

1-1-1825

Lecture Delivered as Introductory to Anatomy Course

George McClellan, MD

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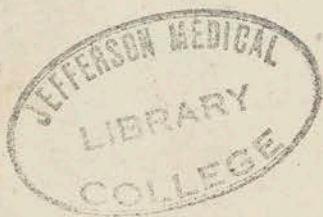
McClellan, MD, George, "Lecture Delivered as Introductory to Anatomy Course" (1825). *Medical Student and Faculty Lecture Notes*. 39.

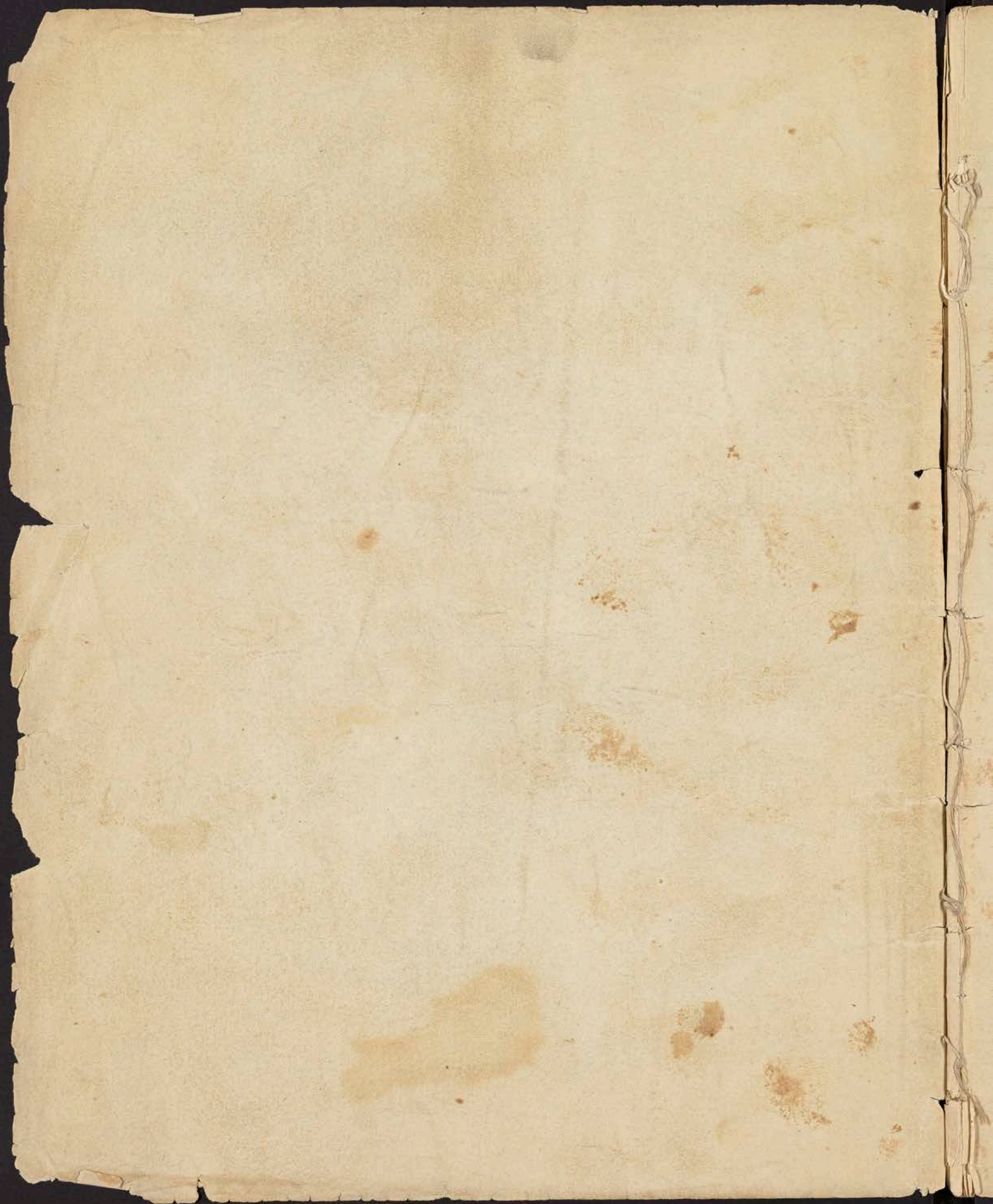
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V. F.

McClellan, George, 1796-1847





Anatomy is a science which investigates the structure of organised beings. Descriptions of the interior formation of all the animal and vegetable classes may with propriety be arranged under this department of knowledge. But man is exalted ^{corporeal} so high above all other beings, by his organization as well as by his intelligence, that the unqualified term Anatomy has been appropriated to dissections of the human subject alone. To introduce an examination of the organs of our own species, therefore, will become the object of this address; and if no promise is offered of directing you to comparative views of the inferior classes, it must not be supposed that I have chosen a narrow path to knowledge. Though the number of organs composing the animal machine is by no means great, yet under so many relations are these described, and with such various appendages do they abound, that the bare nomenclature of Anatomy almost equals that of some of the

departments of natural history, by which many
 thousand individuals are designated. The bones
 and Cartilages — the muscles, nerves, & viscera —
 the organs of sense & generation — the nails & hair
 compose the whole fabric. But every connexion
 among these different parts must be noticed; & each
 fixed appearance throughout the whole arrangement
 has received a name. Thus the 243 individual bones
 not only receive distinct appellations, but their various
 articulations with each other and every hole &
 tubercle must be designated. Each of the ^{Several hundred} muscles
 is to be recollected by its peculiar term, and every
 important branch of each system of vessels has an
 appropriate name. But I need not say more
 to convince you of the extent of our subject; —
 you may already be alarmed at the prospect of its
 technology. Indeed if terms were employed as in
 the common business of life, without constant reference

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to the principle of association, we might exhaust all our zeal in perusing the nomenclature. But science has thrown light into this wilderness of dry names, and what to an untaught man might seem most barren will be found by you garnished, if not composed, with classic materials. Almost every term employed in anatomical description, is derived from the Greek or Latin vocabulary. Every scholar knows with what facility words can be inflected from those languages to express any modification of thought. Of this advantage ample improvement has been made, and Anatomists have now constructed a system of names at once scientific and intelligible. In the signification of each particular term there is some allusion either to the situation, use, form or other quality of the part to which it is appropriated. The properties of the objects are thus identified with the names which designate them, and the

4. mind is in consequence intuitively enabled to associate their corresponding relations. Anatomy has therefore been reduced to the beautiful order of Science, and its study will be pursued with regularly increasing interest even by him who desires a mere acquaintance with the individual organs. Limited, however, must his curiosity be, who, satisfied with the bare demonstration of parts, does not essay to unravel the design of such wonderful machinery. The knowledge of particulars only becomes useful when their mutual relations are understood; and the parts of a machine are never appreciated till their several operations have been explained. But we shall transgress the limits of Anatomy the moment we advance in the path of speculation; for the labours of dissection are only preparatory to more intellectual exertions. ^{beyond} All the outline of rigid demonstration is subject to that Science, which, though altogether obligated to Anatomy, claims our superior regard.

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The object of Physiology is to explain the phenomena of Life. The strict etymology of the term (being derived from the Greek words *Φυσις* & *λογος*) signifies a discourse upon nature: — but by long established usage it is now appropriated to the Science which investigates the causes & effects of organic motions; or, in other words, the nature and laws of life. By Anatomy we unravel the intricate combinations of organised tissues, while Physiology elucidates the actions & uses of these parts. — No recommendations need be advanced in favour of such a study, for where can curiosity be wanting to discover the sources of our being. Speculations upon the nature of the soul afforded captivating employment to the ancient philosophers; and disquisitions upon the animal economy continue to excite the highest interest among modern physicians.

Physiology may very properly be divided into two departments — the one mechanical —

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the other vital. Nearly the same relations prevail among these, as exist between the two physical sciences—Natural Philosophy & Chemistry. As the former treats of the sensible motions of distinct bodies, so Mechanical Physiology illustrates the conspicuous movements of animal parts; and while Chemistry explains the most intimate motions or the powers which combine the minutest atoms into masses of matter—the second department of Physiology (which the German Physicians have called Biology) investigates those mysterious actions of organized structures which maintain life & energy & thought. Though this division of our subject, must be regarded as altogether the most important, Mechanical Physiology is by no means devoid of interest. Almost every part of our fabric is constructed in such a manner as to possess some evident

mechanical advantage, independent of the vital purposes to which all are subservient. Thus the skull is composed of 8 distinct bony plates, that during parturition the infantile head may be diminished ~~in size~~ by an overlapping of the edges of the different pieces.

The ribs decline so obliquely between their anterior & posterior connexions that a very slight elevation produces a great enlargement of the chest in respiration; and the vertebral bones of the back are joined with each other in such a manner, as to allow of considerable motion in the various attitudes of the body, while they are so firmly connected by their peculiar processes as to afford a constant safeguard to the delicate spinal marrow. The wrists & the ankles are composed

of numerous small bones united together by peculiar articulations, undoubtedly for the purpose of protecting the trunk from the concussion of falls. The Ear contains a chain of remarkable little bones, arranged so advantageously that they propagate to the auditory nerves, with greatly increased effect, the most delicate impulses which the vibrations of the air communicate to the tympanum.

The joints are all constructed with such varied surfaces & appendages that they afford every facility to the motions peculiar to each limb; and the larger bones generally are so directed that the greatest advantages are obtained. But it is in their connections with the muscular system that we discover the most astonishing contrivances. Examples of pulleys, of the three different levers, —

& not unfrequently of interesting complications of these various powers will be observed. In fact, they exhibit almost every mechanical principle that has yet been employed; and it may be questioned whether the arts have not derived their greatest improvements from these sources. If the knee & elbow joints did not serve as models for the common-hinge, it is not impossible that the double-joint, now so much used in machinery was taken from the articulations between the head and the first & second vertebra of the peck.

It is certain that Euler was led to the invention of his achromatic telescope by observing the structure of the crystalline lens. This body regularly increases in density from its surface to the centre, by which construction the rays of light are refracted to a focus without the slightest aberration. It was therefore obvious that a similar disposition with plates of soft and of flint glass, would approximate to the

some result; and this fact enabled its discoverer to construct the most perfect optical instrument in existence.

The cavities of the heart and its vessels, are provided with curiously constructed valves to prevent the retrograde motion of the blood; and the veins & lymphatics are furnished with similar contrivances to facilitate the returning circulation. But it will prove impossible to enumerate even the most interesting of the mechanical uses of our structures: the blood-vessels, the nerves, & all the different tissues are so located in regard to the surrounding organs as to perform their appropriate functions with every conceivable advantage.

Under the second department of Physiology the vital powers are elucidated. To this subject the term Biology, which signifies the science

of life, has not been improperly applied, for every action which it investigates is peculiar to the living condition. Respecting the nature and causes of life Physiologists have not neglected to form a sufficient number of hypotheses. The eternal fire has been stolen from the altars of heaven to animate models of clay, and the spirits of departed beings, have been transformed into human souls. But the more rational of these conjectures may all be reduced to some connection with one of the ^{two} prevailing doctrines. Theorists are now divided between the following opinions—

First, that the beautiful mechanism of our frames is complete in itself, maintaining by its very constitution its own principles of action—
 —and second, that to produce the phenomena of life, there must be some peculiar agent superadded to organization.

The former of these has been called by its

advocates, the organic theory of life - while others have stigmatised it, by the epithet materialism. The latter has been denominated the spiritual, or pneumatic doctrine; though lately it has been, idly enough, attempted to style it the Hunterian. As it harmonizes much more with the religious sentiments of the community it has almost become converted into the standard of orthodoxy. But such are not the grounds on which speculation should be cultivated. Science rests on a different basis from religion. The one demands our faith exclusively, while the other denies every thing that agrees not with rigid demonstration. We should, therefore, deprecate every feeling that may interfere with an independent examination of the principles of life.

But do not suppose that I am advocating the

doctrines of materialism. It will be seen in the sequel, that there are a sufficient number of arguments to confirm the most wavering in the belief of an independent source of life. I only desire to dissipate the unfounded fears of those who would suppress all enquiry concerning this mysterious subject. How much more beautiful with the truths of revelation appear, when corroborated by the calm, unbiassed investigations of Inductive Philosophy. The organic theory is not, as many imagine, necessarily opposed to religion. If life were to result from the operation of several different causes combined; still the identity of man would be considered as positive, as though his existence were limited to one distinct principle.

In the natural world it is very difficult to ascertain whether we have discovered one real elementary substance, & yet the individuality of

of all the different compound bodies, is not questioned. We are accountable beings, not because we are material, or spiritual; but because we have a free-will. In our great moral relations, therefore, we shall not be affected; and if Physiologists are sometimes skeptics, their fault should not be charged to Science. Neither the ridiculous hypothesis of accidental combinations, nor the brutish doctrine of fatality, have any necessary connection with the Theories of animal life. As revelation has informed us - evil dwells in the heart; and I question not, if either theory has been supported by unbelievers.

After having made these concessions, I trust I shall be absolved from the common charge of illiberality in not detailing all the arguments advanced by materialists. Much of their reasoning is placed on

such inaccessible ground as to defy all examination.

We are easily led to assent to the correctness of abstract terms when taken individually - especially such as ^{appear to} designate the actions of life. Thus we do not refuse to speak of faculty & function, of sympathy & harmonic functions, of irritability & excitability ~~& harmonic functions~~ - of organic sensibility & animal contractability, ~~and~~ although they indicate no precise ideas. But when many of these are complicated together into one argument, it requires great exertion to bring the particular subjects which they severally designate, under our comprehension. The mind then is very ready to glide over such general terms, without attempting to substitute for them any precise signification; & a most specious appearance is thus easily given to vague reasoning. Of this opportunity, immense improvement has been made; almost every continental Physician has occupied the ground; and scores of volumes

have been filled with such captivating jargon -
To instance, what is every day made familiar to
our ears, the word sympathy - which, though
perhaps the most simple of these abstract terms,
once merely indicated a blank space in our
knowledge, It is a fact that many parts
appear to be so closely associated in their actions
that an impression made upon one is easily
transmitted to another; and before the Anatomy
of the tissues was investigated complete mystery
involved all these circumstances. Now it is
ascertained that almost all such phenomena
prevail in parts either immediately connected
by nervous ramifications, or by continuous
membranes, and as far as they are concerned in
performing similar functions, therefore, they
may fairly be considered not distinct organs.

The other circumstances, if they cannot be explained by the universally acknowledged principles of fluid repulsion and nervous counter-irritation, are certainly not elucidated by the use of an abstract words.

Sympathy, however, ~~has proved too convenient~~ an instrument, in the hands of the sophister, to be honourably relinquished; and we still hear it reiterated with such bold flippancy, as may lead youthful minds to believe it a demonstrable entity. By the varied use of this specious term, not only the actions of life are accounted for, but the operation of almost every remedy is explained.

With such reasoning, it surely is easy to satisfy a superficial enquirer, without resorting to any distinct principle; and the blind-fold of still more indefinite epithets may long continue to usurp the place of intelligence.

But let not the admirers of French & German

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Physiology accuse me of intolerance: I am willing to allow more credit to the other arguments by which their doctrine is supported. Of these my limits will only permit me to notice such as bear the strongest appearance of plausibility.

The animal frame, in health, is compared to a perfectly constructed machine - which of course must require certain powers to keep it in motion. These are supposed to consist in the presence of heat, light, food, drink &c. for it is found that an increase of any or all of them, augments; while their removal correspondingly decreased the actions of life - Their total absence invariably destroys life, and ~~then~~^a careful restoration of them often appears to resuscitate it. The presence of these agents, therefore, being so indispensable to our existence, it would not be very unnatural to conclude that their action on the different organs is productive of vitality. In fact such has been

the belief of a great majority of Physiologists; and they boldly maintain that life is not the cause, but the result of the phenomena presented by living bodies. Casuistical reasoners might perhaps determine that this argument affords no real opposition to the pneumatic theory; and that the difference consists chiefly ^{the application of} in words. But as its advocates acknowledge no such interpretation we are not entitled to take this advantage.

They avow an entire disbelief in a distinct principle of life; and maintain it partly by the circumstances just detailed, though more plausibly, by the agencies of what are called, the imponderable fluids.

Galvanism, when transmitted through any considerable nerve, a short time after death, will excite more convulsive contractions in the muscles to which that nerve is distributed, than could be produced in the living man.

Electricity also repeats the animal motions; and either of these agents can be applied under certain circumstances so as to maintain the more insensible, and vital actions of organization.

Experiments performed upon animals, after decapitation, or division of the important nerves, seem to prove that the influence which the brain and nervous system exercises upon the various functions, if not altogether galvanic, is at least closely assimilated to that power.

By means of this agent, the actions of the heart & arteries are invigorated, respiration may be long continued (if the lungs are at the same time mechanically distended with air,) many of the secretions can be effected, and even digestion appears to be performed. How much farther Galvanism may be discovered to operate we cannot venture to predict.

Some speculators, by its opportune presence, have already unravelled the mysteries of gravitation, and chemical affinities; and, (as if to give our theorists the full benefit of their argument,) it has lately been discovered that the magnet loses its polarity, when in the neighbourhood of a battery whose opposite poles are connected, and of course neutralized, by a conductor. If this fluid can be supposed to exercise such a universal control over the unorganized world, what may not be credited of its agency upon the delicate machinery of life? No backwardness has been evinced in the application of these circumstances; and we are presented with their outline in the following delineation, which, if not complete, cannot fail of amusing you.

The blood, as it passes through the lungs, is constantly receiving from the atmosphere that modification of Electricity, which is called Galvanism — and at the same time, as it performs its regular circuit, it is absorbing, from every part, the same agent. The solids, & non-circulating fluids must, therefore, be deprived of their natural share of this influence; or in other words they become charged negatively; while the blood has assumed to itself a superabundant quality. In the Brain this excess of the galvanic fluid is abstracted, or, as our theorists say, secreted from the circulation, & that organ is, therefore, converted into the positive end of the battery. The nerves, serve as the conductors of the apparatus, & by exerting themselves to restore an equilibrium, are constantly distributing to the various organs that influence, which experi-

ments have proved, can excite the actions of life. Thus the digestive organs are animated to operate upon our food, the lacteals to take up the nutritive particles, & the lungs to assimilate them, the minute vessels to deposit them through every part in growth & nutrition, and the capillaries to throw off the various secretions & excretions in their appropriate places;

The heart is roused to action, & the muscles to contract; the organs of sense are enabled to receive impressions; and, in short, every vital motion is performed. There is only one trifling duty which has not seriously been assigned to this all-pervading agent; — but as thinking has obviously nothing to do with the abstract question about animal life, we will not for the present allow that to interfere.

The common objections to these explanations are too readily surmounted to afford any very formidable opposition to materialists. Thus when it is observed, that in all of the experiments which have been performed some hours after death, no modification of Galvanism has ever restored a single living motion; they answer, that the Blood had ^{then} coagulated, & thereby one of the most essential parts of the whole machine been destroyed. If you require any absolute proof of the electrical state of the body which they assume, they can affirm, what a late author seems to have proved, that by establishing a simple galvanic circle, with its positive pole near the head, & the negative, upon one of the extremities, palsied limbs may be invigorated, & epileptic convulsions prevented.

If you affirm that their doctrine contradicts the divine truths of Revelation; it is negatively replied, that because organization may be subverted, & life suspended, it does not follow that these properties cannot be restored. The same Omnipotence which first constructed this wonderful apparatus, can, at any time, rebuild the same peculiar organization, which may constitute personal identity, & life, & intelligence.

Such, gentlemen, though divested of much of its speciousness, is an outline of the organic theory of life. If you could view it through the mists with which abstract words have enveloped it, you would not, perhaps, be surprised at its prevalence: at least, you would feel inclined to exercise a more charitable judgment, concerning those who cannot lead their minds to an opposite conviction.

However little their arguments may have effected against the doctrine of a distinct principle of life, we must allow them the credit of having developed one of the great secondary causes, by which animation has been imposed upon organised beings.

But shall the veil of hypothetical reasoning hide truth from our sight? and shall we remain contented amidst doubt & conjecture?

While investigating the phenomena of life as developed in the various conditions of the embryo, the fetus, the youth, & the full-grown man, facts will be exhibited which cannot fail to demonstrate the necessity of some principle independent both of galvanic power & of organised matter. But these are so numerous, that it would prove inconvenient to notice them in the short limits of this address; It will hereafter

become my duty to elucidate all such arguments in their appropriate places. At present, it only remains necessary to review the more general circumstances, which, if they do not strike the mind so forcibly, afford ~~the~~ incontrovertible opposition to materialism.

The first general fact, to which I will call your attention, prevails through all living nature; & has been so universally admitted as to constitute, both a law, and definition of vitality. It is, that Chemical powers have no controul over organized bodies, while endowed with life. Changes in the combination of particles, indeed, do often occur in living structures, but these if ever chemical, are always subservient to the predominating vital actions. At the same time it is certain that of all the different

species of matter, dead animal substances are most disposed to undergo spontaneous changes of composition. The moment life is destroyed, the laws of Chemistry begin to prevail, and all organization is speedily reduced to one putrefying mass. If we begin to enquire into the causes of this difference between the two conditions, we shall immediately be struck with the fact, that neither of those agents to whose action life has been attributed, are possessed of any power to resist the chemical changes of putrefaction. On the contrary, both heat & the galvanic influence, are not only the most active decomposing powers known but they are peculiarly calculated to facilitate the putrefactive process. Although in an inferior degree, the same fact obtains with the other agents which have been considered

most favorable to life. Light, motion & moisture, all excite decomposition after death, with greater activity than they support life before that event.

All those causes, therefore, which have been found most propitious to putrefaction in the dead body, are operating upon the living man.

There is no material agent which can oppose their action. Why, therefore, do we not find such an effect produced? If the most unimpeachable testimony can be credited, not even the slightest tendency to putrefaction can be produced in the living animal: and we are consequently, led to the positive conclusion, that there must be some distinct immaterial principle, superadded to organization.

There are other differences between the conditions of life & death which can be constructed into the same argument.

Living bodies resist, to an astonishing extent the powers of heat; whereas the dead are readily exposed to all the sudden effects of that agent. Human beings have remained many minutes, in Ovens heated to almost 300 degrees of Fahrenheit, without sustaining serious inconvenience; and frogs are said to exist in mineral springs of almost a boiling temperature with little elevation of their own natural heat. No satisfactory explanation

of these facts can be drawn from chemical agencies; for meat is readily baked in a temperature below 300. degrees, for dead animals are soon boiled under water, where they receive every protection from heat that ^{its} evaporation can possibly afford.

The natural heat of animals cannot supply any defence, for that is generally above the temperature of surrounding bodies; and the galvanic influence, whenever it affects the

distribution of caloric, always cools it.


Nor can it be objected that the complicated actions of animal life have this remarkable controul over the powers of heat; for the most simply constructed beings, even in their dormant state, exhibit the same phenomenon.

If we can be surpris'd at these circumstances we have equal reason to be astonish'd at the resistance which life invariably offers to the invasion of cold. Instances are recorded of human beings remaining unhurt, almost an incredible number of days, ~~and~~ under drifts of polar snow: and we are all acquainted with the intense degrees of cold which the arctic animals can endure. Some physicians have carefully performed the experiment of immersing their extremities alternately in very hot & cold water & they obtained this curious result - that the

limb of a living man will depress hot, & elevate cold water, to its own temperature, much sooner than a red hot iron, in the one case, or a body of ice in the other, will effect the same result.

But as these cases have received other explanations than appertain to the present argument, I will call your attention to similar phenomena which bear a more unquestionable aspect. An impregnated Egg certainly does not possess any of the complicated motions that originate from undefined causes, nor does it appear to be governed by galvanic laws; and yet, so long as it is susceptible of being animated by incubation, we do not deny it the properties of vitality. It resists the actions of heat, cold & putrefaction; which is the universal & peculiar quality of life. Experiments have proved

-that it will require almost double the time to freeze or boil such an Egg, that need be afforded, under the same circumstances, to one which is not possessed of vitality. Now it is a fact that an Egg may have its principles of animation destroyed, by long exposure to a low temperature, by the influence of an Electrical shock, and by several other circumstances, without differing in any of its sensible properties from those which are altogether uninjured. The only discrepancies we can discover between them lie in their powers of resisting chemical changes, and of undergoing the process of incubation. Their taste, smell, weight, & organization agree undistinguishably. What, therefore, can constitute their difference? All admit that neither galvanism, nor heat interferes; and, as no other material agent is concerned, we

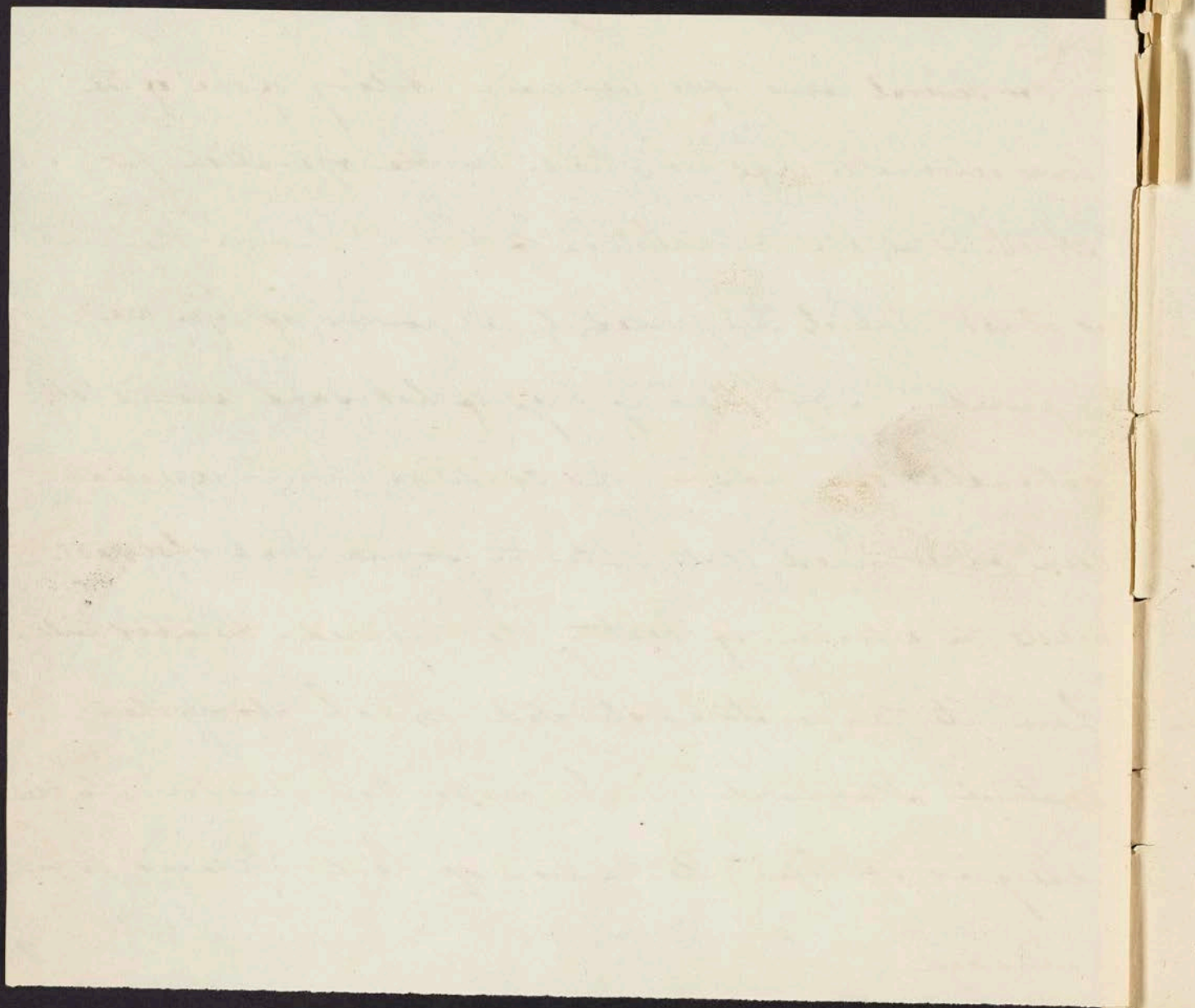
must here also have recourse to that mysterious principle which we have before been forced to acknowledge. 

The experiments, by Mr. Hunter, of freezing fresh drawn blood, and those investigating the influence of cold & heat upon some of the most inferior animals, all terminate in the same conclusion. We are therefore irresistibly led to the conviction that the phenomena of life are dependant upon some peculiar, ~~found~~ undiscovered agent, which residing in organized structures, enabled the material powers of heat, light, electricity &c. to excite both the external animal motions, & the insensible vital actions of organization.

Not the least interesting part of this conclusion is the circumstance that it does



For several hours after the main Artery of one of the lower extremities has been tied in the operation for Aneurism, the circulation of blood through the limb is almost entirely suspended, & the powers of life are impaired. By placing bags of hot sand, around both extremities of a man in this condition, it has repeatedly been ascertained, that ~~with~~ the sound limb obstinately ^{while} resists the entrance of heat; the injured member will have its temperature elevated much above the natural standard. In proportion, therefore, to the energies of life, the action of heat appears to be withstood.



not stand in opposition to one of the facts ~~which~~ have been advanced in favour of the other theory of life. It is not necessary to suppose that no other agent is implicated, because galvanism acts upon living parts and excites many of their motions. When we examine the effects of this power upon unorganized, or upon dead bodies, though ^{they} are very conspicuous, we never can discover them to vary under the same circumstances.

The different metallic & alkaline salts are always decomposed in the same specific manner, when placed in the galvanic circuit; & the combustible substances never fail to be burnt alike when submitted to the same charge. On living organs, however, this influence produces no such unvarying effects. Not a single impression upon any part of our bodies can always be calculated to excite any one particular motion; for, every action is modified according

to the necessity of its influence, & our conditions are unceasingly changed by a great multiplicity of circumstances. An article of food which at one time proved very acceptable to the stomach, at another is quite disagreeable, and upon a third trial is rejected altogether. This difference does not arise from any want of correspondence in the impressions, but because the stomach is not always disposed to ^{& react upon} receive the same impression. In the same way, every other organ ~~often~~ varies its actions without any discoverable change of moving power. The food & stimulants of health, also, prove extremely noxious in disease; while the remedies of the latter condition would soon destroy the active vigour of youth.

We have, from these circumstances, every reason to infer that there must be some active power adherent to organization, which enables the living parts to modify the impressions of all other bodies.

Since heat, galvanism &c, acting upon dead matter always produce the same effects under the same circumstances, we grant that no other agent need be concerned; but as these influences are not found to be attended with uniform results while acting upon a living part, we cannot refuse to believe in the existence of some interfering power. Let the question ^{respecting} ~~about~~ the necessity of external agents to the actions of life, ^{therefore,} be undetermined, & we still have sufficient proof that this power, which may well be called the vital principle, pervades all animated nature. Vegetables possess it, in an inferior degree; & animals are all endowed with it, from the simple polypus, which has neither Brain, nerves, nor any other galvanic apparatus, up to the complicated machinery of intellectual man.

It will become my most interesting duty, Gentlemen, (in the Lectures on Anatomy & Physiology which will be delivered in this room) to explain to you the influences of this mysterious agent upon our frames. How, actuated by it, the small animated drop can draw to itself other particles, & build around a living machine — How this first-moving, & last-expiring organ can throw out streams of blood through gradually developing vessels; which, by the same influence, perform the inexplicable actions of growth, & nutrition — How the various parts of our whole fabric, are thus created, & subsequently increased into the perfect frame.

In what manner the organs of digestion, of absorption, circulation, respiration & secretion maintain the functions of life; while the

The only remaining point for consideration in connexion with this question, is the method of discriminating between material & immaterial agents. Although, at first thought, no difficulty would be apprehended from an investigation of this subject, still it must be acknowledged that the rules of distinction which have usually been adopted, are extremely vague & uncertain. Matter, only presenting ^{certain} qualities, in different forms of combination, to our senses, will, probably, never become so intimately displayed to our view as to allow us to form any ideas respecting its ^{real} ~~apparent~~ nature or mode of existence. ~~Of~~. Its properties have been divided into two classes — 1. essential, & 2. accidental; and formerly

— it was supposed that by the appearance of the first of these its presence could only be ascertained. The following ^{Six} have been admitted as the essential, or general properties of matter by all philosophers.

— Impenetrability, Extension — Figure —
— Divisibility — Inertia — & Attractions.

But several forms of existence, which do not exhibit either of these ~~with~~ ~~of~~ ~~the~~ circumstances to our perceptions, are now universally acknowledged to be material. Neither Light nor caloric can possibly be recognised except by the manner in which they influence all grosser forms; — nor can the galvanic & magnetic agents be detected but by the effects which they produce upon particular substances according to the ancient & well established

definition, ~~therefore~~, these could not
 have been entitled to the appellation
 of material existences. But as they
 are so constantly & universally connect-
 ed with all the various states of org-
 anised & unorganised substances,
 they have very properly been classi-
 fied under the general head of
imponderable fluids; and are associ-
 ated with other more demonstrable
 existences.

The vital principle, however should
 not be confounded with either of
 these terrestrial & comparatively appre-
 ciable agents. It is not concerned
 with any of the changes which are
 effected among the particles of dead

- or unorganised matter; nor does it
 ever exhibit any of the ^{manifested}
 - ions which characterise the other ^{modes} ~~of~~
 of existence.

I do not consider it, however,
 in connexion with that still more
 subtle & ethereal principle which
 directs, & develops the intellectual
 phenomena of man. Though intimately
 connected, they are still discrete; and
 may, according to our own (limited) rule
 of judging, be totally distinct in their
 nature & period of continuance.
 at present it will only be proper
 to remind you of that living cause
 the existence of which appears to me
 to be fully demonstrated; and the effects
 of which are witnessed throughout
 whole world of animated structures.