* 1er. *Paris*, 1828. *Pp.* 613.

A General Treatise on Comparative Anatomy. Translated from the German by MM. Riester *and* Sanson. *Vol.* 1.—1828.

Such is the title of a work which will, we are convinced, form another monument of fame to the already highly distinguished author. Having previously given to the world the result of his researches in human, pathological, and systematic comparative anatomy, the learned professor of Halle brings before the public the present production, with every claim to the respect and gratitude of his fellow labourers in this field of science. His English and American readers must feel themselves under many obligations to his French tranlators, not only for their accurate version, but for the judicious observations contained in their valuable notes. We view the successful prosecution of this valuable department of science, by our contemporaries of the continent of Europe, with mingled feelings of respect and mortification. As Americans, and members of a great and enlightened republic, our pride is naturally wounded by a conviction of the total apathy with which is regarded the teaching of comparative anatomy to our medical students. The science, indeed, is as totally neglected in our medical universities, as if it constituted no branch of medical, not to say of *universal*, knowledge. Perhaps this neglect may be, in some degree, attributable to the aversion of some of the learned members of our profession to acknowledge the importance of a science, to the principles of which they have themselves devoted scarcely any attention ; but let them reflect, for a moment, on the difficulties which they have encountered in the intricate paths of even elementary knowledge ; let them but view the endless chain of exploded theories of respiration, digestion, secretion, the generation of animal heat, &c., which, but for the reprehensible ignorance of their authors, of comparative anatomy and general physiology, would never have found existence. In fine, when we consider that all we do really know of the functions of the human body, is directly or indirectly due to the study of comparative anatomy, including general physiology, we will be forced to acknowledge, with Haller, that medicine is more indebted to this than to any other branch of knowledge.

The labours of BLUMENBACH, MECKEL, RUDOLPHI, TIEDEMANN, RATHKE', TREVIRANUS, CARUS, &c. in Germany, of CUVIER, BLAINVILLE, GEOFFROY, and many others, in France, and of LAWRENCE, M'CARTNEY, and HOME, in England, among the modern authors who have successfully cultivated *comparative anatomy*, justify the assertion, that "a knowledge of the facts to be derived from its study, is absolutely indispensable to the philosophical and successful prosecution of the study of human physiology, pathology, and the doctrines of hygiene." We cannot but cherish the hope that the day is not far distant, when America, who has so liberally repaid her European debt in some other departments of science, will also soon assert her claims in this.

The present work of M. MECKEL should be placed in the hands of every student of comparative anatomy, after he has made himself acquainted with Baron Cuvier's Leçons d'Anatomie Comparée, and with Professor Carus's Comparative Anatomy, which may be considered as epitomies of the whole science. Our author's work abounds in enlightened general views, and contains numerous facts, which, in their origin and promulgation, are peculiarly his own. Among the first must be classed M. MECKEL'S proposition to unite all the varieties, in the corollaries of a common law, which he terms "*The Law of Variety.*"

The author observes, in a natural chain of reasoning;—"after having endeavoured to develope these laws and conditions in memoirs particularly devoted to the subject, I have thought it necessary to collect all the subordinate circumstances which the animal kingdom presents, when viewed in general, into two principal points, viz. *variety*, and *unity* or *analogy*.

"It is, in fact, under these two points of view, that we ought always to consider the animal form; if we expect that the exposition of this form should not consist merely in the enumeration of differences and individualities, or in following specious resemblances, which too frequently exist only in the minds of those who search for them."

We think we detect some allusion, by the author of these remarks, to the peculiar views and speculative philosophy disclosed in the "*Philosophie Anatomique*" of M. GEOFFROY ST. HILAIRE; many of whose ideas have been far from appearing to us as philosophical as they are novel. For example, we are taught that the cranium of animals, as generally considered, has no existence, but that the bones of which it is constructed are rudiments and modifications of the vertebræ. Again, he relates that the cloaca of oviparous animals is nothing more than the bladder of mammalia, with the rectum opening into its fundus, through which must pass not only the fæces, urine, &c., but also the eggs of the female; though the author neglects to inform us, how, in this case, we are to arrange those animals which possess both cloaca and urinary bladder distinct, many examples of which will be furnished him by his intimate knowledge of the anatomy of the amphibia, &c. We have also occasionally been under the necessity of differing with M. Geoffroy in matters of fact, as well as of opinion. We have seen it published, as one of his discoveries, that he has been enabled to detect the existence of the umbilicus in the fœtal opossum. We have been unable to detect any rudiments of the organization alluded to, in the fœtal opossums which we have dissected.

Returning to the work of M. Meckel, we detect no views merely speculative, much less any unphilosophical deductions. In treating of special anatomy, more particularly, he has offered many new observations and descriptions. We must not pass "sub silentio," his interesting discovery of the *mammæ* of the ornithorhynchus, or duck-billed quadruped, of New Holland; an animal hitherto supposed to be oviparous. The animated discussions to which this discovery has given rise in Europe, render the subject highly important. If M. Meckel's opinion should prove correct, it will destroy the intermediate class of "*Monotremata,*" in which M. Geoffroy has arranged the ornithorhynchus and echidna, and replace these in the situation which they formerly held, at the end of the class Mammalia; besides annulling our belief in a circumstance altogether astonishing, and hitherto without analogy; viz. the oviparous birth of animals mammiferous in all the grand points of their organization. But if we can no longer doubt the existence of mammæ in these paradoxical creatures, it yet remains to be proved that the organs really exist otherwise than as mere rudiments. Indeed, how is it possible for a young animal with the bill of a duck to live by sucking? To us it appears that it would require something more than "a great sensibility of the lips," to enable it to suck a mamma confessedly destitute of a nipple. The author states a fact, confirmatory, in his opinion, of the nature of the glands in question; viz. that these organs have no existence in the male. This circumstance would incline us to infer directly the reverse; as in all animals truly mammiferous, these glands, particularly the nipples, equally exist in both sexes. We are strongly inclined to the opinion, that in the ornithorhynchus the mammæ exist, as these organs do in the male of all quadrupeds, viz. as rudiments, or marks of the "mechanical" laws on which the body is constructed. If we rightly remember, the eggs of the animal have recently been received in Europe.*

The order MONOTREMATA must still continue to present us with that truly singular phenomenon, the existence of oviparous mammalia.

M. MECKEL, after having determined the various composite organs which occur in the construction of animals, classes the animal kingdom according to the complication of its organization; placing the polypus first in the scale, as offering the greatest simplicity of structure. The first volume contains four chapters: 1. On the laws of formation. 2. On the most important conditions of the animal form. 3. On the law of variety. 4. On the law of reduction to a common type.

* In a recent account of the proceedings of the Lond. Zool. Soc., it is stated that *milk* has been detected in the stomach of young ornithorhynchi: their lips, it is said, are soft and sensible. December, 1834.

Case of Intussusception.

I HAVE been induced to offer the following case for publication; as it showed some peculiarities both in the symptoms, and in the parts affected by the disease.

On the first of May, 1819, I was requested to visit a child aged five months: I found her very restless, though there was no expression of acute pain;—the tongue was white and furred;—little or no fever; and, on pressing the abdomen, there was no indication of increase of pain.

Previously to my visit she had taken four grains of calomel, a quantity of the oleum ricini, and an injection of infusion of senna: but from the excessive irritability of the stomach, which was one of the earliest symptoms in the disease, the greater part of the medicines were thrown up.

I directed five grains of calomel, made into two pills, to be taken immediately; and one hour afterwards, to take a dessert spoonful of the oleum ricini every two hours; also an injection of turpentine—*made of half a drachm of the oil beat up with the yolk of an egg.*

At 10 o'clock P. M. I found the irritability of the stomach allayed, so as to enable the patient to retain the oil, of which she had taken, altogether, two ounces;—not the least discharge had been produced, per anum:—the enema came away immediately; the restlessness and anxiety were somewhat increased; she rolls her head frequently from side to side; refuses the breast; tosses her limbs in every direction: her eyes look brisk and animated, seldom cries out as if in acute pain; she still makes some efforts to vomit, though nothing comes off the stomach. I directed the oil and injection to be continued, and sinapisms to be applied to the feet.

May 2d—Her bowels have remained obstinately constipated. I was informed that irritability existed about the fundament, which was communicated to the bladder, producing strangury: her eyes yet retain their lustre: throughout the disease, from my first attendance, the patient has neither manifested acute pain, nor fever; at least in the usual manner.

On examining the fundament, we observed what I took to be an inversion of the rectum; which protruded nearly an inch beyond the verge of the anus every time the patient strained; to alleviate tenesmus, I directed an anodyne injection consisting of laudanum six drops, olive oil two ounces; the terebinthinate enema was omitted—the oleum ricini had remained upon the stomach, and was continued: and leeches were directed to be applied to the verge of the anus.

I called at 12 P. M., with a view to order a warm bath, but found the patient "in articulo mortis"—she died after a few slight convulsions.

Dissection.

I examined the body in the presence of Doctor Lawrence—on opening the abdomen we were immediately struck with the size and position of the colon, which appeared as if distended with fæces of a black colour, extending no further than the left hypochondriac region, where an intussusception was evident.

The better to investigate the nature of the case, we passed a ligature around the œsophagus and dissected out the whole alimentary canal:—We found the intussusception to commence, in that portion of ileum just before it enters the caput coli, but instead of entering, as usual, in the right iliac, it was found in the left hypochondriac region.

The parts involved in the disease were as follow: about one inch of the ileum, the whole of the cœcum, with a portion of the colon were received into the remaining portion of the colon: the intussuscepted portions of the cœcum and colon were of course inverted. The cœcum had descended into the rectum; which gave to the latter the appearance of a bowel distended with hardened fæces, whereas there was not more than half an ounce of fæcal matter in the whole extent of the colon, and that was of a fluid consistence.

The cœcum was thickened from inflammation; and its inner surface, together with a portion of strictured colon, was in a state of gangrene. It was this hardened, tumefied, and inverted cœcum which had descended beyond the verge of the anus during the act of straining, and which I before mistook for a prolapsus of the rectum; but as only a small portion, comparatively, of the colon, was intussuscepted, its remaining portion was consequently thrown into a number of folds over the inverted portions of intestine.

The adhesions which, in a natural state, confine the cœcum in the right iliac region, must in the present instance have been considerably stretched, or torn; but it may be remembered that in subjects of this age, they are slender and elastic.

Had the precise nature of this case been known, it would have been impossible to have overcome the obstruction by any mechanical means, as, after the parts were taken out of the body, we were unable to dissolve their connexions without laceration—after such separation, however, we were enabled to produce an artificial intussusception precisely similar to the original.

All the remaining abdominal viscera were in a natural state. In the ventricles of the brain we found much more water than usual; of which there was no characteristic symptom during life, unless the motion of the head from side to side be peculiar to it.

I may here remark, that in the course of my dissections I have found serous effusions into the ventricles of the brain, when obstinate constipation of the bowels was the idiopathic disease, and symptoms of effusion, if any had occurred, were only secondary or symptomatic; and "vice versa."

Cases illustrative of the good effects of Sugar of Lead in Dysentery.

In the summer of 1820, while prescribing in the Dispensary of this city, I employed the saccharum saturni in many cases of dysentery, and the result of my experience has convinced me that it is a safe and efficacious remedy in this disease. I have found it, in the majority of cases, to check the bloody stools, to allay intestinal irritation, and to relieve, in a very prompt manner, tormina and tenesmus. It will be observed that I did not generally prescribe the sugar of lead by itself; and it may, therefore, be inferred, that the remedies with which it was combined, had the principal share in the remediate effects of my practice. This may be so, in some of the cases, but I am, notwithstanding, fully satisfied that the sugar of lead was of much service in the prescriptions I ordered; and this I infer from my having uniformly derived more advantage from my prescriptions when the sugar of lead was added, than when it was omitted. In some instances it was administered alone, or combined only with small doses of opium.

The following cases are extracted from the prescription book of the Dispensary.

Case 1. September 12th. James Roberts. This was a very severe case; the tormina and tenesmus were exceedingly great. The patient discharged a considerable quantity of blood. I saw him within the first twenty-four hours, and immediately ordered him the following prescription.

℞ Sacch. Saturn. gr. xviii.
Pulv. Opii. gr. vi.
M. ft. pulv. vi. One to be taken three times daily.

By the use of this medicine alone this patient was perfectly cured in three days. The tenesmus, tormina, and bloody discharges were promptly relieved, and the cure was permanent.

Case 2. September 29th. James Banfield. This patient had been affected with dysentery for eight days, when I first saw him. I immediately prescribed for him: ℞ Pulv. opii gr. i. ss. P. ipecac. gr. ii. Cal. ppt. gr. vi. Sacch. saturn. gr. iv. ft. pulv.—to be taken at once. Every symptom very soon left him. In forty-eight hours after taking the medicine he had but one stool. I ordered him a dose of oil, which brought away two large stools of the consistence and colour of rye mush. The patient recovered pretty soon, under the employment of calomel and ol. ricini.

Case 3. October 2d. Brunson. Bloody stools, tormina, and much tenesmus. Ordered him ℞ Cal. ppt. gr. xv. Sacch. saturn. gr. xii. M. ft. pulv. iii.—two to be taken daily. This patient was much relieved by the first doses of this prescription, and was soon perfectly cured by its use.

Case 4. Ellen Lithgow, aged about sixty. This patient had been sick eight days before I saw her. She had profuse discharges of blood per anum, attended with much tormina and some tenesmus. These symptoms were immediately and completely removed by the two first doses of the following prescription. ℞ Cal. ppt. gr. xii. Sacch. saturn. gr. ix. M. ft. pulv. iii.—to be taken morning, noon, and evening. The patient, however, sunk into a typhus state, from which she died without any dysenteric symptoms.

Case 5. Mary Eglestone. Bloody stools, tenesmus, tormina; ℞ Cal. ppt. gr. vi. Sacch. saturn. gr. iii. M. ft. ch. iii.—to be taken morning, noon, and evening. The patient recovered very speedily under the use of this remedy.

CASE 6. October 14th. George Howit. Dysentery, combined with phthisis pulmonalis. Has had bloody stools, with much tormina and tenesmus, for several days past. Ordered him, ℞ Sacch. sat. gr. xii. Pulv. opii. gr. iii. to be dissolved in warm water, and administered as an enema. He is also to take one of the following powders three times daily : ℞ Cal. ppt. gr. xii. Sacch. saturn. gr. ix. Pulv. opii. gr. iii. M. ft. pulv. iii.—15th, was much relieved by these remedies. The patient declared that nothing gives him relief from his tormina and tenesmus but these powders. He has tried various other remedies, without advantage. Opium and laudanum always purged him. His bowel complaint subsided, but the affection of his breast returned.

CASE 7. John Cassery. This was the case of a lad about twelve years of age. He complained of much griping, and frequent bloody stools. ℞ Cal. ppt. gr. xviii. P. opii. gr. iii. Sacch. saturn. gr. xii. pulv. ipecac. gr. vi. M. ft. pulv. gr. vi.—take one of these powders three or four times daily. Under the use of this prescription, he was very speedily relieved entirely of his complaint.

In addition to these cases, which are copied by the house surgeon from the Dispensary books, I have used the sugar of lead repeatedly both in private and public practice, and always with unequivocal advantage. I have never, in a single instance, observed any bad symptoms to follow its use.

It appears from the works of Jackson,* and Moseley,† that sugar of lead has been used, both in acute and chronic dysentery, in the West Indies. This I was not aware of until about to draw up these remarks. I believe, however, that this remedy was not used, in such large doses,

* Jackson on Febrile Diseases. Vol. 2, p. 46—Ibid. p. 50.—Ibid. 61.

† Moseley on Tropical Diseases, p. 404. 4th edition.

with similar views, with the same results, and to the same effect, previous to my having used it so very extensively and beneficially in the obstinate epidemic of 1820. I do not, indeed, know that the sugar of lead was ever used at all in the acute dysentery, in this city, previous to the summer of 1820. Whatever may be the origin of this practice, however, I am fully satisfied, that the sugar of lead, properly administered, is calculated to prove extensively useful in dysenteric affections.

I have lately read, in some of the Medical Journals, cases of colica pictonum successfully treated by the internal use of vinegar. As this disease is commonly produced by the white oxyde of lead, vinegar probably acts beneficially by converting the white oxyde into an acetate, in the stomach. I have administered the sugar of lead in colica pictonum, and found it to relieve the violent tormina, and irritation of the stomach. I have not, however, used it often enough to speak confidently as to its powers in this respect. I have known a patient to take ℥i. of the sugar of lead in hæmoptysis, and this dose was frequently repeated without inducing colic. When the bowels are not diseased, however, colic is occasionally produced by the internal use of saccharum saturni.*

* We have met with one instance in which true colica pictonum resulted from the free internal use of saccharum saturni, for several successive days; but this was easily accounted for, by the patient having drunk largely, at the same time, of highly carbonated mineral water, which decomposed the medicine in the stomach, forming *white lead!*

Observations on Colica Pictonum, and other Affections arising from the deleterious Effects of Lead on the System.

Having had, for a number of years, the professional charge of the labourers attached to one of the most extensive white-lead manufactories and chemical laboratories, in the United States, I have had an opportunity of accumulating much practical experience in the treatment of those disorders arising from the deleterious operation of white-lead on the system. I have thought that a brief essay on this subject, including the outline of the practice I have pursued in this complaint, could not fail to prove interesting to the medical public.

The men employed in this establishment, are, for the most part, of robust constitutions, and are principally natives of Ireland and Germany. The factory is placed in a situation in other respects healthy, and personal cleanliness is much insisted on by the careful managers.

In this, as in most other maladies, a certain degree of susceptibility of the system appears necessary to precede the attack. Drunkenness, or habitual dissipation of any kind, renders the system peculiarly liable to the disease, and frequently leads to a fatal issue. Sudden transitions of temperature, together with exposure to cold and moisture, are predisposing causes. The greatest number of cases have fallen under our notice late in the spring and early in autumn.

Of the youths who constantly work at rolling the sheets of lead, in the melting room, only one has been affected with *lead disease*. A boy, about twelve years of age, was attacked at night with paralysis of all his extremities, and with pain in the abdomen. He was treated with mercury, cathartics, &c. He recovered—returned to work, and again relapsed in three or four days. He finally recovered, with the usual remedies, and was discharged from the manufactory.

The different stages of manipulation in the manufacture of white-lead, render the labourer obnoxious to these affections, and also give rise to some peculiarities in the attack and in the symptoms. The most dangerous operation consists in the packing of the kiln-dried white-lead into barrels, a process performed by *negroes*, who are employed for the purpose at short periods, and at considerable intervals; and, though a great quantity of dust is necessarily received by inhalation into their lungs during the continuance of their labours, but a single case of the disease affecting the negro has occurred during my professional attendance on the manufactory: this man had a severe attack of colica pictonum, from which he recovered. Those hands employed in melting the metal in the casting-room, are more liable to be attacked with apoplectic or epileptic convulsions, without pain in the bowels during the first stage; and such cases are more apt to terminate in *paralysis*.

Frequent opportunities have occurred to demonstrate that man is by no means the only animal subject to this disorder. Dogs, cats, cows, and chickens, not unfrequently die with this affection. In the latter, "post mortem" examinations have displayed mortification of the intestines. Symptoms of cerebral derangement have manifested themselves in the feathered tribe, when labouring under the deleterious effects of white-lead. After a few moments of cataleptic abstraction, they have been observed to dash their heads against the wall, or any other resisting object.*

* Since writing the above, cases of disease from lead have been observed in pigeons, which frequent the ordure bank in the lead factory yard. Immediately preceding death, they are occasionally observed to ascend into the air to an immense

As a rational practice in any malady must always vary, according to the symptoms, or, in other words, according to the organ or set of organs whose functions are principally impaired, I propose to offer a few observations on the different modes of attack, together with the various methods of treatment instituted in this complaint.

I have formed no particular theory as to the essential seat of the disorder called "*lead disease*," that is to say, whether or not the liver, colon, stomach, brain, or vascular or nervous systems are *primarily* affected; and shall confine my observations to such symptoms as have first come under the cognizance of my senses in the numerous cases which it has been my lot to treat.

The saturnine carbonate, or white lead, taken into the system, either by the stomach, lungs, or skin, and I believe it may enter the system by all these organs, does by no means invariably produce colic, pain in the bowels, or constipation, as an early symptom. On the contrary, I have frequently observed that some of the most obstinate and severe cases of "lead sickness," are ushered in by a diarrhœa, sometimes continued for two days, but which is mostly checked by proper remedies in a few hours. In other cases, the patient is attacked, generally at night, with symptoms which I have designated as *apoplectic*, from the suddenness of the attack, the stertorous breathing, and insensibility, generally attendant; but at the same time, it must be remembered, that there exists a state of the system very different from that which prevails in apoplexy. Together with the symptoms above stated, the patient is cold, particularly his extremities; his countenance, in place of being suffused, is pallid; and convulsions of the whole frame frequently occur. This order of things continues from a few hours to three or four days. In these cases, as might have been anticipated, the pa-

height, and fall dead to the earth. On dissection, mortification of the intestines is detected. Several cases of lead colic in the negro have subsequently occurred. December, 1834.

tients do not bear general bleeding. The best practice consists in the administration of calomel and opium, notwithstanding the constipation of the bowels and determination to the head, resorting, at the same time, to the early use of cathartics. These remedies, assisted by the application of cups to the head, and a blister to the back of the neck, with rubefacients to the lower extremities, will generally prove successful in curing the disorder, or in transferring it to the bowels. I have witnessed one case of this description treated differently, which terminated in the death of the patient. A young man, of rather a nervous temperament, who had been employed in grinding white-lead in oil, was attacked, early the next morning, with convulsions, and with other symptoms partaking of the character of apoplexy and epilepsy. This patient residing at the extremity of the city, it was late in the day before I was enabled to visit him, when I found a young practitioner in the act of bleeding him from the arm. I soon explained to the doctor my opinion of the nature of the disease, and indicated to him my mode of treatment; but he could not be made to comprehend that opium could be administered with safety in any disease in which constipation is a prominent symptom; in fine, he refused to be advised, or to leave the patient. We subsequently learned, from the relatives of the patient, that the complaint left the head in a short time, and fixed upon the abdominal viscera; (which is the usual progress of this form of the disease;) and that the patient died in three or four days, with symptoms of mortification of the intestines.

But by far the greater number of patients afflicted with "lead sickness," display the symptoms of old-fashioned colica pictonum, or "dry belly-ache;" in which case we find them labouring under excruciating griping pains in the region of the umbilicus; the skin of the abdomen is thrown into folds or knots; obstinate constipation prevailing, with febrile excitement; the tongue being sometimes white, at others covered with a thick brown fur. The pain is principally spasmodic, occurring at intervals of different durations, aud is seldom entirely intermitting. After numerous trials of various remedies, my practice has, for a length of time, been fixed and settled.

We will take, for example, a violent case, characterized by the above detailed symptoms. It is my practice to bleed from the arm; and in some cases cups are applied to the abdomen, or a mustard plaster, followed by an epispastic over the inflamed skin. But, at all events, I lose no time in administering calomel and opium, in the proportion of ten grains of the former to two or three of the latter; and, if there be no nausea present, two grains of ipecacuanha are added. The whole powder is repeated every two or three hours, until pain is relieved, or ptyalism is induced; it is then omitted, and one or other of the following cathartics given. ℞. sal. eps. ℥j., magnes. ustæ. ℥ss.; mix them in a pint of water, and take from a wine glassful to a tea cupful every two hours. Or, ℞. rad. rhei. contus. ℥ss., fol. sennæ ℥j., sem. cardam. ʒij.; decoct in one pint of water. The dose is one wine glassful every two hours, until the bowels are evacuated.

At this stage of the disease, patients will require large doses of the cathartic; and, if administered earlier in the case, or previous to the free administration of mercury and opiates, no quantity that the stomach is capable of containing can be made to produce a cathartic effect on the bowels. I have frequently witnessed the whole quantity of both the above prescriptions taken, together with the addition of castor oil, without any effect. As the excitement of ptyalism is of vital importance in violent cases, the blisters on the abdomen are to be dressed with mercurial ointment, and mercurial frictions, to a greater or less extent, are to be resorted to; especially if any torpor or insusceptibility in this respect is observed in the patient.

As valuable adjuvants in such obstinate constipations, the use of turpentine injections, or injections of molasses and water, with half an ounce of table-salt, is next to be resorted to. In some cases, where the heat of the abdomen was very great, attended with soreness on pressure, anxiety, and restlessness, with other symptoms denoting approaching enteritis, the most decided advantages have been obtained by the use of large and frequently repeated injections of cold pump water. In this manner heat is abstracted, and inflammation prevented or arrested. Affusions of cold water on the lower extremities have also been resorted to with success in similar constipated cases. This treatment, under ordinary circumstances, will seldom fail of success. One patient recovered after having displayed every character of the hippocratic countenance: a state of things, in the present instance, induced by gastric sympathies; the patient, previous to being relieved, having ejected from the stomach a large quantity of matter, resembling thick green paint.

Cases still more violent and difficult of management remain to be noticed. I allude to those attended from the commencement with severe irritability of the stomach and bowels, and with obstinate vomiting, the stomach ejecting every article taken. I have employed laudanum, peppermint, calomel and opium, and oil of turpentine, together with the external application of spices and rubefacients. When all these remedies have failed, I have succeeded in allaying the irritability almost instantly, by a remedy which would not have been "a priori" resorted to in this disorder. I allude to the powdered saccharum saturni. To the use of this article in cases similar to those detailed above, I was first led, by observing its calming effects when used to relieve the tormina, tenesmus, and gastric irritability, occurring in dysentery.

The very successful results of the use of sugar of lead in the obstinate epidemic of the year 1820, has been already detailed in the preceding essay. It is there stated, that I had even resorted to the use of sugar of lead in colica pictonum, complicated with this excessive degree of gastric irritability; but added that I was not prepared, at that time, to speak with sufficient confidence to recommend its general use.

Since this period, I have frequently used the saccharum saturni in dysentery, and always with the most desirable results; and the estimation in which I at that time held this remedy, has been frequently confirmed by the testimony of other practitioners, more especially of those of the southern states.

In those cases of lead-colic, to which I have particularly referred above, I have found no remedy so well adapted to the purpose, as the sugar of lead. After having in vain endeavoured to allay gastric irritability by calomel and opium, assisted by the usual remedies, I resort to the use of the following prescription: ℞ cal. ppt. gr. v., pulv. opii. gr. ij., pulv. sacch. sat. gr. iij.—m. ft. pulv.; to be repeated every two hours until relief is obtained; which is generally the case after two or three powders have been taken. Injections of saccharum saturni, with opium in solution, have also been successfully used for a similar purpose.

I have already administered this remedy with success in bilious fevers of high grade, where excessive irritability of the stomach precluded the internal use of all other remedies. Under similar circumstances, I propose to administer this remedy in *yellow fever*, the next opportunity which presents itself.

In one case of cholera morbus, in an advanced stage, I administered an enema of ℈i. of saccharum saturni, with ʒij. of tincture of opium. By this treatment, once repeated, it appeared to me that the life of the patient was preserved.

After the administration of this remedy in colica pictonum, and when the stomach is calmed, the usual remedies are resorted to. The substances ejected from the stomach, in these cases, consist, for the most part, of vitiated bile, the quantity being at times exceedingly great.

When the bowels have at length given way to the effects of medicine, at times, enormous quantities of feculent matter, with flatus, are discharged, and if not moderated, the catharsis would endanger the life of the patient. For this purpose, if pain still remains, I give castor oil and laudanum, or, if the stomach reject this, small doses of spirits of turpentine and olive oil, alternated with laudanum. But should torpor of the bowels still remain after the violence of the disease has been overcome, I have found a useful remedy in a mixture of castor oil and spirits of turpentine, in the proportion of a table-spoonful of the former, to a tea-spoonful of the latter. In more obstinate cases of torpidity of the bowels, under these circumstances, I have resorted to the use of croton oil, with signal advantage. This was particularly the case in two patients, who, after recovery from a severe attack of colica pictonum, had a *relapse,* without any subsequent exposure to white lead—having been seized with catarrh from exposure to cold and damp.

I stated, in the commencement of this essay, the peculiar liability of one form of this disease to terminate in paralysis of the extremities, most generally of the fore-arms. One instance only has occurred under my own superintendence; but I have had occasion to treat several cases of this nature which had been under the care of other physicians. These patients finally recovered, with the exception of one, under the use of powdered nux vomica, caustic issues on each side of the nape of the neck, and purging medicines, continued for two or three months.

Notwithstanding the utmost care and attention on the part of the medical attendant, this disease will frequently terminate in inflammation of the intestines; but this is by no means necessarily fatal, provided the attention be attracted in time to this symptom. Post-mortem examinations, at least such as occurred under my own inspection, have invariably displayed mortification of the intestines, provided mania à potu had not supervened and carried off the patient. Four cases only have terminated fatally under my own treatment. Three of these were habitually intemperate; and the other, an ignorant German, unacquainted with the dangerous nature of his complaint, suffered himself to be neglected for three days previous to making application for relief.

From the severity of the disease, together with the use of the necessarily violent remedies, dysentery, with copious discharges of blood, is not unfrequently induced; in which case, no remedy is more effectual in relieving pain and suppressing the discharge, than the pulverized saccharum saturni, in combination with calomel, opium, and ipecacuanha. Should the blood discharged, after long continued constipation, present a grumous or coffee-ground appearance, it indicates commencing mortification, which, for the most part, speedily ends in the death of the patient.

In writing the above, I have carefully avoided discussing the various and conflicting opinions of authors, in relation both to the pathology and treatment of these diseases; wishing to confine myself to a record of observations which have been elicited by actual experience. It is unnecessary to add, that I feel by no means satisfied in any of the systems of practice mentioned in the *Dictionnaire des Sciences Medicales.*

Answer to MERAT'S *Remarks on a Paper, entitled "Observations on Colica Pictonum," &c.*

IN the "Journal Generale de Medecine," for the month of July, 1828, I perceive that the editor has done me the honour to translate my essay on the diseases produced by lead, published in the North American Medical and Surgical Journal, for January, 1828.

Appended to this memoir in the French journal, there is a note by M. Le Dr. Merat, author of a treatise on "colique metallique." In referring to the article on lead colic, in the "Dictionnaire des Sciences Medicales," we intended no offence to the author of the very valuable observations contained in it; we considered that article a fair representation of French practice.

M. Merat appears to think that I should have offered more detailed observations on the disease denominated colica pictonum. Having carefully noted the peculiarities of the disease as observed in my practice, arising probably from corresponding peculiarities in constitution, in variation of climate, locality, &c., it appeared to me unnecessary to enter into a more particular detail of symptoms which characterize a disease so well known as colica pictonum. Such varieties as I have noticed, occur more or less generally in all diseases, under similar circumstances.

M. Merat reprobates in the strongest terms the administration of the *acetate of lead* in those cases of colic where the stomach of the patient rejects every thing introduced into it. The annotator remarks, "This salt, which itself causes the disease, given to cure it! We must confess that there is in this recommendation a subversion of ideas calculated to astound the imagination of the boldest practitioner. Unless we adopt the theory of Hannemann, who asserts, that a medicine susceptible of producing a disease, should be the proper one to cure it; we cannot conceive of a curative measure more in opposition with all received doctrines."

M. Merat, in offering these remarks, has permitted his imagination to obscure his judgment. We believe he is too judicious a practitioner to be astonished at a doctrine so commonly acted on. Does not he himself advise the free administration of opium, a powerful astringent, in colica pictonum; a disease whose principal character consists in constipation? Do not practitioners occasionally apply a blister to cure certain inflammations? Nux vomica taken internally in certain quantities will produce palsy and tetanus, yet I can speak with certainty of the beneficial effects of this medicine in these affections, when properly administered. Excessive use of ardent spirits induces mania à potu; here too the bane will prove the readiest antidote. It will be recollected further, that I have not recommended the acetate of lead as a remedy for colic; but merely as a palliative in those rare cases of excessive gastric irritability in which all other remedies are useless; because rejected as soon as offered. Finally, in no case have I observed injurious consequences to arise from the administration of acetate of lead, when its use was clearly indicated.

Case of the Bite of a Rattlesnake (*Crotalus durissus*, Linn.) *successfully treated.*

On Monday, the 13th of September, 1830, Daniel Steel, a showman of living animals, in this city, was severely bitten by a large male rattlesnake, immediately below and on the metacarpal joint of the index finger of the left hand: the accident occurred about four o'clock, P. M. on a warm day, whilst he incautiously seized the reptile by the neck, not so close to the head but that the animal was able to turn upon him. Immediately after the bite the blood flowed freely from both the fang-punctures: the parts in the immediate vicinity of the punctures became tumid and livid, notwithstanding the efforts of the patient at suction with his mouth—which faintness obliged him soon to relinquish. On my arrival, about half an hour after the accident, I found him extremely pale and faint, and was informed that he had fainted several times: the whole of the back of the hand was puffy and tumid, with infused non-coagulable blood, which appeared to have infiltrated from the vessels, and forced its way through the cellular tissue; a ligature had been previously applied on the wrist; another was now placed on the arm, the forearm having already commenced swelling.

The situation of the wound rendered the use of cups inapplicable, and the flow of blood was so rapid as to make their application inexpedient. The punctures were separated some distance from each other, which rendered it requisite to excise two large portions of integument, the incisions extending down to the tendinous fascia; the blood, which flowed freely after the operation, did not appear disposed to coagulate; cold water was now poured on the wounds, in a continued stream, from the mouth of a pitcher, held at a considerable elevation, and the swollen parts in the vicinity of the wounds were forcibly pressed, in order to expel the effused blood. The patient again became very faint, and was laid in a recumbent posture. The wounds were next washed with spirits of hartshorn, several doses of which were administered internally; but being now informed that the patient had drunk freely of sweet oil, the hartshorn was omitted, until the stomach should be evacuated by drinking warm water. A poultice of bread and water was next applied, to encourage the bleeding, and the patient put to bed. At ten P. M. I was sent for in haste; the patient was thought by his attendants to be dying. The bleeding from the wounds had been extensive, the tumefaction had extended up to the arm, the inner and inferior portions of which were discoloured by effused blood: the patient vomited incessantly; he complained of insatiable thirst, and drank cold water every few minutes: he had pain and stricture at the pit of the stomach, great restlessness and anxiety, cold skin, with the exception of the wounded arm, which was very painful: add to which, there existed delirium, singultus, difficulty of breathing, and pulse at the wrist scarcely perceptible. The poultice, bandages, and all ligatures, were immediately removed; the back of the hand was blacker and more swollen, and the skin of the fore-arm was hot and tense. As a substitute for the poultice, and in order to suppress the bleeding, which appeared to endanger the life of the patient by the debility it occasioned, large flat pieces of fresh meat, were bound on the wounds, hand, and fore-arm; before this operation was completed, the patient exclaimed, "that feels comfortable." The indications arising from the present symptoms were: 1st, to allay irritation and thirst; 2d, to arrest the vomiting; 3d, to procure sleep, if possible; and 4th, to excite the sanguineous system to resist the depressing power of the poison, which had so emphatically manifested itself on the system in general.

A mustard plaster was directed to be applied to the pit of the stomach; sixty drops of laudanum to be administered every half hour, until the vomiting be arrested; after which the following bolus, to be taken every two hours until sleep should be induced: ℞. Pulv. opii, six grains. Pulv. gum. camph. eighteen grains. Pulv. carb. ammonii, thirty grains. M. ft. in three boluses. Sig. as directed. Of these pills he took three before the effects desired were manifested. On the morning of the second day his pulse was raised; the extreme thirst and irritability of the stomach were allayed, and reaction of the system in several respects was manifested, but the tumefaction of the arm had extended to the shoulder, with broad black streaks up to the axilla: stricture at the breast, and great local pain were now the chief complaints. The application of raw meat was renewed, as it afforded comfort to the patient, and appeared to reduce the swelling of the hand, and, by pressure, had nearly suppressed the hemorrhage. In order to allay the pain and tension of the whole arm, he was directed to expose it naked to the *fumes of burnt wool*, in a convenient apparatus; which was attended by such marked alleviation of symptoms, that the patient himself was desirous to have the operation frequently repeated, and continued for two or three days; the swelling always diminishing after each application: it caused the arm to perspire profusely, and covered it with a blackish soot impregnated with ammonia, resulting from the decomposition of the wool. During the intervals, the arm was rubbed with volatile liniment. The raw meat having become offensive from its disposition to ferment and putrefy, was omitted, and flaxseed poultices substituted; the anodyne boluses were continued in half doses through the day, and the quantity increased at night to produce sleep. The system again became depressed, and appeared to struggle with the effects of the poison; as the patient had been somewhat addicted to intemperance, he was allowed milk-punch to support his strength. On the third day, a greater degree of reaction was obvious; the bowels were evacuated by castor oil; the dose of the anodyne was diminished, and by carefully nursing the arm, in less than a week suppuration supervened, and the patient was able to leave his bed.

Remarks.—In the case above detailed, the resort to suction by the mouth, and the application of cups being prevented by uncontroulable circumstances, and the local and constitutional symptoms being already in some degree developed, there was no alternative but to resort to those general principles of treatment, which, when properly and timely administered, will seldom fail of success; there was no "specific" at hand, nor do I place any confidence in the thousand "infallible remedies" which are offered in such cases. (The reader is referred to an antecedent essay in this volume, for observations on several of these remedies, and a detail of *experiments* with one of the most noted of these specifics, made by the author in 1828.)

Of the many instances of wounds from the bite of the rattlesnake, perhaps not more than one out of ten would prove mortal if left to nature; and perhaps not more than one out of five cases would be followed by *constitutional* symptoms. It has been also satisfactorily ascertained, that of the many hundred men and animals bitten by rabid animals, not more than one case out of twenty is followed by *hydrophobia:* a fact, in itself, sufficient to account for the origin of the innumerable "specifics" in both the cases under consideration. Nevertheless, several instances of death from the bite of the rattlesnake, in adult men, have unquestionably occurred within my own recollection.

Gangrena Sicca, or G. Senilis.

Dry gangrene, occurring in aged and enfeebled bodies, is generally referrible to ossification of the arteries of the extremities; but this affection is not peculiar to old age: at different periods of life the fingers and toes are liable to dry-rot, from ossification of the arteries of the heart or of the aorta; in either case death is generally the consequence. In the latter instance we have observed a sudden and violent termination of life unexpectedly, the constitution of the patient being apparently not materially affected.

Another cause disposing to this morbid affection, consists in certain articles of diet, and, among others, *horned rye* is a most frequent cause: this is a diseased state of the grain, induced by insects; it is also a powerful medicine in some affections, administered under the name of *Secale cornutum*, or Ergot. There are, no doubt, other impure articles of diet capable of inducing the same morbid diathesis. It is further not improbable that external noxious applications may be followed by gangrena sicca. When this disease occurs in any other case than that of old age or arterial ossification, the constitutional symptoms either precede or attend the mortification, and a successful treatment depends upon our knowledge of the characteristic symptoms, and of the means of combating them. The following is an illustrative case:—

Oct. 27, 1834.—Mary Snyder, æt. 22 years. Admitted a patient in the Philadelphia Alms-house Infirmary. She was born and had resided in Catawissa county, Pennsylvania, where she remained until four years since; at which time she removed to Philadelphia. Occupied in washing and house work. Her general health had been good, with the exception of rheumatism during the last year of her country residence: she had never seen a case or heard of one, similar to her present disease. About three weeks since experienced a numbness and uneasiness in the hands, and particularly in the extremities of several of the fingers, with now and then pricking pains, as if from a wound of a needle; which symptoms were aggravated on attempting to seize on any thing. She continued to experience these symptoms about one week before she observed any discoloration of the affected parts, when a small vesicle was first observed on the extremities of the fingers, resembling a fester; afterwards a small black or bluish spot appeared, which soon became perfectly black, hard, and insensible.

Oct. 27th.—When she entered the house, the two first fingers of the left hand were perfectly black, hard, and insensible, as far as the roots of the nails; the ring-finger, also, tender and painful to the touch. The skin of all the digits hardened. On the right hand the index and fourth fingers were partially discoloured at the tips. There was no local redness. The pain in the fingers increased at night—sleep disturbed—tongue furred—spirits much depressed—appetite impaired or absent—pulse 120—strength low.

Oct. 28th.—11, A. M. I visited and prescribed for the patient.

℞. Pulv. G. Camph. gr. iv.
Pulv. G. Opii. gr. ss.
Pulv. Sal. Volat. gr. vi.

M. ft. pulv.

Sig. One every three hours.

Also, ℞. Pil. Cœrulæ. gr. v.
Pulv. Rhei. gr. v.

M. pil. One every night at bed-time.

And in the mean time to expose her hands frequently in a covered vessel to the fumes of burning tar and wool.

Nov. 4th.—The treatment has been uninterruptedly continued up to the present date, with sensible improvement of the general system :—pulse reduced to 100—skin more natural, and softer—appetite improved—bowels regular, (from being torpid)—tongue clean, &c. Locally, nearly all the fingers of both hands became discoloured, but not blackened—the skin in the vicinity of the dry gangrene became red and inflamed, and slightly tumified —the gums were touched by the blue mass—the progress of the mortification was arrested, and the dead parts came off kindly.

The patient was resigned to the care of Dr. Gibson, my successor, who merely applied blisters to the neighbouring parts, and proposed no additional measures.

Dec. 15th.—Recovering, with the loss of three ultimate phalanges of as many fingers.

During the month of October, 1835, we have had occasion to treat, successfully, another case of gangrena sicca, by the same constitutional remedies, independent of any application to the affected part. The patient was a man, æt. 53, a sailor by profession. The disease was situated on the ridge of his nose, near the tip—in which he first experienced pain, without being able to refer it to any cause; the part, subsequently, became successively yellow, red, and black; a portion, the size of a sixpence, sloughed off, down to the cartilage.

Case of extraordinary Visceral Prolapsus, complicated with Omental Hernia, successfully treated.

Philadelphia Alms House Infirmary, August, 1829. Eliza Gallagher, æt. 26, was admitted into the surgical wards. She has been accustomed to take three or four drachms of opium every week. She has been subject to dysentery for the last four months, attended with much tormina and tenesmus, during the greater part of which period she has laboured under prolapsus ani. She has had no medical assistance. The patient remained in this state until about a week since, when the uterus descended. This morning, 27th, a sudden exacerbation of all her symptoms occurred; in this situation she walked a mile to the Infirmary, without much inconvenience. At 10, P. M., I was requested to visit her as the prescribing surgeon; on examination, a horrid and confused mass of disease presented itself—nearly a third portion of the viscera appeared to have left the abdominal cavity. On examining more at leisure the protruded parts, they were recognised as an extensive prolapsus of the rectum, bladder, and uterus: but what added increased interest and difficulty to the case, was a mass of omentum, six inches in length, thickened and hardened by inflammation and deposition of coagulable lymph, which appeared to be attached to the protruded rectum, several inches above its termination—which, on closer inspection, was seen to pass through an ulcerated opening in the gut, by which it had been strangulated, and to the borders of which it slightly adhered. A ligature was applied to the strictured part, and the protruded portion removed by excision, after which all the remaining parts were, with some difficulty and pain, gradually restored to their natural situation. A candle was introduced into the rectum, and the parts retained in situ by compresses and the T bandage; constant application of lead-water and spirits of camphor was directed, and the following powder to be taken immediately: Pulv. opii. and pulv. camphor. āā gr. iij., acetas. plumbi. gr. ij. M. At 3, A. M., she took, in addition, one drachm of tinct. thebaic.

28th.—8, A. M.—The patient is as comfortable as could be expected; is easy from the narcotics, but complains of abdominal soreness when moved; pulse begins to rise, and the system to re-act; the parts remain in situ.

11, A. M.—Pulse is small, but very tense; complains of much pain and tenderness of the abdomen; tongue red, and disposed to dryness; thirst considerable.—Ordered venesection ℥xx.; the powder to be repeated; warm fomentations of hops to be kept constantly to the abdomen, and warm lemonade for drink.

Evening.—Has been asleep, off and on, ever since she took the last powder; complains of great soreness when she moves, but is easy when quiet; tenderness extends all over the abdomen; head free from uneasiness; bowels remain quiet; pulse small, quick, and tense; the blood drawn is not buffed or sizy.—Ordered forty leeches to the lower part of the abdomen. 2, P. M., the patient sleeps.

29th.—9, A. M.—Feels better this morning; tenderness much diminished; the dressings have been necessarily disturbed, and the uterus again prolapsed. It was returned, and the bandages re-applied. Skin is cool; pulse small, slightly tense, 108 per min.; stomach irritable, with great thirst. She is indulged with warm tea, and takes occasionally the effervescing draught; also the following powder: Acetas. morph. gr. ss., pulv. camph. gr. iij., acetas. plumbi. gr. ij. M.

5, P. M.—Complains considerably of pain, the effects of the last narcotic dose being worn off. The opium powder to be continued, also the fomentations and wash of lead water and spirits of camphor.

7½, P. M.—Bowels open; the stool very thin and dark-coloured, and fetid.

30th.—Slept well last night, and feels better. Another alvine evacuation similar to that of yesterday. Pain has nearly disappeared; complains only of soreness in the uterine region; of nausea, and emptiness—having eaten nothing since she entered the ward. Ordered to repeat the powder, with the addition of oleaginous mixture, and be allowed beef tea, crackers, &c.

7, P. M.—Has taken only two table-spoonfuls of the oleaginous mixture, by which she was purged four or five times; pain in the hypogastrium increased, with considerable tormina and tenesmus; pulse small, 110 per min.—Ordered a tea-spoonful of laudanum, and to use the following as a suppository: Pulv. opii. et ext. hyosciami. āā gr. iij. 10, P. M., purging continues; ordered to repeat the last prescription.

31st.—Pain diminished; bowels still open; pulse 112. Ordered to take one tea-spoonful of laudanum, and continue beef tea. 7, P. M., alvine evacuations more natural; pain has disappeared; pulse full and tense; omit beef tea. 12, P. M., pain returned. Ordered a tea-spoonful of laudanum.

Sept. 1st.—Has some pain and soreness; alvine discharges still improving. Ordered to repeat the suppository, and take gr. ss. of sulph. morph. 11, A. M., some fever, but little pain; pulse tense and quick. Ordered nitrate of potass gr. x. every three hours, and barley water for diet. 7, P. M., pain and purging have returned; pulse tense; has taken 1½ grs. of sulph. of morph. without benefit. Ordered nitre to be discontinued; to repeat the laudanum, and have forty-five leeches applied to the abdomen.

Sept. 2nd—Became easy after taking two doses of the laudanum; purging continues; pulse of good volume, and 108 per min. 1, P. M., complains of pain and soreness in the iliac regions; pulse small and tense, 128 per min. Ordered forty leeches to the seat of pain, and to repeat the laudanum, to relieve the purging and griping; complains, also, of fluttering and palpitation of the heart, for which she is to take a tea-spoonful of the following mixture, occasionally: liq. anodyn. Hoff. ℥iij., laud. ℥i. M.

Sept. 3rd.—All the symptoms relieved, and continued gradually to improve until the 7th of Sept., when she was considered cured. The patient remained some months in the Infirmary, and was employed as nurse.

Case of Prolific Uterus and Sterile Mammæ.

The present case of abnormal function is briefly noticed as one of those remarkable instances of the aberrations of nature, which are occasionally to be met with in civilized society.

Oct. 27th, 1820.—My professional services were requested by Mary Ann Gready, aged thirty years, native of the north of Ireland. She assures me that she is the youngest daughter of twenty-two children, thirteen of whom attained maturity: her mother never secreted a drop of milk wherewith to nourish her infants. Mary Ann, the subject of the present observations, I have just delivered of her thirteenth child, a perfectly formed female. Out of these thirteen progeny, two were aborted, from accidents; two were premature; four are living; and five died from disease. On the third day after parturition, the mammæ are observed to swell a little, and to become slightly painful; on the fourth day they subside again. About the third week after parturition, a stomachic affection supervenes, such as pain, eructation, nausea, vomiting, and other dyspeptic symptoms, which continue until she again becomes pregnant, which has always occurred in five months after delivery. No uncommon appearance of the mammæ is perceptible—they being adequately developed.

Case of Extra-Uterine Fetation.

June 5th, 1820—I assisted Dr. Parrish in the examination of the body of Mrs. Henrietta Ware, widow of the late Captain David Ware, near the Swedes' Church, Swanson street, Philadelphia.

Autopsy twenty-four hours after death. The patient had been under the care of many physicians during the long period of suffering to which she had been subjected; whose opinions of the case were various, none apparently being convinced of the true state of the patient. The last prescribing physician was Dr. Thomas T. Hewson, who was absent from the city when the patient died.

The history of the case, which we received from the friends of the patient, is as follows. Seventeen years ago, that is to say, in the year 1803, Mrs. Ware was married. At the usual final period of gestation, Dr. Dunlap was consulted as accoucheur, who, upon examination, declared that none of the usual symptoms of approaching labour could be distinguished, notwithstanding the regular occurrence of pain, &c.—and the tumor was referred to some other cause, to ovarian dropsy, or enlargement of some other part. Professor Wistar was subsequently consulted, who concurred in the opinion of the accoucheur; and the patient was treated accordingly, but without relief.

The uterine system soon resumed its natural function, and the patient had only ceased to menstruate three months previous to death. The disease finally assumed a hectic form, which eventually terminated a life of much anxiety and pain.

The patient herself, as well as her most intimate friends, always insisted that a living child had existed in utero, a conclusion to which they were led by what they conceived to be indisputable evidence. Although the patient had continued for many years in the connubial state, she never subsequently conceived. Her body was examined at her own request.

Autopsy.—On the examination of the abdominal tumor externally, the existence of bone within was evident to the touch. On grasping the integuments, which had become extremely thin from absorption, the bones of the fœtal cranium could be made to overlap each other. There existed two small fistulous openings through the linea alba, just below the umbilicus, through which there had been for some time an extremely fetid discharge; the integuments adhered firmly over the anterior part of the tumor, particularly at the upper portion.

The tumor occupied a central position in the abdomen, but forced, by long continued pressure of the muscles, deep into the cavity of the pelvis, and measured about seven inches in diameter.

Some portions of intestines adhered to the sides of the tumor; these were left attached, and the whole mass removed from the body. The bladder occupied its usual position. The uterus was perfectly natural in size and structure—not the least appearance of a *cicatrix* was observable on opening its cavity; on the right side, the fallopian tube, the ovary, and ligamentum rotundum were natural: on the left, the ovary had either been removed by pressure and absorption, or destroyed in the dissection; the os tincæ and vagina were also of natural appearance.

On opening the sack, the contents proved to consist of a full grown male fœtus, presenting the position of a breech presentation, or fourth position of Baudelocque. It was more or less destroyed by putrefaction in those parts which had been exposed to the fistulous openings in the sack: the parietal bones were nearly bare, the scalp being nearly destroyed;—the soft parts in general, as well as the cartilaginous epiphyses, were destroyed or altered in texture in those parts most exposed to the influence of the external air—previous to the openings into the sack, and consequent admission of atmospheric air, the whole fœtus was doubtless in a perfect state of preservation. The brain filled the cranium, and the dura mater and pia mater presented nearly a natural appearance;—the brain was soft, and of a reddish complexion; the chin and face were bent upon the thorax, and by pressure had left an indentation upon the sternum. These parts remained in the most perfect state of preservation, all the features being perfectly natural.

The skin of the face, breast, and abdomen, was of a dark dirty-white colour, the integuments of the same parts being of considerable firmness. The thighs were thrown upwards so as to cover the forehead: the genital organs, together with one hand and one foot, were well preserved. The spine and ribs, and all such bones as are early ossified, were perfectly sound. The sack was next removed and separately examined; it was less than one-half the thickness of a gravid uterus, thinned by ulceration in some places, entirely ulcerated through in others: two valvular openings penetrated the tendons of the abdominal muscles; two others communicated with the cavity of the intestinum ilium, which was attached to the right side of the tumor by means of its portion of mesentery, for the length of fifteen inches; the upper portion only of the gut itself adhered to the sack, through which was the ulcerated opening above mentioned. Through these passages the fœtus might in time have been gradually expelled or discharged by the efforts of nature alone, had not the system sunk under the effects of irritation. On the inner side and upper portion of the sack, near to the opening into the gut, was observed the *placenta*, considerably diminished in size, it is true, and altered in texture, though entire; it was of a whitish colour, and of almost a cartilaginous consistence; directly opposite to the placenta, on the outside, the sack firmly adhered to the iliac portion of the mesentery, about one inch clear of the gut. The umbilical cord, that portion of it next the placenta, was destroyed, but several inches of it remained attached to the umbilicus; one turn was also left around the neck of the fœtus. On the inner side of the sack, in several places, was observed some calcareous lamellated incrustations. The preparation was preserved in spirits, and remains in the cabinet of Dr. Hewson.

In this rare and melancholy case, it is much to be regretted that the true situation of the patient was not immediately comprehended, as the Cæsarian operation appears to have been not only justifiable, but would have been attended with but comparatively little danger, provided the adhering portions of the sack were left in the abdomen: but the difficulty of ascertaining the nature of the tumor in the early stage, must have been considerably augmented by the thickness of the abdominal parietes in a natural state, or previous to their partial absorption from pressure. The lungs of the fœtus were of a healthy appearance and structure; the liver was small, but not deranged in structure: the remaining viscera were natural. The present case, perhaps, constitutes the only instance of real *extra-uterine fetation* on record; that described as such by Mr. Turnbull, appears more like a case of rupture uteri. (Vide Mem. of Lond. Med. Soc. Vol. III. p. 176, which refers to fifty or sixty cases of extra-uterine *fetation* and rupture uteri, not one of which was abdominal, or came to full period.)

EXPLANATION OF THE PLATE.

Fig. 1. Anterior view of the tumor, out of the body—one-fourth the size of nature.

A. The abdominal tendons, thrown back.

B. A portion of the intestinum ilium.

C. The mesentery.

D. A duplicature of the peritoneum.

E, F, G. The uterus, os tincæ, and vagina.

H. The fallopian tube.

I. The lateral ligament, torn, so as to show K, the ovary.

Fig. 2. Posterior lateral view, out of the body—one-fourth the size of nature.

L. The rectum.

M. The mesorectum.

N. The intestinum ilium.

O. The mesentery.

Fig. 3. Fœtus—one-half the size of nature.

Pl. 36

Fig 1 ¼ Size of Nature

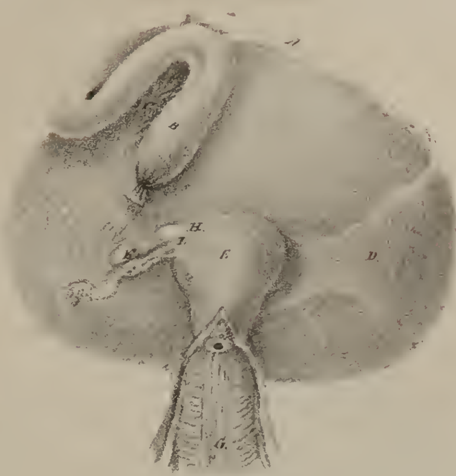
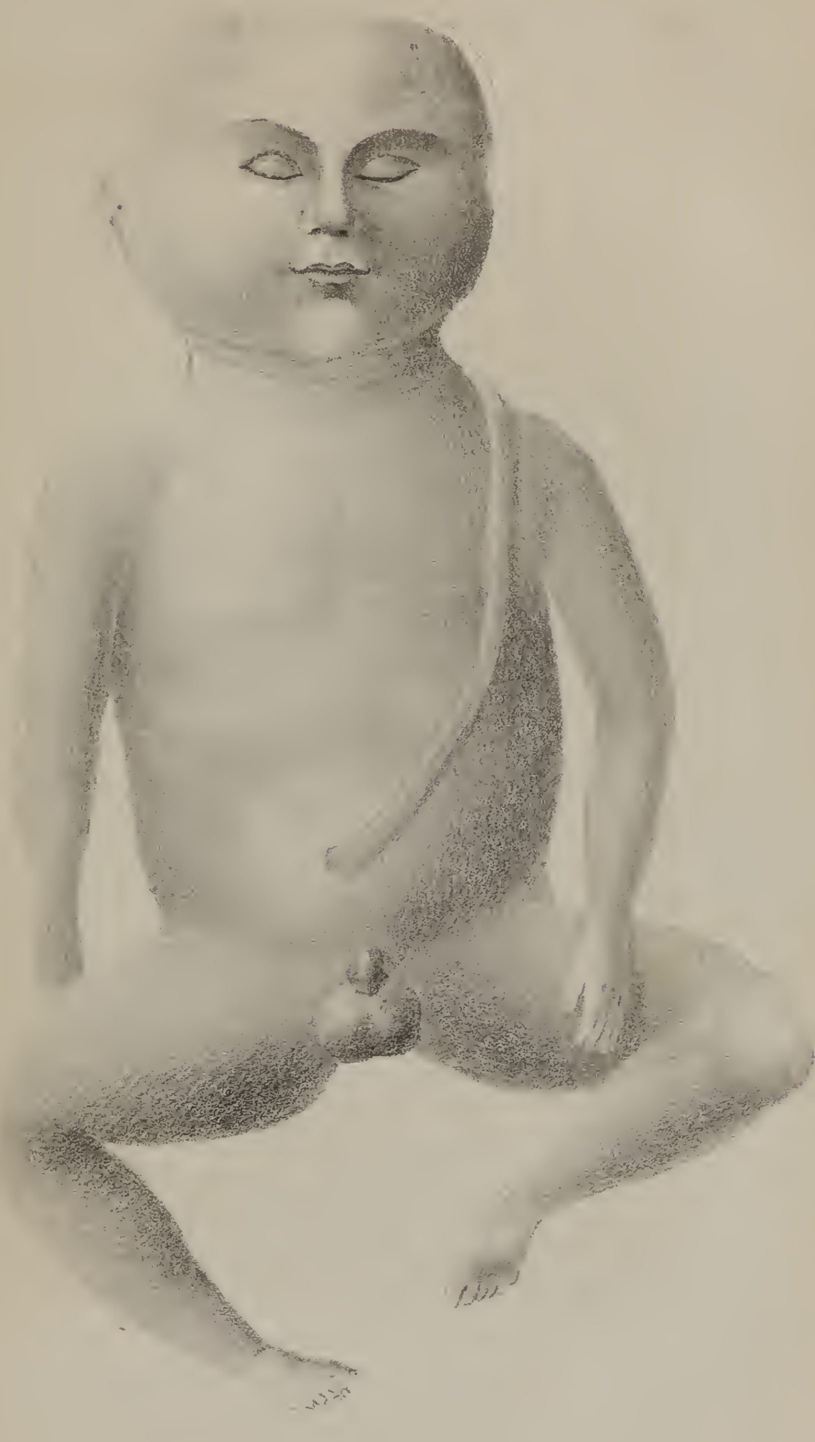


Fig 2 ¼ Size of Nature

Pl. 37

Fig. 3. 1/2 Size of Nature



Observations on the Treatment of Anthrax and Malignant Pustule.

Anthrax or carbuncle are names by which we designate an indurated inflamed tumor, characterized more particularly by a burning sensation in the part, and located in the skin and sub-cuticular cellular membrane. In the pain, heat, and redness, attendant on this affection, and which has been compared to the sensation produced by the application of a burning coal, has originated the names by which it is generally designated.

Carbuncle is most common in aged and debilitated constitutions, especially in such as have been enervated by previous free living and indolence; but is by no means peculiar to such. The inhabitants of Hindostan, who are strictly confined to an exclusively vegetable diet, are very liable to this affection after the age of forty. We have rarely witnessed a case of carbuncle, in any instance, under the age of thirty. The immediate cause of this affection is occasionally referrible to local irritation, but frequently no local cause is assignable. The disease is always attended, and usually preceded, by impaired appetite, and other symptoms of derangement in the chylipoietic viscera, with more or less irritative fever.

It has been long observed that the usual antiphlogistic measures, applied for the purpose of reducing local inflammation, will fail in bringing to a resolution a carbuncular swelling, when once fully established.

The "methodus medendi" has been various and contradictory. Observing the tendency of this kind of inflammation towards ulceration and mortification, some practitioners have considered the cause of the disease to be essentially one of debility; a notion as dangerous as it is unfounded. It is true that in elderly persons, or in impaired constitutions, a state of feebleness often supervenes, requiring a generous diet and the administration of wine, bark, and other stimulants; but in most cases, a treatment more or less antiphlogistic, will be found requisite. Purges, alteratives, and sudorifics, will generally correct the vitiated state of the digestive apparatus, whilst the most approved method of local treatment remains yet a subject of dispute.

From the work of one of the most eminent of modern authors, we quote an extract to show the treatment pursued by the practitioners of England. We allude to the valuable lectures of Wm. Lawrence, Esq., as delivered at St. Bartholomew's Hospital.—"There is, however, a mode of treatment which is fully effectual in relieving the patient at the moment, and in preventing the further progress of the disease; at least in a great number of cases. This consists in making a free incision through the whole of the inflamed cellular membrane, and the skin covering it. Such incisions produce a considerable discharge of blood from the parts, and these no doubt relieve the local inflammation; they set at liberty the parts which have been in a state of inflammatory tension, and thus they give great and immediate relief to the patient. After the performance of these incisions through the carbuncular swellings, which, by the way, I should mention to you, are in an extremely sensible state, patients generally feel themselves comparatively easy and free from a condition of the greatest suffering. These incisions have the further effect of giving free issue to, at all events, a great number of the suppurations that are disseminated throughout the carbuncular mass; and thus they tend to bring the complaint to a crisis, and to prevent the extension of the inflammation in circumference. General experience has so fully established the advantage of this treatment, both as to the immediate relief afforded to the patient by it, and as to its influence in preventing the extension of the disease, that it is now very universally practised; and that person may justly be said to be ignorant indeed of his profession, who would neglect to proceed to its performance to its full extent, in carbuncular diseases. Now you must proceed pretty boldly in making these openings, for if you make a small opening, so as merely to let out a little blood, you may just as well do nothing at all. You must cut through the whole length and the whole depth of the part, and, therefore, you will often have to cut two or three inches in depth. Unless you do this, so as to get to the base of the hardened cake, you do not accomplish the purpose; and if it should require the depth of three or four inches, it is of no consequence, you must go down to it."

Any rule of practice, emanating from an authority so deservedly estimated as that of the learned lecturer just quoted, demands respectful consideration; but judging from our own experience in such cases, which has been by no means of limited extent, in the treatment of carbuncle, we cannot conceive of a surgical operation of a more cruelly painful nature—amputation of the limb is not to be compared to it—we never attempted it but once, and feel assured we shall never again resort to it: and we are happy to be able to assert, that such an operation can never be requisite. Having applied the remedy which I now offer as a substitute, in every variety, and in every stage of the disease under consideration, I have not in a single instance met with disappointment; nor have I ever failed in effecting a cure, unless in a very few cases, in which extensive mortification had already existed for some time previous to its application, and occurring in very aged and enfeebled persons. Applied in the earlier stages of the disease, it immediately arrests the specific action, and establishes healthy suppuration, whilst in the ulcerative stage, it very soon changes the morbid action, and at a still more progressed stage, it separates the sloughs, and produces a healthy sore.

The remedy to which we allude, consists in the liberal application of the *caustic alkali*, followed by the immediate application of a bread and milk poultice, for which, the application of a mixture of Basilicon ointment and spirits of turpentine is occasionally substituted, in order to hasten the separation of the sloughs; this, with the necessary attention to the constitutional symptoms, the treatment of which is to be modified according to the state of the system, is all that is requisite to the cure of carbuncle.

The same treatment is so entirely applicable to malignant pustule, as to render further observations on this affection unnecessary. I have applied it with equal efficacy in cases of sloughing cheek of infants: also to venereal sloughing ulcers—first cutting through the dead cellular mass, in order to apply the fluid caustic to the living parts beneath.

Whilst alluding to inflammations disposed to terminate in gangrene or sloughing ulcers, I embrace the opportunity to add the testimony of my experience of the very important improvement in the mode of treatment in a peculiar case not unfrequently leading to fatal results: this improvement is due to Dr. J. Hartshorn of this city, by whom my attention was first called to this method twenty years since in his practice in the Philadelphia Alms House Hospital. The case alluded to is that of urinary infiltration into the cellular membrane, either in the perineum, scrotum, or neighbouring parts. The treatment consists in making free incisions through the skin over the effused fluid, followed by light pressure, and occasionally in the application of caustic alkali to the wounds, to facilitate the discharge of the sloughs, which are always the consequence of such infiltration.

Cases of Poison from eating the Seeds of the "Euphorbia latus."

It is not generally known that this species of noxious euphorbia exists in the vicinity of Philadelphia. The following cases illustrate the effects of this poison on the human system.

October 16th, 1819.—Saturday evening, was called in haste to visit the son of M. L., aged five years; in the afternoon the child had eaten six small seeds, part of a quantity which his sister, aged about eight years, had picked from a weed on the common, and presented him with, after having eaten a much larger quantity herself. The girl soon vomited and threw them off the stomach, but the boy retained them a considerable time, when they at length occasioned the most violent retching and vomiting, with excessive purging, so as to suspend respiration for a short time, and occasion suffusion of the face. Some hours had elapsed, after the accident, before I saw the patient, at which time the vomiting had ceased, and stupor had supervened, with dilated pupil; he was with difficulty aroused by cold effusions. An emetic was administered, followed by a small dose of calomel and castor oil. The day following the patient appeared quite recovered.

On visiting the spot from whence she had obtained the "berries," I obtained specimens of the plant, and a quantity of the seed, and on presenting them to the late Abbé Correa de Serra, he pronounced the plant to be the *Euphorbia latus*, a species which he had not before noticed so far south as Pennsylvania.

Case of Aneurism of the Pulmonary Artery.

September, 1814.—Assisted Dr. Parrish in the examination of the body of Capt. Man—a middle-aged person of robust constitution. His disease had never confined him to his house, and the day preceding his death, he called on Dr. P. and complained of dyspnœa, and pain in the back of his neck. His symptoms were referred to stricture of the œsophagus, and Professor Wistar, who was consulted, advised the use of the probang; the patient deferred this operation, and during the same night was attacked with increased difficulty of breathing, and exacerbation of all his symptoms. A bleeder being sent for, he lost some blood, with temporary relief—but in a short time after, he expired in convulsions.

Autopsy, about eighteen hours after death, very unexpectedly developed an aneurism of the pulmonary artery—the sack of which had extended so far back as to press upon the œsophagus, and produced symptoms of stricture in that part. There was considerable effusion in the lungs, and a lump of coagulated blood in the trachea, near the glottis—which most probably occasioned his sudden death. The effusion was occasioned by the rupture of the aneurismal sack, which was adhering to the air-cells of the lungs.

There are very few cases of aneurism of the pulmonary artery on record. In the present instance, it was a fortunate circumstance that the probang was not used, otherwise the patient would, most probably, have expired in the hands of the operator.

Observations on the Malignant Cholera, as it occurred in Philadelphia, in 1832.

The epidemic, Malignant Cholera, which was first recognised under this name, as a disease "sui generis," in the vicinity of Calcutta, in the year 1817, and whose destructive influence progressed slowly towards the west—overrunning the greater part of Asia and Europe, destroying several millions in its march—crossed the Atlantic, and reached the shores of the new world, in the year 1832; on the 8th of June of which year, the first case of the malignant epidemic occurred in Quebec, Lower Canada. The most scrupulous inquiry into the history of this scourge, as it prevailed in North America, does not furnish us with any well authenticated facts to prove its importation: or that the disease, under ordinary circumstances, is capable of communication by contagion; and although the progress of the epidemic appears to have been in some degree modified by human intervention, yet we can only refer, as the cause of so universally prevalent a disease, and one so imperceptibly modified by climate and country, to the combined operations of the telluric and celestial influences.

Immediately on the receipt of the intelligence of the prevalence and devastating ravages of the pestilence in Quebec and Montreal—both of which cities were simultaneously afflicted, the City Councils of Philadelphia, with a discrimination and alacrity which cannot be too highly estimated, established a "Sanitary Committee," whose judicious operations were very effectual in calming the excited feelings of the public. At their second meeting, this Board appointed a "Consultation of Physicians," on whose recommendation it was resolved by the Board to "send a mission of three experienced physicians to Canada, at the expense of the city, to inquire into the origin, nature, progress, &c., of the prevailing epidemic." And, accordingly, on the 22nd of June, Drs. Jackson, Meigs, and Harlan, members of the consulting board, were deputed on this mission, and left Philadelphia on the 23rd of June. They arrived at Montreal on the 28th of the same month, and immediately entered on the duties of their mission. At this period the disease had subsided as to the number of cases, but was by no means lessened in malignity. Our personal observations were more immediately directed towards the patients admitted in the "Cholera Hospital," commonly known by the name of "*the Shed*," which consisted of a miserably constructed hut, immediately on the left bank of the river St. Lawrence, in the suburb of St. Ann, one and a half miles from the city. This hospital, which might almost be called a living cemetery—so great was the mortality which destroyed its wretched inmates—was deficient in every thing essential to an establishment of this nature. It proved, however, a good school for observing the disease in its most malignant form, and for investigating its morbid anatomy.

Including emigrants and transient visiters, the inhabitants of Montreal are estimated at 26,000. It was supposed that about 2000 citizens abandoned their homes on the appearance of the epidemic. The degree of mortality may be estimated by the following official register of deaths, during a period of seventeen days, which, however, did not include all the cases during that period.

June 11th,	8 deaths.	June 18th,	112 deaths.	June 25th,	36 deaths.
12th,	2	19th,	141	26th,	44
13th,	27	20th,	100	27th,	39
14th,	56	21st,	89		
15th,	101	22nd,	55	Total	1047 in 17 days.
16th,	80	23rd,	39		
17th,	81	24th,	37		

It is not our object, here, to trouble our readers with minute details concerning this professional visit to Canada—a full account of which may be found, by reference to the Report of the Mission to the City Councils, which was published in pamphlet form, including the writer's visit to the Caughnawaga Indians, on the right bank of the river St. Lawrence, who suffered much by the prevailing epidemic. We except, however, a few of the numerous cases of post mortem examinations which we witnessed or instituted ourselves—these having never been published.

Post Mortem Examinations made at the "Shed," in Griffin town, Montreal.

Case 1st.—June 29th, 1832—7, A. M.—Present at this dissection, besides the operator, Dr. Beaubien—Drs. Coleman, Jackson, Meigs, Mifflin, and Harlan.

The subject, O'Connor, a shoemaker, an Irishman, æt. twenty-three years, resident three years in Montreal, lately resident in Griffintown, not very far from the Hospital. He was sick eighteen hours. Died in ten minutes after reaching the shed, at seven A. M. Took no medicine. The face pale, with deeply sunken eye. The body rigid, hands contracted, the face not presenting the appearance of great age, or wrinkles—the finger nails of a dark colour, approaching to blackness. The autopsy commenced twelve hours after death. On exposing the body, the belly and back were of a bluish-red colour. Did not notice the extraordinary shrinking of the surface and extremities, so often spoken of by writers. The abdomen of an absolutely natural fulness and plumpness.

Spinal Marrow.

The spinal canal of the vertebræ having been opened, a considerable quantity of blood was found on the outside of the theca. Upon cutting off the spinal marrow about opposite to the tenth dorsal vertebra, and drawing it out of the canal, there was a very white and cotton-like tissue, by which it adhered to the anterior part of the canal. There was no bloody effusion into this cellular tissue. The pia mater of the cord injected and red. The cord, on being cut open longitudinally, was bluish, with evident injection of the vessels; the whole was firm.

Thorax and Abdomen opened, by a sweep of the knife extending from the cartilages of the upper ribs on the left, along the side of the abdomen and edge of the pelvis, around the body in a corresponding direction on the opposite side up to the top of the sternum, by which the anterior covering of the abdomen and the sternum were turned up over the face. In this manner we had a full view of the contents of the belly and chest, in their natural situations. The tint of the whole *coup d'œil* was a reddish blue, or rather violaceous, so as to strike all the spectators.

The peritoneum was dry—the lungs not grey, but reddish like the lungs of young children; when cut into they were bloody; they were of a natural consistency: they did not crepitate; they collapsed when exposed.

Heart of a natural size, flaccid to the feel—coagula in the right ventricle, and much fluid black blood—in the left also there were coagula of black fluid blood, "which," to use the language of Dr. B., "is very scarce." The intestines—in mass of a dark violaceous hue. The peritoneum, as before remarked, blue, but where it laid over the proas muscle, it presented on being lifted up, the appearance of very extensive ramifications of vessels, exhibiting the same blue or violaceous tint. The intestines, externally, were universally injected. The spleen being small and dark blue. The mesenteric glands seen were very numerous, and enlarged to double their natural size in most of the specimens. Mucous surface of the stomach dark violet. A living lumbricus, in the upper jejunum, and four others much lower down in the small intestine.

Boiled potatoe (a small piece,) in the stomach; glands of the stomach enlarged; patches of red discerned in various situations in the mucous surface, the mucous lining easily scraped off with the finger nail. Mucous surface of the whole intestine violet; the muciparous glands of the ilium near the ptulpian valve, inflamed, with arborescent injection. Liver collapsed; gall bladder distended with yellowish brown bile.

Brain.—Dura mater violet. Pia mater violet and injections visible; large venous trunks full of black blood; the whole of the blue cholera colour. A horizontal cut into the brain carried quite across, showed the bluish tint both in the cortical and cineritious portions, and the pons varolii decidedly cholera blue upon being incised.

On turning the body on its anterior face, for the purpose of opening the spine, water flowed from the mouth: much gruel like fluid in the small intestines.

Case 2d.—June 30th, 6½ o'clock, A. M.—L. Williams, aged 40; white man. Arrived from Bristol three weeks ago: was attacked at 11 P. M., 28th, and died at 4 o'clock, P. M., 29th: illness of seventeen hours: underwent very little treatment: symptoms of deep-blue malignant cholera.

External Aspect.—Muscles contracted and hard, resembled that of a subject lying for weeks on the dissecting table, and beginning to putrefy: colour of the face like that of a person working in charcoal dust: chest and abdomen the same, but of a lighter colour.

Spinal marrow exposed from the third cervical vertebra to the last dorsal: *externally,* collection of turgid blood-vessels: *the cord removed, the pia mater* was observed to be injected: the central gray substance of a violet hue, vessels injected.

The parietes were turned up from the pelvis to the neck, and the contents of the cavities exposed. The peritoneal membrane drier than usual: the intestines distended with gas: the small intestines externally exhibited a violaceous aspect, and the vessels injected: the colon whitish internally: the mesentery red, deeply tinged, and the veins distended with blood: mesenteric glands enlarged, evidently tumified, but not hardened. The lungs were of their usual bluish hue: collapsed and crepitated between the fingers: their appearance perfectly natural. The cadaveric settling on the posterior part of the lungs much less than usually is found after deaths from acute diseases. The anterior portion, when cut into, contained but little blood: no frothy mucus exuded from the bronchial tubes: the bronchial and tracheal mucous membranes of a deep red.

Pericardium injected; vessels arborescent: the membrane of a pink colour, which resembled washings of flesh. The heart of natural size and firmness: right ventricle contained coagulum of a yellowish-white colour, and of decided firmness; none in the pulmonary artery. The lining membranes of the arteries transparent: no coagulum in the left ventricle, but the pulmonary veins filled with them.

The blood in the mesenteric veins coagulated: vena cava contained thick, half-coagulated blood; its lining membrane clear white. Blood in the femoral vein coagulated: lining membrane white: in splenic vein partially coagulated. Stomach contained a fluid like dirty rice-water: mucous membrane light pink tinge: stellated injections in the cardial extremities: enlargement of the follicular glands, giving to the surface of the stomach in the large curvature, a roughened aspect, resembling shagreen: texture of the mucous membrane bore traction: the duodenum mucous membrane presented numerous red patches of firm consistence. The contents of the superior portion of the small intestines, a dirty whitish fluid of the consistence of thick gruel; at the termination of the ilium the colour of this fluid was reddish or bloody-brown, and the same brown fluid was found in the colon: the mucous membrane of the small intestines throughout, varying from a lighter tint in the upper, to a black, with numerous black points. On the ilium, whitish elevated tumors surrounded with an areola of deep red at its termination: in the ilium several inches were occupied with small glandular tumors: enlargement of muciparous glands, having a dot in the apex; they resembled strongly the vesicles of small pox on the third day: the mucous membrane of the colon highly coloured of a deep red; rough, with a shagreen appearance: the colour diminished on approaching the rectum.

Bladder contracted; contained an ounce of turbid urine: liver nothing unusual in colour and structure; rather small: gall-bladder distended with bile of a natural appearance: kidneys natural: spleen unusually small; very little blood in it.

Brain.—Dura mater natural: arachnoid membrane very slightly opaque: pia mater not unusually injected: medullary substance firm white: iliac and femoral veins natural. The above very careful dissection was made by Dr. Beaubien.

Case 3d.—Dissection of a sailor brought to the shed along with the above subject; they belonged to the same ship, were attacked at nearly the same hour on the night of the 28th, and died next day at 4½ o'clock, half an hour after his companion.

Benjamin Nichols, aged twenty-five years, stout built. Muscles of the thighs and legs drawn into knots, hard and rigid: they had continued to contract considerably after death, as the attendants at the shed reported. The dissection was made by Dr. Harlan, but as our object was to ascertain the condition of the organs of the abdomen and chest, the dissection was not made as thoroughly and minutely as the foregoing.

The external appearance presented the general aspect of indigo blue; face and hands a purple black: the abdomen warm, though dead twelve hours. The parietes being raised and turned up, the peritoneum exhibited the absence of its serosity; the small intestines externally an ash colour, pink tinge, while the internal was white; they were distended with flatus: the bladder was contracted and empty; its internal surface in a natural state.

The alimentary canal laid open, the same kind of contents as in the preceding case prevailed. A thin, rice-water-looking fluid in the stomach: the whitish-looking gruel substance in the intestines: the mucous membrane of the stomach was red, with stellated injections and patches: the jejunum light red, and vessels injected: the extremity of the ilium covered over with pimples, formed by the swelling of the glands of Brunner; the apex of each occupied with a minute bluish spot, semi-transparent; the surrounding membrane at the base of a deep red: arborescent injection of the vessels: the lungs perfectly natural, collapsed, crepitated: the bronchial membrane deep red: blood in the heart grumous: no firm coagula.

Case 4th.—Dissection of a lad aged nineteen, English, and lately arrived; nine days had elapsed from his first attack to his death. The symptoms of Cholera had disappeared—he had left the Shed for two or three days; was brought back yesterday, 27th, in the morning, and died in the evening. The bluish colouring, so common in the recent cases, was absent: the general appearance of the body was a dirty-white. Cadaveric discoloration of the back not deep. The parietes raised as in previous instances; the peritoneum was of a natural aspect; the external appearance of small intestines, reddish, of the large, white; the mesenteric glands enlarged and hardened. The stomach laid open, contained a thin bilious fluid of healthy colour; the mucous membrane, slate coloured, with patches of a deep red—consistency firm—resisting traction; the ilium, at its insertion into the colon, presented numerous ulcerations, from the fourteenth of an inch in size, to a few lines. Jejunum, resembling the ilium, with numerous black pimples, the muciparous glands enlarged—some of the still higher membranes speckled black; the contents of the ilium, a fluid of the colour of Spanish-brown: the colon was not contracted; it contained a thickish fluid of a healthy bilious colour; the mucous membrane whitish in colour, firm in structure; the liver natural in colour and consistency; gall bladder distended with healthy bile; lungs collapsed, crepitated naturally; the heart contained small coagula, soft, and of recent formation. This boy, the day of his last admission, appeared nearly in a state of exhaustion: attempted to walk, but had to lie down from absolute debility.

Case 5th.—*Clain*, aged 67, an Irish emigrant; large body; appearance of a hale man; attacked with symptoms of Cholera, but did not die until the tenth day. Saw him in the Shed. First visit he was constantly vomiting; had cramps in the legs: hands cold, shrivelled, and bluish: lips of a good colour; a light tinge of red in the cheeks. I attempted to press the abdomen, but desisted from his exclamation of pain; pulse at this time of good volume: tongue dryish, red, and furred—thirst. Died on the 29th of June. The small intestines were of a deep purple: the colon black. The stomach contained a bilious fluid; the mucous membrane, in the above portions, dirty-white: in others dull red; consistency good; the small intestines, in the lower portion, contained a thick fluid of sanguineous colour; the ilium of a deep purple-red; the colon had within it an analogous matter, nearly blueish; the mucous membrane of the lower portion of the small intestines elevated into firm ridges, one-eighth to one-sixth of an inch in breadth, of a deep black in the middle; the colour of the upper portion was bright green, having a strong resemblance to moss growing on blackened bark: these elevations were caused by blood effused and coagulated under the mucous tissue; in the extremity of the ilium, mulberry shaped clusters of the Brunnian glands, of a deep black, with the moss-green appearance on the point of each; colon appeared roughened with black elevations resembling the valvulæ conniventes, but of a coal black colour, formed by blood coagulated beneath the mucous tissue.

During the residence of the mission in Montreal, all its members experienced cramps in the legs, impaired digestion, and other symptoms of the premonitory stage of the disease; but notwithstanding the delirium and fever, accompanied with a single watery, colourless, and inodorous dejection, to which the author of these remarks was subjected, in consequence of a lacerated wound inflicted in opening a putrid corpse, we all escaped a more serious attack, by avoiding, as far as the nature of the case would admit, all the exciting causes, but particularly by a regulation of our diet, and by the application of flannel rollers to the abdomen.

The author of these remarks was in Calcutta, in 1817, the year of the commencement of this epidemic in that vicinity; he has since witnessed the treatment of cases which occurred in Paris, London, Canada, New York, and Philadelphia, and feels assured, that strict attention to the following prophylactic measures, by those who may be unavoidably exposed to its malign influence, can not fail to prove advantageous, viz. avoid drinking large quantities of any fluid, never fully satisfying the thirst; abstain from all purgative medicines, but especially those of a saline nature; moderation in eating, keeping the skin healthfully excited; avoiding all exposure to atmospheric vicissitudes; keeping the abdomen, especially, protected: gastric irritation being immediately relieved by flannel bandages; avoiding all raw or uncooked vegetables; avoiding fatigue, overstimulus, and all the depressing passions;

and by the timid, infirm, or convalescent, a retreat to the mountains. Individually, I found good port wine, weakened with hot water, or boiled souchong tea, the most agreeable and wholesome beverages when affected with cholerine.

Having completed the object of our mission to Canada, we lost no time in turning our backs on this "City of the dead."

At New York, where we arrived on our return, July 7th, we delayed one day, in order to visit the patients in the Cholera hospitals—the disease having anticipated us in its southern progress.

Immediately on our return, the mission drew up the following brief results of their observations, for the use of the Sanitary Committee, who directed it to be published, in order to moderate public excitement—subsequent reflection offers me nothing to add to a document, which was considered at the time, fully efficient for the objects of its authors.

SANITARY COMMITTEE.

"*The following report of the Medical Commission appointed to visit Montreal and Quebec, was read, and ordered to be published.*

SAMUEL DAVIS,
Secretary of Sanitary Committee.

July 8, 1832.

"The Medical Commission appointed by the Sanitary Committee to visit Canada, for the purpose of making investigations concerning the epidemic disease prevailing there, in anticipation of a more detailed report, which will be laid before the Committee in a few days, present the following general conclusions as the result of their observations, which they flatter themselves will tend to allay the public anxiety.

"1st. The disease so lately an epidemic in Montreal and Quebec, and which now prevails in the city of New York, and is extending throughout the country, is malignant cholera, the same that has ravaged Asia, and spread its devastations over Europe, under the name of Asiatic and Spasmodic cholera.

"2d. That they have not been able to ascertain any positive unequivocal fact to justify a belief that it is a disease communicated by contagion, or is one of importation.

"3d. That during the prevalence of the epidemic constitution or influence, a general predisposition exists in the whole community, from which very few individuals are exempt, productive of a liability to the disease.

"4th. That this predisposition is manifested by embarrassed and difficult digestion, sense of heat, fulness, uneasiness or pain in the abdomen, irregularity of bowels, a furred and pasty tongue, a sense of general debility, with frequency of cramps or contractions in the muscles of the extremities, especially at night.

"5th. That this state of predisposition will not give rise to an attack of the disease, without the application of an exciting cause.

"6th. That the exciting causes of the disease are moral excitements, especially from the passions of fear and anger; intemperance in the use of fermented and spirituous liquors, or in eating, overloading the stomach; acid drinks, or large draughts of cold water; the use of crude indigestible food, whether animal or vegetable, particularly the latter; the use of drastic and saline cathartics; excessive exertion or fatigue in the heat of the day; exposure to the night air, sitting in currents of air, and particularly sleeping with too light covering, and with the windows raised, except the rooms are very small and confined. Most of the attacks occur in the night, from eleven or twelve o'clock to three or four in the morning.

"7th. That prudence in living during the epidemic period, which continues from six weeks to three months, the wearing of flannel, particularly on the body, keeping the feet warm and dry, the avoidance of improper food and drinks, tranquillity of mind and body, the resort to elevated situations and mountain air, or where this is impracticable, sleeping in the upper stories of houses, are almost certain guaranties against the assaults of the disease, and disarm the pestilence of its malignity.

"8th. That the disease, when abandoned to its course, passes through different stages, in all of which it is easily controlled, except one—the cold stage, or period of collapse, and which is in almost every instance preceded by the symptoms of the forming stage, when the disease, if timely treated, is arrested with facility.

"9th. That the symptoms of this forming stage should be generally promulgated, and persons instructed of the necessity of an immediate attention to them. It is ignorance in this respect, amongst the labouring and lower classes of society, leading to indifference and inattention, together with their habits of life, that plunge so many belonging to those conditions, in the desperate situation so frequently met with, when medical aid and human skill are utterly unavailing. Those symptoms are, a sudden looseness of the bowels, the discharges becoming thin, watery, and colourless or whitish, with little odour—vertigo or dizziness—nausea, oppression, pain and cramps of the stomach, with retching and vomiting of a fluid generally resembling dirty rice water, attended or soon followed by cramps of the extremities, particularly of the legs and thighs.

"10th. When the foregoing symptoms appear, application for remedial assistance must be made immediately. The delay of an hour may usher in the cold stage, or period of prostration and collapse, from which it is almost impossible to resuscitate the expiring energies of the economy.

"11th. That every preparation should be made by the public authorities, in anticipation of the appearance of the disease, providing the means of treatment for those who cannot command them, so that aid may be promptly administered to all, the moment of attack. These means are—a number of small hospitals, or houses of reception, in various parts of the city; stations where nurses, physicians, and students, with suitable medicines and apparatus, can be procured in the night without delay; the evacuation of certain localities, where the occurrence of numerous cases indicates a pestiferous influence, and the furnishing to the poor, as far as practicable, wholesome and nourishing food.

"By the adoption and observance of the foregoing means of precaution and prevention, in addition to the sanative measures already in operation, the commission are convinced that the prevalence of the disease will be greatly circumscribed, its mortality diminished, and the public guarded against panic and alarm, the great sources of danger—and, under the blessing of Divine Providence, the pestilence will be shorn of its terrors, and mitigated in its destruction.

"SAMUEL JACKSON,
"CHAS. D. MEIGS,
"RICHARD HARLAN.

"July 8th, 1832."

In anticipation of an early visit from the epidemic, and at the suggestion of the Board of Consulting Physicians, the Sanitary Committee ordered the establishment of eight municipal Cholera hospitals, in various and distant portions of the city, to be under the control of as many physicians in chief, and including all the members of the

"Consulting Medical Board." These temporary establishments for the accommodation of the improvident classes of society, were all completely equipped, and liberally provided, each with three or four graduates in medicine attached, one of whom, at least, was at all times present, in anticipation of the scourge, whose ravages at this time were laying waste, or scattering the inhabitants of a neighbouring city. The earliest occurrence of Cholera in Philadelphia was about the middle of July: and on the 28th of this month, the first cases were received in the hospital under my charge. The details of a few of the cases are here introduced as specimens of the disease and of our treatment: remarking, that although opportunities for post mortem examinations were occasionally embraced, as no striking deviation from the appearances observed in the autopsies made in Canada occurred, it is unnecessary now to repeat them. The notes of the following cases were taken at the time, by the resident physicians in rotation.

Cases of Malignant Cholera, treated in the Municipal Hospital, No. 7—Situate at the S. E. Corner of Schuylkill 7th and Race streets, from the 28th of July to the 28th of August, 1832.

Case 1st.—Obadiah Morgan, a native of New Jersey, aged 27 years, a river boatman by occupation; occasionally intemperate; was seized with symptoms of Cholera on Friday morning, July 27th, after breakfast, (at which he partook of cucumbers;) the diarrhœa under which he laboured continued throughout the day and night; had constant liquid stools all the night previous to admission. After breakfast, on the day of his admission, he vomited frequently, ejecting principally his food; about half an hour previous to vomiting, he was seized with cramps, chiefly in the muscles of the legs; he was brought from the wharf on Schuylkill—Chesnut street, and admitted at

1 P. M., Saturday, July 28th, into the hospital, No. 7, with the following symptoms, viz.—

Pulse scarcely perceptible; universal coldness of the surface of the body; breath cold; voice sunken, feeble, and sepulchral; cramps in the legs, violent; blueness about the mouth and lower portions of the face; ringing in the ears; tongue moist, cold, and covered with a white fur; adnata of the eyes, of a pearly hue; skin of the fingers, &c., shrunk and corrugated; eyes sunken, and surrounded with a livid circle; countenance haggard and distressed; vomiting and purging had ceased previous to admission; breathing easy; mental faculties entire.

Treatment commenced at 1, P. M.; mustard plasters moistened with spirits of turpentine, were applied to the region of the stomach and to the calves of the legs; bags of heated sand to the lower extremities, with hot bricks to the soles of the feet, and dry heat to the abdomen, as soon as possible after admission, and the following dose of our compound cholera powder, to be repeated at first every fifteen minutes.

℞ Pulv. gum. camph. gr. iij.
gum. opii. gr. i.
Calomel. ppt. gr. iij.
P. carb. ammoniæ gr. vi.

Two of these powders were administered.

2 P. M.—Pulse 120; patient bathed in a profuse and warm perspiration, excepting around the mouth and lower part of the face, which continue cold: complains much of the pain of the sinapisms; is harassed with excessive thirst: breath warm, tongue cold; no cramps or spasms; skin on the hands, &c., still corrugated:—was ordered,

℞ Bi-carb. potassæ ʒi.
Aq. puræ, ℥viij. M

To take a tablespoonful every fifteen minutes.

3 P. M.—Pulse 120; coldness of the lower part of the face has disappeared; tongue warm; breath warm; thirst

continues; complains much of the hot applications. Temperature of the body under the axillæ, &c., 97° of Far.; directed to continue the use of the alkaline solution.

4 P. M.—Pulse 120; cramps have slightly returned, with coolness of the lower part of the face and tongue. Renewed the hot bricks and sand, and administered another compound powder.

5 P. M.—Pulse 120; no cramps; face cold; thirst excessive. Ordered Aq. cinnamomi, ℥i., spts. ammon. aromat. ʒi. Continue the alkaline solution.

6½ P. M.—Pulse the same; coldness of the face, &c., disappeared; surface of the body generally warm: has been sleeping, and complains of feeling too warm. Continues the alkaline solution.

8 P. M.—Pulse 118; restless; without pain; thirst excessive; passed a small quantity of urine for the first time since admission; disposition to spasm has returned; temperature under the tongue and axilla 97°.

9½ P. M.—Disposed to sleep; pulse 112. No disposition to spasm; bowels evacuated by an injection of salt and tepid water, and ʒi. of sal æratus; return of coolness of the tongue and lower part of the face; ordered a repetition of the compound cholera powder.

11 P. M.—Pulse the same; tongue warm; thirst considerable; has slept; temperature under the tongue 98°.

July 29th. 1 A. M.—Pulse 110; sleeps at intervals; has some thirst; is easy in other respects; ordered ℥i. of Spina's elixir, diluted with water.

4 A. M.—Pulse 104; rests well; skin warm and soft; has some thirst; ordered a repetition of the purgative elixir.

5 A. M.—Symptoms favourable; pulse 100; sleeps occasionally; medicine has not yet purged.

6 A. M.—Pulse the same; passed a copious fetid stool of a dirty brown colour; also half a gill of urine.

8 A. M.—Continues to improve; has slept quietly;

pulse 88, full and soft; tongue covered with a yellow fur; the countenance has lost the hippocratic expression of yesterday; the corrugation of the skin has entirely disappeared.

The patient commenced to take light animal food, and on the 30th July, was considered cured. He remained in the hospital for several days discharging the duties of nurse.

Case 2d. Isaac Anderson, a black man, aged forty-three, by trade a coal heaver, employed on the Schuylkill; has had a diarrhœa for a week past; but was seized this morning, August 2d, at 5 o'clock, with vomiting and purging, attended with most violent spasms of the upper and lower extremities. He was admitted into the hospital at 8½ A. M., with the following symptoms, viz. pulse not perceptible at the wrist; violent spasms in the extremities; tongue moist, cold, and covered with a white fur; breath cold; voice weak and sepulchral; skin of fingers and toes corrugated and sodden; purging constant, stools copious and involuntary, liquid resembling rice-water, with flocculi.

Treatment.—Dry heat to the body, hot bricks and sand-bags to the extremities, mustard plaster moistened with spirits of turpentine to the epigastric region, and ℞ spt. ammoniæ aromat. ʒi, aq. cinnamomi ℥i, to be taken immediately; and an injection to be administered, consisting of pulv. sacch. sat. ℈i, tinct. kino, ℥i, tinct. opii ʒij, aq. calid. ℥iv; also to take internally ℞ pulv. opii, gr. ij, pulv. kino, gr. x, sacch. sat. gr. vi, syrup zingeb. ℥i, and a compound cholera powder every fifteen minutes.

Frictions with mercurial ointment and decoction of Spanish flies and oil of turpentine were continued for half an hour without any effect. The dejections, which were so constant and copious, are now restrained: pulse continues scarcely perceptible: complains much of the sinapisms, and of heat, although the surface of the body remains cold: perspires about the head only: the medicines failed to produce the slightest reaction, and the patient died in universal spasms at half past nine, A. M., August 2nd.

Case 3d.—Thomas Black, æt. 29.—Robust constitution: from Arch street prison: admitted at four, P. M., August 2d, with cramp in the stomach, (for which an emetic had been administered in prison:) involuntary and copious stools: universal coldness: colliquative sweat, and sodden fingers: pain in the head, and giddiness: pulse weak, 100 per minute: thirst distressing. Ordered the compound cholera powders, with the alkaline solution: the terebinthinate mustard plaster to abdomen. 7, P. M., pulse 70, and full, with warm perspiration: tongue, &c. remaining cold: dry heat, &c. continued. 8, P. M., Improving: perspiration continues: tongue warm; and the corrugation of the fingers and toes has disappeared.

August 3d.—Took a dose of Spina's elixir, which was once repeated: after its operation took wine and water, and light nourishment.

August 5th.—Discharged, cured.

Case 4th.—Lucy Bradley, æt. 40.—Intemperate habits: admitted August 6th, at 9. A. M., with the following symptoms:—Pulse weak, 120 per minute: skin of the toes and fingers blue and corrugated: voice reduced to whisper: surface of the body cold: tongue cold, moist, and furred: cramps in the inferior extremities: purging constantly: stools of the consistence and appearance of rice water: more or less vomiting: eyes sunken, and of the cholera pearly aspect: head giddy: mind composed. The child of this patient, æt. two years, was admitted at the same time, in the collapsed or last stage of the disease, and died before any remedies could be administered.

Lucy was ordered dry heat, sinapisms, compound cholera powder, sodaic solution, &c. Reaction commenced very shortly after, and she continued gradually improving under the usual treatment, until August 7th, when all symptoms of cholera had disappeared, and mania à potu supervening, she was sent to the convalescent hospital at Bush Hill, where she finally recovered.

Case 5th.—Margaret Cullen, æt. 55.—After eating heartily of meat and potatoes at dinner, was seized with vomiting and rice water purging: admitted into the hospital at 6, P. M., August 13th, with the following symptoms:—Continual vomiting and purging, with cramps: pulse scarcely perceptible: voice not impaired: breath warm: skin warm: tongue cold: fingers corrugated: eyes sunken, &c. Ordered dry heat, sinapisms, compound cholera powders, frictions, simple and medicated, and hot ginger tea for drink.

The system never reacted, and on the 14th the patient died.

Case 6th.—William Campbell, æt. 53.—Labourer from the Shantee; admitted August 12th, 11, A. M. After eating some green peas, was shortly afterwards attacked with vomiting, rice water purging, cramps, thirst, &c. Ordered dry heat, effervescing draught, sugar of lead and opium, to allay irritation of stomach, without the desired effect: compound cholera powders. The patient continued very restless, complaining much of thirst. An emetic of salt and mustard brought off large quantities of fetid matter from his stomach, after which he was much relieved; and finally recovered under the ordinary treatment.

The epidemic Cholera displays too much monotony of symptoms, to render the detail of numerous cases interesting. Of the patients who entered the Municipal Hospital No. 7., in every stage of the disorder, the treatment was occasionally varied in every possible manner—the general plan was on the stimulating principle, but occasionally bleeding, cupping, and other depleting measures were resorted to. The salt and mustard emetic, so successfully used on the European continent, was also resorted to in many instances with decided advantage. Of the numerous medicated ointments and liniments in vogue, we found no particular advantage in them, further than the irritation of the skin which they effected.

The too frequent and long continued application of heat to the surface of the body, was, in many instances, decidedly injurious. Cold drinks, or ice-water, and even frictions with cold water to cold surfaces, were attended occasionally with palliative effects. The gastric irritability was best relieved by small doses of opium and calomel, small doses of Hoffman's anodyne, spirits of turpentine, &c., and irritants to the epigastrium: or where the stomach appeared distended, by the administration of the warm salt water and mustard emetic.

In the Cholerine, or forming stage of the disease, we found no medicine so effectual as the prepared oyster-shell and cinnamon water, made into a julep, with elixir paregoric, gum arabic, and sugar.*

* Regarding the injection of medicated solutions into the vascular system of patients in the last stages of Cholera, together with the transfusion of blood, our personal experience does not authorize their recommendation. That patients have occasionally *escaped* under such treatment, respectable testimony leaves no room for doubt, but that they are ever to be depended upon as safe remedial measures, in like cases, we have no reason to believe. But in anticipation of the use of such vascular injections, we prepared an instrument, free from the very dangerous objection, applicable to most other similar instruments, of the passage of air into the veins, during the operation. This instrument consists in a modification of the French gum elastic cloth injection apparatus, which operates by hydrostatic pressure—a stop-cock being applied to the middle of a silver curved pipe, at the end of the funnel-shaped bag, and the fluid being introduced, the cock is turned, in order to allow the escape of a portion of the fluid, previous to the introduction of the fine extremity of the pipe into the vein; this forces the air before it, and capillary attraction retains the solution in the tube, to the exclusion of the air, when the cock is stopped; the requisite degree of pressure may be kept up, by the gradual introduction of the fluid into the bag, as it flows into the veins; in this manner we intro-

The following table includes numerous cases admitted from the Arch street prison, in a moribund state, and utterly beyond the reach of medicine.

duced several pounds of saline solution into the vascular system of a healthy adult sheep, through the crural vein. The animal suffered no inconvenience from the introduction of air, but died the day following, from the effects of the operation —the blood being rendered unfit to contribute to the various functions of life.

ACCOUNT of Admissions, Results, &c., of Patients at Cholera Hospital No. 7, R. Harlan, M. D. Physician in Chief.

Hospital closed at the recommendation of Dr. Harlan, August 31st, 1832.

No. of Cas.	NAMES OF PATIENTS.	Date of Admission.	PROFESSION.	Age. Yrs.	Sex.	Colour.	Birth Place.	When Attacked.	State on Admission.	Event.	Date of Event.	REMARKS.
1	Obadiah Morgan,	July 28	Boatman.	27	M	White	New Jersey,	July 27	Collapsed	Cured	July 30	Occasionally intemperate.
2	Hugh M'Caffrey,	August 1	Millwright.	36	M	White	Ireland,	" 18	Collapsed	Died	August 2	Intemperate. Case desperate.
3	Thomas Black,	" 2	Labourer.	29	M	White	Philadelphia,	August 2	Collapsed	Cured	" 6	From Arch St. Prison. Intemperate. Transferred to City Hospital.
4	Mary Engles,	" 2	Pauper.	35	F	White	Ireland,	" 1	Typhoid	Cured	" 6	Intemperate. From Prison.
5	Priscilla Robinson,	" 2	Nurse.	42	F	White	Philadelphia,	" 1	Collapsed	Died	" 7	Temperate, with an infant unweaned. Admitted 7 or 8 hours after collapse. After out-door treatment. Died in a typhoid state.
6	Isaac Anderson,	" 2	Labourer.	43	M	Black	Philadelphia,	" 2	Collapsed	Died	" 2	Coal-breaker. Worked at night on Coal Wharves, (Schuylkill.) Desperate.
7	Jane Armstrong,	" 2	Unknown.	40	F	White	Philadelphia,	" 2	Collapsed	Died	" 5	From Arch St. Prison. Intemperate. Died in a typhoid state.
8	Elizabeth Carr,	" 2	Unknown.	32	F	White	Philadelphia,	" 2	Collapsed	Died	" 3	From Prison. Intemperate. Desperate.
9	Japhet Smith,	" 3	Boatman.	36	M	White	New Jersey,	" 2	Collapsed	Died	" 5	From a sand-boat lying at Chestnut St. Wharf, (Schuylkill.) Intemperate.
10	Peter Keyler,	" 3	Pensioner.	76	M	White	Philadelphia,	" 3	Collapsed	Cured	" 6	From Prison. Intemperate.
11	John Keyser,	" 3	Boatman.	35	M	White	Germantown,	" 1	Collapsed	Cured	" 6	From Chestnut Street Wharf, (Schuylkill.) Occasionally intemperate.
12	Joseph Johnson,	" 4	Labourer.	30	M	White		" 4	1st Stage	Cured	" 6	From Prison. Intemperate.
13	Peregrine Sandford,	" 4	Cordwainer.	36	M	White	Philadelphia,	" 2	Collapsed	Died	" 4	From Prison. Intemperate. Third stage.
14	John Dobbins,	" 4	Blacksmith.	30	M	White	Philadelphia,	" 4	Collapsed	Died	" 4	Intemperate. Admitted twelve hours after attack. Desperate.
15	Eliza Riley,	" 5	Unknown.	30	F	White	Philadelphia,	" 5	Collapsed	Cured	" 6	From Prison. Intemperate.
16	Jane Welsh,	" 5	Unknown.	50	F	White	Philadelphia,	" 5	Collapsed	Died	" 5	From Prison. Intemperate. Died typhoid.
17	W. White,	" 5	Labourer.	35	M	Black	Philadelphia,	" 4	Collapsed	Died	" 5	From Prison. Intemperate. Desperate.
18	Thomas Watson,	" 5	Labourer.	50	M	Black	Philadelphia,	" 4	Collapsed	Died	" 7	From Prison. Refused medical aid. Passed into *blue collapse* on the 7th instant, in the evening, and died. Desperate.
19	Thomas Smith,	" 5	Labourer.	29	M	White	Philadelphia,	" 4	Collapsed	Cured	" 6	From Prison. Intemperate.
20	Patrick Keim,	" 5	Labourer.	44	M	White	Philadelphia,	" 4	Collapsed	Died	" 5	From Prison. Intemperate. Desperate.
21	George Comly,	" 5	Labourer.	31	M	White	Ireland,	" 4	Collapsed	Died	" 5	From Prison. Intemperate. Desperate.
22	John Merriman,	" 5	Labourer.	29	M	White	Ireland,	" 5	Collapsed	Died	" 5	From Prison. Intemperate. Desperate.
23	James M'Callion,	" 5	Clerk.	19	M	White	Ireland,	" 5	1st Stage	Cured	" 6	From Prison. Intemperate.
24	John L. Moore,	" 5	Unknown.	19	M	White	Washington,	" 5	1st Stage	Cured	" 7	From Prison. Intemperate.
25	W. Taylor,	" 5	Cordwainer.	29	M	White	Frankford,	" 5	1st Stage	Cured	" 6	From Prison. Intemperate.
26	Helen Dwyning,	" 5	Unknown.	40	F	White	Ireland,	" 5	Collapsed	Died	" 6	From City. Intemperate. Desperate.
27	Helen Hanna,	" 5	Cook.	24	F	White	Ireland,	" 5	Collapsed	Died	" 7	From Prison. Died in Typhus Fever.
28	John Russell,	" 5	Turnkey at Pris.	35	M	White	Philadelphia,	" 5	Collapsed	Died	" 5	Admitted moribund.
29	Edmund Taylor,	" 5	Steward.		M	White	England,	" 6	1st Stage	Cured	" 7	Temperate and healthy habits.
30	Lucy Bradley,	" 5	Servant.	40	F	White	Ireland,	" 6	Collapsed	Cured	" 6	From Market St., near Schuylkill. Transferred to City Hospital with Mania à Potu. Intemperate. Cured of Cholera symptoms.
31	Bradley's Child,	" 6		2	M	White	Philadelphia,	" 6	Collapsed	Died	" 6	
32	Hugh M'Gonegal,	" 6	Labourer.	13	M	White	Philadelphia,	" 6	Collapsed	Died	" 10	Typhoid state.
33	Margaret Stewart,	" 6	Servant.	24	F	White	Ireland,	" 6	1st Stage	Cured	" 7	Transferred to City Hospital.
34	Sarah Thompson,	" 7	Servant.	16	F	Black	Philadelphia,	" 6	1st Stage	Cured	" 7	Returned home.
35	David Larned,	" 7	Blacksmith.		M	White	Philadelphia,	" 7	1st Stage	Cured	" 8	Transferred to City Hospital.
36	Robert Moore,	" 8	Boatman.	42	M	White	Philadelphia,	" 8	Collapsed	Died	" 8	Intemperate.
37	Samuel Mills,	" 8	Boatman.	18	M	White	Philadelphia,	" 8	Collapsed	Died	" 8	Temperate.
38	Margaret Shorten,	" 9	Nurse.	31	F	White	Ireland,	" 9	1st Stage	Cured	" 9	Intemperate, occasionally.
39	Jane Fullerton,	" 9	Nurse.	55	F	White	Ireland,	" 9	2d Stage	Died	" 15	Debilitated constitution. Occasionally intemperate. One of our Hospital Nurses.
40	Robert Radcliffe,	" 9	Mechanic.	42	M	White	Philadelphia,	" 9	Collapsed	Died	" 9	Intemperate.
41	Darby Farrol,	" 10	Labourer.	45	M	White	Ireland,	" 10		Died	" 10	Intemperate.
42	Hugh Lee,	" 11		12	M	White	Philadelphia,	" 11	Collapsed	Died	" 11	
43	Margaret M'Farlan,	" 12		44	F	White	Ireland,	" 12	Collapsed	Died	" 13	Intemperate.
44	Margaret Peterson,	" 12	Washerwoman	43	F	Black	Philadelphia,	" 8	2d Stage	Cured	" 1[illegible]	
45	William Campbell,	" 12	Labourer.	53	M	White	Philadelphia,	" 12	1st Stage	Cured	" 12	Rather intemperate.
46	Charles Carlisle,	" 12	Matmaker.	23	M	Black	Philadelphia,	" 12	Collapsed	Died	" 12	Intemperate, occasionally.
47	Roderick Waller,	" 12	Mechanic.	39	M	Black	Philadelphia,	" 12	1st Stage	Cured	" 12	Intemperate, occasionally.
48	Margaret Wood,	" 12	Washerwoman.	23	F	White	Philadelphia,	" 11	2d Stage	Reliev.		Discharged by her own request.
49	Mary Cullen,	" 13		52	F	White	Philadelphia,	" 13	Collapsed	Died	" 14	Very infirm.
50	Oliver Akins,	" 15	Labourer.	54	M	White	Philadelphia,	" 15	1st Stage	Cured	" 15	Occasionally intemperate.
51	Matilda Gilchrist,	" 15		32	F	White	Philadelphia,	" 5	Collapsed	Died	" 15	Typhus. Half-starved.
52	John Rudolph,	" 15	Labourer.	30	M	White	Ireland,	" 15	1st Stage	Reliev		Transferred by request.
53	John Campbell,	" 16	Labourer.	40	M	White	Philadelphia,	" 16	1st Stage	Cured	" 17	Drinks, occasionally.
54	John Griffiths,	" 16	Vagrant.	29	M	White	Ireland,	" 16	1st Stage	Cured	" 17	Found drunk, in Broad, near Vine street.
55	Benjamin Atkinson,	" 17	Labourer.	37	M	White	New Jersey,	" 16	Collapsed	Died	" 17	Very intemperate.
56	Barney Conway,	" 17	Labourer.	60	M	White	Ireland,	" 17	1st Stage	Cured	" 18	Occasionally intemperate.
57	John Sproat,	" 17	Vagrant.	55	M	White	Ireland,	" 17	1st Stage	Cured	" 19	Very intemperate. Found drunk in street.
58	Michael Baum,	" 18	Quarryman,	19	M	White	Ireland,	" 17	Collapsed	Died	" 18	Perfectly sober.
59	Mary Ann Levering,	" 18	Vagrant.	25	F	White	Philadelphia,	" 11	2d Stage	Cured	" 20	Very intemperate.
60	Francis Carrabee,	" 18	Labourer.	25	M	White	Philadelphia,	" 18	1st Stage	Cured	" 20	Intemperate.
61	Robert Gilchrist,	" 19		8	M	White	Philadelphia,	" 19	Collapsed	Died	" 20	Came from an impoverished and filthy home.
62	Ann Gilchrist,	" 19		7	F	White	Philadelphia,	" 19	1st Stage	Cured	" 20	Came from an impoverished and filthy home.
63	Gilchrist, Infant,	" 19		2 m.		White	Philadelphia,	" 19	1st Stage	Cured	" 20	Came from an impoverished and filthy home.
64	Roderick Glanscy,	" 20	Furrier.	23 yr	M	White	Ireland,	" 20	1st Stage	Cured	" 21	Temperate.
65	Edward Owens,	" 20	Porter.	64	M	Black	Philadelphia,	" 20	2d Stage	Died	" 21	Intemperate.
66	John Lowden,	" 23	Mechanic.	36	M	White	Philadelphia,	" 22	1st Stage	Cured	" 24	
67	Rosey M'Donriek,	" 23	Servant.	30	F	White	Ireland,	" 23	1st Stage	Cured	" 26	Intemperate.
68	James Doubleday,	" 24	Mechanic.	40	M	White	England,	" 24	1st Stage	Cured	" 27	
69	Louisa Stiffler,	" 24	Servant.	19	F	White	Philadelphia,	" 24	1st Stage	Cured	" 27	
70	Patrick Glackin,	" 25		5	M	White	Ireland,	" 25	Collapsed	Cured	" 28	
71	Elias Mulin,	" 25	Labourer.	30	M	White	Philadelphia,	" 23	2d Stage	Cured	" 28	
72	Sarah Barnes,	" 25	Servant.	44	F	White	Philadelphia,	" 22	Collapsed	Died	" 27	Intemperate.
73	George Phillips,	" 26	Labourer.	63	M	Black	Philadelphia,	" 26	Collapsed	Died	" 26	Intemperate.——Total admitted, 73.—Cured, 38.

To face page 626.

De Conceptione Experimentum.

Tametsi persæpe inter proverbia philosophica usurpatur illud,

"*Plus valet unus affirmans quam mille negantes,*"

tamen exitus experimenti quod referemus, quanquam recte affirmandi vim non habens, nihilominus propter difficultatem rei—tanta obscuritate involutæ natura; physiologiæ curiosis, non omnino memoratu indignus esse videatur.

De modo operandi inter semen masculinum et vaginam muliebrem ; tres sunt variæ opiniones.

1. Imprimis credunt aliqui semen maris quodam quasi mutuo affectu, aut aliquo consensu partium simulæ impresserit vaginam, per nervos statim ad ova in ovariis adhuc retenta vim suam perferre.

2. Alii deinde liquorem fœcundantem à vasculis vaginæ sorberi volunt, in ovaria *illico* transmittendum.

3. Multi denique semen pariter à vagina sorberi concedunt; subinde ab ovis, singulari quodam affectu, non recta via, sed per communem sanguinis circulationem, attrahendum. Harum opinionum prima communi physiologorum ætatis nostræ consensu repudiatur. Plerisque enim contactu ipso inter se seminis et ovi opus esse videtur. Namque hoc propositum variis generandi rationibus, et plantarum et animalium, longo multoque labore huc usque detectis, maxime constare affirmant.

Secundum propositum qui tenent quædam indicia à medico Germanico nuper deprehensa, in vaginis vaccæ et suis; vasculorum nempe sorbentium multis cum ramusculis in superficie interna vaginæ extensis atque ad ovaria spectantibus; maxime ad opinionem suam confirmandam valere existimant.

Tertiæ vero sententiæ fautores, haud ullis experimentis, argumentis vero *per consequentiam* deductis, eam confirmare voluerunt; namque ova vasculorum sorbentium, tam vaginæ, quam intestinorum, appetentiam quandam singularem habere putant, qua propria sibi alimenta vindicare, cætera excludere, possint. Addunt quæ pubertatis ætate, tam admiranda in marsibus obveniunt; barbæ, scilicet, incrementum; vocis sonum graviorem, universamque morum mutationem quorum omnium eandem causam, secretionem de testiculis, tum primum editam inque sanguinem absorptam, perhibere solent.

Aliud etiam argumentum adducunt exemplum proferentes eorum animalium quæ, quo tempore anni in venerem pruriunt, simili seminis absorptione, fœtide et quasi odore seminali olent, dum caro mactatorum saporem fert gustui intolerabilem. Additur ut si coitus non concedatur in furorem salacitatis hæc animalia nonnunquam coacta sunt.

His aliisque argumentis sibi persuaserunt, ut si stimulo venereo *mares* tam vehementer afficiantur, *feminæ* nimirum, semine masculino in vaginas recepto, inque sanguinem absorpto, simili modo quanquam non *eadem* ratione offici possent. Hic enim consistit actio seminis, in fœcundatione germinum, id est ovorum, illic, in mutationibus corporis.

Quum coitus bene evaserit totum corpus feminæ per biduum, triduumve sub actione quadam magna et insolita laborare videtur. Oris forma mutatur; oculi languidiores fiunt; pulsus crebriores. Animus facilius excitatur, donec totis viribus novi stimuli in ovaria ad extremum conversis, stabilitatur conceptio novo cum ordine appertuum. Ut hujus opinionis fundamenta exploraremus aut saltem ut inoculationis seminalis vim perhiberemus hæcce experimenta instituimus: viz. Die quinto Martis, A. D. 1834.

Canis venatica alba, ad lasciviam valde propensa, quæ anno superiore catulos primum ediderat, in tugurio aliquot dies retenta, et seorsim a maribus bene custodita fuit, usque dum amore maxime calefieret. Tum ad eandem idoneo modo vinctam, masculus canis subsidens [a setter] valde animosus et notis propriis signatus exiguo intervallo adeo ut non coiret admissus est. Ibi dum stimulis venereis maxime ambo excitabantur drachmam circiter seminis masculini obtinuimus, et per incisionem jam antea factam in superiore parte femoris interni canis feminæ syringe injecimus. Vulneris labia extemplo conjuncta sunt, semenque celeritur absorptum.

Die sexto Martis, 1834.

Idem experimentum iteratur in altero femore ejusdem canis substituto solum cane masculo indagante [a terrier] in loco canis subsidentis.

Die octavo ejusdem mensis.—Proluvies sanguinea vaginalis adhuc fluit, autem externa labia pudendi, minus sunt tumida atque colore pallido. Sexto jam die prurivit canis.

Die nono ejusdem mensis.—Aliquantulum sanguinis stillicidium huc usque apparet, externa vero caloris insignia cesserunt.

Per caute custoditum fuit animal per totum tempus experimenti.

Certe pro fautoribus inoculationis seminalis, non tam prospere evenerunt injectiones nostræ, quam eæ quas fecit celeberrimus Spallanzanius qui, syringe, paululum seminis canis masculi in vaginam caniculæ tres catulos eam edere fecisse dicitur.

Quanquam de unius experimenti exitu, non liceat omnino inoculationis rationem falsam prædicare; tamen dicere possumus naturam humanis consiliis terminos posuisse, quos non transilire licet ubicunque magno suo mandato, "*fœcundi sitis et multiplicamini,*" interveniremus.

Notes and Reflections on the Reproductive Function.

The following notes were made some years since, during an extensive and various course of reading on the function of generation, preparatory to a contemplated series of experiments for a memoir on this most abstruse of physiological questions. This object has been so long deferred, that its future attainment is doubtful; in the mean time, the facts and observations are placed at the disposal of our readers: should any one of whom hereafter "attempt this bow of Ulysses," he will find the curious facts thus collated and noted, worthy of his attentive consideration.

Bonnet remarks, (Vide Contemplations, &c., p. 295, Let. 2d to Spallanzani,) "should some able physiologist ever undertake to compose a complete history of generation, he would undoubtedly begin by a delineation of the *amours* of animals and plants, and, if a great painter, he will be able to engage the understanding, without giving any alarm to modesty; he will produce, not a physical *Venus*, but a physical *Minerva*. There is room for supposing that the different modes of fecundation observable in different animals, bears some relation to their capacity of enjoyment. What a contrast in this respect between the fish and the salamander, and the ape, the stag, and the dog; and in the imperial race of man, how is the physical part modified by the moral!"

We cannot but admire the extreme modesty of Bonnet, in thus reflecting on his favourite hypothesis, "Tout ce que je viens d'exposer sur la génération, on ne le prendra, si l'on veut, que pour un Roman. Je suis moi même fort disposé à l'invisager sur le même point de vue. Je sens que je n'ai satisfait qu'imparfaitement aux phenomènes, mais je demandrai si l'on trouve que les autres hypothèses y satisfaissent mieux." (Vide Considerations sur les corps organisès, Vol. I. p. 24.)

In his dissertation on the generation of plants, Spallanzani has demonstrated, that in the *Spartium junceum,* (Rushy-twigged broom,) the embryos do not appear until after the falling off of the flowers, and consequently not until after fecundation; though the seeds, or to speak more properly, the integuments of the seeds, may be seen in the ovarium long before.—p. 321.

From observations made on the germination of two species of the pumpkin, viz. *Cucurbita melopepo,* and C. *citrullus,* of Linn., Spallanzani discovered, by destroying all the male flowers, (the plant being monoicous,) that the fructification in these plants does not, in any degree, depend on the powder of the stamen. (Vide Dissert. 3d, Vol. 3d.) Experiments made on the *Cannabis sativa,* (Hemp,) and *Spinacia oleracea,* (Spinach,) conducted to similar results. The author was perfectly aware of the fact, that male flowers are not unfrequently found on female individuals of monoicous plants, as remarked by Haller, Linnæus, Duhamel, &c., and observed the necessary precautions.

It is asserted, by some authors, that the *Juniperus Canadensis* is alternately one year male, and the next year female. Can this fact be made to elucidate this anomaly? or are we to conclude from these experiments, that certain plants are generated altogether by the female, without the agency of the pollen? or are we only presented, in these curious exceptions, with anomalies analogous to the generation of the *Aphides,* &c., in which one impregnation suffices to fecundate the eggs for several generations? Spallanzani did not continue his experiments further than was necessary to prove that the ovulæ produced in the plants mentioned, were prolific at least for two generations, without the influence of the pollen; but, be the question settled as it may, it is only exchanging one mystery for another.

Similar experiments repeated on the *mercurialis annua*, of Linn., another monoicous plant, were entirely unsuccessful; hence this principle does not prevail in all that family. p. 379, Diss.

Biron de Buzariengues, has endeavoured to explain this anomaly, by demonstrating that the hemp, &c., may become from monoicous, to be diorchous, or even polygamous. (Vide Annal. des Sc. Nat. Vol. 24. Memoire sur les rapports des sexes dans les Regne vegetal.)

Views somewhat similar have been offered in explanation of Bonnet's pretended "virgin mothers," as exemplified in the generation of the Aphides, &c. These insects are supposed to become androgynous, during the warm season.

A single female *Puceron*, (Aphis, Plant-louse, or Ants-cow,) once fecundated by the male, produces eggs, which give forth pucerons, which are themselves capable of generating, independently of the male, even to the ninth generation—all of these generations being female, excepting the ninth, which includes males. This fact has been proved by Reaumer and Bonnet, by repeated observations. Spallanzani has observed analogous facts relative to the *Helix vivipara*.

Those eggs of the Puceron which are the immediate produce of the union of the sexes, are destined to withstand the winter, as they possess more vitality than the others.

The same fact has also been observed, by Jurine, in the

Water-flea, (Monoculus apus,) in which there occur fifteen generations without copulation. Audebert assures us, that a female spider is fecundated for at least *two years* by a single copulation.

Some plants, (as observed above,) are one year male, another year female; sometimes fecundator, at others fecundating. (Vide Article Sex, and Generation, Dict. des Sc. Med.)

The *manner* in which the pollen of vegetables arrives at, and operates on the ovulæ of female plants, is similar in all vegetables, however different the structure of the male and female reproductive organs. (Brongniart, Ann. des Sciences. Nat. t. 24. p. 125.)

In the Plant-louse, Bonnet observed ten generations in three months; whereas, Spallanzani remarks, it would require as many years for a similar number of generations in the Spinach and Hemp; he observed three generations only in plants, independently of the aid of pollen.

For an account of the obscurity which prevails in vegetable generation, Vide Spallanzani, Dissert. 3. p. 432, where he expresses doubts whether the seeds in the ovarium may not be fecundated by some seminal principle residing in the pistil.

Some vegetables appear to be *viviparous.* Some years ago, an *Agave* in the Jardin du Roi, was observed to grow twenty-seven feet in six weeks: it was expected that it would finish by inflorescence, but in place of which, a species of bulbs was produced, which falling to the ground, instead of germinating like seeds, immediately took root. (Vide Princip. de Physiol. Comparée, Bourdon, p. 60, 1830.)

Vegetables propagated by engrafting, lose in time the faculty of semination.

One of the most remarkable conclusions connected with the very curious and important experiments of Spallanzani, on the generation of amphibia, is the opinion he maintains of the existence of the *tadpole* in the ovaries of the frog, toad, &c., *anterior to fecundation!*

During the first part of the second day after the fecundation of the eggs of the toad, Spallanzani admits that the germ displays neither head, tail, spine, mouth, gills, nor any characteristic feature of the tadpole, and yet he persists in naming this formless mass a tadpole, and argues from it the pre-existence of the germ! (Vide Dissert. p. 159.) Such deductions are none the less illegitimate, though apparently supported by the justly distinguished names of Swammerdam, Haller and Bonnet.

One of the fundamental principles of Spallanzani is, that the young animal belongs exclusively to the female, whilst the male only furnishes a fluid, which determines them to assume life and motion. (Vide p. 203.) But the author admits that the tadpole [ovum] grows considerably from the time at which it is at first visible, and as he grants that growth implies nutrition, nutrition the circulation of fluids, and that the circulation in this animal depends on the pulsation of the heart, our Pavian philosopher infers by specious induction, that the germ, previous to fecundation, possesses both a heart and circulating system: nevertheless, such an inference is directly repugnant to fact, as any one may convince himself by observing the process of incubation in the chicken. In the egg of the hen, the first dot, the earliest perceptible streak of blood, which precedes the existence of the pulsating organ, is recognisable only after fecundation and exposure to blood heat. It is true, that the germs in the ovaries increase in size and arrive at perfection *as germs* or ova, but then this is to be considered as a property which they possess in common with the organs of the female, of which they constitute a part, and not by any independent or specific organization of their own. Thus, in the frog, we are unable to discern any ova in the ovaries during the first year of their existence; in the second year, however, there exist two sets of ova; one larger, for the procreation or fecundation of the present year, and one smaller, for the season following.

It is scarcely to be credited, that such observers of nature as Spallanzani, Vallisneri, Haller, Bonnet, &c., should have attributed the existence of heart and blood-vessels to these immature germs, from the moment they commenced growing. Yet such is the inference which necessarily attaches itself to the mode of reasoning which they have adopted. "I therefore conceive," says Spallanzani, "that previous to the influence of the semen, there was the beginning of motion and life, but in a degree exceedingly slow and languid, from the extreme slowness of the movement of the fluids." (p. 206.)

By reference to the generation of the chicken it can be readily demonstrated, that the only growth of the germ or yolk which takes place previous to fecundation, is whilst it remains attached to the ovary: the albumen, together with its membrane and shell, are all added during the progress of the yolk from the ovary to the uterus, through the oviduct. In the eggs of the frog, also, the gluten, and probably the membranes, are added by the oviducts.

"In the economy of the reproduction of the species of animals, one of the most important circumstances is the aëration of the ovum, and when this is not performed from the blood of the mother, as in the mammalia, by the placenta, there is a system for aërating, as in the oviparous reptiles or fishes, which enables the air freely to pass through the receptacles in which the eggs are deposited, or the egg itself is aërated out of the body, through its coats or shell, and when air is excluded, incubation or artificial heat has no effect. Fishes, which deposit their eggs in water that contains only a limited portion of air, make combinations which would seem almost the result of scientific knowledge or reason, though depending upon a more unerring principle, their instinct for preserving their offspring. Those fishes that spawn in spring or the beginning of summer, and which inhabit deep and still waters, as the carp, bream, pike, tench, &c., deposit their eggs upon aquatic vegetables, which by the influence of solar light constantly preserve the water in a state of aëration. The trout, salmon, hucko, and others of the Salmo genus, which spawn in the beginning or end of winter, and which inhabit rivers fed by cold and rapid streams which descend from the mountains, deposit their eggs in shallows on heaps of gravel, as near as possible to the source of the stream, where the water is fully combined with air; and to accomplish this purpose, they travel for hundreds of miles against the current, and leap over cataracts and dams: thus the Salmo solar ascends by the Rhone and the Aar to the glaciers of Switzerland; the hucko, by the Danube, the Isar, and the Save, passing through the lakes of the Tyrol and Styria, to the highest torrents of the Norie and Julian Alps. The Clupea mosa or common shad of North America, ascend the great rivers early in spring, to the highest streams, to deposit their eggs, and perhaps to end their existence."—*The Last Days of a Philosopher, p.* 191.

From these general facts, predicated on actual inspection, and sanctioned by experience, as well as from others hereafter noticed, we would be led to infer, that not only are the germs increased in size by nutrient particles derived from the female, but that the ovaries have the faculty of originally producing or creating the germs or ova themselves: hence, in many of the inferior animals, there can not be observed the slightest signs of their existence in the ovaries of the female previous to maturity, or until the individual is prepared for reproduction. Witness the immense disparity of size which exists in the ovaries of certain oviparous animals, at different seasons of the same year—the millions upon millions of the rudiments of shad and herring, which exist in the ovaries of each individual female during the season of their amours! Can it be conceived that germs, or rudiments of these germs, pre-existed in the preceding generations, or even in the present individuals previous to the secretion, formation, or generation of them by the ovaries of the individual? To us it appears no more difficult to conceive of the secretion of the germ by the ovaries—organs expressly adapted by the economy of nature to the purposes of reproduction—than that bile should be formed by the liver, or urine by the kidney.

"As long as the uterus is capable of becoming impregnated, it appears that ova are continually formed in the ovaries."—Vide Mayo's Outlines of Physiology, Lond. 1827.

The *corpora lutea* are the beds in which the ova grow. According to the observations of Sir E. Home and Mr. Bauer, the corpus luteum consists of a yellowish granular substance, and has a central cavity in which the germ is detected, partly adherent, partly surrounded with blood.

In the body of a young woman twenty years of age, with a perfect hymen, these authors examined a corpus luteum; the ovum was an oval body $\frac{15}{200}$ of an inch in length, less than $\frac{5}{200}$ in breadth, somewhat contracted in the centre, transparent, imperfectly covered by a membrane by which it adhered to the *corpus luteum*. The fallopian tube was fuller on the side towards the ovum. The fimbriæ were spread out and unusually vascular. No sexual intercourse had taken place.—Vide Philos. Trans. Lond. vol. 108, p. 61. Mr. Bauer thinks that he has ascertained by subsequent observations, that the corpus luteum, when the ovum is fit to become fecundated, bursts and expels its contents, and in time shrinks and disappears. Thus, like other animals as well as plants, the human female prepares an ovum *previously* to impregnation.

"Generation may be considered as a species of primitive *nutrition*, as ordinary nutrition is a species of partial generation in each organ of the body: for example, the claw of the lobster, the tail of the lizard, the limb and eye of the salamander, &c., amputated or destroyed, is regenerated by nutrition solely: here is a case of true generation effected by nutrition. To engender and to nourish are nearly the same function, one applying to the individual, the other to the species"—Dict. des Sc. Med. Art. Generation.

The production and evolution of the egg constitutes but a part of the mystery of the great system of elaboration and assimilation—of that miraculous faculty of organized beings, which enables them to eliminate from elementary principles the materials of their construction: one of the middle links of that chain of causation, by which plants vegetalize minerals, animals animalize vegetables, which enables the latter, even from simple gluten to elaborate bone, tendon, muscle, skin, hair, horn, together with numerous acid and alkaline principles, many of which had no existence in the food of the animal.

The reproduction of the eye of the salamander, with all its coats and humours, when that organ is completely destroyed, presents us with even a greater degree of reproductive energy.

Such are the considerations which lead us to reject the conclusions of the authors above quoted, viz. "I shall therefore, with them," continues Spallanzani, "consider the seminal fluid as a stimulus, which, penetrating to the heart [of the germ or tadpode,] and powerfully irritating the internal parts, excites more frequent and stronger pulsations, whence arises that manifest extension of parts, and that animation which ever follow impregnation."—p. 209.

The phenomenon witnessed in the production of hybrid animals and vegetables, together with the hereditary diseases, similitude in form, feature, and action—monstrosities and blemishes, with other peculiarities of organization which are so constantly observed to exist between the *male* parent and offspring—derive but a very indifferent solution from a theory which considers the seminal fluid as a mere "stimulus, which, penetrating to the heart [an organ which has not as yet been called into existence,] and powerfully irritating the internal parts, excites more frequent and stronger pulsations."

Spallanzani affirms, (p. 207,) that the absolute contact of the semen masculinum with the ovum, (tadpole,) is necessary, or that the fluid semen must pass through the gluten which envelopes the egg, as well as three membranes between the gluten and the liquor amnii, which surrounds the germ proper, (or tadpole,) in order to produce that animation by penetrating the "tadpole," which he considers the semen incapable of doing by mere contact with its coats; though he appears to have possessed no definite notions as to the mode of transmission.

It is not improbable that the new light elicited by the discovery of a principle in physics, denominated *Endosmosy* and *Exosmosy*, will lead to a philosophical solution of the problem in question. The Daltonian theory was also unknown in those days. One of the most curious facts connected with the subject under consideration, consists in the almost inconceivable minuteness of the portion of semen masculinum which is sufficient to produce the most extensive fecundations—it having been clearly demonstrated by Spallanzani, that a single drop of fecundating fluid, taken from the solution of only three grains of semen in a pint of water, is fully adequate to fructify many thousands of eggs.

Both from experiment and induction, we are warranted to conclude, with Spallanzani, absolute contact of the semen masculinum of animals, and the pollen of plants, with their respective germs, to be a *sine qua non* to fecundation: which conclusion alone corroborates, in a great measure, the doctrine of the Epigenisist, which doctrine implies a commixture of the fluids of both sexes, or of the semen masculinum with the fluids of the ovum.

But there are other phenomena derived from our researches in comparative anatomy, which draw a veil of impenetrable mystery over the function of reproduction, or which, at least, are left totally unexplained by any of the theories of generation hitherto advanced.

No less extraordinary and untenable is the doctrine maintained by Haller, in relation to the eggs of birds. The philosopher of Berne rejected the views of the *Spermatists*, and thought he had established the theory of the *pre-existence* of the germ in the ovaries of the chicken; he considered the membrane which surrounds the yolk as part of the fœtus: the *inner* membrane of the yolk he regards as a continuation of the inner coat of the prima via; the *external* membrane as the external coat of the same: "therefore, as the yolk and its membranes exist in the ovaries, previously to fecundation, *the germ pre-exists.*" The premises being false, or at least, resting on a "petio in principio," the deductions are illegitimate and void.

That the membranes of the yolk constitute a necessary part of the ovum, is not to be denied; and that vessels of the umbilicus, connected with the intestines of the fœtal chick, enter the yolk, for the purpose of nutrition, is a fact well established; it is equally true, that at the end of incubation, the yolk is either completely elaborated, or else enters the abdomen of the chick through the umbilicus, and is in a few days entirely absorbed; yet we are forced to conclude, that the yolk and its membranes are no more entitled to be considered as a part of the fœtus, than the food of an animal is a part of that animal, previous to assimilation. Agreeably to Haller's theory, the mucus, gelatine, or albumen, which surrounds the egg of the frog, and which Spallanzani found absolutely requisite to fecundation, must also be considered as part of the fœtus, or tadpole, inasmuch as the vessels of the fœtus appear to derive nutrient principles from it, through the medium of the liquor amnii, perhaps upon the principle of Endosmosy, as before alluded to.

Spallanzani himself admits, that in the ova of the amphibia, previous to fecundation, there does not exist the slightest appearance of organization, "for we see nothing but spherules, consisting of a cover, or skin, filled with a semifluid matter." Vide Diss. p. 390. Further, "during the first hours of incubation, the *organization* of the chicken is not perceptible." p. 389.

Among the most celebrated of the supporters of the theory of the *pre-existence* of the germ, are found the justly distinguished names of Malphigi, Bourguet, Swammerdam, Cheyne, Bonnet, Haller, Spallanzani, and Senebier. The advocates of this doctrine suppose the existence from the beginning of the creation, of the germs of all the organized beings which exist, which have existed, and which shall hereafter be developed. Each acorn, for example, they say, contains within its shell a miniature oak, with its roots, stem, leaves, branches, and seeds; these miniature, or rudimentary seeds, enclosing others ad infinitum, "Nous avons donc tous vécus depuis six mille ans avec les animaux, les animalcules, et les plantes, qui sont nos contemporains." (Vide Senebier Histoire des etres organisés avant leur fecundation.) Senebier himself, offers an insuperable objection against the theory of the pre-existence of the germ: "Si le fétus se develloppe un peu avant la fecundation, pourquoi ne se develloppe-t-il pas entièrement?" He attempts to explain this anomaly by attributing a greater degree of susceptibility for nourishment to the fœtus [ovum] subsequently to fecundation. (ut supra, p. 53.)

According to this same author, "a *fluid* cannot be an organized body, and that if the fœtus exists at all previous to fecundation, it must be in all respects organized like those bodies, to which it is to give rise by development."

Swammerdam remarks, that "the theory of the pre-existence of the germ, explains the reason how Levi, being yet in his father's loins, paid tithes long before he was born, for he was in his father's loins when Melchisedeck met Abraham;" even original sin, he says, may stand on this principle, since all mankind have been laid up originally in the loins of their first parent. (Vide Book of Nature, p. 16. A work which contains valuable plates on the Anatomy of Insects, but his physiology has become obsolete.)

We have seen that the supporters of the theory of the pre-existence of the germ, maintain that the germs do not only exist independently of fecundation, but that they are an integrant part of the whole animal; but as it is physically impossible that the germs of all the eggs, individually and collectively, which are annually produced in such amazing numbers, in various animals, as in the shad and herring, for example, could pre-exist, we must suppose that the germs when fully perfected in the ovaries, or these organs themselves, are endowed with the capacity of secreting or reproducing germs.

We find an approximation to this idea in the work of Bonnet. "For example, a seed of the elm tree, contains the tree to which it is to give rise, with all its branches, seeds, &c., each of which repeats the same phenomenon in miniature. The same rule applies to the branches, and the fœtuses of animals, for the successive races to which they may give birth."

Lamark denies that the seed or germ contains all the parts in miniature of the mature plant or animal. "The acorn cannot contain all the parts of the great oak, because these parts are only formed at the close of successive generations of the annual individual which have lived upon the common body, constituted by the trunk and branches of the tree."

Haller and Spallanzani were of the opinion, that the semen masculinum acted as a stimulus only, in the process of fecundation: Bonnet believed that it acted also as a nutrient: to which Spallanzani urged as an objection, the exceeding minuteness of the quantity of semen sufficient for fecundation. The atomic theory of Dalton was unknown at that epoch, or possibly some solution of this difficulty might have been referred to it.

Peculiarity of external form and internal organization, as well as hereditary diseases, are transmissible from father to son; and the mule resembles the ass as much as it does the horse; which appears to indicate that each parent has substantially and materially combined to form the new being, and not that the semen has merely furnished a peculiar stimulus to establish life, and those curious phenomena constituting individuality. The resemblance so frequently observed between father and son, mother and daughter, in external form and internal organization, can only be attributed to the original union of semen and germ, inasmuch as these resemblances, &c., are equally observed in oviparous animals, and those too in which fecundation is effected out of the body.

We have already alluded to the pretended discovery of Haller, on which he predicated his theory of the pre-existence of the germ; an opinion which this illustrious author admits is more or less conjectural. "Other anatomists, not less celebrated or less worthy of credit, have taught that the fœtus existed in the mother and maternal ovaries; that the semen masculinum excites it into more active life, and likewise influences it variously, but that it finds it always existing and present: for yolks are manifestly found in the female ovary, even although they have not been subjected to any male influence: but the yolk is an appendix to the intestine of the chick, and derives its arteries from the mesenteric artery, and the membrane of the yolk is continued from the nervous membrane of the intestine, which is continuous with the skin of the animal. In the hen, therefore, the fœtus seems to be present along with the yolk, which is a part of it, and receives vessels from it." (Vide Haller. First Lines, p. 433.) Yet in the same page occurs the following sentence, apparently so contradictory: "What first appears distinct and formed in the egg during incubation, are *venous circles*."

We do not hesitate to pronounce as a gratuitous assumption, the existence of blood, heart, or blood-vessel of any description, or any membrane as part of the fœtus, previous to fecundation. The ablest supporters of this theory grant, that the existence of such organization has never been optically demonstrated.

It is true that the umbilical vessels of the fœtus when formed, ramify on the membranes of the yolk, as well as another set of vessels which run from the umbilicus to the large end of the egg, on the membrane in contact with the air confined at that part; but if the yolk be considered part of the fœtus, so also is the membrane at the butt end of the egg! The theory, however, is totally at war with the facts of the case, as well as at variance with all the analogies derivable from the whole scale of animated creation: it leaves totally unexplained the resemblance between father and son, the production of mules, and the existence of hereditary diseases, detailed by both parents to their offspring.

Equally at variance with fact are the supporters of this doctrine, when they assert, that the frog can be distinguished beneath the integuments of the tadpole, the butterfly in the chrysalis, the oak in the acorn, &c. The limbs of the tadpole are protruded in miniature, and gradually increase by natural growth, in proportion as the tail and some other parts become absorbed. Besides, it is well known, that the snail can reproduce its head after decapitation, and the salamander its eye, with all its coats and humours. Are these animals, then, originally produced with a duplicate of these organs *pre*-existing in the germ?

The stem of the plum tree grafted on a peach tree always produces plums; some worms may be divided into as many pieces as there are rings in their bodies, and each separate piece may become a perfect animal; each twig of the plum tree, and each ring of the worm, must contain the elements or germs of many perfect individuals, or must possess the power of forming new ovaria, endowed with powers equivalent to the secretion or creation of germs.

But, inasmuch as matter must at last be reduced to its ultimate atom by infinite division, the theory of the pre-existence of the germ, forces us to the conclusion that organic bodies inherit in themselves collectively, the laws of their own annihilation; this would be to encroach upon the wisdom of omniscience, as it supposes the necessity of a new creation of each species of animal and plant, or else a relapse into that anarchy and chaotic confusion from whence harmonious order originally sprung.

In the examination of the fossil reliquiæ of former worlds—those revelations of nature indelibly impressed upon the rocks, and which testify to the revolutions to which our planet has been subjected, we observe that the work of creation has been progressive, rising from the simple to the more complex structures in plants and animals; many groups of genera and species have been annihilated, and new forms created, yet, in no instance are we led to believe that individual species have been destroyed and subsequently regenerated; but, for the most part, at each grand cataclysm, new plants and new animals have appeared, with new forms, organs, structures, and instincts, calculated to advance them in the scale of perfection, or to adapt them to the improved state of the earth's surface.

A question of exciting interest here presents itself to the consideration of the philosophic mind—have created beings at length attained the acmé of organic structures? is man really "the lord of the creation?" the ne plus ultra of form, action, and apprehension? or has the Omnipotent ruler of the universe still in reserve further displays of his illimitable powers, in the formation of new worlds, enriched with an order of beings as far surpassing man as he himself now does the maggot that revels in the dead lord's socket?

The doctrine of reproduction by the agency of seminal anamalculi, was a much cherished theory among some of the early writers on this knotty subject. Malphighi, (Opera) and Leeuwenhœk, (Arcana naturæ detecta ab Antonio Von Leeuwenhœk, 1695) remark, "that the principle of our body consists in a worm, which, entering the cavity of the uterus, first formed the spinal cord, from whence is derived the whole body."

Hammer, a medical student of Leyden, first demonstrated to Leeuwenhœk in the year 1677, the existence of the animalculi in the semen; to these the latter author referred as the immediate cause of generation; Dumas and other noted French physiologists, have recently revived this doctrine. Hartsœker declared that he discovered spermatic animalculi resembling men in figure. Audry pushed the theory to a most ridiculous extent: this system was subsequently extended by Needham to embrace the vegetable kingdom, (Vide Nouvelle decouvertes faites avec le Microscope,) who thought that in vegetables the embryos *pre-existed* in the pollen, which is conveyed through the pistil into the ovarium: but the embryos do not appear till a week, and sometimes till a month after the dispersion of the pollen.

This "animalculist" theory has long since been consigned to oblivion by the labours of Vallisnieri, Haller, and Spallanzani. The latter author found that the semen of the frog was prolific when totally destitute of animalculi, or after these had been destroyed by mixture of the prolific fluid with vinegar, urine, &c.

Hippocrates and Galen maintained, that the germ is formed by the commixture of the seminal liquor of both sexes—meaning, it is presumed, the semen masculinum with the fluid of the ovum. The ingenious rhapsody of "organic molecules" of Buffon, differs very little from the theory of Hippocrates.

The pre-existence of germs, and their dissemination through space, an ancient doctrine, was also maintained by Perrault and Robinet; its adoption derives no sanction from precedent, nor can its operation be predicted by appeal to any previous experience.

"Omni ab ovi," is a doctrine first advocated by Harvey, though he was not aware of the existence of ova in the ovaries; he taught that the whole system of the female was affected by the semen masculinum, but that it was the peculiar office of the uterus to conceive the fœtus. De Graaf first named the ovaries, who, with Steno, was among the first to detect ova in the human female. The latter author, the contemporary of Harvey, was the first to apply the term "egg" to the ovarian vesiculæ, which previously had been denominated "*vesicles*," simply.

The following are the evolutions of the germ, after fecundation, in the rabbit, according to the observations of De Graaf. Half an hour after coition, no change was perceptible, except that the cornua uteri appeared, in a slight degree, more reddish. After six hours, the envelopes of the ovarian vesicle appeared reddish. After one day, three vesicles on one side, and five on the other, became evidently opaque and reddish. From the twenty-seventh to the fiftieth hour, the horns of the uterus, together with the tubes, became much redder: and one of the tubes embraced the ovary. After three days, vesicles were observed in the tubes of the size of a mustard-seed; they consisted of *two membranes* filled with a *limpid liquor.* On the fourth day, the ova were observed in the uterus, already enlarged, although they contracted no adherence to the uterus until the seventh day. On the ninth day, a *cloudy spot* was observed in a point of the transparent liquid of the ovum—which point assumed the figure of a worm on the tenth day. On the eleventh day the embryon was distinctly visible, and gestation terminated on the thirty-first day. In the human subject, Sir E. Home found the ovum in the uterus on the eighth day after sexual union.

Some estimation may be formed of the industrious application of Spallanzani, from the number of frogs which he dissected in the prosecution of his important experiments on generation, which exceeded two thousand!

There have not been wanting those who have inconsiderately branded with cruelty, the character of this excellent benefactor of man. With every allowance for mistaken ideas of benevolence, such a notion reminds us of a disposition by no means uncommon, "To strain at a gnat, and swallow a camel."

To live,—to breathe,—implies the hourly extinction of millions of organized beings. Man in all countries has declared the war of extermination against those animals, which he, in his mightiness, has named "*pests*," "*vermin*," *&c.*, although their right of existence is at least coeval with, if not anterior to his own. What myriads of creatures fall a prey to his luxuries! The daily supply of his table implies the torture and murder of whole hecatombs! It is, after all, but submission to the law of nature: and yet he would seem to hesitate in sacrificing the lives of a few insignificant animals, for the noble purposes of scientific discovery, the detection of truth, enlargement of the views, amelioration and elevation of the condition of his species.

Alluding to Spallanzani's discovery of the existence of pores in the membrane of the germ, or egg, of the frog, Bonnet remarks, "Each pore is probably the orifice of a vessel communicating with the heart."

The ova of the toad cannot be fecundated until fully perfected by passing through the oviduct, in order to be surrounded with gluten. The egg of the hen, and of birds, on the contrary, is fecundated in the ovarium previous to passing through the oviduct. One single impregnation of the turkey-hen is sufficient to fructify all the eggs which may be laid for the whole season: consequently, in this case, impregnation must take place in the ovarium of the imperfectly formed egg. Such differences occurring, even in oviparous animals, in regard to the phenomenon of impregnation, and the concomitant circumstances requisite to the successful accomplishment of the end, should caution us from precipitate conclusions deduced from analogy.

Spallanzani demonstrated that the semen of amphibious animals is neither viscous nor inflammable, acid nor alkaline.

Spallanzani, who was so successful in producing mules artificially, in many of his experiments, expresses some astonishment in having failed, in all his efforts, to obtain hybrid frogs or toads: none of the species of either could, by any means, be made to mix. In this we observe a wise dispensation of unerring nature.

Senebier remarks, that if it were possible to produce mules between the different species of frogs, or between the frog and toad, the specific distinctions of both, or all, would long ago have ceased to exist—as these animals breed in the same waters; in the vicinity of each other, and often in actual contact.

The celebrated anatomist *Ruish*, thought he had determined that during coition the semen enters the cavity of the uterus; he states that he was called to make the examination of the body of a woman, whose husband had surprised her in the act of adultery and killed; the uterus appearing more swollen than natural, made him suspect that conception had taken place; he removed the uterus for more careful examination; on opening it he found its cavity filled with a substance, which, in appearance, consistence, colour, and odour, resembled perfectly male semen; both fallopian tubes were found filled with the same substance.—Vide Thesaur. 6, No. 21, p. 15.

Physiologists are familiar with the experiment of Hunter, in which he examined the cavity of the uterus of a bitch whilst in union with the male, and detected the semen passing into it. As a general rule there is no reason to doubt, that in those animals in which impregnation is internal, the semen enters the uterus, but that such a result is unnecessary in all cases, is proved by those instances of conception with imperforate hymen.

Cruikshank pithed a rabbit whilst in heat, and minutely examined the uterine system. The external and internal parts of generation were found black, with an unusual quantity of blood: the fallopian tubes were twisted like writhing worms, and exhibited a very vivid peristaltic motion; the fimbriæ embraced the ovaria like the fingers laying hold of an object, so closely and so firmly, as to require some force and even slight laceration to disengage them: round black spots, somewhat less than mustard seeds, appeared below the membrane of the ovarium. Upon injecting the vessels of the pelvis with size, the uterine organs became of a bright red.

Dr. Blundell found that the obliteration of the uterine canal of the rabbit, by division of the vagina, deprives the animal of the power of conception; in individuals thus mutilated, which admitted the male, the uterus enlarged considerably, and contained a fluid of an albuminous nature.—Vide Medico Chirurgical Trans. vol. 10, p. 50.

Dr. Haighton divided the fallopian tubes on each side in rabbits, and found that individuals so treated, invariably *lost the sexual appetite.* Upon dividing the fallopian tube on one side only, he found the same result generally to ensue; in a few cases, however, the animals thus mutilated admitted the male, and became impregnated; but the horn of the uterus, on the side on which the fallopian tube had been divided, never contained ova.—Vide Philos. Soc. Trans. Lond. vol. 85, p. 108.

From these facts, Mr. Mayo, with some other physiologists, concludes that the absolute contact of the semen with the ovum is requisite to conception, and that the semen arrives at the ovaries through the fallopian tubes. Mr. Mayo is of opinion that barrenness in married women occasionally depends upon an obstruction of the os tincæ by viscid mucus, the removal of which by the introduction of a bougie, has been shortly after followed by conception.

Passing sub silentio those well authenticated cases of impregnation where the passage of the vagina was closed;*

* For cases of conception, with imperforate hymen, vide Vinette table de l'amour conjugal, vol. 1, pp. 90 and 50.

in the above experiments, it is admitted that the mutilation of the animal destroyed the function of the ovaries; hence no conclusions of a positive nature can be drawn from them. Spallanzani has published interesting observations on the progress of germination, in the *Spartium junceum* of Linn., and other plants; he concludes that "the foregoing observations show, 1, that the seeds of this species exist in the ovarium many days before fecundation; 2, that they remain for some time solid, and then a cavity, containing a liquid, is formed in them; 3, that after fecundation a body begins to appear within the cavity, fixed by two points to the sides; and when in process of time it has attained a larger size, it proves to be the two lobes enclosing the plantule, and surrounded by a thin membrane, which is itself covered with a husk or cuticle."—Vide vol. 2d, Dissertation 3d, p. 321.

Tadpoles, in Italy, live on a species of water-lentil. In our own country, these rudimentary animals are quite carnivorous. Spallanzani decapitated a male frog whilst in union with a female, and he fecundated the eggs, notwithstanding. p. 94. According to the same author's observations, the frog begins to breed in the second year, when the ova first make their appearance, in two distinct sets: one, larger, for the second: another, smaller, for the third year. p. 112.

The *gills,* which in more advanced tadpoles appear on the outside of the body, are yet, (26th day,) lying under the integuments of the thorax. p. 130. "After impregnation, one extremity of the germ takes on the appearance of head, &c.: and lastly, the *gills* appear, through which coloured blood may be seen circulating." p. 121. "It is well known that tadpoles, both of frogs and toads, *lose their gills* in a few days after they are hatched." p. 75. "About the eightieth day, the tadpole is changed into a frog." p. 131.

The evolution of the tadpole as observed in our climate, takes place sooner or later, according to the temperature; animation may be observed in from one to five days. Even in the chicken, the process of incubation may be forwarded or retarded by increasing or diminishing the natural heat, i. e. 104° of Far., and has been made to vary from twenty-five to thirteen days, in place of twenty-one, the usual period.

The *Rana paradoxa*, of Surinam, remains two years in a tadpole state. In our latitudes, the tadpoles frequently remain such during at least one winter.

A portion of the semen of the frog, nearly ten hundred and sixty-five million times less than the ovum, was found sufficient to fecundate it. Three grains of semen, diluted with twenty-two pounds of water, was found to fructify a few ova. Three grains of semen dissolved in eighteen ounces of water, and a needle being dipped into this mixture, and brought in contact with several ova, they were fecundated.

Any part of the sphere of an ovum, touched with semen, is sufficient to impregnate it. "Fifteen minutes exposure of the ova of the frog, in water, was found to destroy their prolific properties." p. 58. Semen, dissolved in water, retained its prolific influence longer than undiluted seed. In cool temperatures it retained its virtues thirty hours. The semen taken from the body of the frog, retained its prolific virtues from six to eleven hours, according to the temperature.

In the Salamander, the author found it *requisite* to dilute the semen with water, in order to produce artificial impregnation. p. 164.

THE END.

SUBSCRIBERS' NAMES.

	Copies.
PHILADELPHIA.	
J. P. Wetherill,	20
Wm. Hembel,	10
Wm. Wetherill, M. D.,	10
Wm. Norris,	10
James Dickson,	10
Thomas Fisher,	7
Gen. D. Parker,	5
J. Dobson,	4
J. Archer,	2
S. R. Simmons,	2
J. L. Martin, M. D.,	2
Richard C. Taylor,	2
N. Chapman, M. D.,	1
J. J. Audubon,	1
Charles Wetherill,	1
S. Jackson, M. D.,	1
G. B. Wood, M. D.,	1
Robert Hare, M. D.,	1
Wm. E. Horner, M. D.,	1
H. L. Hodge, M. D.	1
Thomas Harris, M. D.,	1
Thos. T. Hewson, M. D.,	1
Joseph Hartshorn, M. D.,	1
C. W. Pennock, M. D.,	1
C. D. Meigs, M. D.,	1
J. K. Mitchell, M. D.,	1
J. Pancoast, M. D.,	1
Wm. Rush, M. D.,	1
J. Randolph, M. D.,	1
Robert Morris, M. D.,	1
Cad. Evans, M. D.,	1
G. B. Emerson, M. D.,	1
Charles Evans, M. D.,	1
W. W. Gerhard, M. D.,	1
Wm. Ashmead, M. D.,	1
Charles Noble, M. D.,	1
Thos. F. Betton, M. D.,	1
Thos. D. Mutter, M. D.,	1
J. B. Biddle, M. D.,	1
Wilson Jewell, M. D.,	1
J. McCrea, M. D.,	1
Wm. Blanding, M. D.,	1
Joseph Parrish, M. D.,	1
J. R. Matlack, M. D.,	1
Thos. B. Wilson, M. D.,	1
Thos. H. Yardley, M. D.,	1
George Mifflin, M. D.,	1
James Mease, M. D.,	1
Joseph Peace, M. D.,	1
Francis West, M. D.,	1
G. M. Norris, M. D.,	1
Mordecai Morgan, M. D.,	1
Wm. Morrison,	1
John Fraser,	1
Lehman & Duval,	1
Walter R. Johnson,	1
T. A. Conrad,	1
A. Seidler,	1
Milton Smith,	1

Clem. S. Miller,	1
Nathan Dunn,	1
John Vaughan,	1
Frederick Brown,	1
Lewis Saynisch, M. D.,	1

NEW YORK.

Charles Cramer,	1
J. C. Jay, M. D.,	1
J. Van Renselaer, M. D.,	1
J. E. Dekay, M. D.,	1
F. Feuchtwanger, M. D.,	1

BOSTON.

John C. Warren, M. D.,	1
G. Hayward, M. D.,	1
G. C. Shuttuck, M. D.,	1
G. Parkman, M. D.,	1
Winslow Lewis, Jr., M. D.,	1
Amos Binney, M. D.,	1
Humphrey Storer, M. D.,	1
Francis Alger,	1

NEW JERSEY.

Edward Harris,	1
J. Spenser, M. D.,	1

NEW HAVEN.

B. Silliman, M. D.,	1

CHARLESTON, S. C.

J. P. Jervey, M. D.,	1
E. Ravenel, M. D.,	1
E. S. Bennet, M. D.,	1
T. Logier, M. D.,	1
S. H. Dickson, M. D.,	1
T. Y. Simons, M. D.,	1
W. T. Wragg, M. D.,	1
J. E. Holbrook, M. D.,	1
W. Ramsay, M. D.,	1
E. C. Keckley, M. D.,	1
J. Moultrie, M. D.,	1
J. Bachman, D. D.,	1
F. Wurdiman, M. D.,	1

COLUMBIA, S. C.

S. Blanding, M. D.,	1
M. H. De Leon, M. D.,	1

WASHINGTON, D. C.

War Department,	1
Navy Commissioners' Office,	1
Engineer Department,	1
Topographical Bureau,	1
Surgeon General's Office,	1
Navy Department,	1

Pennsylvania Hosp. Library,	1
Alms House Library,	1
Athenæum,	1