

**The Harveian oration : delivered at the Royal College of Physicians,
London, June 24, 1870 / by William Gull.**

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Gull, William Withey, Sir, 1816-1890.
Royal College of Surgeons of England

Publication/Creation

London : John Churchill & Sons, [1870]

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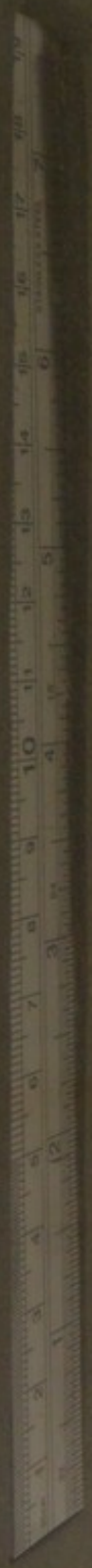
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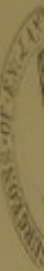
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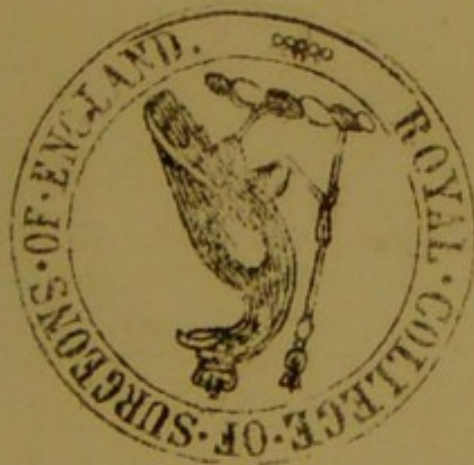
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HARVEIAN ORATION.

DELIVERED AT THE

ROYAL COLLEGE OF PHYSICIANS, LONDON,

June 24, 1870.

BY

WILLIAM GULL, M.D., F.R.S.



LONDON :

JOHN CHURCHILL & SONS, NEW BURLINGTON STREET.

LONDON:

SAVILL, EDWARDS AND CO., PRINTERS, CHANDOS STREET,
COVENT GARDEN.

TO
JAMES ALDERSON, K_T.,
M.A., M.D., D.C.L., F.R.S.,
PRESIDENT OF THE ROYAL COLLEGE OF PHYSICIANS OF LONDON,

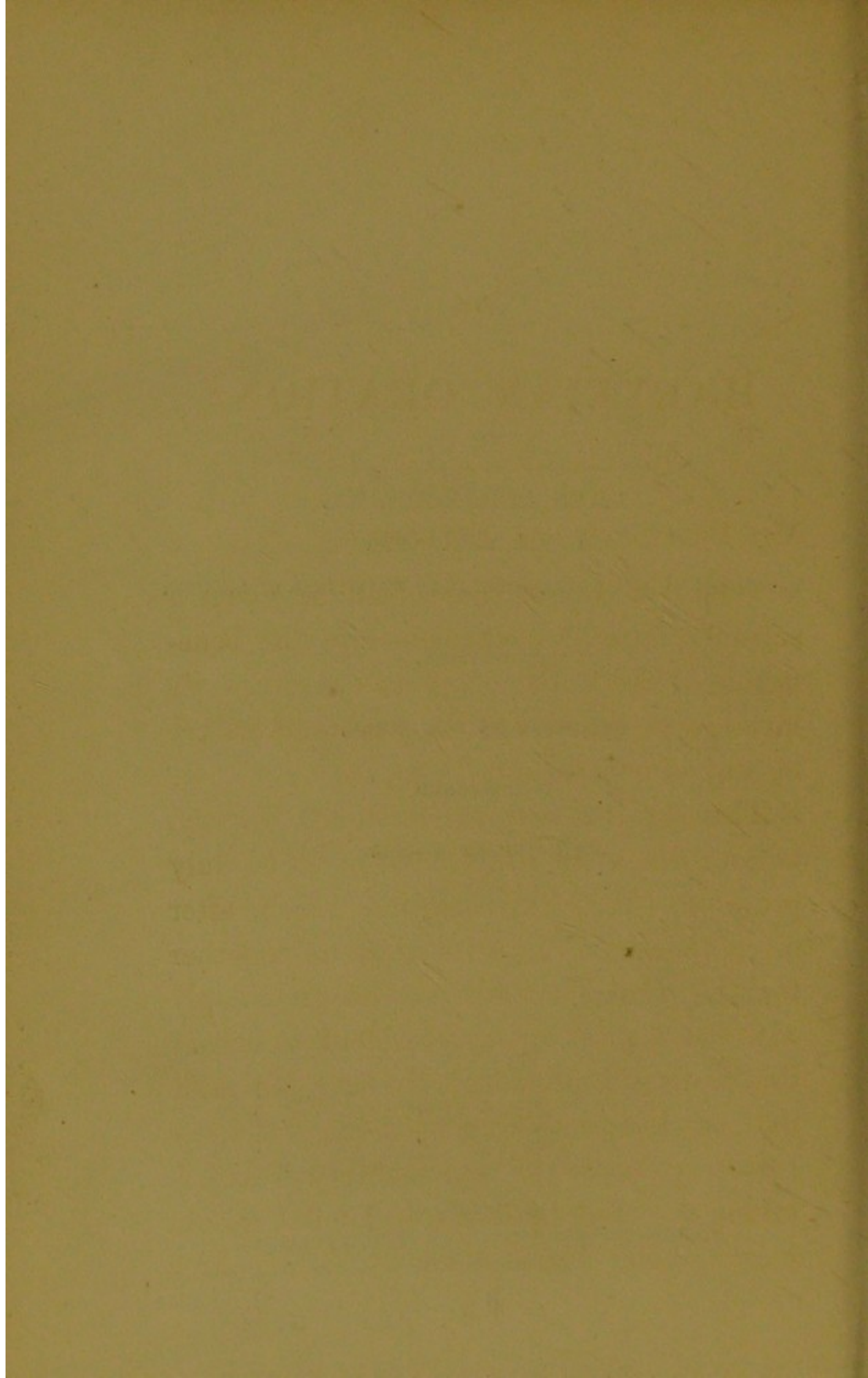
THIS ORATION,

DELIVERED BY HIS DESIRE,

IS INSCRIBED

WITH SINCERE REGARD.

London, Oct. 1870.



THE
HARVEIAN ORATION.

MR. PRESIDENT AND FELLOWS,—

“Once in a year there shall be given a solemn oration to commemorate the benefactors of the College, and to encourage its members to search out the secrets of nature by way of experiment.”

This was the express wish of Harvey, and for the annual fulfilment of it he duly provided. It is this occasion which, after more than two centuries, calls us together to-day. Had I not felt it a duty to comply with the request of our President to deliver this oration, I should gladly have put aside the task thus devolving upon me, feeling as I do very deeply the responsibility of undertaking it. But by doing so I felt I should incur greater blame than by failing in a

faithful attempt, however feeble, to perform it. To have shrunk from this duty would have involved a seeming unreadiness to do my best, and an apparent neglect of the command of Harvey, whose immortal name confers not only the highest honour upon our country, but an undying distinction upon this College.

We have not met to-day to do honour to Harvey by lauding again the splendour of his discoveries, or to justify the scientific method he employed in making them. This has been done so repeatedly and so well in this place that it would be both superfluous and presumptuous to go over the ground again. My duty is rather to fulfil, as far as lies in my power, Harvey's intention in instituting this oration by moving your minds to a consideration of our position as students of medicine, and to encourage a further search into nature's mysteries.

The science of medicine, being the science of man (in health and disease), must occupy the central place in human knowledge—

physics and metaphysics being the poles of his existence, and the social sciences comprising his history. But it may be asked if our minds are made up as to whether man is altogether an object of scientific study or not? whether the mysteries of his organization are fairly subjects admitting of investigation? and, therefore, whether it is becoming in the Harveian orator to stir up your minds to search these mysteries out to their fullest extent? The doubt implied is not one of my own suggesting, for I confess it seems strange to me that any one at this day should assert that "life is a power entirely different from and in no way correlated with matter and its ordinary forces," and consequently, I may add, no proper object of science. Yet this assertion, though not the inference, comes from one amongst ourselves, who is well entitled to respect, and therefore it obliges me to a survey of our present position.

It is not thirty years since it was gravely questioned whether a living body could not

generate, by its vital force, some of the elements of which it is composed. An organism was considered to be a creative agent, forming and transmuting the materials of its higher structures. How far the investigations of chemistry have separated us from such fictions I need not remind you; for whatever may be thought of the forces exhibited by living beings, no one would now question the origin and nature of their materials. No one at this day would even dare to hint at any transmutation of the organic elements. It appears, however, that we are not yet entirely emancipated from such conceptions; and that there is still wanting a full and implicit belief that the as yet mysterious phenomena of life are correlative with the lower forces in nature. Whilst the advances of chemistry were settling the question of material elements, physics was deeply occupied with the relations of forces. These relations, which had so long engaged and perplexed logical ingenuity, still remained comparatively bar-

ren. Cause and effect were to the logician but invariable sequences, of which he could give no account. To the physicist they now became essential continuities: effect was cause in a new form; suppression and re-appearance took the place of mere physical sequence. The stone which logic offered became bread in the hand of science. A boundless vista at once opened before the mind; and, instead of isolated and independent phenomena, the essential relations of all the physical forces became more or less clearly discernible, rendering it probable that as a mechanical cause in its simplest form is evolved into its effect by suppression, or as the higher forms of force, heat, light, electricity, and magnetism could be equally evolved under suitable material conditions from a merely mechanical cause by a similar suppression, so might the organic processes in their entirety be equally correlative of the lower forces. That as the living body neither formed nor transmuted its material elements, neither was it the creative centre

of an immaterial and independent organic law working within.

If in fine it is ascertained beyond all doubt that, in respect of its materials, a living body contains no more than it has received; that, however strange and mysterious its organs and their functions, the warp and woof are of substances with which we are acquainted under simpler conditions, cannot the same be maintained of the form and forces it exhibits?

To begin with the lowest series of living things. There will probably be no hesitation in admitting that the vegetable kingdom is no more than an expression in a higher form of the terrestrial conditions which even common experience proves to be in a general way necessary to vegetable life. And this admission will be freely made, though the infinite details it includes have yet to be made known. Thus the fulfilment of the Almighty fiat—"Let the earth bring forth grass, the herb yielding seed, and the fruit-tree yielding fruit after

his kind"—will be regarded not as the unconditioned effect of an absolute will, but as the working out of that will through means laid open to the investigation of science.

To pass from a lower series to a higher, it will be equally admitted that the animal kingdom is sustained at all points by the vegetable kingdom.

That the forces exhibited in animal functions are those previously stored up in plants by assimilation is a fixed position in physiology, and so far the operation of the law of life is plain; but as we pass to a consideration of the more intimate modes of it, the difficulties increase, and yet probably they are not essentially greater difficulties than such as have been overcome by the patience and docility of those investigators whom it is my duty to commemorate on this occasion.

It may be objected that there is lurking a kind of *petitio principii* in the supposed relations of simpler forces to their higher forms; that, for the conversion of the former into the latter, it is necessary to postulate

material conditions of a certain kind, and that, for the organic conversion we must begin with a living body or its germ. That the boast of the physiologist is like the boast of Archimedes. If he wanted a $\pi\acute{o}\nu\ \sigma\tau\acute{\omega}$, they require germs or ova and a living body. But it is clear that such an objection has no weight as in favour of a vital force which is not material, since it is abundantly proved that, whatever be the conditions required, they do not generate any power, but only vary the form of it.

They who maintain the hypothesis of a separate vital force independent of the ordinary forces of nature, and which has no essential relation to them, do, by the very terms of the hypothesis, assume that the phenomena in living things are out of the proper range of science, and they consign us to a perpetual mental inactivity and ignorance in that region of knowledge in which above all others man is interested. They seem to abjure that birthright which a learned physiologist has spoken of as our highest in-

heritance when he says: Man is not only the most wonderful creature God hath created, in the perfection of his organization, but most in this that He hath endowed him with an intellect to understand himself. "When this height is reached," this same writer adds, "then, and not till then, will man be a perfect monument of the wisdom and power of his Maker, a created being knowing his own existence, and capable of explaining it."* A hypothesis, like that of a separate vital principle, which demands so much, which stops inquiry at once, making progress impossible, by removing the steps by which it could ascend, should at least have the highest sanctions of our intellect. This, however, seems not to be so; for, says one of the acutest thinkers,† "to a reflecting mind the very fact that the powers peculiar to life *include* cohesion, elasticity, &c., that living

* Draper's "Human Physiology," 1856, p. 25.

† Coleridge, "Hints towards the Formation of a more Comprehensive Theory of Life," 1848.

matter exhibits these physical properties, would demonstrate that, in the truth of things, they are homogeneous, and that both the classes are but degrees and different dignities of one and the same tendency. For the latter are not subjected to the former as a lever or walking-stick to the muscles; the more intense life is, the less does *elasticity*, for instance, appear *as* elasticity. It sinks down into the nearest approach to its *physical* form by a series of degrees, from the contraction and elongation of the irritable muscle to the physical hardness of the insensitive nail. The lower powers are *assimilated*, not merely *employed*, and assimilation presupposes the homogeneous nature of the thing assimilated; else it is a miracle, because it would imply that additional and equal miracle of annihilation. In short, all the impossibilities which the acutest divines have detected in transubstantiation, would apply *totidem verbis et syllabis* to that of assimilation, if the objects and the agents were really heterogeneous. Unless there-

fore a thing can exhibit properties which do not belong to it, the very admission that living matter exhibits *physical* properties includes the further admission that those physical or dead properties are in themselves vital in essence, really distinct, but in appearance only different." The impassable chasm between the living and the dead, which this hypothesis of a vital force assumes, and then attempts to bridge over, appears to be a human figment, arising out of the mechanical mode by which alone man can work upon material ; but, says Newton,* "The main business of natural philosophy is to argue from phenomena without feigning hypotheses, and to deduce causes from effects until we come to the first cause, which certainly is not mechanical." Science may probably never be able to give an account of the primitive germs of living things, if only because the primeval conditions of the world cannot repeat themselves for our investigation ; but it is not improbable that the con-

* Optics, p. 344, 1718.

ception we form of germs and ova is as faulty as was that of early physiologists respecting the generation of elementary substances by organic bodies, or of that till lately generally entertained, and still entertained by some, respecting the vital forces, as if they were not terrestrial. That living things throw off at times portions of their mass, which become through a definite set of physical relations like the parent from which they sprang, is of common experience; but whether these masses, germs or ova as they may happen to be called, are as limited and specific as we have hitherto regarded them, is the *questio vexata* of the day.

That like should beget like, might *à priori* be inferred from the equality of the conditions. But observation also shows that, the conditions varying, like does not necessarily beget likeness; and this variation occurs both upwards towards a higher organization, downwards towards an extinction of it, and divergently towards variety of organic form.

The dogma "omne vivum ex ovo," for the truth of which Harvey so justly contended against the fanciful notions of his age, cannot, perhaps, be now maintained in its integrity. Whether, to use an expression of that day, living things are ever produced automatically—that is, *de novo*—through putrefaction or otherwise, is, like the question of the limitation or universality of the germ power, still a matter upon which opinion is divided; and if it is my duty on this occasion to exhort you to investigate nature by way of experiment, I must ask you not readily to accept negative conclusions, which impose limits where none may really exist.

Still, it must be admitted that it is under the strictest and severest limits that nature does operate. If organization be automatic, it is so in a deeper and higher, in a wider and stricter sense than the mind of man hath as yet conceived. It is a process of whose beginning we have no knowledge or conception, and the present facts of which must

ever make greater and greater demands upon the intellect to fathom them. It is an operation which reaches so far as to include in its last developments an intellectual and a moral law,—all the infinite organic variety we see around us, and that subtle world we feel within.

The time is passing in which the human mind can remain satisfied to rest under the fetters it has imposed upon itself, or to cherish its own phantasms as if its very existence depended upon them. “Man knows only what he has observed of the course of nature” is the notorious dictum of science, showing the limit and the mode of the acquirement of our knowledge: the limit as wide as nature itself; and the mode but readiness to be taught. Notwithstanding, therefore, the adverse decision of schools and dogmas, science still occupies itself with the possibilities of occasional automatic generation. And that it should be so, let it not raise antagonism in the minds of those whose inquiries lie in another

direction, since the infinity of nature may well include facts which at first seem to be antagonistic.

But here, as in all search after truth, we pass between Scylla and Charybdis. On the one hand, we may not incline to those easy systems which satisfy the intellect by explanations which the imagination supposes; neither may we, on the other, give ourselves over to systems of immature science, which, whilst they seem to be carrying us forward, are but revolving us in the narrowest circles of knowledge, for mind is not mechanical, life is not chemistry, anatomy is not physiology; and I think, as the poet says, that we are not altogether magnetic mockeries. Still, as it has been stated elsewhere, the student of medicine would gladly yield up the department of knowledge in which he labours, to be partitioned amongst the claimants of the collateral sciences, of physics and chemistry, if their claim was fairly made out; but, however much we may congratulate our fellow-labourers on the work they have

accomplished, we cannot admit that their investigations have as yet approached even the confines of the organic kingdom.

Physiology, in the range of animal and vegetable morphology, has done much to give us the assurance that the infinite variety of organic forms will be traced to their secondary causes. It may seem but trifling to note how vegetable symmetry is dependent upon the relations of light and moisture, and the circumambient fluids, air or water; or that leaves and flowers will be regular or not, according to the varying firmness of the stem on which they are supported. But if from these observations we can be carried on to those elaborate arrangements which have been described as so admirable in their intentions as to surpass the utmost ingenuity of man to conceive, we cannot believe that there is a limit to our progress but that which our supineness or pride of intellect imposes upon us. Whilst we accept this encouragement, it is to be remarked that the explanations afforded are chiefly statical or

mechanical—that they do not approach the conditions which we are accustomed to regard as in a higher sense vital. Yet, even with respect to these, as was brought before you on a former occasion, science does not shrink from the task of ultimately unveiling their mystery. “To suppose,” says Darwin,* “that the eye, with all its inimitable contrivances for adjusting the focus to different distances, for admitting different amounts of light, and for the correction of spherical and chromatic aberration, could have been formed by natural selection, seems, I freely confess, absurd in the highest possible degree. Yet reason tells me, that if numerous gradations, from a perfect and complex eye to one very imperfect and simple, each grade being useful to its possessor, can be shown to exist; if, further, the eye does vary ever so slightly, and the variation be inherited, which is certainly the case; and if any variation or modification in the organ be ever useful to an animal under changing

* Darwin on the Origin of Species, p. 186.

conditions of life, then the difficulty of believing that a perfect and complex eye could be formed by natural selection, though insuperable by our imagination, can hardly be considered real."

Admitting the full force of this reasoning, and though anatomy shows that the elementary eye arises by a simple involution of the integument, the difficulty is, that the same, or nearly the same, occurs for the ear; and we have no knowledge which would enable us to predict from such beginning the formation of organs so elaborate as these ultimately become, for that can hardly be called knowledge which but deals with facts by contemplation alone. We cannot be said to have acquired a clue to the idea of organic operations until we are able to try our knowledge by prediction, and to foretell what must arise under given conditions. Although, however, physiology is obliged to assume the unit of each organ, we cannot survey the relations of organic beings throughout their whole extent without the conviction that we have before us the varied

illustrations of one pervading law, reaching from the simple elements to the highest tissues and organs.

Not to occupy time by recapitulating the arguments of the Bridgewater Treatises, which, although written from another point of view, would equally prove this unity, I cannot forbear asking you for one moment to consider again this organization of our own bodies in relation to the earth we inhabit, and then say if it be otherwise conceivable but as the expression of the highest correlation of these external conditions. But some will reply, 'this is admitted, and explained by the direct operation of a Divine Power upon the material, fitting one thing to another—the organ to its function, the sense to its object.' Accepting to the full all that could properly be contained in this assertion, it is still to be asked, in the interests of science, that, instead of closing the inquiry, it should, on the contrary, but open it, and quicken and make patient the understanding in our search after the facts by which such results are obtained; for the

operation of an infinite wisdom and power in nature does not obviate secondary causes or explain the processes which lie between the extremes of existence. I admit that, as Darwin says, the imagination fails to conceive the means in their operation, and that it would rather avoid the labour of inquiry. But if, in the study of natural phenomena, our choice lies between the inconceivable and the miraculous, there can be no doubt where it must be made. That which is only inconceivable may be made clear by advancement of knowledge; but that which is miraculous supposes agencies above and beyond human knowledge, and therefore makes all labour to investigate it useless and vain.

The feebleness and impatience of the intellect will ever incline us to believe that each advance of knowledge is bringing us near to the point of its consummation. It is so with every discovery; and it is well it should be so, otherwise the ardent inquirer might sit down hopeless at the extent and difficulties of the route to be traversed and

of the ascent to be made; still we must beware of accepting any conclusions as final. As I had to remark upon chemistry, that when it reaches the confines of organization, it probably ceases in our living tissues under that form, to appear under some higher correlative—so, no doubt, the same may be said of those molecular conditions with which we are now becoming acquainted. The investigation of the reactions of colloids is doing for organic tissues and functions what chemistry has done for elements and elementary composition; but how far the explanations thus afforded extend can be determined only by the further progress of knowledge. Whether we are justified in speaking of muscle and nerve as if they had any relation to mere colloid substances, or whether by a knowledge of these we approach nearer to an explanation of nerve force and its transmission, or to the contraction of muscle, is at least doubtful; for, notwithstanding the admitted instability of homogeneous substances of complex composition, and the

tendency to differentiate in various ways, our knowledge of the evolution of the various tissues and organs of the body from the apparently homogeneous ovum is almost as much beyond scientific comprehension as it was when this oration was instituted. It is still, as Harvey remarked, "as if the whole body (chick) was created by a command to this effect of the Divine Architect: 'Let there be a similar colourless mass, and let it be divided into parts and made to increase; and in the meantime, while it is growing, let there be a separation and delineation of parts; and let this be harder and denser and more glistening—that be softer and more coloured: and it was so.'" Yet let it be remembered that Harvey felt the same difficulty when he began the study of the motion of the heart. "I found the task," he says, "so truly arduous, so full of difficulties, that I was almost tempted to think . . . that the motion of the heart was only to be comprehended by God. For I could neither rightly perceive at first when the systole and when the diastole took

place, nor when and where dilatation and contraction occurred, by reason of the rapidity of the motion, which in many animals is accomplished in the twinkling of an eye, coming and going like a flash of lightning: so that the systole presented itself to me now from this point, now from that; the diastole the same; and then everything was reversed, the motions occurring, as it seemed, variously and confusedly together. My mind was, therefore, greatly unsettled; nor did I know what I should myself conclude, nor what believe from others." Yet if Harvey's immortal labours overcame the apparently superhuman difficulties of the circulation, who can doubt that some kindred genius shall hereafter lay open before us the springs of development (evolution). That this will be done cannot be doubted; for who can draw a limit either in nature or in the understanding, after contemplating the greatness of results, and the simplicity of the factors presented to us in the history of generation? Prior to experience, what could have made such demands upon our

belief as that which is daily presented to us in the development of the ovum? From a cell so simple that our minds are baffled by its simplicity in attaching any significance to it whatever, the whole complex organism grows into form and activity. Is it not therefore conceivable, is it not rather by this example suggested, that the higher organic forms which inhabit the world to-day may, by the keen eye of science, be tracked through the dim vista of past time to their equally simple beginnings, varied and modified by the changing circumstances in and around them? Simplicity, as we have proof in these early conditions of the ovum, raises of itself no objections. It is imposed upon the highest as well as on the lowest organisms to have the same homogeneous beginnings; and if, as a modern physiologist* says, "a single cell, under appropriate conditions, becomes a man in the space of a few years, there can surely be no difficulty in understanding

* Herbert Spencer, "Principles of Biology," vol. i. p. 350.

how, under appropriate conditions, a cell may, in the course of untold years, from the same simple beginning, give origin to the human race." Biology teaches us that apparently insignificant forces may work large increments of change, when the time of their operation is unlimited. It teaches us that there is a simplicity in nature, greater than the untutored mind could suggest; that the agents are so apparently simple and insignificant that the common sense—or, as remarked, the "common ignorance"—of mankind passes by them without thinking them worthy of attention. But, says Coleridge, to whom I have already referred, "the positions of science must be tried in the jeweller's scales, not like the mixed commodities of the market on the weigh-bridge of common opinion and vulgar usage."

Every advancement of science exhibits to us new illustrations of great results from causes apparently the most inefficient. Tyndall has lately shown the probability that the green parts of plants may be formed by the decomposition of carbonic acid, through

the mechanical action of light, under favourable conditions ; yet what imagination can picture to itself the force of a single vibration of such light, millions of millions of which strike in a second upon the retina, without causing even a sensation, or only the feeblest. But if Tyndall be right, such force repeated, inconceivably small as it is, is sufficient to clothe our forests from spring to spring, and to fill our fields and vineyards with ample store of food. If we cannot as yet dogmatically assert "*ubi vero lumen, ibi quoque vita,*" we do thus by every advance of knowledge more clearly perceive that the physical existence, as well as the intellectual development of living things, was involved in the first fiat, "Let there be light."

To turn from these considerations to such as more immediately concern us, let me speak now of the progress which has been made in our knowledge of the nervous system.

Since the discovery of the circulation, no greater work has probably been done in phy-

siology than that by Marshall Hall when he established the conditions of a reflex nervous action. This unit appears to be the key of the most complex nervous phenomena, if it be not, indeed, an expression of the law which determines the form of the whole. From it physiologists have obtained a clue whereby to track the labyrinths of instinct and habit; for, assuming, as we must, that the mechanical arrangements in the nervous system, at periphery and centre, are, in their way, as artificial as the optical arrangements of the eye, or the acoustic arrangements in the ear, we can recognise how the instinctive and volitional acts are performed independently of the conscious determination of the individual.

Physiologists have long pointed out that the basis of our volitional acts is instinctive. That the most instructed anatomist has no advantage over the ignorant in directing his voluntary movements, each being guided by the objective intention, and both equally intellectually unconcerned in the steps whereby

that intention is fulfilled. Together with these innate arrangements, it would appear that habit and education can induce new capacities of a similar kind upon us. From anatomical proof, as well as from actual experience, it would seem that the nervous tissue is highly plastic. Not only is it capable of receiving and registering the impressions made upon it, but of acquiring an instinct for complicated acts.

This, the physical basis of education, and even of morals, though not overlooked, is too little regarded in daily practice. We may therefore congratulate the College that the Gulstonian lecturer of this year has taken up this difficult and important subject, and treated it so ably.

By quitting all abstract considerations, and limiting the inquiry to the secondary conditions upon which depend the mental operations, we open a mine rich in practical wealth. Medicine yet owes it to society to demonstrate more fully those secondary conditions whereby a healthy mental activity

may be secured and advanced ; for of nothing can we be more certain than that the laws of life, in their unimpeded operation, culminate in the advancing perfection of man, corporeally, intellectually, and morally. But the operation of these laws depends upon common things. Whilst the ignorant have recourse to the supernatural, science asserts that everything, if not traced, is yet traceable to its antecedents ; and thus, as the handmaid of religion, proves that what a man soweth that shall he also reap.

But to return. Whilst lower natures in the organic scale are the immediate subjects of external influences, which act upon and mould them with but little resistance, the reflex nervous actions institute a new order of phenomena, culminating in the intellect and the use of means. As feeling dawns into sensation, the sentient being directs its movements so as to avoid what is injurious, and to attain what is useful, and in that degree resists those disturbances which would modify the equilibrium of non-sentient natures. As

sensation grows into perception, wider relations for good and for evil disclose themselves, and these higher creatures, in the same proportion, avoid what is unfavourable, or seek, on the contrary, by wider movements, the necessary conditions for their existence. As perception leads to knowledge, and mind develops, means of a higher kind are used, and the intellect obviates or regulates the disturbing conditions, until man becomes cosmopolitan, and greatly independent of the varying forces around him.

He stands, as it has been remarked, at the beginning of a new epoch of existence. His body, moulded by those conditions which have equally acted upon other forms, retains a natural alliance to them, so that the comparative anatomist finds it difficult to place him in a group distinct from quadrumana; but the inner developments of his nature have fixed a gulf between him and the creatures outwardly allied to him which is immeasurable and impassable. By what steps or

processes the perception of sense graduated towards the higher forms of intelligence cannot now be discerned; but when mind began to exercise its prerogative of subduing the earth, it obviously brought the subject of it under a new law of existence. The outward agencies which in the beginning had co-operated to produce mechanical results upon our frame, were now opposed and hindered by the operations of mind, and the equilibrium of our physical condition was maintained in spite of circumstances the most variable. Art controlling nature is but a partial expression of the law of man's existence; but even this separates him from creatures next to him by what I have said is an immeasurable and impassable gulf—immeasurable, because there is no known increment which could multiply knowledge according to sense into knowledge according to reason; impassable, because in the onward course of nature those primeval conditions which have culminated in man cannot be supposed ever to recur. Though, there-

fore, our outward forms remain, like geologic strata in the earth, to indicate the forces by which they were originally moulded, they can be considered no measure of the relation we at present stand in to the lower animals. "Man is," to use the words of the writer* to whom I am indebted for these suggestions, "a being apart, since he is not influenced by the great laws which irresistibly modify all other organic beings." He is a being who is, in some degree, superior to nature, inasmuch as he knows how to control and regulate her actions, and to keep himself in harmony with her, not by a change in his body, but by an advance in his mind.

The lower law of nature advances in man to a higher form. It ceases to be mechanical, and becomes intellectual and moral. Force does not now properly balance force, as of individual against individual, and kind against kind, as in the lower natures; but force is properly balanced by right, and

* Alfred R. Wallace on the Origin of Human Races, "Anthropological Review," May, 1864.

right modified by duty. Man is social, as distinct from gregarious; and, in the highest conceptions of that state, would be governed by love rather than by law; for, as we are taught, "Love is the fulfilling of the law," which latter, to use the expression of a friend,* "is as it were latent in love, like an inscription in a fountain, becoming visible only when the stream is dry."

And this brings me to speak of a subject now much under discussion, and which touches *our* duty to society.

We cannot, I think, agree to neglect any means which lie within our power of preventing disease. If a rigid scientific method excludes the consideration of final causes where they are so patent, and I may say prominently set forward, as they seem to us, in organic structures; and if it teaches us that this appearance may be more to human eyes than in the sight of Him who ordereth all things by a wisdom transcend-

* "Man and his Dwelling-place," chap. vii.

ing our comprehension ; if we may not, in fine, without the charge of temerity, venture to assign the *why* in physical causes, how much more open are we to the charge when we set up ourselves as judges of the moral purposes of disease ?

I cannot doubt it is on all sides imperative upon us to limit, and if possible to blot out, all diseases of whatever kind. Who would assume the responsibility of letting a preventable evil fester in society, on a pretence of a knowledge of the divine purposes, or under the pretext that public morality would be thereby promoted ? The duty which lies nearest to us must ever have the first claim ; and it cannot but be admitted that the nearest duty each man has to his fellow is to save him as far as possible from all injury, even though that injury may arise as the consequence of his own fault. Nor will it be questioned that the cause of morality is more advanced by beneficent interference than by permitting ourselves to stand passively by whilst intemperance

and vice work ruin and infect the very fountains of life.

In what way society should work thus to protect itself may involve considerations of the most delicate and difficult kind; but the object no less remains, and the duty of striving to attain it becomes daily more and more imperative. These remarks apply to all diseases which are common to the social state.

It is now universally acknowledged that the art of medicine is all but powerless in controlling the morbid actions set up in the large class of diseases called zymotic. Specifics will no doubt continue to be sought after, but preventive medicine will more largely obtain the suffrages of the best-informed members of our profession.

There can be no more saddening task allotted to the physician than that of having to prescribe drugs against agents which he knows will work out their destructive effects to the end, in spite of such means. It may be that there do not exist, nor may

ever be formed by art, antidotes to these poisons. But should it be otherwise, my duty at this moment still seems to be clear, that I ought not to stir up your minds to search out *such* secrets of nature. Upon this search already too much time has been wasted, and an incalculable amount of life has been lost. On the contrary, I ought to urge upon the profession the most strenuous and united exertions for limiting the spread of these diseases, if it be not possible to altogether stamp them out; and then, if hereafter antidotes should be discovered, we may hope the cases will be rare upon which their operation could be tried.

I cannot pass from this subject without congratulating the College that we number amongst ourselves many distinguished labourers in this department of medicine, or without acknowledging the debt we owe to the late Sir James Simpson. No one more earnestly drew attention to the demands of preventive medicine than he did; and amongst the many claims his memory has

upon posterity, there is perhaps none higher than this, that his mind was intent upon the means which might be best calculated to extinguish contagious diseases. It might seem Utopian were I to attempt to foreshadow the results of a perfect preventive medicine and hygiene; but I may at least say that, followed to their conclusions, they would leave us with a greatly reduced nomenclature of disease.

By drainage of the soil alone, the mortality from pulmonary consumption has been in several places largely reduced. By drainage, as it affects the purity of water-supply, the prevalence of enteric fever has also been greatly limited. And whatever may be the ultimate value of the germ theory of disease, had it done no more than promote the purity of the water-supply to large towns, its good results would have been incalculable. We already owe to it the Metropolitan Drainage Works, the Thames Embankment, the Royal Commission on the Water-supply of large Towns,

the purification of the Thames, and such partial filtration of our drinking water as the public waterworks-companies cannot avoid.

We have lately been rather blamed for not gratefully and more fully accepting the germ theory of disease; but to this College the theory is not new, and, I think I may add, has not been proved to be true to the extent its more zealous supporters believe. It will be in the remembrance of many present that in the year 1849 a theory was put forth that epidemic cholera was due to fungi and their germs. Peculiar bodies, it was said, had been found in the rice-water evacuations, and also in the air and drinking waters of the infected localities.

It was confidently asserted that we had substantial facts in support of the theory, and that it fulfilled the conditions required of being both true and sufficient. This College thought the subject of such moment that a sub-committee was formed from the Cholera Committee of that day for its investigation. The drinking water of infected

places was examined, the air of rooms in which cholera patients were dying was condensed, that it might afford whatever floated in it for examination; dust was collected from cobwebs, window-frames, books, surfaces of exposed food, and every imaginable place, to try it for cholera germs. The rice-water stools and the intestinal evacuations passed in different diseases were scrutinized without stint of labour; but the value of the facts put forth by the promoters of the theory gradually faded under the inquiry. The supposed germs, when really germs (for many shapes had been included in the supposed direful growth), were found to be spores of known harmless fungi and *confervæ*, of which, if even the startling number of thirty-seven and a half millions should be contained in about two drachms of water, as quoted by Tyndall, from Mr. Dancer's examination, it is probable that the whole or repeated units of such millions might be harmlessly swallowed.

But for the most part the supposed germs

were not germs of any kind, but broken scraps of vegetable and animal tissues, spiral vessels from dried horse-dung, hairs, wings, and legs of insects, detrita of dress, and the like. The results were, in fact, entirely negative of any peculiar bodies to which the epidemic disease could be referred.

One general result arrived at at that time, however, agrees with the observation of Tyndall in his recent investigation of dust by a beam of light—viz., that the floating particles in the air are chiefly of an organic nature. This we might have been prepared for, from the specific weight of dried organic material, enabling such dust to float, when the heavier inorganic substances would be deposited.

That infectious diseases, as the name imports, spread by emanations from the sick, must have been long known, and that such emanations are of a solid nature we may infer from the fact that they may be dried and conveyed from place to place; but in what state, whether as amorphous material or as

germs, we know no more to-day than was known a thousand years past.

No new fact bearing upon the propagation of contagious diseases has been reached by the recent investigations on dust. We cannot infer that summer catarrh is due to infusoria, because the nasal mucus formed in the disease, and at no other time (?), was found peopled by vibriones, since decomposing mucus is generally populous with these infusorial creatures.

The phenomena of fermentation and putrefaction in dead and decomposing substances afford no explanation of the changes observed in a living body in a fever process. The purulent matter produced in small-pox is not in any way comparable to the yeast plant, growing in fermenting fluids. The microscope shows no forms in variolous pus, which are not contained in other purulent innocuous exudations. It is to be regretted that a confusion in terms has been made. Instead of dust and disease, it should rather have been dust and putrefaction,

or dust and fermentation, since the relation of dust to disease has not been revealed anywhere in the inquiry. That the air conveys the material causes of infectious diseases from the sick to the healthy, is a notorious fact, which had equal force before these inquiries were instituted, though, owing to the exigencies of social intercourse, it is a fact now more neglected than in times of comparative ignorance.

It is difficult to vindicate exactness in progress without seeming to be at the same time a hinderer of it. The onward and the regulating forces of a machine, though not incompatible, but necessary, require the nicest balance. This reflection suggests itself by the way the spread of infectious diseases has been handled. The theories it has given rise to have been so easily put forward as to thereby create distrust. But the spirit of science is no favourer of negations. "Der Geist der stets verneint" finds no greater friend in medicine than in theology. But it will be admitted that no

progress can be made by the ready acceptance of every proposition, however distinguished the source from which it emanates. The parasitic origin and nature of epidemics may be true, but it has yet to be proved. As a hypothesis, it admits of proof or disproof, and so has further claim upon the industry of those who have put it forward as a suggestion. Without going to the length which this hypothesis demands, we must admit, however, that we know enough to guide us much further than we have yet gone in the practice of prevention.

To leave these discursions, and in a few words to conclude my task, I would repeat that the distinction of Medicine, as a study, lies in its comprehensiveness. The student of physical science admits that he has to deal with but one-half of that truth which is expressed in man. The student of medicine cannot so limit himself. The facts of sensation, whether pleasurable or painful; the influence of the mental emotions, whether exciting or depressing; the dominion of

the conscience, approving or disapproving, are for him facts due to the operation of laws into which he must inquire. Looked at from the point of view which the Student of Medicine occupies, these higher facts of man's nature are as essentially parts of one law, and control and modify human existence equally with those lower conditions with which physics alone is concerned. This constitutes the unspeakable difficulty which every student of medicine must feel in the present imperfect state of knowledge. To hold the mind in an equal balance as it passes from the contemplation of the lower facts of our existence to those which characterize the highest claims of our humanity, so as neither to degrade the one nor neglect the other, is one of the highest attainments. What eye is single enough to survey the range of life from the material atoms which build our structures, to those "mighty hopes which make us men," without faltering in the vision, or without confusion of the objects?

Every student exalts and distorts the work upon which he is chiefly occupied. The anatomist with his microscope hopes thereby to fathom the depths of nature, and the student of the pure intellect despises his labours, each arriving at impotent conclusions by not mutually aiding and supporting his fellow-labourer. Yet perhaps the chasm between the two orders of human facts is other than it seems. It may be due to our not seeing that we are not dealing with *contraries*, but with *opposites*: opposites in the highest sense; not as if the terms of the one contradicted the terms of the other, but with the assurance that each will be understood by admitting its antithesis. Here, says Herbert Spencer, "we arrive at the barrier which needs to be perpetually pointed out, alike to those who seek materialistic explanations of mental phenomena, and to those who are alarmed lest such explanations should be found. The last class prove by their fear, almost as much as the first prove by their hope, that they believe Mind may

possibly be interpreted in terms of Matter, whereas there is not the remotest possibility of so interpreting them.”*

What the student of nature's mysteries always needs to remember is his position as viewing things from his own centre, rather than from *the* centre. What he has chiefly to avoid is that discouragement should not pass into denial. If our difficulties are great, our hope is assured that the organic laws, in their highest conception, correlate with laws of truth, and culminate in that moral nature expressed by the term holiness. Thus, only to those unacquainted with the practice of medicine can it seem strange that, ever occupied as we are with the failures of humanity, the mists of physical and moral disease cannot obscure the brightness of that ideal perfection which the “law of life” casts upon our path.

* “Principles of Psychology,” p. 158.



