

Nathl. S. P. M.

LECTURES

UPON

ANIMAL LIFE.

THREE LECTURES

UPON

ANIMAL LIFE,

DELIVERED IN THE

UNIVERSITY OF PENNSYLVANIA,

BY

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P R E F A C E.

A REQUEST was made to me some years ago by my pupils, to publish the following lectures. I declined complying with it, because I did not think them fit for the public eye; but a more importunate application of the gentlemen who attended them last year, has prevailed upon me to commit them to the press in their present imperfect state. The reader will soon perceive, that I disclaim being the author of the great and original conception upon which they are founded. I have done but little more than carry the hod, to assist in completing part of a fabric, the foundations of which were laid by two of the most distinguished master builders in medicine of the eighteenth century.

I have endeavoured to render the facts and principles contained in these lectures, intelligible to gentlemen of all professions as well as to physicians. This attempt to diffuse medical knowledge more generally, has been made necessary, by the controversies about systems of medicine, and remedies, which now divide the physicians of every part of the world. They can never be settled, but by men who do not trade in physic, and who will not be actuated in deciding upon medical questions, by an improper competition for interest, or fame.

BENJAMIN RUSH.

PHILADELPHIA, }
25th June, 1799. }

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LECTURES

LECTURES

O N

ANIMAL LIFE.

LECTURE I.

GENTLEMEN,

MY business in this chair is to teach the institutes of medicine. They have been divided into Physiology, Pathology, and Therapeutics. The objects of the first are, the laws of the human body in its healthy state. The second includes the history of the causes, and seats of diseases. The subjects of the third, are the remedies for those diseases. In entering upon the first part of our course, I am met by a remark delivered by Dr. Hunter in his introductory lectures to his course of anatomy. “ In our branch (says the Doctor) those teachers who study to captivate young minds with ingenious speculations, will not leave a repu-

tation behind them that will outlive them, half a century. When they cease from their labours, their labours will be buried along with them. There never was a man more followed, and admired in physiology, than Dr. Boerhaave. I remember the veneration in which he was held. And now, in the space of forty years,——his physiology is —— it shocks me to think, in what a light it appears.”* Painful as this premonition may be to the teachers of physiology, it should not deter them from speculating upon physiological subjects. Simple anatomy is a mass of dead matter. It is physiology which infuses life into it. A knowledge of the structure of the human body, occupies only the memory. Physiology introduces it to the higher, and more noble faculties of the mind. The component parts of the body, may be compared to the materials of a house, lying without order in a yard. It is physiology, like a skilful architect, which connects them together, so as to form from them an elegant, and useful building. The writers against physiology, resemble in one particular, the writers against luxury. They forget that the functions they know, and describe, belong to the science of physiology; just as the declaimers against luxury, forget that all the conveniences

which

* Lect. xi. p. 98.

which they enjoy beyond what are possessed in the most simple stage of society, belong to the luxuries of life. The anatomist who describes the circulation of the blood, acts the part of a physiologist, as much as he does, who attempts to explain the functions of the brain. In this respect Dr. Hunter did honor to our science; for few men ever explained that subject, and many others equally physiological, with more perspicuity and eloquence, than that illustrious anatomist. Upon all new and difficult subjects, there must be pioneers. It has been my lot to be called to this office of hazard, and drudgery; and if in discharging its duties, I should meet the fate of my predecessors, in this branch of medicine, I shall not perish in vain. My errors, like the bodies of those who fall in forcing a breach, will serve to compose a bridge for those who shall come after me, in our present difficult enterprise. This consideration, aided by just views of the nature, and extent of moral obligation, will overbalance the evils anticipated by Dr. Hunter, from the loss of posthumous fame. Had a prophetic voice whispered in the ear of Dr. Boerhaave in the evening of his life, that in the short period of forty years, the memory of his physiological works would perish from the earth; I am satisfied, from the knowledge we have of his elevated genius and piety,

piety, he would have treated the prediction with the same indifference, that he would have done, had he been told, that in the same time, his name should be erased from a pane of glass, in a noisy and vulgar country tavern.

The subjects of the lectures I am about to deliver, you will find in a syllabus which I have prepared, and published, for the purpose of giving you a succinct view of the extent, and connection of our course. Some of these subjects will be new in lectures upon the institutes of medicine, particularly those which relate to morals, metaphysics, and theology. However thorny these questions may appear, we must approach and handle them; for they are intimately connected with the history of the faculties, and operations of the human mind; and these form an essential part of the animal œconomy. Perhaps it is because physicians have hitherto been restrained from investigating, and deciding upon these subjects, by an erroneous belief that they belong exclusively to another profession; that physiology has so long been an obscure, and conjectural science.

In beholding the human body, the first thing that strikes us, is its LIFE. This, of course should

be the first object of our inquiries. It is a most important subject ; for the end of all the studies of a physician is to preserve life ; and this cannot be perfectly done, until we know in what it consists.

I include in animal life as applied to the human body, *motion*—*sensation*—and *thought*. These three, when united, compose perfect life. It may exist without thought, or sensation ; but neither sensation, nor thought, can exist without motion. The lowest grade of life, probably exists in the absence of even motion, as I shall mention hereafter. I have preferred the term *motion* to those of oscillation, or vibration which have been employed by Dr. Hartley in explaining the laws of animal matter ; because I conceived it to be more simple, and better adapted to common apprehension.

In treating upon this subject, I shall first consider animal life as it appears in the waking, and sleeping states in a healthy adult, and shall afterwards inquire into the modification of its causes, in the foetal, infant, youthful, and middle states of life, in certain diseases, in different states of society, in different climates, and in different animals.

I shall begin, by delivering three general propositions.

I. Every

I. Every part of the human body (the nails and hair excepted) is endowed with sensibility, or excitability, or with both of them. By sensibility is meant the power of having sensation excited by the action of impressions. Excitability denotes that property in the human body, by which motion is excited by means of impressions. This property has been called by several other names, such as, irritability, contractility, mobility, and stimulability. I shall make use of the term excitability, for the most part, in preference to either of them. I mean by it, a capacity of imperceptible, as well as obvious motion.—It is of no consequence to our present inquiries, whether, this excitability be a quality of animal matter, or a substance. The latter opinion has been maintained by Dr. Girtanner, and has some probability in its favor.

II. The whole human body is so formed, and connected, that impressions made in the healthy state upon one part, excite motion, or sensation, or both, in every other part of the body. From this view, it appears to be an unit, or a simple and indivisible quality, or substance. Its capacity for receiving motion, and sensation, is variously modified by means of what are called, the senses. It is external

nal, and internal. The impressions which act upon it, shall be enumerated in order.

III. Life is the EFFECT of certain stimuli acting upon the sensibility, and excitability which are extended in different degrees, over every external, and internal part of the body. These stimuli are as necessary to its existence, as air is to flame. Animal life is truly (to use the words of Dr. Brown) “a forced state.” I have said, the *words* of Dr. Brown; for the opinion was delivered by Dr. Cullen in the University of Edinburgh in the year 1766, and was detailed by me in this school, many years before the name of Dr. Brown was known as a teacher of medicine. It is true, Dr. Cullen afterwards deserted it; but it is equally true, I never did; and the belief of it, has been the foundation of many of the principles, and modes of practice in medicine which I have since adopted. In a lecture which I delivered in the year 1771, I find the following words, which are taken from a manuscript copy of lectures given by Dr. Cullen upon the institutes of medicine. “The human body is not an automaton, or self-moving machine; but is kept alive, and in motion by the constant action of stimuli upon it.” In thus ascribing the discovery of the cause of life which I shall endeavour to establish, to Dr. Cullen; let it not be supposed, I mean to detract from the
genius

genius, and merit of Dr. Brown. To his intrepidity in reviving, and propagating it, as well as for the many other truths contained in his system of medicine posterity, I have no doubt, will do him ample justice, after the errors that are blended with them, have been corrected, by their unsuccessful application to the cure of diseases.

Agreeably to our last proposition, I proceed to remark, that the action of the brain, the diastole, and systole of the heart, the pulsation of the arteries, the contraction of the muscles, the peristaltic motion of the bowels, the absorbing power of the lymphatics, secretion, excretion, hearing, seeing, smelling, taste, and the sense of touch, nay more, thought itself, are all the effects of stimuli acting upon the organs of sense and motion. These stimuli have been divided into external, and internal. The external are light, sound, odors, air, heat, exercise, and the pleasures of the senses. The internal stimuli are food, drinks, chyle, the blood, a certain tension of the glands, which contain secreted liquors, and the exercises of the faculties of the mind; each of which I shall treat in the order, in which they have been mentioned.

I. Of external stimuli. The first of these is light. It is remarkable that the progenitor of the human

race

race was not brought into existence until all the luminaries of heaven were created. The first impulse of life, was probably imparted to his body by means of light. It acts chiefly through the medium of the organs of vision. Its influence upon animal life is feeble, compared with some other stimuli to be mentioned hereafter ; but it has its proportion of force.— Sleep has been said to be a tendency to death ; now the absence of light we know invites to sleep, and the return of it excites the waking state. The late Mr. Rittenhouse informed me, that for many years he had constantly awoke with the first dawn of the morning light, both in summer and winter. Its influence upon the animal spirits strongly demonstrates its connection with animal life, and hence we find a cheerful and a depressed state of mind in many people, and more especially in invalids, to be intimately connected with the presence or absence of the rays of the sun. The well known pedestrian traveller Mr. Stewart in one of his visits to this city informed me, that he had spent a summer in Lapland in the latitude of 69° during the greatest part of which time the sun was seldom out of sight. He enjoyed he said during this period, uncommon health and spirits, both of which he ascribed to the long duration, and invigorating influence of light. These facts will surprize us less when we attend to the ef-

fects of light upon vegetables. Some of them lose their colour by being deprived of it; many of them discover a partiality to it in the direction of their flowers; and all of them discharge their pure air only while they are exposed to it.*

2. Sound has an extensive influence upon human life. Its numerous artificial and natural sources need not be mentioned. I shall only take notice, that the currents of winds, the passage of insects through the air, and even the growth of vegetables, are all attended with an emission of sound; and although they become imperceptible from habit; yet there is reason to believe they all act upon the body, through the medium of the ears. The existence of these sounds, is established by the reports of persons who have ascended two or three miles from the earth in a Balloon. They tell us that the silence which prevails in those regions of the

* "Organization, sensation, spontaneous motion and life, exist only at the surface of the earth, and in places exposed to light. We might affirm the flame of Prometheus's torch was the expression of a philosophical truth that did not escape the ancients. Without light, nature was lifeless, inanimate and dead. A benevolent God by producing life has spread organization, sensation and thought over the surface of the earth." Lavoisier.

the air is so new and complete, as to produce an awful solemnity in their minds. It is not necessary that these sounds should excite sensation, or perception in order to their exerting a degree of stimulus upon the body. There are a hundred impressions daily made upon it, which from habit, are not followed by sensation. The stimulus of aliment upon the stomach, and of blood upon the heart and arteries, probably cease to be felt, only from the influence of habit. The exercise of walking, which was originally the result of a deliberate act of the will, is performed from habit without the least degree of consciousness. It is unfortunate for this, and many other parts of physiology, that we forget what passed in our minds the first two or three years of our lives. Could we recollect the manner in which we acquired our first ideas, and the progress of our knowledge with the evolution of our senses, and faculties; it would relieve us from many difficulties, and controversies upon this subject. Perhaps this forgetfulness by children, of the origin and progress of their knowledge, might be remedied by our attending more closely to the first effects of impressions, sensation, and perception upon them as discovered by their little actions; all of which probably have a meaning, as determined as any of the actions of men or women.

The influence of sounds of a certain kind in producing excitement, and thereby increasing life, cannot be denied. Fear produces debility which is a tendency to death.—Sound obviates this debility, and thus restores the system to the natural, and healthy grade of life. The school boy and the clown, invigorate their feeble and trembling limbs, by whistling or singing as they pass by a country church yard, and the soldier feels his departing life recalled in the onset of a battle by the noise of the fife, and of the poet's "spirit stirring drum." Intoxication is frequently attended with a higher degree of life than is natural. Now sound we know will produce this with a very moderate portion of fermented liquor; hence we find men are more easily and highly excited by it at public entertainments where there is music, loud talking, and hallooing, than in private companies where there is no auxiliary stimulus added to that of the wine. I wish these effects of sound upon animal life to be remembered; for I shall mention it hereafter as a remedy for the weak state of life in many diseases, and shall relate an instance in which a scream suddenly extorted by grief, proved the means of resuscitating a person, who was supposed to be dead, and who had exhibited the usual recent marks of the extinction of life.

I shall conclude this head by remarking that persons, who are destitute of hearing and seeing, possess life in a more languid state than other people; and hence arise the dulness, and want of spirits which they discover in their intercourse with the world.

3. Odors have a sensible effect in promoting animal life. The greater healthiness of the country, than cities, is derived in part from the effluvia of odoriferous plants which float in the atmosphere in the spring and summer months, acting upon the system, through the medium of the sense of smelling. The effects of odors, upon animal life, appear still more obvious in the sudden revival of it, which they produce in cases of fainting. Here the smell of a few drops of hartshorn, or even of a burnt feather, has frequently in a few minutes restored the system, from a state of weakness bordering upon death, to an equable and regular degree of excitement.

4. Air acts as a powerful stimulus upon the system through the medium of the lungs. The component parts of this fluid, and its decomposition in the lungs, will be considered in another place. I shall only remark here, that the circulation of the blood

blood has been ascribed by Dr. Goodwin exclusively to the action of air upon the lungs and heart. Does the external air act upon any other part of the body besides those which have been mentioned? It is probable it does, and that we lose our sensation and consciousness of it, by habit. It is certain children cry, for the most part, as soon as they come into the world. May not this be the effect of the sudden impression of air upon the tender surface of their bodies? And may not the red color of their skins, be occasioned by an irritation excited on them by the stimulus of the air? It is certain it acts powerfully upon denuded animal fibres; for who has not observed a fore, and even the skin when deprived of its cuticle, to be affected, when long exposed to the air, with pain, and inflammation?—The stimulus of air, in promoting the natural actions of the alimentary canal, cannot be doubted. A certain portion of it seems to be necessarily present in the bowels in a healthy state.

5. Heat is an uniform and active stimulus in promoting life. It is derived, in certain seasons and countries, in part from the sun; but its principal source is from the lungs, in which it appears to be generated by the decomposition of pure air, and from whence it is conveyed by means of the circulation, to every part of the body. The extensive influence

influence of heat upon animal life, is evident from its decay and suspension during the winter in certain animals, and from its revival upon the approach and action of the vernal sun. It is true, life is diminished much less in man, from the distance and absence of the sun, than in other animals; but this must be ascribed to his possessing reason in so high a degree, as to enable him to supply the abstraction of heat, by the action of other stimuli upon his system.

6. Exercise acts as a stimulus upon the body in various ways. Its first impression is upon the muscles. These act upon the blood vessels, and they upon the nerves and brain. The necessity of exercise to animal life is indicated, by its being kindly imposed upon man in paradise. The change which the human body underwent by the fall, rendered the same salutary stimulus necessary to its life, in the more active form of labor. But we are not to suppose, that motion is excited in the body by exercise or labor alone. It is constantly stimulated by the positions of standing, sitting, and lying upon the sides; all of which act more or less upon muscular fibres, and by their means, upon every part of the system.

7. The

7. The pleasures we derive from our senses have a powerful and extensive influence upon human life. The number of these pleasures, and their proximate cause, will form an agreeable subject for two or three future lectures.

We proceed next to consider the internal stimuli which produce animal life. These are

I. FOOD. This acts in the following ways. 1. Upon the tongue. Such are the sensibility and excitability of this organ, and so intimate is its connection with every other part of the body; that the whole system is invigorated by aliment, as soon as it comes in contact with it. 2. By mastication. This moves a number of muscles and blood vessels situated near the brain and heart, and of course imparts impressions to them. 3. By deglutition, which acts upon similar parts, and with the same effect. 4. By its presence in the stomach, in which it acts by its quantity and quality. Food, by distending the stomach, stimulates the contiguous parts of the body. A moderate degree of distention of the stomach and bowels is essential to a healthy excitement of the system. Vegetable aliment, and drinks, which contain less nourishment than animal food, serve this purpose in the human body. Hay acts in the same manner in a horse. Sixteen pounds

pounds, of this light food, are necessary to keep up such a degree of distention in the stomach and bowels of this animal, as to impart to him his natural grade of strength and life. The *quality* of food, when of a stimulating nature, supplies the place of distention from its quantity. A single onion will support a lounging Highlander on the hills of Scotland for four and twenty hours. A moderate quantity of salted meat, or a few ounces of sugar, have supplied the place of pounds of less stimulating food. Even indigestible substances, which remain for days, or perhaps weeks in the stomach, exert a stimulus there, which has an influence upon animal life. It is in this way the tops of briars, and the twigs of trees, devoid not only of nourishing matter, but of juices, support the camel in his journeys through the deserts of the Eastern countries. Chips of cedar posts, moistened with water, have supported horses for two or three weeks, during a long voyage from Boston to Surinam; and the indigestible cover of an old Bible, preserved the life of a dog, accidentally confined in a room at New Castle upon Tyne, for twenty days.

5. Food stimulates the whole body by means of the process of digestion which goes forward in the stomach. This animal function is carried on in part by fermentation, in which there is an extrica-

D

tion

tion of heat, and air. Now both these, it has been remarked, exert a stimulus in promoting animal life.

Drinks when they consist of fermented or distilled liquors, stimulate from their quality; but when they consist of water, either in its simple state, or impregnated with any sapid substance, they act principally by distention.

II. The chyle acts upon the lacteals, mesenteric glands, and thoracic duct, in its passage through them; and it is highly probable, its first mixture with the blood in the subclavian vein, and its first action on the heart, are attended with considerable stimulating effects.

III. The blood is a very important internal stimulus. It has been disputed whether it acts by its quality, or only by distending the blood vessels. It appears to act in both ways. I believe with Dr. Whytt, that the blood stimulates the heart and arteries by a specific action. But if this be not admitted, its influence in distending the blood vessels in every part of the body, and thereby imparting extensive and uniform impressions to every animal fibre, cannot be denied.—In support of this assertion it has been remarked, that in those persons who

who die of hunger, there is no diminution of the quantity of blood in the large blood vessels.

IV. A certain TENSION of the glands, and of other parts of the body, contributes to support animal life. This is evident in the vigor which is imparted to the system, by the fulness of the seminal vesicles and gall bladder, and by the distention of the uterus in pregnancy. This distention is so great, in some instances, as to prevent sleep for many days and even weeks before delivery. It serves the valuable purpose of rendering the female system less liable to death during its continuance, than at any other time. By increasing the quantity of life in the body, it often suspends the fatal issue of pulmonary consumption, and ensures a temporary victory over the plague and other malignant fevers; for death, from those diseases, seldom takes place until the stimulus, from the distention of the uterus, is removed by parturition.

V. The exercises of the faculties of the mind have a wonderful influence in increasing the quantity of human life. They all act by *reflection* only, after having been previously excited into action by impressions made upon the body. This view, of the *reaction* of the mind upon the body, accords with the simplicity of other operations in
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the animal œconomy. It is thus the brain repays the heart for the blood it conveys to it, by reacting upon its muscular fibres.—The influence of the different faculties of the mind is felt in the pulse, in the stomach, and in the liver, and is seen in the face, and other external parts of the body. Those which act most unequivocally in promoting life, are the understanding, the imagination, and the passions. Thinking belongs to the understanding, and is attended with an obvious influence upon the degree and duration of life. Intense study has often rendered the body insensible to the debilitating effects of cold, and hunger. Men of great and active understandings, who blend with their studies, temperance and exercise, are generally long lived. In support of this assertion, a hundred names might be added to those of Newton and Franklin. Its truth will be more fully established by attending to the state of human life in persons of an opposite intellectual character. The Cretins, a race of idiots in Valais in Switzerland, travellers tell us, are all short lived. Common language justifies the opinion of the stimulus of the understanding upon the brain, hence it is common to say of dull men, that they have scarcely ideas enough to keep themselves awake.

of the system of the mind upon the body
with the simplicity of other operations in

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The imagination acts with great force upon the body, whether its numerous associations produce pleasure or pain. But the passions pour a constant stream upon the wheels of life. They have been subdivided into emotions and passions properly so called. The former have for their objects present, the latter, future good and evil. All the objects of the passions are accompanied with desire or aversion. To the former belong chiefly, hope, love, ambition, and avarice; to the latter—fear, hatred, malice, envy, and the like. Joy, anger, and terror, belong to the class of emotions. The passions and emotions have been further divided into stimulating and sedative. Our business at present is to consider their first effect only upon the body. In the original constitution of human nature, we were made to be stimulated by such passions and emotions only as have moral good for their objects. Man was designed to be always under the influence of hope, love, and joy. By the loss of his innocence, he has subjected himself to the dominion of passions and emotions of a malignant nature; but they possess, in common with such as are good, a stimulus which renders them subservient to the purpose of promoting animal life. It is true, they are like the stimulus of a dislocated bone in their operation upon the body, compared with the action of antagonist muscles stretched over bones, which
gently

gently move in their natural sockets. The effects of the good passions and emotions, in promoting health and longevity, have been taken notice of by many writers. They produce a flame, gentle and pleasant, like oil perfumed with frankincense in the lamp of life. There are instances likewise of persons who have derived strength, and long life from the influence of the evil passions and emotions that have been mentioned. Dr. Darwin relates the history of a man, who used to overcome the fatigue induced by travelling, by thinking of a person whom he hated. The debility induced by disease, is often removed by a sudden change in the temper. This is so common, that even nurses predict a recovery in persons as soon as they become peevish and ill-natured, after having been patient during the worst stage of their sickness. This peevishness acts as a gentle stimulus upon the system in its languid state, and thus turns the scale in favour of life and health. The famous Benjamin Lay of this state, who lived to be eighty years of age, was of a very irascible temper. Old Elwes was a prodigy of avarice, and every court in Europe furnishes instances of men who have attained to extreme old age, who have lived constantly under the dominion of ambition. In the course of a long inquiry, which I instituted some years ago into the state of the body and mind in old people, I did not

not

not find a single person above eighty, who had not possessed an active understanding, or active passions. Those different and opposite faculties of the mind, when in excess, happily supply the place of each other. Where they unite their forces, they extinguish the flame of life, before the oil which feeds it is consumed.

In another place I shall resume the influence of the faculties of the mind upon human life, as they discover themselves in the different pursuits of men.

I have only to add here, that I see no occasion to admit, with the followers of Dr. Brown, that the mind is active in sleep, in preserving the motions of life. I hope to establish hereafter the opinion of Mr. Locke, that the mind is always passive in sound sleep. It is true it acts in dreams; but these depend upon a morbid state of the brain, and therefore do not belong to the present stage of our subject; for I am now considering animal life only in the healthy state of the body. I shall say presently, that dreams are intended to supply the absence of some natural stimulus, and hence we find they occur in those persons most commonly, in whom there is a want of healthy action in the
system

system induced by the excess, or deficiency of customary stimuli.

Life is in a languid state, in the morning. It acquires vigor by the gradual, and successive application of stimuli in the forenoon. It is in its most perfect state about midday, and remains stationary for some hours. From the diminution of the sensibility and contractility of the system to the action of impressions, it lessens in the evening, and becomes again languid at bedtime. These facts will admit of an extensive application hereafter in our lectures upon the practice of physic.

LECTURE II.

GENTLEMEN,

The stimuli which have been enumerated, when they act collectively, and within certain bounds, produce a healthy waking state. But they do not always act collectively, nor in the determined and regular manner that has been described. There is in many states of the system, a deficiency of some stimuli, and in some of its states, an apparent absence of them all. To account for the continu-

ance

ance of animal life under such circumstances, two things must be premised, before we proceed to take notice of the diminution, or absence of the stimuli which support it.

1. The healthy actions of the body in the waking state, consist in a proper degree of what has been called excitability, and excitement. The former is the medium on which stimuli act in producing the latter. In an exact proportion, and a due relation of both, diffused uniformly throughout every part of the body, consists good health. Disease is the reverse of this. It depends *in part* upon a disproportion between excitement and excitability, and in a partial distribution of each of them. In thus distinguishing the different states of excitement and excitability in health and sickness, you see I dissent from Dr. Brown, who supposes them to be uniform and equable, in the morbid, as well as the healthy states of the body.

2. It is a law of the system, that the absence of one natural stimulus is generally supplied by the increased action of others. This is more certainly the case, where a natural stimulus is abstracted *suddenly*; for the excitability is thereby so instantly formed and accumulated, as to furnish a highly sensible and moveable surface for the remaining stimu-

li to act upon. Many proofs might be adduced in support of this proposition. The reduction of the excitement of the blood vessels, by means of cold, prepares the way for a full meal, or a warm bed, to excite in them the morbid actions which take place in a pleurisy or a rheumatism. A horse in a cold stable eats more than in a warm one; and thus counteracts the debility which would otherwise be induced upon his system, by the abstraction of the stimulus of warm air.

These two propositions being admitted, I proceed next to inquire into the different degrees and states of animal life. The first departure from its ordinary and perfect state, which strikes us, is in

I. Sleep: This is either natural or artificial. Natural sleep is induced by a diminution of the excitement, and excitability of the system by the continued application of the stimuli which act upon the body in its waking state. When these stimuli act in a determined degree, that is, when the same number of stimuli act with the same force, and for the same time, upon the system; sleep will be brought on at the same hour every night. But when they act with uncommon force, or for an unusual time, it is brought on at an earlier hour.

Thus

Thus a long walk, or ride by persons accustomed to a sedentary life, unusual exercise of the understanding, the action of strong passions, or emotions, and the continual application of unusual sounds seldom fail of inducing premature sleep. It is recorded of Pope Ganganelli, that he slept more soundly, and longer than usual, the night after he was raised to the papal chair. The effects of unusual sounds in bringing on premature sleep, is further demonstrated by that constant inclination to retire to bed at an early hour, which country people discover the first and second days they spend in a city, exposed from morning till night to the noise of hammers, files and looms, or of drays, carts, waggons, and coaches rattling over pavements of stone.—Sleep is further hastened by the absence of light, the cessation of sounds, and labor, and the recumbent posture of the body on a soft bed.

Artificial sleep may be induced at any time by certain stimulating substances, particularly by opium. They act by carrying the system beyond the healthy grade of excitement, to a degree of indirect debility which Dr. Brown has happily called the sleeping point. The same point may be induced in the system at any time by the artificial abstraction

straction of the usual stimuli of life. For example. Let a person shut himself up at mid-day in a dark room, remote from noise of all kinds, let him lie down on his back upon a soft bed in a temperate state of the atmosphere, and let him cease to think upon interesting subjects, or let him think only upon one subject, and he will soon fall asleep. Dr. Boerhaave relates an instance of a Dutch physician who having persuaded himself that waking was a violent state, and sleep the only natural one of the system; contrived by abstracting every kind of stimulus in the manner that has been mentioned, to sleep away whole days and nights, until at length he impaired his understanding, and finally perished in a public hospital in a state of idiotism.

In thus anticipating a view of the cause of sleep, I have said nothing of the effects of diseases of the brain in inducing it. These belong to another part of our course. The short explanation I have given of its cause, was necessary in order to render the history of animal life, in that state of the system, more intelligible.

At the usual hour of sleep there is an abstraction of the stimuli of light, sound and muscular motion.

The

The stimuli which remain, and act with an increased force upon the body in sleep are,

1. The heat which is discharged from the body, and confined by means of bed clothes. It is most perceptible when exhaled from a bed fellow. Heat obtained in this way, has sometimes been employed to restore declining life to the bodies of old people. Witness the damsel who lay for this purpose in the bosom of the king of Israel. The advantage of this external heat will appear further, when we consider how impracticable, or imperfect sleep is, when we lie under too light covering in cold weather.

2. The air which is applied to the lungs during sleep probably acts with more force than in the waking state. I am disposed to believe that more air is phlogisticated in sleep than at any other time; for the smell of a close room in which a person has slept one night, we know, is much more disagreeable than that of a room under equal circumstances, in which half a dozen people have sat for the same number of hours in the day time.—The action of decomposed air on the lungs and heart was spoken of in a former lecture. An increase in its quantity must necessarily have a powerful influence upon animal life during the sleeping state.

3. Respira-

3. Respiration is performed with a greater extension, and contraction of the muscles of the breast in sleep than in the waking state; and this cannot fail of increasing the impetus of the blood in its passage through the heart and blood vessels. The increase of the fulness and force of the pulse in sleep, is probably owing in part to the action of respiration upon it. In another place I hope to elevate the rank of the blood vessels in the animal œconomy, by shewing that they are the fountains of power in the body. They derive this preeminence from the protection and support they afford to every part of the system. They are the perpetual centinels of health and life; for they never partake in the repose which is enjoyed by the muscles and nerves. During sleep, their sensibility seems to be converted into contractility, by which means their muscular fibres are more easily moved by the blood, than in the waking state. The diminution of sensibility in sleep is proved by many facts to be mentioned hereafter; and the change of sensibility into contractility will appear, when we come to consider the state of animal life in infancy and old age.

4. Aliment in the stomach acts more powerfully in sleep, than in the waking state. This is evident from digestion going on more rapidly when we are
awake

awake than when we sleep.—The more slow the digestion, the greater is the stimulus of the aliment in the stomach. Of this we have many proofs in daily life. Labourers object to milk as a breakfast; because it digests too soon, and often call for food in a morning, which they can feel all day in their stomachs. Sauflages, fat pork, and onions are generally preferred by them for this purpose. A moderate supper is favourable to easy and sound sleep; and the want of it in persons who are accustomed to that meal, is often followed by a restless night. The absence of its stimulus is probably supplied by a full gall bladder (which always attends an empty stomach) in persons who are not in the habit of eating suppers.

5. The stimulus of the urine, accumulated in the bladder during sleep, has a perceptible influence upon animal life. It is often so considerable as to interrupt sleep; and it is one of the causes of our waking at a regular hour in the morning. It is moreover a frequent cause of the activity of the understanding and passions in dreams; and hence we dream more in our morning slumbers when the bladder is full, than we do in the beginning, or middle of the night.

6. The

6. The fæces exert a constant stimulus upon the bowels in sleep. This is so considerable as to render it less profound, when they have been accumulated for two or three days, or when they have been deposited in the extremity of the alimentary canal.

7. The partial and irregular exercises of the understanding and passions in dreams have an occasional influence in promoting life. They occur only where there is a deficiency of other stimuli. Such is the force with which the mind acts upon the body in dreams, that Dr. Brambilla, physician to the emperor of Germany, informs us, that he has seen instances of wounds in soldiers being inflamed, and putting on a gangrenous appearance in consequence of the commotions excited in their bodies by irritating dreams. The stimulating passions act through the medium of the will; and the exercises of this faculty of the mind sometimes extend so far as to produce actions in the muscles of the limbs, and occasionally in the whole body, as we see in persons who walk in their sleep. The stimulus of lust often awakens us with pleasure or pain, according as we are disposed to respect, or disobey the precepts of our Maker. The angry and revengeful passions often deliver us in like manner, from the imaginary guilt of murder.

Even

Even the debilitating passions of grief, and fear, produce an indirect operation upon the system that is favourable to life in sleep, for they excite that distressing disease called the night mare, which prompts us to speak, or halloo, and by thus invigorating respiration, restores the languid circulation of the blood in the heart and brain. Do not complain then, gentlemen, when you are bestrode by this midnight hag. She is kindly sent to prevent your sudden death. Persons who go to bed in good health, and are found dead the succeeding morning, are said most commonly to die of this disease.

I cannot dismiss the subject of the stimulating effects of dreams, without taking notice of an opinion of Dr. Darwin which is connected with it. He supposes dreams are never attended with volition. The facts which have been mentioned, prove, that the will frequently acts with *more* force in them, than in the waking state.

I proceed now to inquire into the state of animal life in its different stages. I pass over for the present its history in generation. It will be sufficient only to remark in this place, that its first motion is produced by the stimulus of the male seed upon the female ovum. This opinion is not originally mine.

You will find it in Dr. Haller.* The pungent taste which Mr. John Hunter discovered in the male seed, renders it peculiarly fit for this purpose. No sooner is the female ovum thus set in motion, and the foetus formed, than its capacity of life is supported,

1. By the stimulus of the heat which it derives from its connection with its mother in the womb.

2. By the stimulus of its own circulating blood.

3. By its constant motion in the womb after the third month of pregnancy. The absence of this motion for a few days, is always a sign of the indispotion or death of a foetus. Considering how early a child is accustomed to it, it is strange that a cradle should ever have been denied to it after it comes into the world.

II. In infants there is an absence of many of the stimuli which support life.—Their excretions are in a great measure deficient in acrimony, and their mental faculties are too weak to exert much influence

* “ Novum foetum a feminis masculi *stimulo* vitam concepisse.” *Elementa Physiologiae*, vol. viii. p. 177.

ence upon their bodies. But the absence of stimulus from those causes, is amply supplied

1. By the very great excitability of their systems to those of light, sound, heat, and air. So powerfully do light and sound act upon them, that the author of nature has kindly defended their eyes and ears from an excess of their impressions by imperfect vision, and hearing, for several weeks after birth. The capacity of infants to be acted upon by moderate degrees of heat is evident from their suffering less from cold than grown people. This is so much the case, that we read in Mr. Umfreville's account of Hudson's Bay, of a child that was found alive upon the back of its mother after she was frozen to death. I before hinted at the action of the air upon the bodies of new born infants in producing the red color of their skins. It is highly probable, (from a fact formerly mentioned) that the first impression of the atmosphere which produces this redness is accompanied with pain, and this we know is a stimulus of a very active nature. By a kind law of sensation, impressions, that were originally painful, become pleasurable by repetition, or duration. This is remarkably evident in the impression now under consideration, and hence we find infants at a certain age, discover signs of an increase of life by their
delightful

delightful gestures, when they are carried into the open air. Recollect further gentlemen, what was said formerly, of excitability, predominating over sensibility in infants. We see it daily, not only in their patience of cold, but in the short time in which they cease to complain of the injuries they meet with from falls, cuts, and even severe surgical operations.

2. Animal life is supported in infants by their sucking, or feeding, nearly every hour in the day, and night when they are awake. I explained formerly the manner in which food stimulated the system. The action of sucking, supplies by the muscles employed in it, the stimulus of mastication.

3. Laughing and Crying, which are universal in infancy, have a considerable influence in promoting animal life, by their action upon respiration, and the circulation of the blood. Laughing exists under all circumstances, independently of education or imitation. The child of a negro slave born only to inherit the toils and misery of its parents, receives its master with a smile every time he enters his kitchen, or a negro-quarter. But laughing exists in infancy under circumstances still more unfavourable to it, an instance of which is related by Mr. Bruce. After a journey of several hundred miles

miles across the sands of Nubia, he came to a spring of water shaded by a few scrubby trees. Here he intended to have rested during the night, but he had not slept long, before he was awakened by a noise which he perceived was made by a solitary Arab equally fatigued, and half famished with himself, who was preparing to murder and plunder him. Mr. Bruce rushed upon him, and made him his prisoner. The next morning he was joined by a half starved female companion, with an infant of six months old in her arms. In passing by this child, Mr. Bruce says it laughed and crowed in his face, and attempted to leap upon him. From this fact it would seem as if laughing was not only characteristic of our species, but that it was early and intimately connected with human life. The child of these Arabs had probably never seen a smile upon the faces of its ferocious parents, and perhaps had never, (before the sight of Mr. Bruce), beheld any other human creature.

Crying has a considerable influence upon health and life in children. I have seen so many instances of its salutary effects, that I have satisfied myself that it is as possible for a child to "cry and be fat," as it is to "laugh and be fat."

4. As children advance in life, the constancy of their appetites for food, and their disposition to laugh, and cry, lessen, but the diminution of these stimuli is supplied by exercise. The limbs, and tongues of children are always in motion. They continue likewise to eat oftener than adults. A crust of bread is commonly the last thing they ask for at night, and the first thing they call for in the morning. It is now they begin to feel the energy of their mental faculties. This stimulus is assisted in its force, by the disposition to prattle which is so universal among children. This habit of converting their ideas into words as fast as they rise, follows them to their beds, where we often hear them talk themselves to sleep in a whisper, or to use less correct, but more striking terms, by *thinking aloud*.

5. Dreams act at an early period upon the bodies of children. Their smiles, startings, and occasional screams in their sleep appear to arise from them. After the third or fourth year of their lives, they sometimes confound them with things that are real. From observing the effects of this mistake upon the memory, a sensible woman whom I once knew, forbade her children to tell their dreams, lest they should contract habits of lying, by confounding imaginary, with real events.

6. New objects whether natural or artificial, are never seen by children without emotions of pleasure which act upon their capacity of life. The effects of novelty upon the tender bodies of children may easily be conceived, by its friendly influence upon the health of invalids who visit foreign countries, and who pass months, or years in a constant succession of new and agreeable impressions.

III. From the combination of all the stimuli that have been enumerated, human life is generally in excess from fifteen to thirty-five. It is during this period, the passions blow a perpetual storm. The most predominating of them is the love of pleasure. No sooner does the system become insensible to this stimulus, than ambition succeeds it in,

IV. The middle stage of life. Here we behold man in his most perfect physical state. The stimuli which now act upon him are so far regulated by prudence, that they are seldom excessive in their force. The habits of order the system acquires in this period, continue to produce good health for many years afterwards, and hence bills of mortality prove that fewer persons die between forty and fifty-seven; than in any other seventeen years of human life.

V. In

V. In OLD AGE the senses of seeing, hearing and touch are impaired. The venereal appetite is weakened, or entirely extinguished. The pulse becomes slow, and subject to frequent intermissions, from a decay in the force of the blood vessels; Exercise becomes impracticable, or irksome, and the operations of the understanding are performed with languor and difficulty. In this shattered and declining state of the system, the absence and diminution of all the stimuli which have been mentioned are supplied,

1. By an increase in the quantity, and by the peculiar quality of the food which is taken by old people. They generally eat twice as much as persons in middle life, and they bear with pain the usual intervals between meals. They moreover prefer that kind of food which is savoury and stimulating. The stomach of the celebrated Parr, who died in the one hundred and fiftieth year of his age, was found full of strong, nourishing aliment.

2. By the stimulus of the fæces which are frequently retained for five or six days in the bowels of old people.

3. By

3. By the stimulus of fluids rendered preternaturally acrid by age. The urine, sweat and even the tears of old people, possess a peculiar acrimony. Their blood likewise loses part of the mildness which is natural to that fluid; and hence the difficulty with which sores heal in old people; and hence too the reason why cancers are more common in the decline, than in any other period of human life.

4. By the uncommon activity of certain passions. These are either good or evil. To the former belong an increased vigor in the operations of those passions which have for their objects the Divine Being, or the whole family of mankind, or their own offspring, particularly their grand-children. To the latter passions belong, malice, a hatred of the manners and fashions of the rising generation, and above all, avarice. This passion knows no holidays. Its stimulus is constant, though varied daily by the numerous means which it has discovered of increasing, securing, and perpetuating property. It has been observed that weak mental impressions produce much greater effects in old people than in persons in middle life. A trifling indisposition in a grand-child, an inadvertent act of unkindness from a friend, or the fear of losing a few shillings, have in many instances produced

in them a degree of wakefulness that has continued for two or three nights. It is to this highly excitable state of the system that Solomon probably alludes, when he describes the grasshopper as burdensome to old people.

5. By the passion for talking, which is so common, as to be one of the characteristics of old age. I mentioned formerly, the influence of this stimulus upon animal life. Perhaps it is more necessary in the female constitution than in the male; for it has long ago been remarked, that women who are very taciturn, are generally unhealthy.

6. By their wearing warmer clothes, and preferring warmer rooms, than in the former periods of their lives. This practice is so uniform, that it would not be difficult in many cases to tell a man's age by his dress, or by finding out at what degree of heat he found himself comfortable in a close room.

7. By dreams. These are universal among old people. They arise from their short and imperfect sleep.

8. It has been often said that "We are once men, and twice children." In speaking of the state of
animal

animal life in infancy, I remarked that the contractility of the animal fibres, predominated over their sensibility in that stage of life. The same thing takes place in old people, and it is in consequence of the return of this infantile state of the system, that all the stimuli which have been mentioned act upon them with much more force than in middle life. This sameness, in the predominance of excitability over sensibility in children and old people, will account for the similarity of their habits with respect to eating, sleep, exercise, and the use of fermented or distilled liquors. It is from the increase of excitability in old people, that so small a quantity of strong drink intoxicates them; and it is from an ignorance of this change in their constitutions, that many of them become drunkards after passing the early and middle stages of life with sober characters.

Life is continued in a less imperfect state in old age, in women than in men. The former sew, and knit, and spin, after they lose the use of their ears and eyes; whereas the latter, after losing the use of those senses, frequently pass the evening of their lives in a torpid state in a chimney corner. It is from the influence of moderate and gently stimulating employments, upon the female constitution, that more women live to be old, than men,

and

and that they rarely survive their usefulness in domestic life.

Hitherto the principles I am endeavouring to establish, have been applied to explain the cause of life in its more common forms. Let us next inquire, how far they will enable us to explain its continuance in certain morbid states of the body, in which there is a diminution of some, and an apparent abstraction of all the stimuli, which have been supposed to produce animal life.

I. We observe some people to be blind, or deaf and dumb from their birth. The same defects of sight, hearing, and speech, are sometimes brought on by diseases. Here animal life is deprived of all those numerous stimuli, which arise from light, colors, sounds, and speech. But the absence of these stimuli is supplied,

1. By increased sensibility and excitability in their remaining senses. The ears, the nose, and the fingers, afford a surface for impressions in blind people which frequently overbalances the loss of their eyesight. There are two blind young men, brothers, in this city, of the name of Durton, who can tell when they approach a post in walking across a street, by a peculiar sound which the ground under

under their feet emits in the neighbourhood of the post. Their sense of hearing is still more exquisite to sounds of another kind. They can tell the names of a number of tame pigeons, with which they amuse themselves in a little garden, by only hearing them fly over their heads. The celebrated blind philosopher Dr. Moyses can distinguish a black dress on his friends, by its smell; and we read of many instances of blind persons who have been able to perceive colors by rubbing their fingers upon them. One of these persons mentioned by Mr. Boyle, has left upon record an account of the specific quality of each color as it affected his sense of touch. He says, black imparted the most, and blue, the least perceptible sense of asperity to his fingers.

2. By an increase of vigor in the exercises of the mental faculties. The poems of Homer, Milton and Blacklock, and the attainments of Sanderfon in mathematical knowledge, all discover how much the energy of the mind is increased by the absence of impressions upon the organs of vision.

II. We sometimes behold life in idiots in whom there is not only an absence of the stimuli of the understanding and passions; but frequently from the weakness of their bodies, a deficiency of the locomotive

motive powers. Here an inordinate appetite for food, or venereal pleasures, or a constant habit of laughing, or talking, or playing with their hands and feet, supply the place of the stimulating operations of the mind, and of general bodily exercise. Of the inordinate force of the venereal appetite in idiots we have many proofs. The Cretins are much addicted to venery; and Dr. Michaelis tells us that the idiot whom he saw at the Pefaiac falls in New-Jersey, who had passed six and twenty years in a cradle, acknowledged that he had venereal desires, and wished to be married, for the Doctor adds, he had a sense of religion upon his fragment of mind, and of course did not wish to gratify that appetite in an unlawful manner.

III. How is animal life supported in persons who pass many days, and even weeks without food, and in some instances without drinks? Long fasting is usually the effect of disease, of necessity, or of a principle of religion. When it arises from the first cause, the actions of life are kept up by the stimulus of disease. The absence of food when accidental, or submitted to as a means of producing moral happiness, is supplied,

1. By the stimulus of a full gall bladder. This state of the receptacle of bile, has generally been found

found to accompany an empty stomach. The bile is sometimes absorbed, and imparts a yellow color to the skin of persons who suffer or die of famine.

2. By increased acrimony in all the secretions and excretions of the body. The saliva becomes so acrid by long fasting, as to excoriate the gums, and the breath acquires not only a fœtor, but a pungency so active, as to draw tears from the eyes of persons who are exposed to it.

3. By increased sensibility and excitability in the sense of touch. The blind man mentioned by Mr. Boyle who could distinguish colors by his fingers, possessed this talent only after fasting. Even a draught of any kind of liquor deprived him of it. I have taken notice in my account of the yellow fever in Philadelphia in the year 1793, of the effects of a diet bordering upon fasting for six weeks, in producing a quickness and correctness in my perceptions of the state of the pulse, which I had never experienced before.

4. By an increase of activity in the understanding and passions. Gamesters often improve the exercises of their minds when they are about to play for a large sum of money, by living for a day

day or two upon roasted apples and cold water. Where the passions are excited into preternatural action, the absence of the stimulus of food is scarcely felt. I shall hereafter mention the influence of the desire of life, upon its preservation under all circumstances. It acts with peculiar force when fasting is accidental. But when it is submitted to as a religious duty, it is accompanied by sentiments and feelings which more than balance the abstraction of aliment. The body of Moses was sustained, probably without a miracle, during an abstinence of forty days and forty nights, by the pleasure he derived from conversing with his Maker “ Face to face, as a man speaking with his friend.”*

I remarked formerly that the veins discover no deficiency of blood in persons who die of famine. Death from this cause seems to be less the effect of the want of food, than of the combined and excessive operation of the stimuli, which supply its place in the system.

IV. We come now to a difficult inquiry, and that is, how is life supported during the total abstraction of external and internal stimuli which
takes

* Exodus xxxiii. 11. xxxiv. 28.

takes place in asphixia, or in apparent death, from all its numerous causes ?

I took notice in a former lecture, that ordinary life consisted in the excitement, and excitability of the different parts of the body ; and that they were occasionally changed into each other. In apparent death from violent emotions of the mind, from the sudden impresson of miasmata, or from drowning, there is a loss of excitement ; but the excitability of the system remains for minutes, and in some instances for hours afterwards unimpaired, provided the accident which produced the loss of excitement has not been attended with such exertions as are calculated to waste it. If for example, a person should fall suddenly into the water, without bruising his body, and sink before his fears, or exertions had time to dissipate his excitability ; his recovery from apparent death might be effected by the gentle action of heat, or frictions upon his body, so as to convert his accumulated excitability gradually into excitement. The same condition of the system takes place when apparent death occurs from freezing, and a recovery is accomplished by the same gentle application of stimuli, provided the organization of the body be not injured, or its excitability wasted, by violent exertions previously to its freezing. This excitability is the

vehicle of motion, and motion when continued long enough produces sensation, which is soon followed by thought ; and in these, I said formerly, consists perfect life in the human body.

For this explanation of the manner in which life is suspended, and revived in persons apparently dead from cold, I am indebted to Mr. John Hunter, who supposes, if it were possible for the body to be *suddenly* frozen by an instantaneous abstraction of its heat, life might be continued for many years in a suspended state, and revived at pleasure ; provided the body were preserved constantly in a temperature barely sufficient to prevent reanimation, and never so great, as to endanger the destruction of any organic part. The resuscitation of insects that have been in a torpid state for months, and perhaps years, in substances that have preserved their organization, should at least defend this bold proposition from being treated as chimerical. The effusions even of the imagination of such men as Mr. Hunter, are entitled to respect. They often become the germs of future discoveries.

In that state of suspended animation which occurs in acute diseases, and which has sometimes been denominated a *trance* ; the system is nearly in
the

the same excitable state that it is in apparent death from drowning, and freezing. Resuscitation in these cases is not the effect as in those which have been mentioned of artificial applications made to the body for that purpose. It appears to be spontaneous; but it is produced by impressions made upon the ears, and by the operations of the mind in dreams. Of the action of these stimuli upon the body in its apparently lifeless state, I have satisfied myself by many facts. I once attended a citizen of Philadelphia, who died of a pulmonary disease in the 80th year of his age. A few days before his death he begged that he might not be interred until one week after the usual signs of life had left his body, and gave as a reason for this request, that he had when a young man, died to all appearance of the yellow fever in one of the West-India islands.—In this situation he distinctly heard the persons who attended him, fix upon the time, and place, of burying him. The horror of being put under ground alive, produced such distressing emotions in his mind, as to diffuse motion throughout his body, and finally excited in him all the usual functions of life. In Dr. Creighton's essay upon mental derangement there is a history of a case nearly of a similar nature. "A young lady (says the Doctor) an attendant on the princess of —, after having been confined to her bed for

for a great length of time, with a violent nervous disorder, was at last, to all appearance, deprived of life. Her lips were quite pale, her face resembled the countenance of a dead person, and her body grew cold. She was removed from the room in which *she died*, was laid in a coffin, and the day for her funeral was fixed on. The day arrived, and according to the custom of the country, funeral songs and hymns were sung before the door. Just as the people were about to nail on the lid of the coffin, a kind of perspiration was observed on the surface of her body. She recovered. The following is the account she gave of her sensations; she said, "It seemed to her as if in a dream, that she was really dead; yet she was perfectly conscious of all that happened around her. She distinctly heard her friends speaking and lamenting her death at the side of her coffin. She felt them pull on the dead clothes, and lay her in it. This feeling produced a mental anxiety which she could not describe. She tried to cry out, but her mind was without power, and could not act on her body. She had the contradictory feeling as if she were in her own body, and not in it, at the same time. It was equally impossible for her to stretch out her arm or open her eyes, as to cry, although she continually endeavoured to do so. The internal anguish of her mind was at its utmost height when

when the funeral hymns began to be fung, and when the lid of the coffin was about to be nailed on. The thought that she was to be buried alive was the first which gave activity to her mind, and enabled it to operate on her corporeal frame.”

Where the ears lose their capacity of being acted upon by stimuli, the mind by its operations in dreams, becomes a source of impressions which again set the wheels of life in motion. There is an account published by Dr. Arnold in his observations upon insanity,* of a certain John Engelbrecht a German, who was believed to be dead, and who was evidently resuscitated by the exercises of his mind upon subjects which were of a delightful and stimulating nature. This history shall be taken from Mr. Engelbrecht's words. “It was on Thursday noon (says he) about 12 o'clock when I perceived that death was making his approaches upon me from the lower parts upwards, insomuch that my whole body became stiff. I had no feeling left in my hands and feet, neither in any other part of my whole body, nor was I at last able to speak or see, for my mouth now becoming very stiff, I was no longer able to open it, nor did I feel it any longer. My eyes also broke in my head

* Vol. ii. p. 298.

head in such a manner that I distinctly felt it. For all that, I understood what they said, when they were praying by me, and I distinctly heard them say, feel his legs, how stiff, and cold they have become. This I heard distinctly, but I had' no perception of their touch. I heard the watchman cry 11 o'clock, but at 12 o'clock my hearing left me. After relating his passage from the body to heaven with the velocity of an arrow shot from a cross bow, he proceeds, and says that as he was twelve hours in dying, so he was twelve hours in returning to life. "As I died (says he) from beneath upwards, so I revived again the contrary way from above to beneath, or from top to toe. Being conveyed back from the heavenly glory, I began to hear again something of what they were praying for me, in the same room with me. Thus was my hearing, the *first* sense I recovered. After this I began to have a perception of my eyes, so that by little and little, my whole body became strong, and sprightly, and no sooner did I get a feeling of my legs and feet, than I arose and stood firm upon them with a firmness I had never enjoyed before. The heavenly joy I had experienced, invigorated me to such a degree, that people were astonished at my rapid, and almost instantaneous recovery."

The explanation, I have given of the cause of re-fuscitation in this man, will serve to refute a belief in a supposed migration of the soul from the body in cases of apparent death. The imagination, it is true, usually conducts the whole mind to the abodes of happy or miserable spirits, but it acts here in the same way that it does when it transports it in common dreams, to numerous and distant parts of the world.

There is nothing supernatural in Mr. Engelbreght being invigorated by his supposed flight to heaven. Pleasant dreams always stimulate and strengthen the body, while dreams which are accompanied with distress, or labour debilitate, and fatigue it.

LECTURE III.

GENTLEMEN,

Let us next take a view of the state of animal life in the different inhabitants of our globe, as varied by the circumstances of civilization, diet, situation and climate.

I. In the Indians of the northern latitudes of America, there is often a defect of the stimulus of aliment, and of the understanding and passions. Their vacant countenances, and their long and disgusting taciturnity, are the effects of the want of action in their brains from a deficiency of ideas; and their tranquillity under all the common circumstances of irritation, pleasure or grief, are the result of an absence of passion; for they hold it to be disgraceful to shew any outward signs of anger, joy, or even of domestic affection. This account of the Indian character, I know is contrary to that which is given of it by Rousseau, and several other writers, who have attempted to prove that man may become perfect and happy, without the aids of civilization and religion. This opinion is contradicted by the experience of all ages, and is rendered ridiculous by the facts which are well ascertained in the history of the customs and habits of our American savages. In a cold climate they are the most miserable beings upon the face of the earth. The greatest part of their time is spent in sleep, or under the alternate influence of hunger and gluttony. They moreover indulge in vices which are alike contrary to moral and physical happiness. It is in consequence of these habits, that they discover so early the marks of old age, and that so few of them are long-lived. The
absence

absence and diminution of many of the stimuli of life in these people is supplied in part, by the violent exertions with which they hunt, and carry on war, and by the extravagant manner with which they afterwards celebrate their exploits, in their savage dances and songs.

II. In the inhabitants of the torrid regions of Africa, there is a deficiency of labor; for the earth produces spontaneously nearly all the sustenance they require. Their understandings and passions are moreover in a torpid state. But the absence of bodily and mental stimuli in these people, is amply supplied by the constant heat of the sun, by the profuse use of spices in their diet, and by the passion for musical sounds which so universally characterises the African nations.

III. In Greenland the body is exposed during a long winter to such a degree of cold as to reduce the pulse to 40, or 50 strokes in a minute. But the effects of this cold in lessening the quantity of life, are obviated in part by the heat of close stove rooms, by warm clothing, and by the peculiar nature of the aliment of the Greenlanders, which consists chiefly of animal food, of dried fish, and of whale oil. They prefer the last of those articles in so rancid a state, that it imparts a

factor to their perspiration which, Mr. Crantz says, renders even their churches offensive to strangers. I need hardly add, that a diet possessed of such diffusible qualities, cannot fail of being highly stimulating. It is remarkable that the food of all the northern nations of Europe is composed of stimulating animal, or vegetable matters, and that the use of spiritous liquors is universal among them.

IV. Let us next turn our eyes to the miserable inhabitants of those eastern countries which compose the Ottoman empire. Here we behold life in its most feeble state, not only from the absence of physical, but of other stimuli which operate upon the inhabitants of other parts of the world. Among the poor people of Turkey there is a general deficiency of aliment. Mr. Volney in his travels tells us "That the diet of the Bedouins seldom exceeds six ounces a day, and that it consists of six or seven dates soaked in butter-milk, and afterwards mixed with a little sweet milk, or curds."—There is likewise a general deficiency among them of stimulus, from the operations of the mental faculties; for such is the despotism of the government in Turkey, that it weakens not only the understanding; but it annihilates all that immense source of stimuli which arises from the exercise of the domestic and public affections. A
Turk

Turk lives wholly to himself. In point of time, he occupies only the moment in which he exists; for his futurity, as to life and property, belongs altogether to his master. Fear is the reigning principle of his actions, and hope and joy seldom add a single pulsation to his heart. Tyranny even imposes a restraint upon the stimulus which arises from conversation, for “They speak (says Mr. Volney) with a slow feeble voice, as if the lungs wanted strength to propel air enough through the glottis to form distinct articulate sounds.” The same traveller adds, that “They are slow in all their motions, that their bodies are small, that they have small evacuations, and that their blood is so destitute of serosity, that nothing but the greatest heat can preserve its fluidity.” The deficiency of aliment, and the absence of mental stimuli in these people is supplied,

1. By the heat of their climate.

2. By their passion for musical sounds and fine clothes, and

3. By their general use of coffee and opium.

The more debilitated the body is, the more forcibly these stimuli act upon it. Hence according

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ing to Mr. Volney, the Bedouins, whose slender diet has been mentioned, enjoy good health; for this consists not in strength, but in an exact proportion being kept up between the excitability of the body, and the number and force of the stimuli which act upon it.

V. Many of the observations which have been made upon the inhabitants of Africa, and of the Turkish dominions, apply to the inhabitants of China, and the East Indies. They want in many instances the stimulus of animal food. Their minds are moreover in a state too languid to act with much force upon their bodies. The absence and deficiency of these stimuli are supplied by,

1. The heat of the climate in the southern parts of those countries.

2. By a vegetable diet abounding in nourishment, particularly rice and beans.

3. By the use of tea in China, and by a stimulating coffee made of the dried and toasted seeds of the datura stramonium, in the neighbourhood of the Indian coast. Some of these nations likewise chew stimulating substances, as too many of our citizens do tobacco.

Among

Among the poor and depressed subjects of the governments of the middle and southern parts of Europe, the deficiency of the stimulus of wholesome food, of clothing, of fuel, and of liberty, is supplied in some countries by the invigorating influence of the Christian religion upon animal life; and in others, by the general use of tea, coffee, garlic, onions, opium, tobacco, malt liquors, and ardent spirits. The use of each of these stimuli seems to be regulated by the circumstances of climate. In cold countries where the earth yields its increase with reluctance, and where vegetable aliment is scarce, the want of the stimulus of distention which that species of food is principally calculated to produce, is sought for in that, of ardent spirits. To the southward of 40° a substitute for the distention from mild vegetable food is sought for, in onions, garlic and tobacco. But further, a uniform climate calls for more of these artificial stimuli than a climate that is exposed to the alternate action of heat and cold, winds and calms, and of wet and dry weather. Savages and ignorant people likewise require more of them than persons of civilized manners, and cultivated understandings. It would seem from these facts that man cannot exist without *sensation* of some kind, and that when it is not derived from natural means, it will always be sought for in such as are artificial.

In no part of the human species, is animal life in a more perfect state than in the inhabitants of Great Britain,* and the United States of America. With all the natural stimuli that have been mentioned, they are constantly under the invigorating influence of liberty. There is an indissoluble union between moral, political and physical happiness; and if it be true, that elective and representative governments are most favourable to individual, as well as national prosperity, it follows of course, that they are most favourable to animal life. But this opinion does not rest upon an induction derived from the relation, which truths upon all subjects bear to each other. Many facts prove, animal life to exist in a larger quantity and for a longer time, in the enlightened and happy state of Connecticut, in which republican liberty has existed above one hundred and fifty years, than in any other country upon the surface of the globe.

It remains now to mention certain mental stimuli which act nearly alike in the production of animal life, upon the individuals of all the nations in the world. They are,

1. The desire of life. This principle so deeply, and universally implanted in human nature, acts very

* Haller's *Elementa Physiologiae*, vol. viii. p. 2. p. 107.

very powerfully in supporting our existence. It has been observed to prolong life. Sickly travellers by sea and land, often live under circumstances of the greatest weakness, till they reach their native country, and then expire in the bosom of their friends. This desire of life often turns the scale in favor of a recovery in acute diseases. Its influence will appear, from the difference in the periods in which death was induced in two persons, who were actuated by opposite passions with respect to life. Atticus, we are told, died of voluntary abstinence from food in five days. In Sir William Hamilton's account of the earthquake at Calabria, we read of a girl who lived eleven days without food, before she expired. In the former case, life was shortened by an aversion from it; in the latter, it was protracted by the desire of it. The late Mr. Briffot in his visit to this city, informed me that the application of animal magnetism (in which he was a believer) had in no instance cured a disease in a West India slave. Perhaps it was rendered inert by its not being accompanied by a strong desire of life; for this principle exists in a more feeble state in slaves than in freemen. It is possible likewise the wills and imaginations of these degraded people may have become so paralytic by slavery, as to be incapable of being excited by the impression of this fanciful remedy.

2. The love of money sets the whole animal machine in motion. Hearts which are insensible to the stimuli of religion, patriotism, love, and even of the domestic affections, are excited into action by this passion. The city of Philadelphia between the 10th and 15th of August 1791, will long be remembered by contemplative men, for having furnished the most extraordinary proofs of the stimulus of the love of money upon the human body. A new scene of speculation was produced at that time by the scrip of the bank of the United States. It excited febrile diseases in three persons who became my patients. In one of them, the acquisition of twelve thousand dollars in a few minutes by a lucky sale, brought on madness which terminated in death in a few days.* The whole city felt the impulse of this paroxysm of avarice. The slow and ordinary means of earning money were deserted, and men of every profession and trade, were seen in all our streets hastening to the coffee house, where the agitation of countenance, and the desultory manners, of all the persons who were interested in this species of gaming, exhibited a truer picture of a bedlam, than of
a place

* Dr. Mead relates upon the authority of Dr. Hales, that more of the successful speculators in the South Sea Scheme of 1720 became insane, than of those who had been ruined by it.

a place appropriated to the transaction of mercantile business. But further, the love of money discovers its stimulus upon the body in a peculiar manner in the games of cards and dice. I have heard of a gentleman in Virginia who passed two whole days and nights in succession at a card table, and it is related in the life of a noted gamester in Ireland, that when he was so ill as to be unable to rise from his chair, he would suddenly revive when brought to the hazard table, by hearing the rattling of the dice.

3. Public amusements of all kinds, such as a horse race, a cockpit, a chase, the theatre, the circus, masquerades, public dinners and tea parties, all exert an artificial stimulus upon the system, and thus supply the defect of the rational exercises of the mind.

4. The love of dress is not confined in its stimulating operation to persons in health. It acts perceptibly in some cases upon invalids. I have heard of a gentleman in South Carolina, who always relieved himself of a fit of low spirits by changing his dress; and I believe there are few people who do not feel themselves enlivened, by putting on a new suit of clothes.

5. Novelty is an immense source of agreeable stimuli. Companions, studies, pleasures, modes of business, prospects, and situations with respect to town, and country, or to different countries, that are *new*, all exert an invigorating influence upon health and life.

6. The love of fame acts in various ways; but its stimulus is most sensible and durable in military life. It counteracts in many instances the debilitating effects of hunger, cold and labor. It has sometimes done more, by removing the weakness which is connected with many diseases. In several instances it has assisted the hardships of a camp life, in curing pulmonary consumption.

7. The love of country is a deep seated principle of action in the human breast. Its stimulus is sometimes so excessive, as to induce disease in persons who recently migrate, and settle in foreign countries.—It appears in various forms; but exists most frequently in the solicitude, labors, attachments, and hatred of party spirit. All these act forcibly in supporting animal life. It is because newspapers are supposed to contain the measure of the happiness, or misery of our country, that they are so interesting to all classes of people. Those vehicles of intelligence, and of public pleasure or pain, are frequently

frequently desired with the impatience of a meal, and they often produce the same stimulating effects upon the body.

8. The different religions of the world, by the activity they excite in the mind, have a sensible influence upon human life. Atheism is the worst of sedatives to the understanding, and passions. It is the abstraction of thought from the most sublime, and of love, from the most perfect of all possible objects. Man is as naturally a religious, as he is a social, and domestic animal; and the same violence is done to his mental faculties, by robbing him of a belief in a God, that is done, by dooming him to live in a cell, deprived of the objects and pleasures of social and domestic life. The necessary and immutable connection between the texture of the human mind, and the worship of an object of some kind, has lately been demonstrated by the atheists of Europe, who after rejecting the true God, have instituted the worship of nature, of fortune, and of human reason; and in some instances, with ceremonies of the most expensive and splendid kind. Religions are friendly to animal life, in proportion as they elevate the understanding, and act upon the passions of hope and love. It will readily occur to you, that Christianity when believed, and obeyed, according to its original consistency with itself, and
with

with the divine attributes, is more calculated to produce those effects, than any other religion in the world.—Such is the salutary operation of its doctrines, and precepts upon health and life, that if its divine authority rested upon no other argument, this alone would be sufficient to recommend it to our belief. How long mankind may continue to prefer substituted pursuits and pleasures, to this invigorating stimulus, is uncertain; but the time we are assured will come, when the understanding shall be elevated from its present inferior objects, and the luxated passions be reduced to their original order.—This change in the mind of man, I believe, will be effected only by the influence of the Christian religion, after all the efforts of human reason to produce it, by means of civilization, philosophy, liberty, and government, have been exhausted to no purpose.

Thus far, gentlemen, we have considered animal life as it respects the human species; but the principles I am endeavouring to establish, require that we should take a view of it in animals of every species, in all of which we shall find it depends upon the same causes, as in the human body.

And here I shall begin by remarking, that if we should discover the stimuli which support life in
certain

certain animals, to be fewer in number, or weaker in force than those which support it in our species; we must resolve it into that attribute of the Deity which seems to have delighted in variety in all his works.

The following observations apply more or less, to all the animals upon our globe.

1. They all possess either hearts, lungs, brains, nerves, or muscular fibres. It is as yet a controversy among naturalists whether animal life can exist without a brain; but no one has denied, muscular fibres, and of course contractility, or excitability to belong to animal life in all its shapes.

2. They all require more or less air for their existence. Even the snail inhales it for seven months under ground, through a pellicle which it weaves out of slime, as a covering for its body. If this pellicle at any time become too thick to admit the air; the snail opens a passage in it for that purpose. Now air we know acts powerfully in supporting animal life.

3. Many of them possess heat equal to that of the human body. Birds possess several degrees beyond it. Now heat, it was said formerly, acts with great force, in the production of animal life.

4. They

4. They all feed upon substances more or less stimulating to their bodies. Even water itself, chemistry has taught us, affords an aliment not only stimulating, but nourishing to many animals.

5. Many of them possess senses, more acute and excitable, than the same organs in the human species. These expose surfaces for the action of external impressions, that supply the absence, or deficiency of mental faculties.

6. Such of them as are devoid of sensibility, possess an uncommon portion of contractility, or simple excitability. This is most evident in the Polypus. When cut to pieces, it appears to feel little or no pain.

7. They all possess locomotive powers in a greater or less degree, and of course are acted upon by the stimulus of muscular motion.

8. Most of them appear to feel a stimulus, from the gratification of their appetites for food, and for venereal pleasures, far more powerful than that which is felt by our species from the same causes. I shall hereafter mention some facts from Spalanzani upon the subject of generation, that will prove the stimulus, from venery, to be strongest in those

those animals, in which other stimuli act with the least force. Thus the male frog during its long connection with its female, suffers its limbs to be amputated, without discovering the least mark of pain, and without relaxing its hold of the object of its embraces.

9. In many animals we behold evident marks of understanding, and passion. The elephant, the fox and the ant, exhibit strong proofs of thought; and where is the school boy that cannot bear testimony to the anger of the bee, and the wasp?

10. But what shall we say of those animals, which pass long winters in a state in which there is an apparent absence of the stimuli of heat, exercise and the motion of the blood. Life in these animals is probably supported,

1. By such an accumulation of excitability, as to yield to impressions, which to us are imperceptible.

2. By the stimulus of aliment in a state of digestion in the stomach, or by the stimulus of aliment restrained from digestion by means of cold; for Mr. John Hunter has proved by an experiment

on a frog, that cold below a certain degree, checks that animal process.

3. By the constant action of air upon their bodies.

It is possible life may exist in these animals, during their hybernation, in the total absence of impression and motion of every kind. This may be the case where the torpor from cold, has been *suddenly* brought upon their bodies. Excitability here, is in an accumulated, but quiescent state.

11. It remains only under this head to inquire; in what manner is life supported in those animals which live in a cold element, and whose blood is sometimes but a little above the freezing point? It will be a sufficient answer to this question to remark, that heat and cold are relative terms, and that different animals according to their organization, require very different degrees of heat for their existence. Thirty-two degrees of it are probably as stimulating to some of these cold blooded animals (as they are called) as 70° , or 80° are to the human body.

It might afford additional support to the doctrine of animal life, which I have delivered, to point out

out the manner in which life and growth are produced in vegetables of all kinds. But this subject belongs to the professor of botany, and natural history,* who is amply qualified to do it justice. I shall only remark, that vegetable life is as much the offspring of stimuli as animal, and that skill in agriculture consists chiefly in the proper application of them. The seed of a plant, like an animal body, has no principle of life within itself. If preserved for years in a drawer, or in earth below the stimulating influence of heat, air and water, it discovers no sign of vegetation. It grows, like an animal, only in consequence of stimuli acting upon its *capacity* of life.

From a review of what has been said of animal life in all its numerous forms and modifications; we see that it is as much an effect of impressions upon a peculiar species of matter, as sound is of the stroke of a hammer upon a bell, or music, of the motion of the bow upon the strings of a violin. I exclude therefore the intelligent principle of Whytt, the medical mind of Stahl, the healing powers of Cullen, and the vital principle of John Hunter, as much from the body, as I do an intelligent principle from air, fire, and water.

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* Dr. Barton.

It is no uncommon thing for the simplicity of causes, to be lost in the magnitude of their effects. By contemplating the wonderful functions of life, we have strangely overlooked the numerous and obscure circumstances which produce it. Thus the humble but true origin of power in the people, is often forgotten in the splendor and pride of governments. It is not necessary to be acquainted with the precise nature of that form of matter, which is capable of producing life, from impressions made upon it. It is sufficient for our purpose, to know the fact. It is immaterial moreover whether this matter derive its power of being acted upon wholly from the brain, or whether it be in part inherent in animal fibres. The inferences are the same in favour of life being the effect of stimuli, and of its being as truly mechanical, as the movements of a clock from the pressure of its weights, or the passage of a ship in the water, from the impulse of winds, and tide.

The infinity of effects from similar causes, has often been taken notice of in the works of the Creator. It would seem as if they had all been made after one pattern. The late discovery of the cause of combustion, has thrown great light upon our subject. Wood and coal are no longer believed to contain a principle of fire. The heat and
flame

flame they emit, are derived from an agent altogether external to them. They are produced by a matter which is absorbed from the air, by means of its decomposition. This matter acts upon the predisposition of the fuel to receive it, in the same way that stimuli act upon the human body. The two agents differ only in their effects. The former produces the destruction of the bodies upon which it acts; while the latter excite the more gentle, and durable motions of life. Common language in expressing these effects is correct, as far as it relates to their cause. We speak of a coal of fire being *alive*, and of the *flame* of life.

The causes of life which I have delivered, will receive considerable support, by contrasting them with the causes of death. This catastrophe of the body consists in such a change induced on it by disease, or old age, as to prevent its exhibiting the phenomena of life. It is brought on,

1. By the abstraction of all the stimuli which support life. Death, from this cause, is produced by the same mechanical means that the emission of sound from a violin is prevented by the abstraction of the bow from its strings.

2. By the excessive force of stimuli of all kinds. No more occurs here than happens from too much pressure

pressure upon the strings of a violin preventing its emitting musical tones.

3. By too much relaxation, or too weak a texture of the matter which composes the human body. No more occurs here than is observed in the extinction of sound by the total relaxation, or slender combination of the strings of a violin.

4. By an error in the place of certain fluid, or solid parts of the body. No more occurs here, than would happen from fixing the strings of a violin upon its body, instead of elevating them upon its bridge.

5. By the action of poisonous exhalations, or of certain fluids vitiated in the body, upon parts which emit most forcibly the motions of life. No more happens here than occurs from enveloping the strings of a violin in a piece of wax.

6. By the solution of continuity by means of wounds in solid parts of the body. No more occurs in death from this cause, than takes place when the emission of sound from a violin is prevented by a rupture of its strings.

7. Death

7. Death is produced by a preternatural rigidity, and in some instances by an ossification of the solid parts of the body in old age; in consequence of which they are incapable of receiving and emitting the motions of life. No more occurs here, than would happen if a stick, or pipe-stem were placed in the room of catgut, upon the bridges of the violin. But death may take place in old age without a change in the texture of animal matter, from the stimuli of life losing their effect by repetition, just as opium from the same cause, ceases to produce its usual effects upon the body.

Should it be asked, what is that peculiar organization of matter, which enables it to emit life, when acted upon by stimuli, I answer, I do not know. The great Creator has kindly established a witness of his unsearchable wisdom in every part of his works, in order to prevent our forgetting him, in the successful exercises of our reason. Mohammed once said "that he should believe himself to be a God, if he could bring down rain from the clouds, or give life to an animal." It belongs exclusively to the true God to endow matter with those singular properties, which enable it under certain circumstances, to exhibit the appearances of life.

I cannot

I cannot conclude this subject, without taking notice of its extensive application to medicine, metaphysics, theology and morals.

The doctrine of animal life which has been taught, exhibits in the

First place, a new view of the nervous system, by discovering its origin in the extremities of the nerves on which impressions are made, and its termination in the brain. This idea is extended in an ingenious manner by Mr. Valli in his treatise upon animal electricity.

2. It discovers to us the true means of promoting health and longevity, by proportioning the number and force of stimuli to the age, climate, situation, habits and temperament of the human body.

3. It leads us to a knowledge of the causes of all diseases. These consist in excessive, or preternatural excitement in the whole, or a part of the human body, accompanied *generally* with irregular motions, and induced by natural, or artificial stimuli. The latter have been called very properly by Mr. Hunter *irritants*. The occasional absence of motion in acute diseases, is the effect only of the excess of impetus in their remote causes.

4. It discovers to us that the cure of all diseases depends simply upon the abstraction of stimuli from the whole, or from a part of the body, when the motions excited by them, are in excess; and in the increase of their number and force, when motions are of a moderate nature. For the former purpose, we employ a class of medicines known by the name of sedatives. For the latter, we make use of stimulants. Under these two extensive heads, are included all the numerous articles of the *Materia Medica*.

5. It enables us to reject the doctrine of innate ideas, and to ascribe all our knowledge of sensible objects to impressions acting upon an *innate* capacity to receive ideas. Were it possible for a child to grow up to manhood without the use of any of its senses, it would not possess a single idea of a material object; and as all human knowledge is compounded of simple ideas, this person would be as destitute of knowledge of every kind, as the grossest portion of vegetable, or fossil matter.

6. The account which has been given of animal life, furnishes a striking illustration of the origin of human actions, by the impression of motives upon the will. As well might we admit an inherent principle of life in animal matter, as a self determining

mining power in this faculty of the mind. Motives are necessary not only to constitute its *freedom*, but its *essence*; for without them, there could be no more a will than there could be vision without light, or hearing without sound. It is true, they are often so obscure as not to be perceived; and they sometimes become insensible from habit, but the same things have been remarked in the operation of stimuli; and yet we do not upon this account deny their agency in producing animal life. In thus deciding in favor of the necessity of motives, to produce actions, I cannot help bearing a testimony against the gloomy misapplication of this doctrine by some modern writers. When properly understood, it is calculated to produce the most comfortable views of the divine government, and the most beneficial effects upon morals, and human happiness.

7. There are errors of an impious nature, which sometimes obtain a currency, from being disguised by innocent names. The doctrine of animal life that has been delivered, is directly opposed to an error of this kind, which has had the most baneful influence upon morals and religion. To suppose a principle to reside necessarily, and constantly in the human body, which acted independently of external circumstances, is to ascribe to it an attribute,

tribute, which I shall not connect, even in language, with the creature man. Self existence belongs only to God.

The best criterion of the truth of a philosophical opinion, is its tendency to produce exalted ideas, of the Divine Being, and humble views of ourselves. The doctrine of animal life which has been delivered, is calculated to produce these effects in an eminent degree, for

8. It does homage to the Supreme Being, as the governor of the universe, and establishes the certainty of his universal, and particular providence. Admit a principle of life in the human body, and we open a door for the restoration of the old Epicurean or atheistical philosophy, which supposed the world to be governed by a principle called nature, and which was believed to be inherent in every kind of matter. The doctrine I have taught, cuts the sinews of this error; for by rendering the *continuance* of animal life, no less than its commencement, the effect of the constant operation of divine power and goodness, it leads us to believe that the whole creation is supported in the same manner.

9. The view that has been given of the dependent state of man for the blessing of life, leads us to contemplate with very apposite and inexpressible feelings, the sublime idea which is given of the Deity in the scriptures, as possessing life “within himself.” This divine prerogative has never been imparted but to one being, and that is, the Son of God. This appears from the following declaration. “For as the Father hath life in himself, so hath he given to the Son to have life *within himself*.”* To this plenitude of independent life, we are to ascribe his being called the “life of the world,” “the prince of life,” and “life” itself, in the New Testament. These divine epithets which are very properly, founded upon the manner of our Saviour’s existence, exalt him infinitely above simple humanity, and establish his divine nature upon the basis of reason, as well as revelation.

10. We have heard that some of the stimuli which produce animal life, are derived from the moral, and physical evils of our world. From beholding these instruments of death thus converted by divine skill into the means of life, we are led to believe goodness to be the supreme attribute of the Deity,

* John v. verse 26.

Deity, and that it will appear finally to predominate in all his works.

11. The doctrine which has been delivered, is calculated to humble the pride of man; by teaching him his constant dependence upon his Maker for his existence, and that he has no pre-eminence in his tenure of it, over the meanest insect that flutters in the air, or the humblest plant that grows upon the earth. What an inspired writer says of the innumerable animals which inhabit the ocean, may with equal propriety be said of the whole human race. “Thou sendest forth thy spirit, and they are created. Thou takest away their breath—they die, and return to their dust.”

12. Melancholy indeed would have been the issue of all our inquiries, did we take a final leave of the human body in its state of decomposition in the grave. Revelation furnishes us with an elevating, and comfortable assurance that this will not be the case. The precise manner of its re-organization, and the new means of its future existence, are unknown to us. It is sufficient to believe, the event will take place, and that after it, the soul and body of man will be exalted in one respect, to an equality with their Creator. They will be immortal.

Here,

Here, gentlemen, we close the history of animal life. I feel as if I had waded across a rapid and dangerous stream. Whether I have gained the opposite shore with my head clean, or covered with mud and weeds, I leave wholly to your determination.

THE END