MEMOIR

OF

JEFFRIES WYMAN.

1814-1874.

BY

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BIOGRAPHICAL MEMOIR OF JEFFRIES WYMAN.

MR. PRESIDENT AND GENTLEMEN OF THE ACADEMY:

In reviewing the life and works of JEFFRIES WYMAN we shall consider his contributions to comparative anatomy and physiology, and to palæontology, as well as to ethnology and archæology. We mention these sciences in the order in which he took them up, since Wyman began his life's work as a comparative anatomist and physiologist, and in his riper years ranked as an anthropologist of a high order, his wide range of biological studies peculiarly fitting him for doing work of an unusual degree of excellence in the science of man, which may well be regarded as the synthesis of the biological sciences.

In all the sciences to which reference has been made his studies were pursued with a thoroughness, ease, and accuracy of treatment, a breadth of view, and general philosophic grasp which proved him to be second to few in those peculiar gifts which mark original investigators of the highest order.

While Jeffries Wyman possessed a quality of mind that allied itself to genius, together with the patience and unwearied devotion to work which accompanies what we usually understand by that term, his mind was of the judicial order, and he was too equably developed intellectually to show that brilliancy and special aptitude in a single direction to be classed as a "genius." The reverse of erratic or doctrinaire, never one-sided in his views of a subject, he weighed every problem which presented itself to his mind with the exact methods of the physicist and chemist, combined with the exercise of the peculiar gifts of the biologist.

Wyman never allowed himself to be mastered by a guess; to follow his intuitions beyond the point they naturally led. On the contrary, he proved all things by repeated experiments. He once said to the writer, "One experiment alone proves nothing." He fully possessed the spirit of modern science. His characteristic

traits as a man and scientist were extreme truthfulness, accuracy, equipoise, and modesty. He was reticent in publicly expressing his views on those problems of life unanswerable by the science of his day and of ours. On the other hand, he was courageous in his private convictions on ultimate questions, stepping to the very edge of the precipice overlooking the speculative, misty depths below.

As a friend and companion, light-hearted, genial, warm in his affections, unselfish, and thoroughly unassuming, Wyman has left a memory to be revered and loved. And it is a rare privilege and pleasure to recall the features of his high moral and intellectual worth, to trace his scientific development, and to review the results of a life so wholly devoted to the advancement of a knowledge of nature for its own sake.

Jeffries Wyman* was the third son of Dr. Rufus Wyman and Ann Morrill, daughter of James Morrill, a Boston merchant.

Dr. Rufus Wyman, says Professor Gray, was a man of marked ability and ingenuity. He was born in Woburn, Mass., graduated at Harvard College in 1799, and in the latter part of his life was physician to the McLean Asylum for the Insane at Somerville, Mass.

An older brother of Jeffries, who was the third son, is Morrill Wyman, distinguished as a physician, and author of various medical works, and for his warm interest in science. He, with another brother, Edward, a merchant in Boston, are the survivors of a family of five—four brothers and a sister. Jeffries derived his baptismal name from the distinguished Dr. John Jeffries, a Boston physician, with whom his father studied medicine.

The subject of our memoir was born August 11th, 1814, at Chelmsford, a small town situated near the present city of Lowell. When he was at the age of four his father removed to the McLean Asylum at Somerville. In his early boyhood he attended a private school at Charlestown, but afterwards attended the academy at Chelmsford.

* The biographical facts here given are mainly taken from the memorial address of Professor Asa Gray, delivered October 7th, 1874, before the Boston Society of Natural History, and printed in its proceedings, vol. xvii, pp. 95–124; also Dr. Oliver Wendell Holmes: "Professor Jeffries Wyman, a Memorial Outline," in the Atlantic Monthly, November, 1874. Other notices are by Professor B. G. Wilder, in "Old and New" and the Popular Science Monthly, and by Professor F. W. Putnam, in the Proceedings of the American Academy of Arts and Sciences, Boston.

The following extract from a letter from his brother, Dr. Morrill Wyman, to Dr. Holmes will recall his tastes and preferences as a boy:

"He early showed an interest in natural history. When less than ten years old he spent half his holidays in solitary walks along the banks of the Charles river and the margin of the creek near the asylum to pick up from the sedge anything of interest that might be driven ashore. It was seldom that he returned from these walks without something, either dead or alive, as a reward of his search. In college the same preference continued, and, although he did not neglect the prescribed course, he made many dissections and some skeletons, especially one of a mammoth bull-frog, once an inhabitant of Fresh Pond, which was a subject of interest to his classmates, and is now, I believe, in his museum of comparative anatomy. He early commenced drawing, but with very little regular instruction. He also, when ten or twelve years old, painted on a panel with house paints a portrait of himself, which was something of a likeness, but deficient in proper tints. The nearest approach he could make to the color of his hair was green. His facility in sketching in after life was remarkable. He drew anatomical subjects with great accuracy and rapidity. His drawing upon the black-board, in illustrating his lectures, done as it was as he lectured, was most effective. His diagrams for his lectures to the under-graduates of Harvard College were nearly all drawn and colored by his own hand."

Wyman was fitted for college at Phillips Exeter Academy, then presided over by the distinguished Dr. Abbot.

The impression young Wyman made while a pupil at this famous school upon his fellow-students is recorded in a letter to Dr. Holmes by Professor Bowen, who, after speaking of him when a boy of fourteen as "pure-minded, frank, playful, happy, careless, not studious, at least in his school-books, but not mischievous," added: "He *would* take long rambles in the woods and go into the water and a-fishing, and draw funny outline sketches in his school-books, and whittle out gimcracks with his penknife, and pitch stones or a ball farther and higher than any boy in the academy, when he ought to have been studying his lessons. Only a few years ago, when we were chatting together about our early life at Exeter and in college, he said, in his frank and simple way, with a laugh and half a sigh:

'Bowen, I made a great mistake in so neglecting distasteful studies, though you may think I made up for it by following the bent of my inclinations for catching and dissecting bull-frogs. I have been obliged, even of late years, to study hard on some subjects distinct from and yet collateral with my especial pursuits, which I ought to have mastered in my boyhood.' The boy was very like the man, only with age, as was natural, he became more earnest, persistent, and methodical."

"One need not be surprised to learn," adds Dr. Holmes, from "another class-mate, himself distinguished as a scholar, that many of those whom Jeffries Wyman distanced and left out of sight in the longer trial of life stood above him in scholarship during his college course."

Entering Harvard College in 1829 he graduated in 1833 in a class numbering fifty-six, five of whom besides himself afterward became professors in the University.

Professor Gray remarks that young Wyman, while in college, "was not remarkable for general scholarship, but was fond of chemistry, and his preference for anatomical studies was already developed. Some of his class-mates remember the interest which was excited among them by a skeleton which he made of a mammoth bull-frog from Fresh Pond, probably one which is still preserved in his museum of comparative anatomy. His skill and taste in drawing, which he turned to such excellent account in his investigations and in the lecture-room, as well as his habit of close observation of natural objects met with in his strolls, were manifested even in boyhood."

Under the old regime (with the restricted curriculum and iron-clad system of the college of the first half of this century) such unwonted aptitudes and turn of mind as distinguished young Wyman were certainly not fostered; on the contrary, such growths were considered as abnormal, almost pathological, and were unconsciously, or with intention, removed or frowned upon. With little chemistry and less physics, a smattering of astronomy, but no physiology, botany, zoölogy, or geology, for those sciences were then *in embryo*, and even the first germs considered by most pedagogues as pernicious; the microscope not then in general use, and no laboratory open for experiment—no wonder the limited range of studies then pursued had slight attractions for the inquiring mind,

the ingenuity in manipulation, and the overmastering love of external nature so predominant in that college boy.

Fitted neither by temperament nor bodily health for the exacting duties of the clerical, medical, or legal professions, the future physiologist and anatomist, who was to become so distinguished as a college professor as well as investigator, had inherited a native ability which supplied the place of severe labor in uncongenial studies. If in these times the legal profession as well as the medical or clerical demand the most careful preparation in the limited range of studies of the olden time, certainly none the less honorable or less liberal are those studies in the physical, natural, and psychological sciences, which are now open to those who would become professional physicists, physiologists, botanists, zoölogists, geologists, or astronomers. These professions are now regarded as fairly abreast those of theology, medicine, or law. All are learned professions, and equal in honor and usefulness to mankind.

During his senior year in college young Wyman suffered from a dangerous attack of pneumonia, which, says Dr. Holmes, "seems to have laid the foundation of the pulmonary affection that kept him an invalid, and ended by causing his death." To recover from the effects of this attack he spent the winter of 1833–'34 in the Southern States, and this flight southward at the approach of winter was but the precursor of many others.

The following spring Wyman began his medical studies under Dr. John C. Dalton, who had succeeded his father at Chelmsford. For the two following years he divided his time, given to earnest study, between his medical teacher, his father, and the Medical College in Boston. In the third year of his medical course he was house physician in the medical department at the Massachusetts General Hospital, finally receiving (1837) the degree of doctor of medicine. His graduation thesis was upon the eye, and the results were probably in part embodied in his essay entitled "Indistinctness of Images Formed by Oblique Rays of Light," published in September of the same year.

After graduation he rented an office in Boston on Washington street, and performed the duties of demonstrator of anatomy, under Dr. John C. Warren, then well known as a comparative anatomist.

These situations were far from remunerative, and Dr. Gray tells us that, "in order to eke out his subsistence, he became at this time a member of the Boston Fire Department, under an appointment

of Samuel A. Eliot, mayor, dated September 1, 1838. He was assigned to engine No. 18. The rule was that the first-comer to the engine-house should bear the lantern and be absolved from other work. Wyman lived near by, and his promptitude generally saved him from all severer labor than that of enlightening his company."

But it was in lighting the hidden ways of nature that our associate was to devote his life rather than to practicing the healing art. He turned from physic to pure science. "Excellent as he would have been as a physician, welcome as his gentle voice and pleasant smile would have been at the bedside, keen as he would have been in detecting the nature and causes of disease, and conscientiously assiduous as he would have shown himself in doing all he could to alleviate it, many of his most precious natural gifts would never have found a full opportunity of exercise if he had not followed the course for which nature had marked him out from his boyhood."*

If the studies open to young Wyman at the preparatory school and college were not such as to immediately bear upon his future profession, there is little doubt but that the training of the eye and of the reasoning powers in the medical school and the hospital was the best education then open to one destined for original research and for logical, clear exposition of biological phenomena and laws. Fortunate in his birth and early surroundings, young Wyman was fortunate in his medical advisers and teachers. The atmosphere he breathed in Boston was not alone a medical one, but pervaded by high scientific aims and warmed with a zeal for scientific discovery. If a chill penury repressed the dreams of his youth, and his immediate prospects of getting a livelihood were discouraging, he was even then rich in the unseen influences of friendship and regard of men like Dr. J. C. Warren, Mr. John A. Lowell, and others,† who, if

* Dr. Oliver Wendell Holmes, Atlantic Monthly.

† "Of penury in a literal sense we may not speak, for although Prof. Wyman's salary, derived from the Hersey endowment, was slender indeed, he adapted his wants to his means, foregoing neither his independence nor his scientific work, and I suppose no one ever heard him complain. In 1856 came unexpected and honorable aid from two old friends of his father, who appreciated the son and wished him to go on with his scientific work without distraction. One of them, the late Dr. William J. Walker, sent him ten thousand dollars outright; the other, the late Thomas Lee, who had helped in his early education, supplemented the endowment of the Hersey

they themselves could not take it up, appreciated the scientific life, with its intellectual and moral triumphs, its consecration to truth for its own sake, its high ideals. Such friends as these opened the gate to those pleasant, peaceful paths of pure scientific research along which Wyman was to walk the remainder of his days, spotless from the stains of ambition, jealousy, and self-seeking which have marked too many scientific careers.

The Lowell Institute was the result of the scientific spirit already aroused in Boston and vicinity, which made that city only second, in the first half of the century, to Philadelphia as a scientific centre. Mr. John A. Lowell, who administered the affairs of this institution, offered Wyman the curatorship of it. In the winter of 1840–41 he delivered a course of twelve lectures upon comparative anatomy and physiology.

The proceeds of these lectures enabled him to spend part of a year in Europe, his stay, however, being shortened by the illness and death of his father.

Paris was then the scientific centre of Europe, though Cuvier, a few years previous its central figure, had passed away.

Though he seemed to have given some time to human anatomy at the School of Medicine we may feel sure that a larger portion saw him in the lecture-rooms of the physiologists, Flourens, Majendie, and Longet, as well as those masters in zoölogy and comparative anatomy, De Blainville, Isidore St. Hilaire, Valenciennes, Dumeril, and Milne-Edwards.

When the lectures were over he made a journey on foot along the banks of the Loire, walked down the valley of the Rhine, thence through Belgium, and by steamer to London, where he made the personal acquaintance of Professor (now Sir) Richard Owen, then in charge of the Hunterian Museum of the Royal College of Surgeons.

In 1843 he was appointed to the chair of anatomy and physiology in the medical department of Hampden Sidney College at Richmond, Va. Here he spent the winter and spring months for five years, spending the summer and autumn at his northern home,

professorship with an equal sum, stipulating that the income thereof should be paid to Prof. Wyman during life, whether he held the chair or not. Seldom, if ever, has a moderate sum produced a greater benefit."—*Dr. Asa Gray's Memorial Address.*

until in 1847 he was called to succeed Dr. Warren as Hersey professor of anatomy in Harvard College. He soon became established in Boylston Hall, with a suitable museum, lecture, and work rooms. Here he delivered his weekly lectures on comparative anatomy and physiology to the senior class, and gave advanced instruction in human and comparative anatomy to special students, many of whom are among our leading physicians, surgeons, and scientists. His leisure hours were devoted to building up his museum, where neatness, order, and system prevailed. It was an education to walk by the cases. As the collection has been removed, and now incorporated in that of the Boston Society of Natural History, we will let the graphic, facile pen of Dr. Holmes, then his friend and colleague in the medical school, portray the appearance of this unique collection, the work of his own hands, brought together by his almost unaided exertions, without grants from public or private funds:

"We enter the modest edifice known as Boylston Hall, and going up a flight of stairs find a door at the right, through which we pass into a hall extending the whole length of the building. The tables in the centre of the floor, the cases surrounding the apartment, and the similar cases in the gallery over these are chiefly devoted to comparative anatomy. Above the first gallery is a second devoted to the archæological and ethnological objects, which make up the Peabody Museum. The fine effect of the hall and its arrangements will at once strike the observer. In the centre of the floor stands the huge skeleton of a mastodon found in Warren county, New Jersey, in 1844. Full-sized casts of the 'fighting gladiator,' as it was formerly called, and the Venus of Milo stand at the two extremities of the hall, and one of the Venus de Medici opposite the door. Stretched out at full length in glass cases are the anatomical wax figures, male and female, which used of old to be so wondered over by the awe-struck visitors who had gained admission into little Holden Chapel. The skeletons of a large alligator and of an overgrown anteater; a rattlesnake of fearful size and aspect and a youthful sawfish, both in alcohol; a slab with fossil foot-prints from the Connecticut river valley, and cases of separate bones from the four animal kingdoms are the other principal objects grouped about the mastodon.

"In the cases around the room are great numbers of fine skeletons of man and various animals, among them of the jaguar, the ostrich, the boa-constrictor, and of immense sea-turtles. Most interest-

ing of all are the skull and other bones of a mighty gorilla. His head and pelvis are far from human in their aspect, but his arm-bone is so like that of his cousin-Darwinian, that it looks as if it might have belonged to Goliath of Gath, or Og, king of Bashan. The skeleton of a young chimpanzee, by the side of that of a child, has a strongly marked effect of similar significance. There are whole series of special preparations to show the parts of the skeleton concerned in locomotion in different classes of animals

"The cases in the gallery contain a vast number of wet and dry preparations, of which a very few may be indicated. One of Prof. Wyman's last labors was to refill the jars of the wet preparations with alcohol, and they are in excellent condition. Among these are many careful dissections of the nervous centres and the organs of sense and a series of embryological specimens, which cannot fail to arrest the most careless observer. There are the Surinam toads, with their ova on their backs, like potatoes in their hills; there are strange fishes, with their mouths full of eggs; there is the infant skate, with a broad laugh on his face as if he thought it a good joke to have been hatched and forthwith drowned in proof spirit, like Clarence in his butt of malmsey. Then come monstrosities of various kind and degree, wonders, and nothing more to the vulgar—keys to some of nature's deepest secrets to the man of science. We pass next to the nests of wasps and hornets and the combs of bees, with casts of the cells, from some of which, it may be mentioned, Prof. Wyman took impressions directly upon paper, thus insuring that accuracy for which he was almost unrivaled. The nests of the great ants will next attract the eyes of the curious, and near these the wonderful carpentry of the beavers, as shown in the sticks they have cut into lengths as if with tools of human workmanship; the great chisels of the rodents, those enamel-shaped incisors, which are so contrived as to keep their sharp bevel by the mere wear of use, grin in the crania ranged in rows above; and so we might go on through almost innumerable specimens filling the shelves—not with the rubbish of cheap collections, but with objects each of which has an idea behind it and each important series of which has been illustrated by a paper well known to the scientific world."

While his museum was enriched by preparations of specimens gathered at or near home he added largely to its resources during his travels abroad. His first journey out of the country was in the summer of 1849 to the coast of Labrador, obtaining the means for the trip by

a second course of lectures upon comparative physiology before the Lowell Institute. These were published from the condensed shorthand notes, with diagrammatic figures, as a thick pamphlet, which was the nearest approach to a general work which Wyman could ever be induced to publish, although in after years urged to prepare a manual on that subject.

The winter of 1852 was spent in Florida. Driven there by ill-health he yet found time and strength to begin his examination of the shell heaps of that region, which from time to time were renewed, the rich material thus collected forming the subject of a volume whose proof-sheets he did not live to read. The winter of 1854 was devoted to traveling in Europe, visiting museums and scientific men.

His most fruitful journey, amid scenes he would often recall with keen delight, was that to Surinam. Leaving Cambridge in the spring of 1856, accompanied by his pupils, Green and Bancroft, we may be sure that immediately upon landing he visited the fish market of Surinam in search of Anableps, to whose unusual mode of gestation his attention had been called two years previous by Dr. Cragin, once United States consul at Paramaribo. In his canoe journey up the Surinam river, besides other objects, he collected specimens of the Surinam toad, whose singular metamorphoses he described. These were the *optima spolia* of this journey, though the Indians of the country must have been critically scanned with his observant, trained eye. But his opportunities for extensive study and exploration were hampered by a severe attack of the fever of the country, from which he recovered slowly.

In 1858–9 he made a voyage, as the guest of Capt. J. M. Forbes, to the La Plata, ascending the Uraguay and the Parana in a small iron steamer. Thence, with his friend, Mr. G. A. Peabody, of Salem, Mass., he crossed the pampas to Mendosa and the Cordilleras to Santiago and Valparaiso, returning home by way of the Peruvian coast and the Isthmus of Panama.

His later field work was confined to the glades of Florida and to expeditions along the coast of Maine and Massachusetts, where he investigated the Indian shell heaps, visiting twenty-five different localities and selecting from them several thousand specimens.

His connection with the Boston Society of Natural History was almost life-long—he joined the society in 1837; from 1839 to 1841 was its recording secretary; from 1841 to 1847 filled the office of

curator of ichthyology and herpetology, of herpetology alone from 1847 to 1855, was curator of comparative anatomy from 1855 to 1874, and was its president for fourteen years, from 1856 to 1870. At the meetings of this society Wyman often presented in brief form the results of most of his biological investigations, the number of his communications amounting to one hundred and five. Of these, many which occupied a goodly portion of the evening in their delivery, are unfortunately represented by brief abstracts of but a few lines in length.

As a presiding officer Wyman showed tact, dignity, and efficiency. His store of varied information, often drawn upon, seemed unfailing, and his simplicity and directness of diction were marked.

As a college lecturer Wyman was clear, simple, and attractive. He used brief notes on a slip of paper, drawing with facile hand on the blackboard. Never aiming at effect, unrhetorical, his method and manner were stamped not only with the air but the reality of truthfulness. The weekly Saturday lecture was a rare treat, and his lectures were models of their kind.

Wyman's skill in planning methods and performing experiments was noticeable. The years in which he taught were before the days of a complicated anatomical technique and of chemical reagents, hardening processes, staining with various animal and vegetable dyes, and of section cutting, but Wyman was inferior to no one in inventive skill and ingenious devices. One of these was his method of demonstrating the motive power of cilia. The apparatus is described in his paper, entitled "Experiments with Vibrating Cilia," and was a delicate and skillful device for rendering the effects of ciliary movements visible in a large lecture-room. In his memorial notice of Jeffries Wyman, contributed to the Popular Science Monthly, Prof. B. G. Wilder recalls an apparatus for demonstrating the entire circulation, arterial, venous, and capillary, an account of which was never published.

Although a comparative anatomist and embryologist, contributing to science memoirs of classical worth, and strong in the field of morphology, we much doubt whether Wyman would have allowed himself to have been called a "morphologist" or a "biologist," or have allowed the name of "morphological laboratory" to be applied to his workshop, however useful such an appellation may now be regarded in some quarters. He avoided the use of polysyllabic Latin or Greek words if plain English would answer the purpose.

The reverse of pedantic, prolix, or prosy, he was intolerant of these defects in others. We well remember in the council meetings of the Boston Society of Natural History his protest against using in the printed lists of the offices such titles as "curator of mammalogy" or of ichthyology, preferring the simpler English terms "curator of mammals," "fishes," etc.

Wyman did little work in systematic zoölogy. In his simple but decisive way he once expressed to the writer his scorn of nomenclature, and, half in earnest, half in jest, declared that it would be better to drop the use of scientific binomials and to designate species simply by numbers—and those were before the day of trinomial or polynomial appellations.

Whether this habit of mind was the result of his exact and detailed studies, and the desire to express in few, well-chosen words just what he saw, and to present his inductions in a terse, epigrammatic form, or whether his ill-health and ordinary museum drudgery left him little time, Wyman failed to write out at length his results with detailed consideration of all the facts and their relations leading to them. In after life he saw his mistake, and in the kindly, friendly, frank way he had with his young friends told the writer that he had erred in not writing out at greater length his observations and publishing them in more complete manner, with elaborate illustrations.

Here his modesty and reticence stood in his way. His delicacy and tact, as well as his self-respect, made controversy and claims for priority foreign to his wishes. And after all it is a waste of time, a squandering of intellectual power, to indulge too freely the simple desire for mastery in a contest, though in debates and disputations new views may often be elicited. Throughout Wyman's writings we shall look in vain for a claim for priority, a reclamation, or a wordy dispute. He was content in a too brief abstract to announce his conclusions, based perhaps on weeks and months of laborious experiments or dissections, and to leave to the naturalists of the future to judge as to the merits of his work.

"If he had ambition," writes Dr. Holmes, "it was latent under other predominating characteristics. So far as could be seen his leading motive was an insatiable, always active, but never spasmodic, desire of learning some new secret of nature. If a discovery came in his way he told of it without any apparent self-applause or vanity. He, who never made blunders, might fairly be indulged

in a quiet smile at those of his neighbors, but he was considerate with scientific weaklings, and corrected them as tenderly as Isaac Walton would have the angler handle his frog."

"He never took part in any controversy," wrote Mr. Alexander Agassiz to Dr. Holmes, who adds that "on one occasion, to which Mr. Agassiz refers, when he was unfairly treated by a leading man in science, 'he never complained of it or even mentioned it;'" and Mr. Agassiz added: "Unless he could add something of importance to the memoirs of his predecessors he never allowed himself to print his observations if they were mere confirmations. At the time Owen and the younger Milne-Edwards published their memoirs on the dodo he had been at work for a long time on the same material in the Museum of Comparative Zoölogy, and was just ready to commence; yet he was satisfied in criticising a few points in the above papers, and returned the series of bones, all carefully labeled, saying he should have no further use for them."

Writes Dr. Weir Mitchell in Lippincott's Magazine:

"Everywhere, indeed, his letters, which made the most of our intercourse, were full of the broadest sympathy in pursuits which often were—but often were not—in the same direction as his own life-long studies. At times, too, the sympathy broke out into the extreme of generosity. Thus, having learned from me that certain very important and hitherto undescribed anatomical structures would probably be found in serpents and frogs, he tells me soon after that he has found them; also that he has discovered them in birds, and that he has been led finally to a series of unlooked-for discoveries in the anatomy of the nerves of the frog; and he wishes experiments made on living frogs to learn the physiological use of the structures thus found. Then not long after he proposes that, as the first discovery came from this writer, he should take and use the notes and drawings which recorded his own researches, and should use them in a second paper. It is needless to say that this was declined, and the results appeared under Wyman's name. It was characteristic of the man, and was not the only time when I had to thank him for the kindest offers of aid."

Having considered Wyman's career as a student of medicine, also the period covering about twenty years during which he actively taught and built up with his own hands a large and well-arranged museum of comparative anatomy, we are brought to the third and

last epoch in his life, in which he founded and elaborated a second grand collection—the Peabody Museum of American Archæology and Ethnology.

With his previous studies in human and comparative anatomy, besides physiology, his widespread explorations of Indian mounds, his studies of skeletons and crania, and his increasing interest in the study of the physical history of man, as well as the extensive collections which overcrowded the shelves in Boylston Hall—with all these favorable presages the fullness of time had come for the creation of a new museum and department in Harvard College. And when in 1866, by the beneficence of the late George Peabody, the philanthropist, such a museum and department of instruction was founded, Jeffries Wyman was named as one of the seven trustees of the museum and professorship, and, as was most natural and befitting, he was appointed by his associate trustees to the curatorship of this rapidly increasing collection. It goes without saying that Wyman was the best equipped man in America for the task before him. Morton had passed away, and no one since Wyman's time has filled the latter's place as a student of crania and a general ethnographer, though in archæology, perhaps an easier field, there are worthy successors. What rare opportunities, means, and facilities for work now opened up before him. And though struggling with declining health, often obliged to forego all work, in the seven annual reports which he left, the last one published just before his death, and in the elaborate memoir on the shell heaps of Florida, with its ethnographical and archæological riches, we have but the earnest of what he might have accomplished with a more robust constitution.

Dr. Holmes tells us in his inimitable way how he went about these duties: "He entered with the enthusiasm of youth upon the duties of the office. What he accomplished in the way of personal contributions, obtaining donations, making judicious purchases, classifying, distributing, arranging, describing, repairing, labeling, the visitor whom we have supposed to have walked around the gallery would not expect to be told within the limited compass of these pages. How many skulls broken so as to be past praying for he has made whole, how many Dagons or other divinities shattered past praying to he has restored entire to their pedestals, let the myope who can find the cracks where his cunning hand has joined the fragments tell us. His manipulation of a fractured bone from a

barrow or a shell-heap was as wonderful in its way as the dealing of Angelo Mai with the scraps of a tattered palimpsest."

As emphatically stated in 1874 by Dr. Asa Gray, "If this museum be a worthy memorial of the founder's liberality and foresight it is no less a monument of Wyman's rare ability and devotion. Whenever the enduring building which is to receive it shall be erected surely the name of its first curator and organizer should be inscribed, along with that of the founder, over its portal." We may feel sure that all that affection and justice could do has been accomplished by the present authorities. Since Wyman's death the monument has been erected, one worthy of its founder and organizer, and one worthy of comparison with others of its kind in the Old World.

Wyman's labors under these new circumstances were constantly and for long periods interrupted by ill health. Several winters were spent in Florida and one in Europe. The winter before his death was passed in Florida, with some temporary benefit to his health, and during the summer of 1874 the work which he accomplished in his museum "might have tasked a robust man." Late in August of that year he left Cambridge for his usual visit to the White Mountains, to avoid the autumnal catarrh; but while at Bethlehem, on the 4th of September, he suddenly died from the effects of a hemorrhage from the lungs.

Professor Wyman was married in December, 1850, to Adeline Wheelwright, by whom he had two daughters. She died in June, 1855. In August, 1861, he married Anna Williams Whitney, who died in February, 1864, soon after the birth of a son, who bears his father's name.

Professor Wyman was from 1843 an active Fellow of the American Academy of Arts and Sciences in Boston and a member of its council for many years. He was elected president of the American Association for the Advancement of Science for the year 1857; but, whether from a disposition which led him to avoid publicity or from ill-health, he did not perform the duties of that office. He was, however, treasurer of the first meeting, held in 1848, was secretary of the second meeting, and about the year 1856 made two communications to that body. He was also one of the original members of the Association of American Geologists and Naturalists, held in Boston in 1847, and read that year before this learned body an account of the gorilla. Appointed by Congress as one of the

original members of this Academy, he resigned the position, but his name remains on its roll as an honorary member. He was also one of the faculty of the Museum of Comparative Zoölogy at Cambridge.

It remains for us now to call attention to the more important results of Wyman's life's work, as recorded in his scattered papers and memoirs.

Besides notes on the formation of ripple marks and on the morphology of the leaves of Sarracenia, Wyman's few purely zoölogical observations were made on parasitic worms, on the fresh-water sponge, the species of fishes from the Surinam river, the larvæ of *Dactylethra capensis*, the white whale, on the localization of species, on amœba, amphioxus, the habits of spiders, of wasps; his only contributions to systematic zoölogy being descriptions of a new species of torpedo, new species of intestinal mites and worms, a new species of Manatus, and a description of the gorilla.

In the domain of comparative embryology his minor notices related to the formation of the egg-case of skates, the habits of the Scaphiopus toad, the mode of formation of the rattle of the rattlesnake, on eggs of salamanders, the development of the human embryo, and the mode of impregnation of the ova in Pomotis.

His papers on Anableps added much that was novel to the interesting subject of unusual modes of gestation in viviparous fishes. In the markets at Surinam he found seven species of these fish, the males of which had their mouths "crammed to the fullest capacity" with the eggs which the females had laid. He supposed that the eggs must be disgorged while the animals were feeding. Of equal interest, in their relations to the evolution theory, are his observations on the Surinam toad, whose young are provided with small gills, which, however, are of no use to them, as the tadpoles do not enter the water, but are carried about in cavities on the mother's back, where they are placed by the male at the time they are fertilized. The female then enters the water, the skin thickens, rises up around each egg, closing over it, thus forming a marsupial sack or cell. The young pass through their metamorphosis in the sacks, having tails and rudimentary gills; these are absorbed before they leave their cells, the limbs then develop, and the young leave their cells in the shape of the adult Pipa.

Wyman's most important embryological treatise was on the development of the skate (*Raja batis*). The condensed results, state-

ments, and conclusions fill but a dozen quarto pages, but these, with the wide anatomical knowledge and reading displayed, render it a paper of first-rate importance, even though much fuller treatises on the embryology of the Elasmobranchs, have since been made by Balfour and others. In considering the origin and disappearance of temporary organs, Wyman's mind ranged through the animal series for unusual, almost inexplicable, phenomena, and if at that date light had not been thrown upon the subject by the doctrine of evolution and the great mass of knowledge we now possess as to rudimentary or temporary structures he, by their orderly arrangement, could call them up, and thus only fall short one degree of a theoretical explanation. This may be seen by the following extract, in which he refers to the anal fins of the skate, which appear only to be absorbed and wholly removed before the end of gestation: "This development, temporary existence, and early removal of the anal fins gives us another interesting example of the formation of parts which have no obvious use in the economy, and which must be regarded as having merely a morphological value. It falls into the same category with the caudal fin of the embryo of Pipa, which is never used, the teeth of certain cetaceans, the inferior incisors of the female mastodon, which are all removed without being used, and the milk incisors of the Guinea pig, which are shed *in utero*."

The results of this masterly treatise are thus stated by the author:

"1. The yelk case is formed in the glandular portion of the oviduct and is begun previously to the detachment from the ovary of the yelk which is to occupy it.

"2. The embryo, before assuming its adult form, is at first eel-shaped and then shark-shaped.

"3. The embryo is for a short time connected with the yelk by means of a slender umbilical cord; the cord afterwards shortens, and the young skate remains in contact with the yelk until the end of incubation.

"4. There are seven branchial fissures at first; the foremost of these is converted into the spiracle, which is the homologue of the eustachian tube and the outer ear canal; the seventh is wholly closed up and no trace remains; the others remain permanently open.

"5. There are no temporary branchial fringes or filaments on the first and seventh arches; on the others the fringes are devel-

oped from the outer and convex portion of the arch, and are not at first prolongations of the internal gills.

"6. The nostrils, as in all vertebrates, consist at first of pits or indentations in the integuments; secondly, a lobe is developed on the inner border of each; and, finally, the two lobes become connected, and thus form the homologue of the fronto-nasal protuberance. The transitional stages of these correspond with the adult conditions of them in other species of selachians.

"7. The nasal grooves are compared with the nasal passages of air-breathing animals, and the cartilages on either side of these to the maxillary and intermaxillary bones.

"8. The foremost part of the head is formed by the extension of the facial disk forward; while this extension is going on the cerebral lobes change their position from beneath the optic lobes to one in front of them.

"9. Two anal fins, one quite large and the other very small, are developed, but both are afterwards wholly absorbed.

"10. The dorsals change position from the middle to the end of the tail. At the time of hatching, however, there is still a slender terminal portion of the tail, which is afterwards either absorbed or covered up by two enlarged dorsals, as they extend backwards."

For the primitive caudal fin Wyman suggested the name protocercal, and he discovered that it "does not at any period assume the heterocercal form, but retains permanently its primary embryonic or protocercal condition."

In palæontology an early paper brought Wyman's name before the public in a way thus related by Dr. Holmes:

"One of his earlier publications in comparative anatomy and palæontology made the name of Wyman known to many outside of the scientific world. This was his paper on certain fossil animal remains which were for a time on public exhibition in Boston. They consisted of a chain of vertebræ, one hundred and fourteen feet long, a few ribs, and portions of what were said to have been the paddles. This formidable antediluvian, obtained by a Mr. Koch from the marly limestone of Alabama, was christened by the name *Hydrarchus Sillimani*, and was advertised as an extinct form of sea-serpent. Dr. Wyman showed conclusively that the "king of the waters" was no reptile at all, but a warm-blooded mammal; that the bones were never parts of one and the same individual

creature, and that some at least of the so-called paddles were casts of the cavities of a chambered shell."

That singular form, the *Castoroides ohioensis*, found fossil in Ohio and the southern Mississippi valley at Memphis, and remarkable not only as being the most gigantic rodent, recent or fossil, was described by Wyman in a joint paper by Prof. James Hall and himself.

While living at Richmond, Va., Wyman described and figured the remains of sharks, skates, reptiles, seals, and cetaceans from the tertiary beds underlying that city. He also reported on the remains of mastodons, both from the Southern States and the Andean plateau at Rio Bamba; upon the Megalonynx and on the vertebrate footprints discovered by Prof. Henry D. Rogers in the carboniferous strata of Pennsylvania. He also described the skull of *Mastodon giganteus* and the form of its brain, the latter a field of research to which of late much attention has been paid by French and American palæontologists.

In the course of their researches on the scaly, reptile-like batrachians or labyrinthodonts of the carboniferous beds of Nova Scotia, Sir Charles Lyell and Mr. (now Sir) J. W. Dawson had occasion to submit to Wyman certain bones. He recognized their reptilian character and prepared descriptive notes of the principal bones, which appeared to belong to two species. The specimens were afterwards taken to London and re-examined by Professor Owen, who confirmed Wyman's inferences, and named the best-preserved species *Dendrerpeton acadianum*. The other species, "originally detected," says Dawson, "by Prof. Wyman, in the specimens brought from the Joggins by Sir C. Lyell and myself," was named *Hylonomus Wymani* by Dawson. He also described a singular labyrinthodont from the carboniferous beds of Ohio, named by him *Raniceps Lyelli*. It was while examining the remains placed in his hands by Sir Charles Lyell that, as Dawson states, he detected, "among the fragments an object of different character, apparently a shell, which was recognized by Dr. Gould of Boston, and subsequently by Mr. Deshayes as probably a land-snail, and has since been named *Pupa vetusta*."* This was at that date the oldest known land-snail.

* The air-breathers of the coal period in Nova Scotia. By J. W. Dawson, LL.D., F. R. S., F. G. S., etc. Montreal, 1863, p. 19.

The larger number of Wyman's papers related to comparative anatomy. Among the more important of his minor articles were brief condensed abstracts of his observations on the brain and spinal cord of Lophius, or the goose fish, and of the lump-fish; on the morphology of the urinary bladder of batrachians, the anatomy of the sharks and of the chimpanzee. He discovered an electrical organ in the tail of the ray (*Raia lævis*). He also gave an account of the anatomy of two land mollusks (*Tebennophorus Carolinensis* and *Glandina truncata*). He devoted much time to certain points in human anatomy. Says Dr. Holmes:

"He has given an admirable description of the arrangement of the spicula of bone in the neck of the human femur, and contrasted this arrangement with that observed in other animals not destined for the erect posture. All his figures of the internal structure of this and other bones of the human frame are, like other illustrations from his own skillful pencil, clear and bold. He knew just what he wanted to show, and his hand obeyed his intelligence. Another article of more popular interest is his description of the brain and cranial cavity of Daniel Webster. Of a more practical bearing is his account of a hitherto unnoticed feature of the two lower lumber vertebræ, dependent on their anatomical peculiarities. In a memorable trial his evidence relating to the bones which had been submitted to great heat is of singular excellence as testimony, and his restoration of the fragments is a masterpiece of accuracy and skill."

But a more elaborate essay was that on the anatomy of the blind fish of Mammoth Cave, Kentucky. Dr. Tellkampf had previously dissected the fish, had detected its rudimentary eyes, and figured the brain, as well as called attention to the "folds on the head serving as organs of touch, as numerous fine nerves led from the trigeminal nerve to them and to the skin of the head generally." In 1853 Dr. Wyman published a description of the eye and ear in Silliman's Journal for 1854. It was a brief paper, but he afterwards turned over to Mr. F. W. Putnam his unpublished drawings and notes, which were incorporated in Mr. Putnam's article in the "American Naturalist" for January, 1872, where he gives especial attention to the nature of the tactile organs on the front of the head. "These papillæ," Wyman states, "are largely provided with nervous filaments, and, as is obvious from their connection with branches of the fifth pair of nerves, must be considered purely tactile, and the large number of them shows that tactile sensibility is

probably very acute, and in some measure compensates for the virtual absence of the sense of sight."

One of his earliest papers (1843) was a curious inquiry into the resemblance between the microscopic character of the teeth of the gar-pike as compared with those of the labyrinthodont batrachians. His description and figures show the close resemblance between the teeth of these forms.

During the same year Wyman began to publish the results of his studies of the higher apes. In his account of the structure of the chimpanzee, in a joint paper by Dr. Savage and himself, he corrected some of Owen's statements. He was the first author to give a scientific description of the gorilla, based on specimens sent him by Dr. Savage. His essay, published in 1847, "contained the essence," says Wilder, "of all that was afterwards published by Owen, who refers to the author as a most accomplished anatomist and physiologist."

Professor Gray refers at length to these studies:

"But the memoir by which Prof. Wyman assured his position among the higher comparative anatomists was that communicated to and published by this society in the summer of 1847, in which the gorilla was first named and introduced to the scientific world, and the distinctive structure and affinities of the animal so thoroughly made out from the study of the skeleton that there was, as the great English anatomist remarked, 'very little left to add and nothing to correct.' In this memoir, the 'Description of the habits of *Troglodytes Gorilla*' is by Dr. Thomas S. Savage, to whom, along with Dr. Wilson, 'belongs the credit of the discovery.' The osteology of the same and the introductory history are by Dr. Wyman. Indeed, nearly all since made known of the gorilla's structure, and of the affinities soundly deduced therefrom, has come from our associate's subsequent papers, founded on additional crania brought to him in 1849 by Dr. George A. Perkins, of Salem; on a nearly entire male skeleton of unusual size, received in 1852 from the Rev. William Walker, and now in Wyman's museum, and on a large collection of skins and skeletons placed at his disposal in 1859 by Du Chaillu, along with a young gorilla in spirits, which he dissected. It was in the account of this dissection that Prof. Wyman brings out the curious fact that the skull of the young gorilla and chimpanzee bears closer resemblance to the adult than to the infantile human cranium.

"In Prof. Wyman's library, bound up with a quarto copy of the memoir by Dr. Savage and himself, is a terse but complete history of this subject, in his neat and clear handwriting, and with copies of the letters of Dr. Savage, Professor Owen, Mr. Walker, and M. du Chaillu.

"In the introductory part of the memoir, Prof. Wyman states that 'the specific name, *Gorilla*, has been adopted, a term used by Hanno in describing the wild men found on the coast of Africa, probably one of the species of the Orang.' The name *Troglodytes Gorilla* is no doubt to be cited as of Savage and Wyman, and it was happily chosen by Prof. Wyman, after consultation with his friend, the late Dr. A. A. Gould, for the reason just stated. But it is interesting to see, in the correspondence before me, how strenuously each of the joint authors deferred to the other the honor of nomenclature. Dr. Savage from first to last insists in repeated and emphatic terms that the scientific name shall be given by Dr. Wyman as the scientific describer, and that he could not himself honestly appropriate it. Prof. Wyman, in his MSS. account, after mentioning what his portion of the memoir was, and that 'the determination of the different characters on which the establishment of the species rests was prepared by me,' briefly and characteristically adds: 'In view of this last fact, Dr. Savage thought, as will be seen in letter, that the species should stand in my name, but this I declined.'

"This memoir was read before this Society on the 18th of August, 1847, and was published before the close of the year. But it had not, as it appears, come to Prof. Owen's knowledge when the latter presented to the London Zoölogical Society, on the 22d of February, 1848, a memoir founded on three skulls of the same species, just received from Africa through Capt. Wagstaff. When Prof. Owen received the earlier memoir, he wrote to compliment Prof. Wyman upon it, substituted in a supplementary note the specific name imposed by Savage and Wyman, and reprinted in an appendix the osteological characters set forth by the latter.

"It does not appear (adds Dr. Wyman) either in the Proceedings or the Transactions of the [Zoölogical] Society at what time our memoir was published, nor that we had anticipated him in our description.

"It is safe to assert that in this and the subsidiary papers of Dr. Wyman may be found the substance of all that has since been

brought forward bearing upon the osteological resemblances and differences between men and apes. After summing up the evidence he concludes:

"'The organization of the anthropoid quadrumana justifies the naturalist in placing them at the head of the brute creation, and placing them in a position in which they, of all the animal series, shall be nearest to man. Any anatomist, however, who will take the trouble to compare the skeletons of the negro and the orang cannot fail to be struck at sight with the wide gap which separates them. The difference between the cranium, the pelvis, and the conformation of the upper extremities in the negro and Caucasian sinks into comparative insignificance when compared with the vast difference which exists between the conformation of the same parts in the negro and the orang. Yet it cannot be denied, however wide the separation, that the negro and orang do afford the points where man and the brute, when the totality of their organization is considered, most nearly approach each other.'"

Another subject, one in transcendental anatomy, was more difficult, but in its treatment Wyman's common sense, tact, caution, and freedom from excess in speculation were conspicuous. This was his thoughtful essay on symmetry and homology in limbs, published in 1867. He thus opens the subject:

"Anatomists who have compared the fore and hind limbs of man and animals have mostly described them as if they were parallel repetitions of each other, just as are any two ribs on the same side of the body. By a few they have been studied as symmetrical parts, repeating each other in a reversed manner from before backwards, as right and left parts do from side to side. We have adopted this last mode of viewing them because, though open to grave objections, as will be seen further on, the difficulties met with are, on the whole, fewer than in the other, and because, too, it is supported by the indications of fore and hind symmetry in other parts of the body."

This subject would seem in part to be metaphysical, and unless treated with careful hands a discussion of it is liable to become tinged with mysticism and scholasticism, and not to be scientifically productive.

Another subject which likewise borders upon what has been called transcendental anatomy is the relation between the vertebrates and

invertebrates. This has been treated in Wyman's best manner in his elaborate treatise on the nervous system of Rana pipiens, published in 1853. His style is comprehensive and yet simple and clear; his decisions sound, judicial; and his views, notwithstanding recent embryological work, especially on the ascidians and Amphioxus, are, it seems to us, well based.

We quote the following passage as an example of his logical style of reasoning and the force and aplomb of his language, and also because the question has again come up for renewed discussion, and Wyman's arguments will hold as well now as thirty-two years since:

"Although frequent attempts have been made to homologize the nervous systems of vertebrates and articulates, yet in reality there seems to exist no correct basis on which the alleged homology may rest. Among the earlier advocates of this view were Gall and Spurzheim, but a more able advocate was found in Geoffroy St. Hilaire. Still more recently the doctrine has been revived, at least, in part. In the recent edition of his General and Comparative Physiology Dr. Carpenter seems to recognize the homology of certain portions, at least, of the nervous systems of articulates and vertebrates, though in others he admits simply an analogy. After stating that there is nothing in the articulates homologous with the cerebrum and cerebellum of the vertebrates, he says: 'The first subœsophageal ganglion, which has been likened to the latter (the cerebellum), being really homologous, as the distribution of its nerves abundantly proves, with the medulla oblongata.'*

"In speaking of the spinal chord he says: 'It consists of a continuous part of gray matter inclosed within strands of longitudinal fibres, and it may thus be regarded as *analogous* to the ganglionic chain of the articulates. If there be any homology, it seems to us as if the whole nervous system of the articulates, as far as it is developed, should be homologous with a corresponding portion of that of the vertebrates. If the subœsophageal ganglion is homologous with the medulla oblongata, that which follows it should be homologous with the spinal chord. There seems sufficient ground for the belief that all homology between the nervous systems of the two divisions is as much contraindicated as between their skeletons or their muscular systems. If a true homology existed we ought at

*Gen. and Comp. Phys., 3d edit., p. 1017.

least to have representatives from the articulates and vertebrates, in which the identity would be obviously proximate, if not absolute. But as yet there has been described no instance where the spinal chord, structurally considered, is fairly and distinctly represented in the articulates, nor among vertebrates any true ganglionic chain with an œsophageal ring through which the œsophagus passes. The existence of separate lateral halves of the spinal chord in the vertebrate embryo has been adduced as evidence of identity. Has there, however, ever been seen an embryo of a vertebrate in which there were developed on the lateral halves of the spinal chord itself distinct and separate ganglionic masses united with the masses above and below? It is true, as already stated, that in many vertebrates distinct enlargements of the chord correspond with the attachments of the different pairs of spinal nerves. But still, in these instances, the chord never loses its vertebrate type. There is always, at least, even in amphioxus, an uninterrupted mass of cell substance occupying the entire length of its centre, and this substance in all other vertebrates is enclosed in two half-sheaths of longitudinal nerve tubes. The likeness recognized between the subœsophageal ganglion and medulla oblongata is *physiological*, but not anatomical; and physiology, all philosophical observers agree, does not teach us homology. The wings of birds and insects, physiologically considered, are corresponding parts, but not so as anatomical structures. On the other hand, the tongue of the giraffe, of the woodpecker, the chameleon, and the lamprey, anatomically considered, are identical parts, are homologous with the organ ordidinarily subservient to taste, but, physiologically studied, are appropriated to widely different uses. Thus the subœsophageal ganglion may be, as regards its functions, the analogue of the medulla oblongata, an analogy, however, which the pure anatomist, independently of experiment, would never discover.

"Professor Owen, in speaking of the interspace in fishes, 'produced by the divarication of the main lateral columns of the encephalon,' through which passes the membranous tube (infundibulum) connected with the hypophysis, asks: 'Is this vertical slit homologous with the encephalic ring perforated by the œsophagus of the invertebrata?'* The homology in this case appears to be opposed by the fact that the slit in question in the fish opens *in front* of the

* Lectures on Comparative Anatomy, vol. II, Fishes, p. 181.

optic lobes, which last, if there be any homology between the nervous systems of the vertebrates and invertebrates, would be the homologues of the supraœsophageal ganglia which give off the optic nerves. The slit should therefore be behind and not in front of these lobes.

"It is contended that the homology between the nervous centres of vertebrates and articulates is contra-indicated by the following facts:

"1st. The brain and spinal chord are enveloped in a common sheath, the vertebral column and its contained membranes, and are never in the same cavity with the viscera, even in the embryo, while the ganglionic chain is lodged and developed in the common cavity with the organs of organic life. 2d. In vertebrates the spinal chord is always on the back and the ganglionic chain always on the abdominal side in the Articulates. 3d. One consists of a continuous mass of both tubular and vesicular structure, while in the other the vesicular structure is interrupted. 4th. The œsophageal ring, with the œsophagus inclosed, never exists in vertebrates, but is always present in the articulates in common with nearly all other invertebrates. 5th. The embryonic conditions of the two systems do not at any period clearly assimilate each other. 6th. Two parts, to be homologous, must be structurally and morphologically similar, and not simply the seat of similar processes."

Work like that on the higher apes and the one under present consideration has placed Wyman's reputation fairly on a level with that of the leading European comparative anatomists. In such work it is quality, and not necessarily quantity, of matter or abundant illustrations which mark a first-rate workman.

We might, in further illustration, quote from the same work what he says as to another debated point in transcendental anatomy which has engaged the attention of morphologists from the days of Oken, Carus, Goethe, St. Hilaire, and the early days of Owen's life. We refer to the vertebrate theory of the skull, regarding which so much has been published by English and German morphologists since Wyman's death:

"The determination of the typical number of cranial nerves becomes a matter of importance in consequence of its bearing upon the philosophical anatomy of the skull. On the hypothesis that the cranium is made up of a series of vertebræ, one of the first questions

which is presented is as to the number which enter into its composition. Throughout the vertebral column, as ordinarily understood, the pairs of nerves equal the number of vertebral pieces. If the cranium is reducible to the vertebral type we might, from analogy, expect that there would be found a series of nerves corresponding in number to the vertebræ of which the cranium is made up. If we admit only such nerves as present the true spinal character to be indicative of the number of vertebræ—that is, those which have motor and sensitive roots, are provided with ganglia, and have a similar mode of development—then, according to the analysis given above, there being three pairs of nerves conforming to the spinal type, we should infer the existence of three vertebræ."

"Anatomists, however, have not generally followed these indications, and it is a singular fact that, in establishing the number of cranial vertebræ, they have rested their conclusions on such widely-different foundations. Oken, in his latest publication, admits the existence of four vertebræ, based on the organs of sense and the lower jaw, and which he designates as the "nose vertebra," the "eye vertebra," the "ear vertebra," and the "jaw vertebra." Bojanus also recognizes four, and substitutes the "tongue vertebra" for Oken's jaw vertebra. Agassiz admitted but a single cranial vertebra, since the chorda dorsalis of the embryo did not extend beyond that portion of the base of the skull which corresponds with the basilar portion of the occiput. Professor Owen, the most recent writer on the subject, who has investigated it very minutely, and has worked out his system with admirable skill, bases his vertebral theory upon the principal subdivisions of the encephalon, from which he deduces a "rhinencephalic," "prosencephalic," "mesencephalic," and "epencephalic" vertebra. A larger number has been admitted by others, as Geoffroy St. Hilaire, Carus, and Maclise, based mainly on an unsound determination of the different osseous elements.

"If we apply the analogies of the spinal chord and vertebral column to the cranium and its nerves we ought to base our determinations on the repetitions of the true spinal nerves and of the true vertebral elements. If the theory be true which reduces the cranial nerves (exclusive of the special sense nerves) to three, namely, the trigeminus, vagus, and hypoglossus, then we ought, *à priori*, to detect at least three vertebral segments. This conclusion agrees perfectly well with the determinations from osteology, for the larger part of modern anatomists admit at least three vertebræ, though

some admit more, but are not precisely agreed as to the exact number of elements which enter into the composition of each. These vertebræ may be designated as follows: 1st, the occipital, of which the basilar bone is the body; 2d, the parietal, of which the posterior sphenoid is the body; 3d, the frontal, of which the anterior sphenoid is the body. Prof. Owen admits a fourth, of which the vomer is the body, and, as this vertebra is associated with the organs of smell, he designates it as the rhinencephalic vertebra. It is through or between these three vertebræ enumerated above that the trigeminus, vagus, and hypoglossus have their exit from the cranial cavity, and it is likewise through or between these same vertebræ that the special sense nerves make their escape. If the number of pairs of nerves of both kinds is to regulate the number of vertebræ then, instead of three pairs, we must admit six for the cranium alone, leaving wholly out of view the face. But if the special sense nerves, for reasons already stated, can be rejected as indications of vertebræ, the cranio-spinal nerves will give us just the number which accords with osteology. In this conclusion we are supported by both osteology and neurology. Johannes Muller admits the existence of three vertebræ, and argues from them the number of pairs of cranio-spinal nerves. 'According to my view there are three vertebral nerves of the head, just as there are three cranial vertebræ. The first is the fifth, or trigeminus; the second is the vagus, with the glosso-pharyngeal and accessory, and the third is the hypoglossus.'

"The three-vertebra theory given above relates simply to the bones constituting the walls of the cranial cavity, which include the brain; no account is taken of the jaws and other bones of the face, nor of the os hyoides. Prof. Owen, in his system, regards these, with the scapular arch, as forming a series of four inferior or 'hæmal' arches to the four cranial vertebræ, with their 'neural arches;' that they, in fact, are serial repetitions of ribs.

"It would be foreign to the purpose of this paper to discuss the grounds on which these conclusions rest. Another hypothesis seems to us worthy of consideration, but which can only be stated in general terms, as follows:

"The teeth in the early embryonic conditions are developed from, and are dependencies of, the mucous membrane of the mouth. In many fishes these conditions are permanent. In rays, sharks, and other cartilaginous fishes the jaws, or other bones which support teeth, are equally developed in the internal integument or mucous

membrane, and are never closely connected with the cranium except by ligament; the hyoid apparatus is likewise developed in the walls of the alimentary canal. If to these facts we add another, namely, that primarily the mouth and nostrils form a single cavity, and are only separated after development has advanced to a certain stage, we have a strong ground for the hypothesis that all the bones of the face, which are developed in the walls of the primitive cavity of the mouth, which they surround, are, in their anatomical and physiological relations, splanchnic, connected either with digestion or respiration, rather than parts of the endo-skeleton of animal life.

"The conclusions which have been drawn from the statements made above are as follows:

"That in frogs the *vagus* comprises the glosso-pharyngeal and accessory nerves; that the *trigeminus* comprises the facial, the abducens, and in the Salamanders the patheticus and portions of the motor-communis; that other evidence sustains the hypothesis that the whole of the motor-communis is a dependence of the trigeminus. If to these we add the *hypoglossus* (which in frogs is exceptionally a spinal nerve) we shall have three pairs of cranial nerves, each having all the characters of a common spinal nerve, namely, motor and sensitive roots and a ganglion; that there are no nerves to indicate a fourth vertebra, unless the special sense nerves are considered. If these are admitted as indications, then we must presuppose either two pairs of nerves to each vertebra or the existence of six vertebræ, which is a larger number than can be accounted for on an osteological basis. The functions and mode of development of the special sense nerves we have taken as affording sufficient grounds for considering them as of a peculiar order, and not to be classified with common spinal nerves."

Another field of research which has engaged the attention of the master-minds in anatomical science is that of teratology, or the description of and explanation of the causes which induce abnormal developments. Among Wyman's minor contributions to this topic are his notes on double-headed snakes, as well as cyclopean and partly-double pigs. But the essay which at once attracted attention, from its ingenious and able attempt to explain the ultimate origin of double monsters, as well as bilateral symmetry in general, was his description of a double human fœtus, published in 1866, in which he came to the following conclusions:

"The descriptions of double monsters by many different observers all show that the tendency is to symmetrical development, so that when an organ ordinarily single becomes double the two organs are always right and left. This is well seen in the specimen just described in the existence of a right and left heart, right and left stomach, spleen, &c. In the cases where organs commonly double are increased in number we may have either a third organ or two entire ones. In the first case the law of symmetry is manifest in a most striking manner, for all such third organs, if not compound in structure, are divisible into right and left halves and half from a different fœtus, and repeating each other oppositely. If, however, they are made up of many parts, as a limb, then the individual parts repeat each other in a smilar way. In the arm already described the muscles repeat and balance each other exactly throughout, and the same is mostly true of the legs.

"The force, whatever it be, which regulates the distribution of matter in a normal or abnormal embryo always acts symmetrically, and if we look for anything among known forces analogous to it it is to be found, if anywhere, in those known as polar forces. The essential features of polarity, as in symmetry, are antagonism, either of qualities or forms. Studying the subject in the most general manner there are striking resemblances between the distribution of matter, capable of assuming a polar condition and free to move around a magnet, and the distribution of matter around the nervous axis of an embryo.

"In every complete series of magnetic curves there are two neutral lines, one extending lengthwise of the magnet, so that the curves formed are divided into right and left; secondly, a transverse one, the particles on each side of which are known as forming the north and south curves. In the right and left series those which are on one side of the magnet are symmetrical with those on the other, but not in themselves; and in the north and south series those on either side of the transverse neutral line are symmetrical with each other, but not in themselves. Thus we have in the first case something analogous to right and left or bilateral symmetry and in the second to fore and hind symmetry.

"If two magnets are placed parallel to each other and at a distance then two complete sets of curves are formed in the usual way, but if they are brought so as to be within each other's influence the magnetic figure now becomes a compound one, the central portion

of which consists of the united curves from the two adjoining sides of the magnet, and the particles from either series of curves do not pass beyond the line where the forces of the two magnets are in equilibrium."

In comparative physiology Wyman's minor notices related to the reproduction of lost parts in planarian worms and other animals on which he experimented, to respiration in beetles, and to the poison of the rattlesnake, which he published in 1860. In that paper he demonstrated the want of direct continuity between the duct of the poison gland and the tooth canal. He explains how the poison is carried from one to the other. A projecting papilla at the end of the duct is held by the gum in close contact with the fang-opening, and when the fang, in rising, thrusts back its mucous cloak this presses so closely upon the parts at the base of the fang as to bring them into perfect opposition.

He also published an account of the mechanism of the tibio-tarsal articulation of the ostrich.

Perhaps his most ingenious and striking work in general physiology is to be found in his novel "Experiments with Vibrating Cilia," published in the "American Naturalist" in October, 1871. He was the first author to call attention to the fact that the force exerted by cilia is unexpectedly great. His attention was first called to the possibility of moving weights much larger than was supposed possible by noticing the ease with which a piece of skin which was accidentally placed upon the ciliated membrane was swept off. By loading the piece of skin with weights the mass moved was found to be unexpectedly large. An ingenious device was therefore planned, which we will let him describe in his own words:

"The mucous membrane being carefully dissected from the roof of the mouth is pinned to a board. A piece of skin from near the throat of the frog, and from one-third to half an inch square, is placed upon this membrane with the inner surface in contact with the cilia, it being kept in mind that these vibrate from before backwards towards the throat. On the skin may be placed a plate of lead of somewhat smaller size. This serves as a vehicle, to which weights may be added at will to increase the load.

"Pains should be taken to have the board on which the experiment is made perfectly horizontal; otherwise a sliding motion, especially when heavy weights are used, may come in to vitiate the experiment."

The rate of movement was determined either by direct observation of the lead "vehicle" with its load or by means of an index attached to the axle of the smaller of a pair of cog-wheels, the "vehicle" being connected with the apparatus by means of a thread coiled round a drum on the axle of the larger wheel. By experiments performed in this way it was found that a weight of thirteen grammes was carried fifteen m. m. in about one minute, the weight resting on a surface of twelve m. m. square, and that "forty-eight grammes, resting on a surface fourteen m. m. square, moved, though very slowly, across the whole length of the membrane; but the exact time was not noted."*

In the broad field of general biology Wyman contributed excellent material. He noticed the effects of the absence of light in retarding the development of tadpoles by keeping those of the bull-frog for seven years in a cellar.

He writes to Mr. Darwin a fact bearing on the correlation between the color of animals and their susceptibility to poison, who reproduces his statement in the "Origin of Species:"

"Prof. Wyman has recently communicated to me a good illustration of this fact. On asking some farmers in Florida how it was that all their pigs were black, they informed him that the pigs ate the paint-root (lachnanthes), which colored their bones pink, and which caused the hoofs of all but the black varieties to drop off; and one of the 'crackers' (*i.e.*, Florida squatters) added, 'We select the black members of a litter for raising, as they alone have a good chance of living.'"

A most admirable research and one thoroughly characteristic of Wyman's mode of working was his essay on the cells of the hive-bee. Here his critical, patient, and in all respects admirable spirit in dealing with a difficult problem are conspicuous. On investigating Maraldi's statements and Lord Brougham's assertions regarding the mathematical exactness of the cells of the bee, Prof. Wyman, by a series of remarkably ingenious measurements, taking plastic casts and natural imprints of the combs, found a surprising amount of variation in the thickness of the different walls, so that he doubted if a typical or mathematically exact cell is ever made. His method of research as compared with that of his prede-

*Compare also Dr. H. P. Bowditch's studies on this subject in the Boston Medical and Surgical Journal, August 10, 1876.

cessors enabled him to utter with authority the dictum that "the isolated study of anything in natural history is a fruitful source of error." In concluding this classical essay he remarks:

"In view of the fact, too, that in meeting a given emergency they do not always adopt the same method, one is driven to the conclusion that the instinct of one and the same species either is not uniform in its action and is quite adaptive in its quality, or to admit, with Réaumur, that bees work with a certain degree of intelligence."

Among the more delicate and difficult researches which he made were his experiments on spontaneous generation. In 1862 he published his "Experiments on the formation of infusoria in boiled solutions of organic matter enclosed in hermetically-sealed vessels and supplied with pure air." The results of these experiments are, in his own words, "that the boiled solutions of organic matter made use of exposed only to air which has passed through tubes heated to redness or enclosed with air in hermetically-sealed vessels and exposed to boiling water became the seat of infusorial life." Wyman then, in his usual judicial manner, gives the conclusions that would probably be drawn by those in favor of and those opposed to the doctrine of spontaneous generation, and leaves the matter quite undecided in the reader's as probably in the author's mind. The subject, however, was not allowed to rest here. Five years after appeared his "Observations and Experiments on Living Organisms in Heated Water." The conclusions he arrived at we will not pause here to recount more than to say that he showed that no life appeared in water boiled beyond a period of five hours.

In print Prof. Wyman refrained from expressing any ultimate opinion relative to the general question of spontaneous generation. To the writer he once remarked that spontaneous generation probably did not occur at the present day, though the first organism might have arisen in this manner; but, he added, "even if we had been on the spot when it occurred we might not have discovered it."

But naturally, from the nature of the subject, the most complex and difficult field of inquiry of the present day is the science of anthropology in its widest sense. This embraces not only the early sciences of archæology and ethnology, but the developmental history of man, and not his physical history only, for the border land

of anthropology merges into the domain of psychology and mythology and the comparative study of religions. In the broadest sense the new science treats of man not only in his physical but in his intellectual, moral, and religious relations.

At the time of his death Wyman was indisputably the leading anthropologist of America, though he had published nothing upon myths, languages, and little on the social relations of the human races. But to the physical history of mankind, particularly of the American aborigines, he has made important contributions, and for this he was well qualified by his early studies in human osteology and comparative craniology, also by his studies in comparative anatomy and physiology. Many have the leisure and disposition to collect Indian relics, to take down the myths and traditions of the red man, to unearth the contents of mounds, and to measure skulls, but Wyman's wide experience, care, cautiousness, self-restraint in dealing with problems over which so many have gone astray—these qualities, together with his ingenuity, good judgment, exact and philosophic cast of mind, have placed him by universal consent among the leading anthropologists of his time.

His early studies in human osteology and that of the higher apes, dating from 1843, paved the way to his later successes. In 1855 he published the results of his measurements of four East Indian crania; in 1862 and 1863 he gave to the public the results of his dissection of a Hottentot; two years later he described the distorted skull of a child from the Hawaiian Islands; in 1868 he published his valuable "Observations on Crania." In this series of papers he begins with suggestions as to the different methods of measuring crania, in the course of which he remarks:

"Brain, not cranial measurement, is, of course, the object of the study of the capacity of the skull; but until some definite results are obtained which will enable the observer to make accurate corrections, we must remain content with cranial measurement for the present, and apply the corrections hereafter." This section is followed by remarks on the relative position of the foramen magnum; the description of crania from the Island of Kauai; the crania of Tsuktshi obtained from the Asiatic side of Behrings Straits; on synostotic crania, and finally he remarks on the Neanderthal skull. To whatever subject he touched upon in anthropology, as in other sciences, he added something new and noteworthy.

In 1864 he published the results of his first examination of In-

dian mounds on the Atlantic coast. A number of minor papers succeeded this first notice. His six reports on the condition of the Peabody Museum of American Archæology and Ethnology contain much that is new and valuable. His most elaborate essay forms the fourth of the memoirs of the Peabody Academy of Science, at Salem, Mass. This was devoted to a special topic, the fresh-water shell heaps of Eastern Florida; but the breadth of treatment, the learning, ingenuity, skill, and literary style of the memoir render it a model. We quote the general conclusions:

1. The shell heaps are the work of man.

2. They are composed of the bones and shells used as food.

3. They contain fire-places and various tools and implements made of stone, bone, or shell; the stone implements are of great rarity in the mounds proper, though not unfrequent on the surface; the former are exceedingly rude; the latter are skillfully wrought as well as more abundant, and are believed to have been introduced by Indians migrating from the north, and are not, therefore, the work of the builders.

4. Fragments of pottery exist in the later but not in the oldest mounds. The pottery was in all cases of a rude kind.

5. The mounds contain human bones, broken up in the same manner as the bones of edible animals, and are believed to be the remains of cannibal feasts.

6. They contain fragments of the bones and teeth of extinct animals, as the mastodon, elephant, horse, ox, turtles, manatee, and a cetacean. These have undergone changes, which show that they were not contemporaneous with the builders of the mounds.

7. The mounds have undergone more or less destructive changes by the action of the river, and in some cases have been separated from the river by the shifting of the channel, in consequence of which swamps have been formed between the mound and the receding shore.

8. Though the absolute age of the mounds cannot be determined a minimum age of several hundred years has been approximately ascertained, justifying the conclusion that some of them were essentially two or three centuries before the arrival of the white man, as shown by the age of the trees growing upon them. Other but not

exact signs of age are to be found in the changes of the channel since the mounds were built, the greater or less destruction of the mounds by the river, the growth of swamps, and the consolidation of the shells through the agency of percolated water charged with lime.

9. Only a single skull of the builders has been found; this differs from some of the burial mounds in being longer, with the ridges and processes more pronounced. There are bones from other parts of the body, from two individuals, in both of which there was the flattening of the tibia. A second collection of human bones was found embedded in sandstone, under a shell heap, at Rock Island, Lake Monroe; only a part of the skull was found; the tibiæ were flattened, but no other peculiarities were observed.

10. Whether the builders of the mounds were the same people as those found there by the Spaniards and the French is uncertain. The absence of pipes in all and of pottery in some of the mounds, and the extreme rarity of ornaments, are consistent with the conclusion that they were a different people. To these may be added the negative fact that no indications have been found that they practiced agriculture.

This memoir was published in December, 1875, a little more than a year after his death. Although the subject seems a limited one—it was discussed in so full and comparative a way; so much relating to general American archæology was comprised in it—it so far excelled any other American work of the same nature that in his death it was at once realized what a loss American anthropology had sustained.

Prof. Wyman left no bulky printed works behind him. The results of long, unwearied investigations were usually condensed into a page or two, the original manuscript, of which it was the abstract, remaining unpublished. His papers and memoirs already published will be classics—models of the best and most ingenious modes of research. Had his health been more robust he would probably have been a more prolific writer, but not a more careful and painstaking investigator. His style was clear, forcible, elegant, and he was impartial in the exposition of the facts he had to communicate.

It remains to learn how Wyman thought on those ultimate problems which have confronted the physiologist and thoughtful naturalist from the days of Democritus down to the time of Lamarck and

Darwin. We have seen that he approached the question of biogenesis or spontaneous generation with a mind free from bias, bigotry, and untrammeled by public opinion. He desired to know the whole truth, or, if that were unattainable, what was the probable truth.

He seemed rather inclined to the belief that in the beginning what we understand as spontaneous generation took place, but that it does not occur at the present time.

He did not believe in a "vital force"—that it was an entity. He distinctly disavowed to the writer his belief in the popular conceptions as to what is usually denominated by that phrase. At the same time he did not give his views in detail as to what he regarded to be the nature of life. He by no means took a purely monistic view of the matter.

As regards the theory of descent, we well remember in 1861 and 1862, while a student attending his lectures, the impartial way in which he would refer to the subject. He then taught that creation went on in one of two modes, either by a series of progressive acts of creation or by a continuous process of evolution. We suppose that Wyman had lectured on the subject in the same judicial, unbiased way for years previous.

At that time the public had begun to take a lively interest in the theory of evolution. But the same calm, dispassionate mode of treatment which the subject received in his public lectures probably characterized his own thoughts on the subject. A few years later, before 1870, in conversations with Professor Wyman it was evident that his mind had fully accepted the doctrine of evolution, and that no other view appeared to him philosophically probable. He did not wait until these views became popular. In his posthumous work on the Florida shell heaps, which must have been written in 1873 or early in 1874, he thus expressed his views:

"The steady progress of discovery justifies the inference that man, in the earliest periods of his existence of which we have knowledge, was at the best a savage, enjoying the advantage of a few rude inventions. According to the theory of evolution, which has the merit of being based upon and not being inconsistent with observed analogies and processes of nature, he must have gone through a period when he was passing out of the animal into the human state, when he was not yet provided with tools of any sort, and when he lived simply the life of a brute." (P. 45.)

As a man he was genial, unassuming, though independent. He

never had a controversy—never lost the friendship or respect of any one; he was not a partisan; he was strangely free from bigotry; he was conspicuously modest. We had almost said that it were better if he had had a little more self-assertion, but his character was so well balanced that we could not have changed the features of his symmetrical nature a hair's breadth.

It would have seemed possible to one who for many years had been a pronounced evolutionist (though not in print), and a disbeliever in the so-called "vital" force as distinguished from the chemico-physical forces, who had dealt so largely in speculative questions of science, who had thought so freely on all points in general and philosophic anthropology, that he would have been skeptical, or indifferent, to the prevailing religious views of his day. So far from this he was an habitual attendant on public worship. Wyman was a Christian philosopher. His well-balanced, comprehensive mind, so absorbed in the study of material things, also acknowledged the Infinite Force operating in and through matter. His nature had too much equipoise, his religious aspirations too much cultivation and strength, to allow him either to fall into an indifferent, negative nescience, an aggressive, self-asserting materialism, or a nerveless, protoplasmic pantheism.

Such, in all its varied, many-sided aspects, was the life-work of this sincere lover of nature, whose whole mind was given to seeking the causes of things. He unreservedly gave his intellectual force to the study of living things. Whatever was endowed with life—that elusive principle or energy animating and pervading matter—attracted his quick glance and serious thought.

We may paraphrase the Latin sentence, and put in his lips, omitting what might be the first clause: "*Vivi nihil a me alienum puto.*"

Never more forcibly than now press upon the mind of the inquiring naturalist those ultimate questions: What is life, and what its origin? The solution of these questions, of such vast moment to the philosophic student of biological science, would seem to be in the lines of inquiry which Wyman pursued with such eagerness and success as his strength would allow. He realized to the full that joy and exultation of soul which comes from the discovery of natural truth, which every true naturalist feels. "I think," he once said to a friend,* "that the most happy and heart-filling thing

* Dr. S. Weir Mitchell. See Lippincott's Magazine, March, 1875.

in the world is to come face to face with something which no one but God ever saw before." He ranks in the advance guard of those students of living nature who have so exalted and widened the scope of the circle of those sciences which have to do with organic nature.

If in considering the character and attainments of the subject of this imperfect notice we have seemed too eulogistic, we can but plead the example of far abler judges of human nature, his own contemporaries, who knew him better than most others, and whose language may seem exaggerated to those who never personally knew our departed associate.

His friend, Dr. S. Weir Mitchell, in the pages from which we have already quoted, thus testifies to the charm of the almost ideal life we have so inadequately sketched:

"I had three or four sets of associations with Wyman, no one of which fails to come back to my remembrance filled with the charm of a man whose whole nature was simple, wholesome, pure, and generous. Others have said all that need be said of what he did for his much-loved science. It is less easy to convey to those who knew him not an impression of the influence he exerted upon younger workers and a sense of the social pleasure which came of his remarkable combination of vast knowledge and general culture, combined with a certain loveliness of character and an almost childlike simplicity. I once heard our greatest preacher nobly illustrate, with Sampson's riddle as his text, the delightfulness of that form of human character in which sweetness and strength are blended. As I listened somehow I began to recall Wyman, for it was just here that his social charm resided. He was intellectually stronger even than any of his contemplated work showed, but he was also the most lovable of men. His mind was very active and remarkably suggestive—so much so that in social chat, even the most careless, he was constantly saying things which made you think or left you thoughtful. For many years he wrote to me frequently, and his letters are filled with the most lucid and happy suggestions, explanations, and comments. After the failure on the part of one of his friends to attain a deserved object of just ambition he wrote to me to state his own extreme regret, and this not once but thrice, as if he was haunted by the sorrow of another's disappointment. At times he was full of the most boyish spirit of jesting, as when in 1862 he wrote me grieving over the secession of Virginia, because we

had both of us lost our easiest supply of rattlesnakes. Then he rejoiced over the fact that we still had the bull-frog, and in another note regrets that the rattlesnakes had not been allowed to vote on the question of seceding."

Dr. Holmes has drawn his portrait in the following words:

"Jeffries Wyman looked his character so well that he might have been known for what he was in a crowd of men of letters and science. Of moderate stature, of slight frame, evidently attenuated by long invalidism, with a well-shaped head, a forehead high rather than broad, his face thin, his features bold, his expression mild, tranquil, intelligent, firm, as of one self-poised, not self-asserting, his scholarly look emphasized by the gold-bowed spectacles his near-sightedness forced him commonly to wear—the picture of himself he has left indelibly impressed on the memory of his friends and pupils is one which it will always be a happiness to recall."

And of his inward graces the following sketch:

"Who has ever preached such a sermon as this sweet and lovely life has been always setting forth in the golden letters of daily action? * * * His characteristic excellencies recall many points of the apostle's description of the virtue which never faileth. He suffered long and was kind; he envied not; he vaunted not himself; he was not puffed up; he sought not his own; was not easily provoked; thought no evil, and rejoiced in the truth. If he differed from Charity in not believing all things, he followed the apostolic precept of trying all things and holding fast that which had stood the trial. Many scientific men of great note have had too obvious failings. Hunter was ill-tempered; Davy was ill-mannered; Wollaston was acquisitive. It is with men like Faraday and Edward Forbes that we would name Jeffries Wyman—Faraday, living in uncomplaining poverty, happy in the incessant pursuit of knowledge, absorbed and earnest as a child over his toys in performing his wonderful experiments at the Royal Institution, simple-hearted, devout in his adhesion to his singular and self-denying creed; Edward Forbes, as shown in Dr. John Brown's eloquent pages, 'the delightful man, the gifted teacher, the consummate naturalist,' 'a child of nature, who lived in her presence and observance,' to whom all were welcome, and who was welcomed by all, 'who won all hearts' by his gifts and 'his unspeakable good nature,' who lived for science, and, when his summons came, 'behaved at the close, with his old composure, considerateness, and sweetness of nature.'"

And then adds a benediction, to which every one who ever knew our associate will from the soul assent:

"The work of his busy hands is done; the sound of his cheerful voice is heard no more; his smile will never welcome us again at the threshold of his beautiful museum; the benediction of his presence will no more hallow our friendly meetings. It is a pleasure of the purest nature, and not easily to be forgotten, to associate one's name but for an hour with such a fragrant memory. It may seem as if too much had been made of his virtues and graces; but all that has been said is no more than all that knew him are saying, and less, how much less! than such a life is entitled to claim. To other hands which will fill out this imperfect outline and add color to these scarcely-tinted features, which will show his intellect in its full proportions, his labors in their entire extent, his thoughts in their complete expression, his character in its noble sincerity, the sweet remembrance of Jeffries Wyman is lovingly commended."*

To Jeffries Wyman.

The wisest man could ask no more of fate
Than to be simple, modest, manly, true,
Safe from the many, honored by the few;
Nothing to count in world, or church, or state,
But inwardly in secret to be great;
To feel mysterious nature ever new,
To touch, if not to grasp, her endless clew,
And learn by each discovery how to wait,
To widen knowledge and escape the praise;
Wisely to teach because more wise to learn;
To toil for science, not to draw men's gaze,
But for her love of self-denial stern;
That such a man could spring from our decays
Fans the soul's nobler faith until it burns.

JAMES RUSSELL LOWELL.

* Atlantic Monthly, November, 1874.

LIST OF SCIENTIFIC PAPERS AND WORKS

By JEFFRIES WYMAN.*

1. On the indistinctness of images formed by oblique vision. Boston Medical and Surgical Journal. Sept., 1837.

2. On fossil bones from Georgia and Burmah and a recent elephant's tooth from Singapore. Amer. Journ. Sci , xxxvi, 1839, pp. 385-386.

3. Note on a collection of fossil bones from Athens. Amer. Journ. Sci., July, 1839; Proc. Bost. Soc. Nat. Hist., 1839.

4. Remarks on the worms in measly pork. Amer. Journ. Sci., July, 1839; Proc. Bost. Soc. Nat. Hist., 1839.

5. Remarks on a bat, *Molossus ater*, etc., from Surinam. Amer. Journ. Sci., July, 1839. Proc. Bost. Soc. Nat. Hist., 1839.

6. Notice of the tooth of a mastodon. Amer. Journ. Sci., xxxix, 1840, pp. 53–54.

7. On the anatomy of *Tebennophorus carolinensis*. Boston Proc. Nat. Hist. Soc., i, 1841–44, pp. 154–155; Boston, Journ. Nat. Hist., iv, 1843–44, pp. 410–415.

8. On the anatomy of *Otion cuvieri Leach*. Proc. Bost. Soc. Nat. Hist. [1840.] Amer. Journ. Sci., xxxix, p. 182. June, 1840.

9. On a species of Filaria in the lungs of a sheep. Proc. Bost. Soc. Nat. Hist. [1840.] Amer. Journ. Sci., xxxix, p. 183. Oct., 1840.

10. Report on *Nautilus umbilicatus*. Proc. Bost. Soc. Nat. Hist. [Feb. 19, 1840.] Amer. Jour. Sci., xxxix, p. 185. Oct., 1840.

11. On buried wood, Unio, etc , in river sand at Lowell. Proc. Bost. Soc. Nat. Hist. [July 15, 1840.] Amer. Journ. Sci., xl, p. 388. March, 1841.

12. Note on the cranium of a seal (*Stenorhynchus leptonyx*) from the South Pacific. Proc. Bost. Soc. Nat Hist. [Jan. 20, 1841.] Amer. Journ. Sci., xl, p. 390. March, 1841.

13. Notice of the howling monkey (Simia seniculus). Amer. Journ. Sci., xl, 1841, pp. 387–388.

14. On the anal pouches of the skunk (*Mephitis Americana*). Boston, Proc. Nat. Hist. Soc., i, 1841–44, p. 110.

15. On the sternum of a male trumpeter swan (*Cygnus buccinator*). Boston, Proc. Nat. Hist. Soc., i, 1841–44, p. 119.

16. On the microscopic structure of the teeth of the Lepidosteus and their analogies with those of the labyrinthodonts (with a plate). Boston, Proc.

*This list has been compiled from the Royal Society's list and that published by Prof. F. W. Putnam, with additions.

Nat. Hist. Soc., i, 1841–44, pp. 131–132; Amer. Journ. Sci., xlv, 1843, pp. 359–363; London Physiol. Journ., 1843–44 (?).

17. Review of Vogt's Embryologie des Salmones. Amer. Journ. Sci., xlv, pp. 211–214. June, 1843.

18. Notice of the Zoölogy of New York. By J. E. DeKay. Amer. Journ. Sci., xlv, pp. 397–399. Sept., 1843.

19. Notice of Agassiz's Monographies and Echinodermes vivans et fossiles. Amer. Journ. Sci., xlv, pp. 399–400. Sept., 1843.

20. On the anatomical structure of *Glandina truncata*, Say. Boston, Proc. Nat. Hist. Soc., i, 1841–44, pp. 154–155; Boston Journ. Nat. Hist., iv, 1843–44, pp. 416–421.

21. Description of a blind fish from a cave in Kentucky. Amer. Journ. Sci., xlv, 1843, pp. 94–96.

22. (With Thomas S. Savage.) Observations on the external characters, habits, and organization of the *Troglodytes niger*, Geof. Boston Journ. Nat. Hist., iv, 1843–44, pp. 362–376, 377–386.

23. On *Echinorhynchus nodosus*. Proc. Bost. Soc. Nat. Hist. Jan. 4, 1843.

24. On a Rotifer and Tardigrades. Proc. Bost. Soc. Nat. Hist. Feb. 1, 1843.

25. Linguatula from a boa. Proc. Bost. Soc. Nat. Hist. March 1, 1843.

26. Ascarides from Cyclopterus. March 1, 1843.

27. Description of a new species of torpedo. Proc. Amer. Acad. Arts and Sci. April 25, 1843.

28. Annual address as president of the Boston Society of Natural History. May 17, 1843.

29. On *Spongia fluviatilis*. Proc. Bost. Soc. Nat. Hist. Sept. 4. 1844.

30. (With Thomas S. Savage.) Notice of the external characters, habits, and osteology of *Troglodytes gorilla*, a new species of ourang from the Gaboon river. Boston Journ. Nat. Hist., v, 1845–47, pp. 417–422; Ann. Sci. Nat., xvi (Zool.), 1851, pp. 176–182; Boston, Proc. Nat. Hist. Soc., ii, 1845–48, pp. 245–248; Amer. Journ. Sci., viii, 1849, pp. 141–142.

31. On the spiculæ of actinia. Boston, Proc. Nat. Hist. Soc., ii, 1845–48, pp. 51–52.

32. *Linguatula armillata* and *L. clavata*. Boston, Proc. Nat. Hist. Soc., ii, 1845–48, p. 59; Boston, Journ. Nat. Hist., v, 1845, pp. 255–296.

33. On the fossil skeleton recently exhibited in New York as that of a sea-serpent under the name of Hydrarchos Sillimani. Boston, Proc. Nat. Hist. Soc., ii, 1845–48, pp. 65–68.

34. On the fossil cranium and lower jaw of an extinct rodent. Boston, Proc. Nat. Hist. Soc., ii, 1845–48, pp. 138–139.

35. A new species of Troglodytes. Silliman Journ., v, 1848, pp. 106–107.

36. On two malformed cods' skulls. Boston Proc. Nat. Hist. Soc., iii, 1848–51, pp. 178–179.

37. (With James Hall.) Notice of the geological position of the cranium of the *Castoroides ohiocensis;* also an anatomical description of the same. Boston Journ. Nat. Hist., v, 1845 47, pp. 385–401; Bibl. Univ. Archives, ix, 1848, pp. 165–167.

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