The Hunterian Oration : delivered February 14, 1861 / by William Coulson.

HUNTERIAN ORATION

1861.

With the Author's compliments.

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DELIVERED FEBRUARY 14, 1861.

BY

WILLIAM COULSON.

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1861.

TO

THE PRESIDENT AND COUNCIL

OF THE

ROYAL COLLEGE OF SURGEONS OF ENGLAND,

THIS ORATION,

PUBLISHED AT THEIR REQUEST,

IS INSCRIBED BY

THEIR COLLEAGUE

THE AUTHOR.

THE HUNTERIAN ORATION.

MR. PRESIDENT AND GENTLEMEN,

IN many foreign countries there prevails a religious custom of devoting a particular day in each year to the memory of the departed.

This day is called "the holy day of the dead." The commemoration is of the simplest kind. The relative or friend utters a prayer or deposits a wreath of flowers at the tomb of him whom he loved, and he returns home with sentiments elevated perhaps by admiration of intellectual greatness, or, at least, purified by affection and the discharge of its self-imposed duties.

In the same spirit, though after a different manner, have we met together this day—the anniversary of the birthday of John Hunter. We are not called upon, it is true, at this remote period, to revive the lamentations created by his loss, or to mourn over his remains, but we summon, as it were, his spirit among us; and here, amid the work of his hands, and surrounded by the fruits of his labours, we pay to genius its due homage, we hold forth a great example to incite and instruct.

That such homage has been offered so often and so ably must not deter me from adding my humble tribute to the master-mind which we venerate as the creator of the science to which we have devoted ourselves.

The outer life of John Hunter was extremely simple, and affords little matter for remark. He was born at Long Calderwood, Kilbride, in the neighbourhood of Glasgow, on the 14th of February, 1728, and was the youngest of ten children, his father being, at the time of his son John's birth, sixty-eight years of age. Being intended for some mechanical occupation, his early education appears to have been neglected. In the twentieth year of his age he repaired to London, and commenced the study of anatomy in the celebrated school established by his brother, Dr. William Hunter. During the summer months of 1749 and 1750, he studied surgery at Chelsea Hospital under Cheselden, and in 1751 became a pupil of Pott, at St. Bartholomew's Hospital. In 1754, Hunter entered as surgeon's pupil at St.

George's Hospital, and two years later served the office of House-Surgeon in that institution. During the whole of this time he pursued the study of Anatomy with unwearied diligence, and made such progress that he shortly became a partner with his brother in the anatomical school.

The first ten years of his professional life were thus almost exclusively devoted to human anatomy; after this he turned his attention to comparative anatomy, by the aid of which he hoped to elucidate the structure and functions of many parts of the human frame. Illness, however, compelled him to suspend his labours for a season. Consumption was in his family; his eldest brother had been cut off by the disease, and Hunter himself seemed to be threatened by it. He was, therefore, advised to seek, for a time, a milder climate; and, accordingly, he became an army surgeon, and went abroad for the three years preceding the conclusion of the war in 1763.

Hunter, on his return, established himself as a surgeon in London, and continued to toil in his profession for a period of thirty years, during which time every spare moment was devoted to subjects connected with the advancement of surgical science. He had never been much above poverty, and his only resource, at the commencement of his career, was the scanty half-pay of a military surgeon. He therefore delivered lectures, and took pupils; amongst whom are recorded the names of Jenner, Home, Lynn, and Carlisle.

In 1768, Hunter was elected Surgeon to St. George's Hospital; in 1771 he married Miss Home; in 1776 he was appointed Surgeon Extraordinary to the King; in 1783 he received the Copley medal from the Royal Society; and in the same year had the gratification of being able to throw open his Museum to his friends and to the profession. Ten years more were consumed in the single-minded elaboration of the work which he had proposed to himself at the commencement of his career; and that career closed, in the midst of unremitting labours, in 1793, being the sixty-fifth year of his age. He was buried privately in the Church of St. Martin's-in-the-Fields. Mrs. Hunter, anticipating rightly the verdict of time, desired to have a monument to his memory erected in Westminster Abbey, but she failed in this object. Since, however, we last met to commemorate this anniversary, Mrs. Hunter's daring hope has been brought to pass. Mainly through the exertions of yourself, Mr. President, and those of Mr. Buckland, Hunter's remains have found a resting-place in that sanctuary where the earthly tabernacles of

Britain's choicest spirits are collected, awaiting the summons which shall unite those spirits in their second immortality. It has also been decided that the bust of Hunter shall be preserved in marble, and deposited where the fruits of his labours exist, for our instruction and for that of posterity.

In now turning our attention to Hunter's scientific labours, we find that they extended over the latter half of the eighteenth century—a period most remarkable for the production of men of genius. In his own peculiar department we recall the three remarkable men who revived in France the study, and indeed almost created the science, of Natural History. Need I mention that I allude to Buffon, Geoffroy St. Hilaire, and Cuvier, men who seem to have been, in a peculiar manner, predestined and chosen out for the work they accomplished, each having adopted his successor, and bequeathed to him his task to complete?

Meckel also was on the scene, with the learned Frank, and his pupil Scarpa; there were Blumenbach, Camper, and Volta, Portal, the patient investigator of pathology, and those brilliant lights which illuminated the Academy of Sciences—D'Alembert and Laplace, Condorcet and Lavoisier. These were the men who were living at this time. Among such "giants of intellect," as Mr. Lawrence has happily called them, Hunter was great, and his name will ever survive, eminent amidst theirs, in the pages of the history of human progress.

Hunter entered on the vast field of his investigations with a mind free from prejudice; he avoided, to use the words of Bacon, "the shadows " of things, which are to be found in the books of " men, and devoted himself to their substance in " the unerring works of nature."

The intellectual character of Hunter was rather marked by a rare combination of many high powers than by the manifestation of any single quality in a way to overshadow all others. This, however, was the character best suited to the study of a science like Surgery, the progress of which had been long retarded from want of a mind "ministering and interpreting" like his. He possessed a strong power of generalizing. For him isolated facts and disconnected views had no value; each fact led to another, each view was extended to a co-ordinate prospect, and all were followed through a series to the establishment of sound general doctrines.

Previous to the labours of Hunter, Surgery was an art, a merely empirical art, although resting on the accumulated experience of ages; but Hunter raised it to a scientific art—" experience reasoned " on and brought under general principles." His constant aim was to discover these general principles, that they might find an application in practice.

In Hunter the faculty of comparison was likewise greatly developed, strengthened by constant exercise, and aided by minuteness of research and accuracy of observation. While investigating any subject, he left no stone unturned under which truth might possibly lie hid; every accessible fact, however remotely connected, was interrogated and described with individual minuteness and accuracy of observation as remarkable as the generalizing power which he brought to bear upon its interpretation.

The activity and industry displayed by Hunter were indeed marvellous. The mind of a great natural philosopher is distinguished by this invariable characteristic, that it finds no repose except in full and entire knowledge in the direction of its inquiries. The impulse has been given by a Divine hand, and it is the restless seeking after truth which constitutes the strength of the mind during labour and its joy in the act of discovery. This restless activity was never absent from Hunter, nor was his ardour ever confined to one point of investigation alone, but simultaneously extended to many. "My mind," he said, "is like a bee-"hive." His labour both of body and intellect was incessant. He gave to rest only five out of the twenty-four hours, the remainder were a constant round of unremitting work, continued for a period of thirty years.

How many a weary hour must he have devoted to the observation of the habits of living animals, to the preparation of his lectures, to the numerous papers which he published, to the record of all he saw and all he thought, to his practice, and to his profession! How heavily also must the cares of daily life have weighed on a mind thus occupied! Hunter had to live not only for himself but for posterity. He spent £70,000 on the monument of his labours which we now possess, and he erected it from his own resources, "al-"though it was a royal work, requiring"—as might seem—"the purse of a prince and the "assistance of a people."

Every man who has become great has had an object which has been pursued by him with inveterate steadiness, and as if from inward compulsion, until attained. As a distinguished German philosopher* has observed, "All men animated "by noble sentiments regard themselves as exist-"ing only for a certain purpose, and as a means to "a higher end. This temporal life shall leave be-"hind it in the spiritual world an imperishable "and eternal result—a particular result arising "from the life of each individual, belonging to him "alone and demanded of him alone."—Lord Bacon felt that he had a destiny of this kind to fulfil, and he worked at it for thirty years with unwearied industry. He frequently refers to it in his letters as a pursuit "whereby he should be able to main-"tain the memory and merit of times succeeding." Hunter had a similar object and a similar destiny. His great aim was to establish the laws of life in health and in disease, and to trace them to their source; and this aim he appears to have pursued with a truly philosophic delight in the work itself, and with a view rather to the benefit than the gratitude of posterity.

If Hunter chose a great object, he was gifted with the will to follow it. He had in a remarkable degree that earnestness of purpose, that energetic and abiding determination, which, when

* On the Nature of the Scholar and its Manifestations, by Fichte, p. 155; translated by William Smith.

directed aright, always seems to bring the power of attainment with it. The steady perseverance with which he followed a favorite subject through all its bearings was indeed one of the principal characteristics of his mind. He had no irregular accessions of activity, but he combined with an intelligence of the highest order a steadiness of action truly marvellous. Hence it is that the number of the principles which he established is as remarkable as their value.

If we bear in mind the state of medicine, and of its accessory departments of knowledge, at the time when John Hunter entered on the reformation of physiology, we shall see at once how free he was from those errors of the learned by which the progress of knowledge had been, before his time, so much retarded.

Like all wise observers he was himself slow to believe, and hence not given to deceive others. He kept truth, like a glass, constantly before him, to reflect Nature under her own forms. He never consented to receive doctrines merely because they had been handed down from by-gone times, or to promulgate his own views, without having established them on the sure basis of experiment and observation. He did not believe, with some of his contemporaries, and with many who had gone before him, that time had drunk dry the fountain of human knowledge. He knew full well that the steps of science are slow, and that the field of nature is inexhaustible; that the life of ages is short, while the art of the universe is infinite; that genius only picks up at intervals a grain or two of the seed which has been sown broad-cast by the hand of the Creator.

Hunter was, furthermore, pre-eminently free from the dangerous error "of an over-early and "peremptory reduction of knowledge into arts "and methods, from which science commonly "receives small or no augmentation." He seems even to have carried the avoidance of this "distem-"per" to a degree which limited the extent of his own discoveries; for if we examine the admirable manner in which his investigations of the animal kingdom were conducted—the scientific order in which his illustrative preparations are arranged—the object evidently aimed at in their form and arrangement,—we cannot but admit that he laid the foundation of that natural method which was the glory of his successors; but from the establishment of which he was himself diverted by his absorption in his favorite object, and his rigid mode of pursuing it.

To Hunter must also be awarded the praise that he was eminently free from that which Lord Bacon designates as the greatest of all errors, the "mistaking or misplacing the farthest end of "knowledge," that is, the object for which knowledge is cultivated. His desire of knowledge was no idle curiosity—no pursuit of mere intellectual delight—no vain desire of distinction—no thirst for gain; his end was the attainment of knowledge—the attainment of truth—in order principally to the benefaction of his fellow men.

[Nothing proves more clearly that Hunter placed our knowledge of living organization on its true basis, than the fact that his views have been confirmed by near a century of observation, and that the immense progress of Surgery since his time can be mainly traced to the method of investigation which he initiated, and to the scientific principles which he established.

Take, for example, the vast field of inflammation. Have recent investigations done much more than stamp with the seal of truth the original principles established by Hunter?]*

It is hardly necessary for me to repeat what has been so often remarked by my predecessors, that the chief claims of Hunter to our respect

* In the delivery of the Oration the passages between brackets were omitted.

and admiration rest on the views which he took of life, on the manner in which he established these views, and lastly, on his application of them to the improvement of Surgery,—which he thereby raised from an empirical art to a reasoned science.

The secret of his success seems to me to have depended mainly on the intuitive manner in which he took up and followed the Baconian method of interpreting Nature for the discovery of her laws. The unceasing application of this method is manifest in his principal writings, and more particularly in the great storehouse where he has accumulated and arranged his facts as the ground-work of his inductions.

Hunter commenced by a patient observation of facts in the whole range of animated nature; but he knew full well that, as habitual sight is not observation, so observation does not lead to knowledge, unless pursued in an orderly course, and under the guidance of certain principles. He therefore raised his superstructure on the only true and solid basis, that of organization, and on this wide foundation—comparing—analysing—and eliminating phenomena—he raised that enduring monument of his glory,—the theory and laws of organic life.

Facts cannot constitute a science. Besides and beyond the phenomena we must have the principle—the primary law—the idea which binds together the phenomena in one harmonious and scientific whole. This idea or primary law was enunciated by Hunter when he declared that—

"Life is a power superadded to matter;"

that—

"Organization arises from and depends on life, "and is the condition of vital action; but that life "never can arise out of, or depend on, organi-"zation."

From the properties and laws of life Hunter ascended, as nearly as he could, to a knowledge of the principle itself, which he regarded as a reality—not as an abstraction invented for the convenience of explaining certain phenomena. He failed, it is true, in a search in which failure is probably inevitable, but his successive defeats were so many collateral victories. If he did not arrive at the knowledge he sought, "he gathered, at least, the "first vintage," in the rich field of scientific physiology.

It is most difficult—it may be, I repeat, impossible—to arrive at a knowledge of the causes of vital phenomena as distinguished from their laws; but the same, or nearly the same difficulties beset us when we investigate the nature of those invisible and imponderable agents which Nature employs in many of her most marvellous works. Hunter was fully aware of the existence of these difficulties. [He usually avoided offering any definition of life, its nature being so little known to him. "Life," he said, "is a property we do not understand, we can only see the necessary steps to it." But in a note to his Paper on suspended animation I find the following definition, which seems to have been overlooked:—*" The living principle "is that principle which preserves the body from "dissolution with or without action, and is the "cause of all its actions." This is the best definition of animal life which has been yet offered, for it embraces more of the essential character than any other, and includes the chief states in which the vital principle may be observed. These are three, similar to the three conditions of the electric fluid—static, dynamic, and residual; conditions which were familiar to Hunter, although not designated by him under names which have become familiar to us.

Static life is life at rest. It exists under this form in the seed and embryo, before external stimuli have been applied to develope it into an active state. Life here exerts a power of pre-

* Palmer's edition of Hunter's Works, vol. iv. p. 167.

servation only, and this appears to be its most simple function.

Dynamic life is life in action,—the vital principle acting for growth, repair, or secretion.

Residual life is that portion which remains for a short time in any part of the body when separated from the whole. The residual state may continue for several hours and with sufficient energy to produce several vital phenomena. This fact depends on a principle which Hunter was the first to adopt and establish in its entire truth —that every part and particle of a living body, whether solid or fluid, is endowed with life in a degree and with a direction peculiar to each.

" Every individual particle of the animal " matter is possessed of life, and the least imagin- " able part that we can separate is as much alive " as the whole."

The blood, then, is alive as much as the brain; the smallest elementary cell as well as the most complicated organ.

The importance of this grand and simple law cannot be overrated, it is the clue to the secret of diseased as of healthy action.

The vital principle is not only universal,—that is, superadded to every particle of a living body, —but it is a simple principle or unity, one and the same in every compound organ, in every tissue, and in every elementary particle of which those tissues are composed.

This grand philosophical idea runs through the whole of Hunter's physiology. According to him "there are not many lives, but one life," which pervades the whole animal kingdom, its differences depending on differences in the organized apparatus, and not in the principle itself.

The difficulties connected with a due investigation of the laws of the vital principle are almost insurmountable.] Hunter was fully aware of their existence, and directed the full force of his genius to overcome them. The written records of his labours—destined, there can be little doubt, to have formed a complete treatise on the science of life—have, alas! irreparably perished; but the facts displayed in their admirable order and significance still remain for the instruction of those who, endowed with some portion of Hunter's spirit, are enabled to interpret them.

To understand and appreciate the vast conception illustrated by the exquisite preparations of our Museum is no easy task in the absence of the text which was intended to explain them; but, like the picture-writing on the walls of an ancient temple, they are invaluable to those who can read aright, for each picture is a page in a history before unknown.

[The difficulties connected with the study of life, both in its effects and laws, but more particularly as a primary force or principle, have been clearly stated by many philosophical writers; among whom I cannot avoid noticing Coleridge, who considered that the essence of life must be an object of the supersensual reason, not of the understanding. "There is nothing," he says, "the absolute ground of which is not a mystery; "the contrary, indeed, were a contradiction in "terms, for how can that which is to explain all "things be susceptible of an explanation? It "would be to consider the same thing first and "second at the same time."]

The chief difficulty in the way of admitting life as a principle, independent of and antecedent to organization, appears to be connected with an old distemper of the human mind; namely, the tendency to clothe with reality nothing which is not evident to the senses—to attribute substance exclusively to modifications of matter. But even laying aside the question of a vital force, and the speculations whether "this finite life which we "have may not be, like the life which we seek "after, a mystery," we are still entitled to infer its existence from its effects, and to seek its laws in its divers modes of operation. Even this is a grand and immense task, beset, as I have said, on all sides by difficulties arising from the nature of the subject. For how different in every respect is the science of life from any of the exact sciences. In these we are able to regulate all the conditions of the phenomena which we examine; we can analyse them, compare them, and then arrive at general laws. But the science of life is not an exact science which we can submit to calculations, or one in which consequences can be certainly deduced from ascertained principles. In other sciences objects may be observed accurately, and problems may be determined independently of one another; but in biology the observer has no such advantage: he must take things as they are; he cannot regulate the conditions under which he may observe objects, or analyse them so as to arrive at general conclusions; he is unable to reduce any problem to its elements, as may be done in physics or in chemistry, comparing element with element. He is compelled to take them with all their conditions united, and analyse them in his mind, not with his scalpel, or in his crucible.

Every attempt to analyse life in this manner must necessarily fail, because we are unable to obtain a single element separately from the others. Life must be taken as a whole. We cannot isolate a single organ, a single particle of living matter from the whole, without its instantly losing that essential character which is the subject of inquiry —without its relapsing from life into death.

But Nature has done for us what we cannot ourselves effect. She has made this vital dissection, she has combined organs in such endless variety, she has performed so many experiments and displayed them before us, that, with industry to inquire and intelligence to deduce, we arrive at various substantial and important conclusions.

In the living Museum of Creation, Nature has exhibited, in the different classes of animals, nearly every possible combination of organs, suppressing some, adding others, experimenting as the chemist does in his laboratory, and demonstrating for our instruction the results of her experiments. Hence, if we follow our observations through a sufficient range of animal life, we arrive at well-founded conclusions concerning the uses and functions of parts and organs, and are able to determine that which is essential, and to approximate to the knowledge of the seat, and to an apprehension of the nature, of the vital force.

An examination of Hunter's Museum will show at once that such an inquisition of the experiments made for us by Nature was his guiding principle. Here he has stored up, in one vast laboratory, the results of those experiments which lead to, if they do not actually establish, so many of Nature's laws. Here he has arranged that matchless series of preparations, through which life is pursued, in an unbroken sequence, from the most perfect and complex to the most simple of animals; and by means of which, each non-essential element being gradually eliminated, we are enabled to lift from life all but its last material veil.

The most notable general character which is to be remarked of force is that it is derived from an antecedent force of the same kind. A knowledge of this character at once relieves us from the supposed necessity of tracing life to a point or time at which it begins. Life is not to be noted in any particular point, but is universally diffused throughout every particle of animated matter; it does not begin at any particular time, but has existed from all time. Life contains life within itself for its propagation and continuance. The new being is not made up of elements taken from complex bodies, but from a particle of life detached from the parent body and endowed with the same creative and formative force as the original. Life, then, is a chain, the links of which unite beings from one generation to another. One end is hidden in the womb of time, the other—to borrow the sublime phrase of the philosopher—is attached to the very footstool of the throne of God.

Although all efforts to arrive at the first source of life have thus necessarily failed in the main point, they have yet not been altogether fruitless. They have led to higher considerations than before prevailed. We find that every living being has formed part of another living being previous to independent existence. The vital principle is not inherent, but transmitted; and, ascending thus from life to life, we arrive at the point when life commenced, fresh-born, yet perfect unto all time, from the hands of its Creator; and in this single deduction from material observation we behold the death-blow of materialism, and all its inferential errors, scientific as well as moral. Again, were speculation in this most tempting field permitted, I might observe, as life has no finite beginning here, so perhaps life, when once established, has in its proper nature no limit of duration. Life evinces a tendency to continue its development incessantly; and it seems to cease, not from any inherent imperfection in itself, but merely from the impediment of matter.

[The most simple and elementary function of life is the one first included in Hunter's definition; namely, the power of resisting dissolution. This is the power of static life, essential also to the dynamic form, and manifested in an imperfect manner even after life has apparently ceased. This essential element opposes itself to the other known forces of nature, and makes them for a time subservient to its ends. An organ, while it lives, is for the most part withdrawn from and always independent of those purely physical principles which regulate the action of inorganic bodies. The vital force, no doubt, is associated with other natural forces, but it dominates and directs them, preventing them from being destructive, and forcing them to act for the conservation of the machine. No sooner does this preservative force cease to act than the physical forces resume their sway, and hence commencing decomposition is the one certain sign of death.

As the character of static life is resistance, so the essential character of dynamic life is assimilation; that is to say, the power to overcome death, to convert inanimate matter into a living substance.

Ancient philosophy taught us that "like attracts "like;" but the phenomena of electricity, to which the vital force has been so often compared, establish a doctrine completely opposite, that like repels like and attracts unlike. In an analogous manner animate matter seems to attract inanimate. However this may be, it appears to be another of the general laws of life that the more active an organ is the more perishable it is; hence the lungs, in which the vital act is more concentrated than elsewhere, are more subject to disorder and decay than other parts of the machine.

The same principle leads to the conclusion, that, in order to prolong life, static life at least, we should control and diminish action—a rule confirmed by the phenomena of hybernation, and many other facts on which I shall not now insist.

In man and the superior animals the functions of life are manifold, and its essential characters are not therefore readily ascertained. But if we proceed in the manner already alluded to, eliminating one after another, in the scale of animated beings, parts and organs which are not essential to life, because life can go on without them, we arrive at the most simple form of dynamic life; and here we find that it consists in the faculty possessed by corporeal combinations to exist for a certain time and under a determinate form, drawing to and assimilating with themselves external matter, and then throwing it off. So long as this movement exists, so long exists life. When it ceases we have death; or, as Dr. Davy has so happily expressed it, " Life is a perpetual miracle, " in which material particles are, without cessation, " living and dying."]

The original views of Hunter on the character and laws of life, thus developed in his pursuit of its essential nature, could not fail to influence his pathological doctrines. As he laid the foundation of Scientific Surgery, so did he found what I venture to term Physiological Pathology; that is, the science of disease referred to and interpreted by the laws of life.

Diseased actions, he tells us, are established on nearly the same principles as healthy action. Inflammation—to which a great majority of disordered actions can be reduced—is " an increased " action of that power (or degree of vital force) " which a part naturally possesses." Disease, then, is not something special superadded to the living body, but a modification of healthy action—an effect produced by aberrations of the vital power in force or in direction. This simple, yet prolific doctrine is not yet sufficiently understood or universally accepted. It admits of several apparent exceptions; but these would probably disappear if we were better acquainted with the laws of healthy molecular nutrition.

Although the early years of Hunter's professional life were exclusively devoted to Anatomy, the character of his mind prevented him from confining his researches at any time to the determination of mere form or structure. His objects were at once vast and elevated, as became the man of genius. While the most celebrated anatomists were building their fame on the discovery or description of a single organ or system in the human body, Hunter surveyed the whole animal kingdom, and endeavoured to effect that in which Linnæus and Buffon had both failed, viz. to furnish a complete classification of animals.

In this attempt Hunter was but partially successful. The glory of accomplishing it was reserved for Cuvier. Yet for Hunter may be claimed the merit of having discovered the only true and perfect principle on which such classification can be founded.

The greatest result of Hunter's anatomical labours was a demonstration of the truth that organized creation has been formed on a single plan or type, which may be traced throughout the whole animal world, and that the lower animals represent permanently the successive stages through which higher animals pass, until they have attained their full and perfect development. Thus, Hunter reduced organization to one type as he had reduced life to a single principle. The theory may have been announced before, but the demonstration was his.

I may be permitted to dwell somewhat in detail upon these grand and lofty generalizations, comprising the laws of unity of type and analogy of development,—fields in which the merit due to Hunter has too often been attributed to others.

In treating of the skeleton, for example, Hunter shows how the shape and many parts of an animal depend on the bones, and how, "although "these appear to be so different in different orders "of animals, yet there is almost always an endea-"vour to reduce them as much as possible to the "same principles."

Again, in his account of the organ of hearing in fishes, there is the following passage:—"I am "still inclined to consider whatever is uncommon "in the structure of this organ in fishes as only a "link in the chain of varieties displayed in its "formation in different animals descending from

" the most perfect to the most imperfect in regular " progression."

But the most striking illustration and proof of Hunter's priority in this region of investigation are to be found in the remarkable disquisition which he has prefixed to the account of the pneumo-branchiata. The difference between the circulatory system of fishes and amphibious animals is so great that a link seemed wanting in the scale of transition. The chain seemed to have been broken, until two new animals from South Carolina fell into Hunter's hands, and enabled him to complete the series. This he did with his usual sagacity; and the discovery enabled him to afford an additional proof of the law by showing, " how Nature, " proceeding always by the nicest gradations, has " formed two animals which partake so much of the " structure of fish and amphibious animals, that " they gently lead us on from one to another."

Hunter even pushed his observations further, by explaining some of the laws which govern the progression in the scale of organized beings. Thus, although the descent is regular, it is confined within limits. Certain vital organs, characteristic of one class of animals, are never found in the species of another class; nor is the structure of the organ of hearing, or any other sense which characterizes a higher vertebrate, ever combined with a modification of the vital organs peculiar to a lower class.

We find, then, in Hunter's Works and Museum, a complete demonstration of the grand truth that Nature pursues a general plan of gradation from the highest to the lowest animals.

No sooner is a general law discovered in any science than it becomes available for the explanation of many phenomena apparently unconnected, and previously misunderstood or wrongly interpreted.

The light of genius spreads wider the higher it ascends, bringing into view hitherto undiscovered objects. Unlike the light which emanates from material bodies, the higher it mounts the brighter it becomes, increasing in strength as its field extends in circumference.

Thus, in the admirable law, so clearly enunciated by Hunter, that, in its development from the embryonic to the complete state, each animal passes through the forms of animals inferior to it, is to be found a solution of the phenomena of malformation—a subject which had been long delivered up to ignorance and superstition.

As diseased actions are in so many cases quantitative modifications of healthy actions, so are these so-called monstrous formations nothing, for the most part, but quantitative modifications of normal development. During the metamorphoses of fœtal life, the transition may be arrested at any given point—the transitory structure becomes permanent, and the malformation—now denominated "arrest of development"—is produced. Need I call to mind how much honour the supposed discovery of this law has shed on the French school? Yet that Hunter had applied the law of development to an explanation of congenital malformations is clearly shown in various parts of his works.

From what I have now said, it must sufficiently appear how vastly Hunter's labours have assisted in impressing on Modern Philosophy its highest and most characteristic tendency—which is to establish a unity of principles, to reduce to their most simple expression those causative laws by which sciences are governed, and thus to approach in a direct line towards that Divine unity on which all things depend; and by which, the more we approach it, the more we become awed by the infinitude of the distance that remains untraversed and untraversable.

No careful student of the recent history of science can have failed to observe how many are the errors and absurdities which are swept away as we advance by successive steps—by the patient observance of Nature, or with the intuitive gaze of genius—towards that unity of principles in the various branches of Science or Philosophy. Illustrations present themselves at every step we take. How perplexing were the relations between the electric and magnetic forces, which were so long considered as distinct, until their unity was demonstrated by the labours of Oersted and Ampere. How many useful applications have resulted from this interesting discovery, without which the establishment of the Electric Telegraph would have been impossible! But a further step had to be made—the circle was to be enlarged by reducing within it the vast and prolific field of chemical affinity. Here theory anticipated observation, and the science of Faraday only confirmed what the brilliant genius of Davy had previously conjectured.

In 1806, Sir Humphry Davy had declared his conviction that chemical and electrical attractions were produced by the same cause. His view limited this action to the extreme poles, and he affirmed that it was exercised in one case on particles, and in the other on masses. The soundness of this theory was questioned, until it was established by Mr. Faraday, who proved that the electric force was exerted at every point of the circuit as well as at the poles—that it acted on particles as well as on masses—that each particle so acted on had opposite poles—that polarities so co-existent must be connected; and thus he advanced step by step until he crowned the whole by his beautiful demonstration of the identity of quantity between the two forces.

Again, what phenomena can apparently be more different than those of light and sound? Yet modern researches indicate a more than probable coincidence in the main condition, namely, the vibratory motion of an elastic medium.

Scarcely less striking and important is the law of unity in the development of plants and animals as established by Schwann. His profound and minute researches show "that a common prin- "ciple of development presides over all the ele- "mentary parts of organisms" in both kingdoms.

In the establishment of this law he was aided by the previous labours of Schleiden with reference to the vegetable kingdom. Schleiden had shown that the tissues of plants are reducible, at their origin, to modifications of vesicles or cells formed by previously-existing nuclei.

Schwann ascended a step higher, and established on a new basis the modern doctrine of development. He showed not only that animal tissues, like those of plants, are developed from cells, but that cells originate from minute previously-existing nuclei.

Here life—as far as our senses are concerned—first exhibits its formative force; and, as the instrument with which it acts in both cases is the same, we infer that the force likewise is one and the same in animal and in vegetable existence.

The same principle of unity which prevails in the development of elementary structures extends to complete organizations. In the vast range of animal creation Science sees but a single animal —all are reduced to the same type; and while, through the boundless varieties of organized life, we thus discover one grand plan, one simple and sublime system, connecting together the links of creation, and binding into one chain the present world with the worlds which have passed away—we are strongly led to infer, from such unity of organization, unity of the force from which that organization receives its movements. Let us also observe how much this argument from analogy is strengthened by the fact that the human embryo, during its various stages of development, passes through various forms which shadow forth the range of the animal kingdom. Successive forms appear and disappear; yet here we must admit that the same life presides over the successive transformations—that the motor power remains one, while the parts of the machine are undergoing change to transform one motion into another.

Considered in the sublime unity which modern investigations have thus revealed or suggested, as subsisting throughout the entire range of the sciences, Natural Philosophy itself loses its isolating limitations, and promises to unfold relations to ethics and theology, which were undreamt of in the days when it was thought much that Nature could be persuaded to afford to the moral philosopher an occasional proof or illustration of intelligent contrivance. It was vision, not fancy, which inspired the greatest living poet to affirm the unity of the material and spiritual, the temporal and eternal worlds, in the famous lines,—

> "One God, one law, one element,
> And one far-off, divine event,
> To which the whole creation moves."

Having thus considered the leading characters of Hunter's mind, and the principal result of his labours, it is only becoming that I should make some allusion to the task which has devolved on the Council of this College, and to the manner in which the important duties entrusted to it have been fulfilled. We have become the guardians of the Hunterian Museum, that magnificent epitome of organized nature—in which the multifarious and complex phenomena of life are illustrated by a most perfect display of the organs concurring to their production—in which diseases are traced to the primary changes connecting them with natural conditions—in which the plan of the Supreme Architect is revealed in all the greatness of its unity—in which also are preserved the earliest traces of that sublime science which connects the history of the present world with the worlds which have passed.

Sixty years ago Hunter's Museum fell into the hands of the College of Surgeons, and since that period the Council has never ceased to preserve and enlarge it, and to render it more and more intelligible to all.

John Hunter spent £70,000 on the original collection, for which the Government gave £15,000. In 1806, another sum of the same amount was granted to the College toward the Building Fund—the rapidly-increasing additions to Hunter's original collection having caused a corresponding demand for exhibiting space. In the following year a further vote of £12,500 was passed for the same purpose; and finally, in 1852, during the presidency of Mr. Arnott, and mainly through his exertions, the college obtained a grant of £15,000; raising the sum total contributed by the nation towards the support of the Museum to £57,500. In addition to this, the Council of the College, since the year 1835, has devoted £60,000 to the improvement of the various departments of the collection; so that the entire sum hitherto expended amounts to £118,000—a sum which, it will be observed, does not include the expenses of keeping up the Museum. This is borne wholly by the College, which, up to the present time, has spent little short of £100,000 for this purpose.

The increase of the Museum, partly by purchase, and partly by contribution, but mainly through the industry of our own conservators, has been prodigious. The number of preparations constituting the collection at the time of its purchase by the Government was 13,682, the great majority of these having been made by Hunter's own hands. Since that time numerous additions have accrued to every division, and the total number of preparations at present in the Museum, including the microscopical collection of 16,000 preparations, which we owe to our indefatigable Curator, Mr. Quekett, is no fewer than 44,700.

So much for the manner in which the College has discharged the duties which devolved upon it, in immediate connection with the Hunterian Museum. It now remains for me to speak of the controlling influence which has been exercised by this Corporation upon surgical education.

With the labours of John Hunter commenced a new era in Surgery, for from his time it dates its existence as a science. Professional education —the control of which was entrusted by public consent to this College—thenceforward assumed a more important rank, and required to be directed into new channels. The task was great and noble. The duty has been faithfully and efficiently performed. We have kept pace with the progress of the age—bearing steadily in view, and endeavouring to reconcile with each other, the advancement of science, and the true interests of the profession and the public.

If Surgery be a science, it must enter that circle which embraces all sciences and connects them together, establishing a fundamental relation which renders the progress of all dependent one on the other. And such connection, such mutual dependency or relation, must necessarily exist;

for in reality there are not many sciences, but one—viz. a knowledge of the causes of those various effects which are produced around us.

These effects, it is true, are infinite ; but, as we have seen, the causes or forces which produce them are few. The identity or similarity of the cause or force must necessarily connect the phenomena or effects proceeding from it. The domain of medicine is indeed the living world, not the dead ; but life, although a force distinct from all others, and incapable of being ever reduced to any other causative principle, employs, or rather renders subservient to its ends, many of the known forces of nature. Hence these forces—hence the sciences which reveal to us the laws under which they act—are intimately connected with the science of medicine, and should form an integral part of medical education.

It follows, then, that although a mere professional education may suffice for the practice of Surgery, yet the advancement of the science requires that the mind should be trained and disciplined by previous study of the exact sciences.

Where the effects, then, are so numerous and so different from any with which we are familiar, while the causes are so obscure,—where such a wide field is open to conjecture and error, while the measure of correction is so narrow and confined, it is obviously our duty to fortify the mind against its own failings, to strengthen reason by early discipline, and to ensure—so far as we can—that her powers shall not be wasted in the pursuit of vain shadows and empty speculations.

This discipline a liberal education in its most extensive sense can alone bestow. The education thus desiderated will shortly be required as the preliminary discipline of all who strive to obtain the diploma of this College.

If an enlarged and liberal scheme of education be a necessary foundation for professional science—if the status which we are to occupy in society must depend in great measure on our acquaintance with those *literæ humaniores* which are cultivated by the members of every other liberal profession,—then have the Council of this College done wisely in ordaining that the student shall commence his career by a course of study similar to that pursued by the gentry of this land, and the professors of other liberal sciences.*

This principle, long since voluntarily adopted by the College, has recently been sanctioned by Law. But let it never be forgotten that, although

* For fuller views on this subject, see the admirable orations on Vital Dynamics by Mr. Green.

honoured by Royal charters, the existence, prosperity, and influence of this College have not been owing to legislative protection, but are the fruits of public confidence, freely bestowed, because fairly merited.

For more than half a century has the College been the guardian of surgical science in this country, and it may point with pride to its present position as proof that it has neither betrayed its trust, nor laboured in vain for the advancement of knowledge. Although Hunter established Surgery on its true basis—although his labours converted the barren field of empiricism into the fruitful garden of science, he might have lived in vain, had not the process of culture been continued by those who succeeded him in this place. When we reflect on the peculiar position of this College, on the numerous and conflicting interests with which it has had to contend—when we compare its working and its results with those of kindred institutions, it may be fearlessly asserted that the governing body has not failed in the high mission entrusted to it; but that it has directed surgical education in a manner conformable to the spirit of the times, and best suited to promote the ends of science and the interests of humanity.

In conclusion, let me express my hope that the development of the unity of science, upon which I have dwelt this day, may be aided more and more by union among the members of our profession; and that personal and party jealousies and interests may interfere less and less with those great and noble projects for co-operative improvement which are characteristic of the scientific activity of the present day. I advance no novelty in affirming the closest connection between moral and intellectual unity,—between the development of unity in the spirits of men, and the reduction to unity of their outward science. "The desire of unity," says one not long removed from this scene,* "is inherent in man. It pervades all the expressions, all the modifications of his being, and may in a manner be termed an elementary principle of his nature. It lies, very often without his being conscious of it, at the bottom of all the workings of his mind, which is ever seeking, in one way or other, to infuse unity into the subjects of its contemplation, to bring them under one head, to arrange them under one law, to find out some analogy, some relation, some likeness, and harmony amongst them. . . . While the efforts of all science

* Archdeacon Hare on "The Unity of the Church."

are to discover and demonstrate the unity of the laws of nature, the might of poetry is displayed in investing all things with a unity of feeling, and philosophy is ever yearning and seeking after the one all-pervading principle of the universe. That this desire of beholding unity in all things arises from that unity of consciousness in which man was made, and in which his Maker mirrored his own unity, cannot well be doubted. But while we have this principle of unity within us, we are set in the midst of a world, in which everything, when we first look out over it, seems to jar and war against all unity. . . . It is only so far as we retain this true unity in ourselves that we can succeed in discovering a living unity without us."

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