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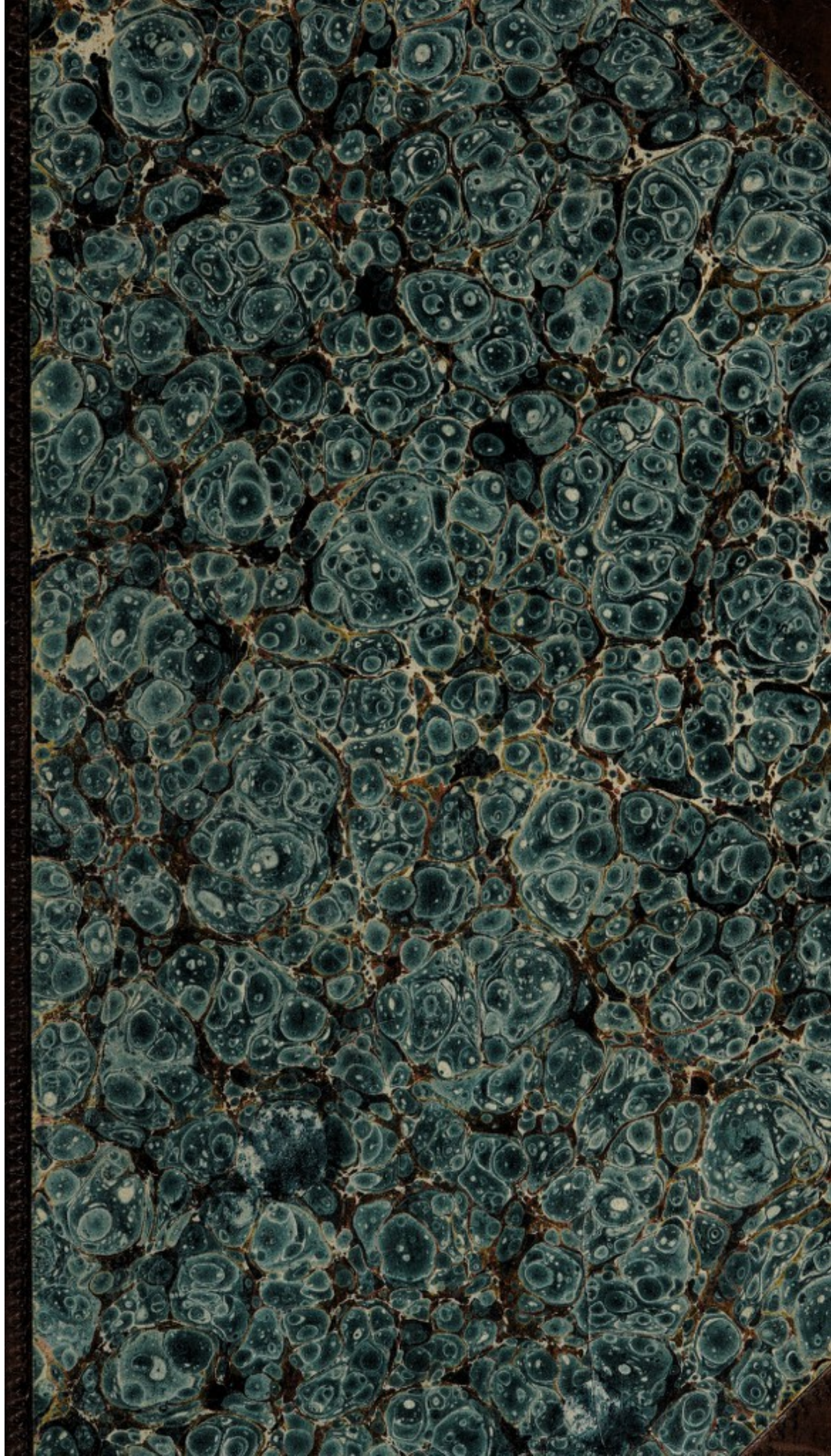
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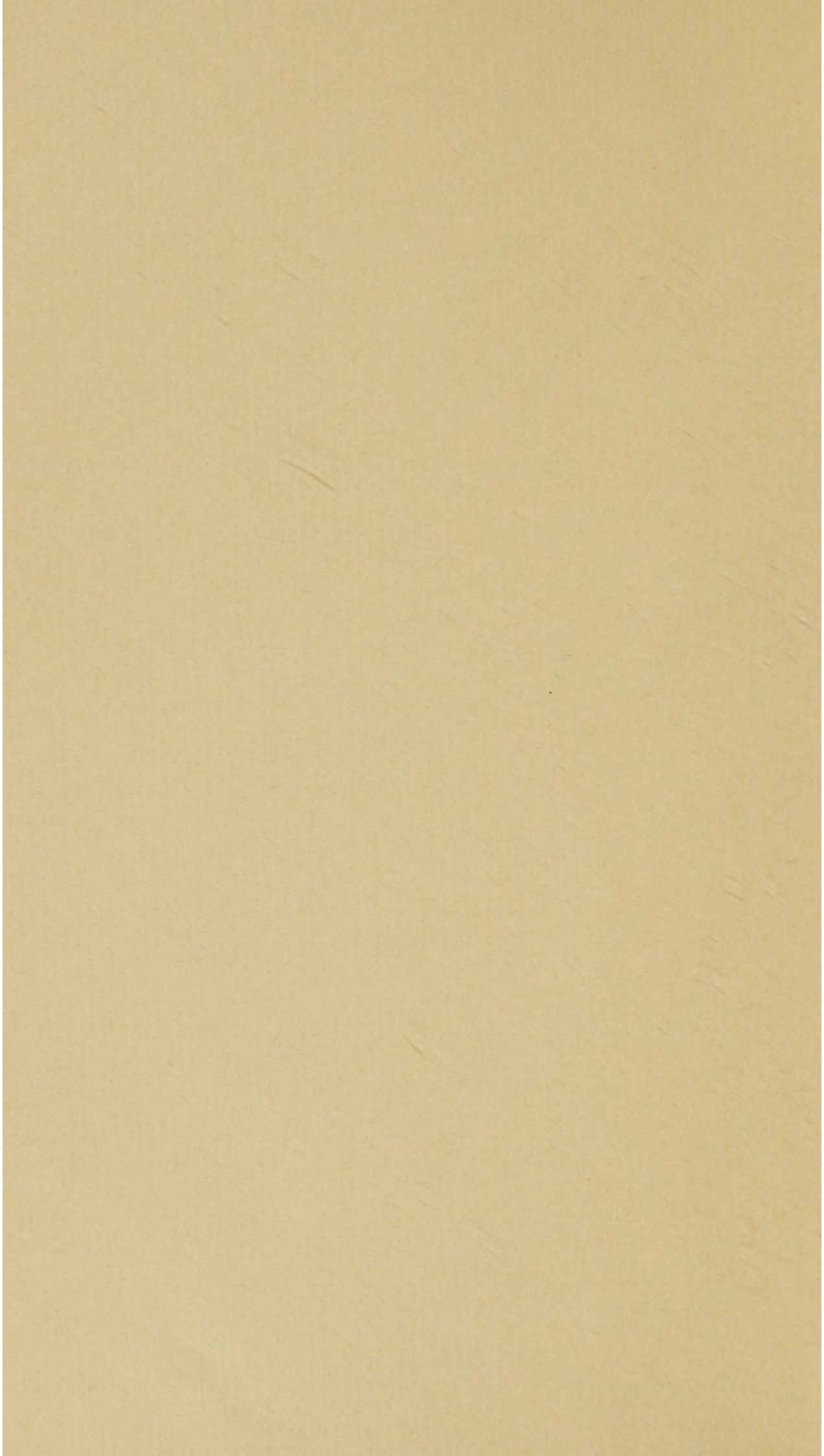


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T H E O R Y

OF THE

H U M A N

SENSATIONS.

By MARMADUKE BERDOE, M. D.

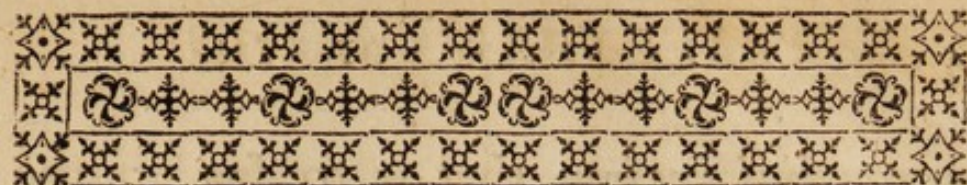
—non tam Cerebrum, quàm Cor ipsum, primum
principium esse judicemus—

Exercitatio : HERV. 56.

Printed by S. HAZARD, for A. TENNANT, BATH,
and CROWDER and LOWNDES, LONDON.

M.DCC.LXXIII.

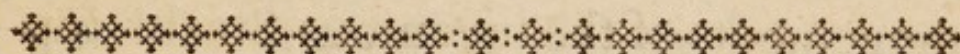





T H E O R Y

O F T H E

HUMAN SENSATIONS.



 H E sensations have hitherto been too much considered in a metaphysical sense; I shall endeavor to explain what they really are in the human body.

I have already endeavored to shew, how much more probable it was, and how satisfactory the results have always been, when the seat of human sentiment, was considered as fixed in the

precordial region, that is to say in the heart rather than the brain.—This opinion seemed to gain a great degree of credit, from the sentiments of Mr. Hervey, which placed the seat of animal life within the heart.—Borelli has proved also since his time that the diaphragm acts as a spring, to direct the various efforts of the body. The tonic movements of the ingenious Staahl supposed an active force, in the primitive fibres of all those organs which comprehended the circle of animal existence, or in other words, in the general struggle of the organic parts which determined their mutual influence, and efforts to each other.

The first attempt therefore, towards the investigation of the human sensations, will be, to ascertain the extended influence of the *diaphragm*, *phrenic-centers*,

or the *precordial region*, and their various effects on the animal faculties.

The human body can neither act nor make any effort, without a very evident contraction of those parts, which are situated near the diaphragm and the rectus muscle of the abdomen.—Without this contraction, the body would become incapable of those spontaneous and necessary efforts, to which it is determined, either by the influence of the will, or the idea of its own safety.

We observe likewise, that when the muscles have long been under the influence of various efforts, a degree of lassitude, seems to manifest itself in the region of the diaphragm: more especially so, when these efforts have been continued, either very feverely, or for a considerable length of time.—The organs of this

this region, are in such case, peculiarly affected, because it is they which have been the most employed.—Borelli observes that the diaphragm is peculiarly affected when we ascend a precipice or stairs, or use a more than common degree of force.—This muscle seems therefore to be the principal center, of the animal forces.

One observation may be offered in proof of this last assertion, which is, the uneasy feel, or kind of pain, which several persons find, when the body is laid in an horizontal situation, and its immediate cessation, when they stand upright.

It were to be wished, that some certain and just theory could be given, why the peculiar sensibility of the whole machine, seems as it were to be concentrated, within the small space of

the body, called the pit of the stomach.—Anatomical enquiries have left us very uncertain as to that point, for very little is to be reaped from dissections of the part.—And if conjecture may be allowed, it should seem probable, that this great degree of sensibility is owing to some peculiar properties in the neighboring organs.

To consider this circumstance with more attention, we find that the *diaphragmatic centers* are those only in the human body, which are in a continual state of action.—The impressions of the ambient air, put the diaphragm in motion, which ceases with our existence. Let not the objection however be too severely urged against me, that in various disorders of the body, and feminine affections, the breath is scarce to be perceived, or that persons have
lain

lain as it were for several days together in a trance, without any apparent degree of sentiment or motion, and who soon after have performed all the vital functions with the same regularity as before the accident. For I might in strictness observe, even in this case that the diaphragm will appear to be at least, the point of appuy, for the muscular forces of the body. All that I want to prove, is, that from its continued and almost incessant action, it forms a general *center* towards which the nervous influence,* ought as constantly to be directed.—If this is allowed, I assert that there must be an intimate and continued connection between the brain, and the

* By the nervous influence I mean that peculiar property by which the various nerves of the human body perform its different functions. It may perhaps be a nervous fluid, or an electric principle, but this at present is foreign to our design.

diaphragmatic centers, or else the nervous influence could not *tend* towards them, with such invariable energy.

Let me remark, however, that the nervous influence is not directed towards the *diaphragmatic centers*, by the active influence of the brain.—The brain is in itself more inactive and insensible than many other subordinate organs of the human structure.—But in fact it is the constant and superior energy of the diaphragm alone, which attracts the nervous influence towards its own center, as it would be directed in course to any other organ, that was equally as active.

The active powers of the *diaphragmatic centers* may then very reasonably be supposed to have a primitive and superior impulse on the brain and muscular forces of the body by attracting

B the

the nervous influence. The brain has likewise a degree of power over the *diaphragmatic centers*, which it exerts in return. This harmony of active impulse is the grand basis of the Human Sensations, which we shall next proceed to enquire into.

It may easily be imagined, that whatever objects make an impression through the organs of the senses, must consequently increase the intrinsic action of the brain. The increased action of the brain must unavoidably then, and at the same time, either suspend for a moment, or diminish in some peculiar degree, the relative action of the *diaphragmatic centers*.—This circumstance will acquire more certainty from the following considerations, *viz.* The human body has in itself but a determined quantity of action, which is distributed into each respective organ of

the frame, as into so many detach'd centers. Whatever organ, therefore, becomes active, either from a spontaneous or necessary influence, must consequently deprive the neighbouring organs of some part of their respective forces. For the functions of the body are not performed from an increased degree of action in every organ, but from their respective proportions of existence variously modified,—From hence we deduce this general axiom, *viz.* That no one part of the body can move, but from the diminished action of some other part.

From this circumstance it is asserted, that the brain, when occupied by its object must, from its increased action, diminish the peculiar portion of some other organ,—Now as the most intimate connection prevails between the brain

and the *diaphragmatic centers*, it should follow, that these centers participate the soonest of this unequal distribution of the forces, and the increased powers of the brain. It has already been observed, that the *diaphragmatic centers* were the most active organs of the human structure,—Now the first effects produced on the precordial region by the active powers of the brain, are manifested in certain elevations of the diaphragm, proportioned to their influence. The elevations of the diaphragm cannot happen without affecting the whole intestinal canal to which this muscle is connected; nor can the intestinal canal pursue its peristaltic action, without the rectus muscle of the abdomen participating in these motions: and to complete the whole, the rectus muscle of the abdomen will communicate again by its influence to the whole

exterior surface of the body which forms what is called the exterior organ of it.*

If we consider the connection of the spinal with the intercostal nerves, we shall find that the least contraction of the exterior organ will soon affect the intestinal canal; which last, in consequence must continue its action on towards the diaphragm.—By these mutual efforts of the brain, the diaphragmatic centers, intestinal canal, muscles of the abdomen, and the exterior organ; a just center of *appuy* is completed, and without which the body would be deprived of its loco-motive powers, or become incapable of vanquishing the least resisting obstacle.

This

* See Essay on the Circulation of the Blood.

This harmony of actions, and due efforts of the animal organs, seem to correspond with the sentiments of Hippocrates on the state of illness, the result of an undue harmony in the various organs.—*Unaquamque vero corporis pars altera alteri, quum hinc vel illinc proruperit, statim morbum facit.*

Reasoning alone, although from undoubted observations, will have the appearance of a futile and vain theory, unless you bring experiment to its aid:—With an intention, therefore, of giving a greater degree of certainty to these new opinions, the following experiment was made on a living dog.

A small apperture was cut in the belly of the animal, so as to admit a portion of one of the intestines to appear externally.—Two lateral incisions were made soon after, extending from the

xiphoid cartilage to the spine. The diaphragm enter'd immediately into strong and evident convulsions, far more violent than those which it appeared to have when the first incisions were made. The whole intestinal canal followed the influence of this muscle,—For at each contraction of the diaphragm, the mesentery and intestinal canal seemed to lift themselves in weak undulations towards the umbilical region. As the animal expired, the contractions of the diaphragm became weakened and less frequent: the portions of the intestinal canal seemed to follow the same variations; and both subsided afterwards with each other.

It is evident in this case that the contractions of the intestinal canal* proceeded

* The intestinal canal is form'd of various circumvolutions. I distinguish it from the term of

ceeded from the increased effort of the diaphragm, for the contractions of the diaphragm affect the mesentery, which last by augmenting the efforts of the intestinal nerves, must force them into a state of vicious irritation.

The experiments made by the ingenious M. De Lamure, after Schlintig, prove the great connection between the diaphragm and the dura-mater.*—It is

interior region, because the last implies the whole internal structure of the trunk from the mouth and œsophagus, including the stomach, liver, spleen pancreas heart, kidneys, and in short every viscus contained in the belly, whereas the intestinal canal includes those membraneous tubes only, which reach from the pylorus to the rectum.

* The following experiments were tried by M. De Lamure, and will serve to illustrate the opinions of Mr. Hervey and myself, concerning the intimate connection between the brain and the diaphragm.

more than probable, therefore, that the same action which we find was communicated by the diaphragm to the intestinal canal was carried on from the diaphragm to the dura-mater. This

C experiment

After trepanning a young dog, the brain covered by the dura-mater was observed to rise and fall in exact measure with the elevation and depressions of the diaphragm, as in inspiration and expiration.

These successive motions of elevation and depression, became considerably increased when a small portion of the dura-mater had been cut away.

After tying the trunks of the carotid arteries in a strong dog, the animal laid in a state of insensibility.—In this situation part of the skull was taken off without discovering any apparent motion in the brain, tho' the dura-mater had also been cut away.—The ligatures on the carotid arteries were taken off, and the brain had the same successive motions as in the preceding experiment.—*Vide Recherches sur la pulsation des Arteres, et les mouvemens du Cerveau dans l'Homme et les Animaux trepannés.*—P. 128, 129.

experiment might easily have been tried, by trepanning the animal, at the same time the lateral incisions were made from the xiphoid cartilage. But where conviction itself seems to leave us without any doubts, it is unnecessary to sacrifice a whole hecatomb of animals, for the sake of controversy.

The action of the exterior organ* was considered as necessary to muscular motion, but it has a much more extensive influence on the animal œconomy. For the exterior organ furnishes such a continued source of reaction to the interior region, that without its influence the strict union

* For the term exterior organ, see my Essay on the Circulation of the Blood. The exterior organ comprehends the whole external surface of the skin. That the skin is necessary to muscular motion, is proved by its inert state in every hemiplegia or palsy.

between the diaphragm and brain, must intirely subside. The functions of the animal œconomy chiefly depend therefore, on the intimate connections between the head, the diaphragmatic centers,* and the exterior organ.—There is this difference; the exterior organ of the body does not only equal, but perhaps exceed the other two in powers, and is far inferior to either of them in the proportions of animal sensibility.—Now the consequences of its diminished sensibility are such, that whenever the *exterior organ* of the body

C 2 is

* Diaphragmatic centers, phrenic centers, or the precordial region, have all of them one and the same meaning, that is to say, they comprehend those parts of the body which are situated under the coverings of the epigastric region, but more particularly the part which is bounded on each side by the right and left hypochondres, and called *præcordia vel scrobiculus cordis*.

is influenced by any causes which will produce a degree of vicious irritation on the skin, its effects will not occasion either so sudden or so violent effects upon the constitution, as when they proceed from the vicious irritations of the diaphragm or the brain. The reason is obvious,—The action of the exterior organ depends in part on the impressions it constantly receives from the various constitutions of hot and dry, or cold and moist air, but the undue efforts of the brain and the diaphragm generally proceed from some more violent and internal cause, rather than any primitive effects from the circumambient atmosphere.

Before we quit the subject, it may be proper to mention a few circumstances concerning some anatomical inspections in that part of the exterior organ, which covers the diaphragmatic

centers, commonly called the pit of the stomach.—It offers at first view a very complicated structure, and shews at the same time an evident connection with the diaphragm. For the peritonæum and all the insertions of the muscles of the abdomen and the linea alba, do unite in several places, and are mixed with the tendinous parts of the diaphragm.—These prolongations form some part of the aponeurotic membrane, and by communicating with the cellular substance, seem more peculiarly adapted to promote a due connection between the exterior and interior organs: for there are so few nerves in this part of the body, that if its sensibility depended upon them alone, we should very much doubt of any, or at least should not suspect that peculiar degree of exquisite feelings which we find in the diaphragmatic centers.

centers.—But it is evident from observation, that the sensibility of certain parts of the body, depends as much on its peculiar structure, as on the quantity of its nerves. It is for this reason we asserted that the nervous fibrils of the organs were not so much the instruments of their active powers, as the cause* which determined their motions.

The tendinous insertions which were found so abundant near the diaphragm do seem to confirm the opinion that this part of the body, is the general center of the whole exterior organ.—We may be allowed at least to suppose, as the tendons are the most sensible parts of the muscles, that the tendinous insertions do the same offices as those which in-

* Enquiry into the Structure of Animated Beings. P. 15.

close the muscular fibres,—For, in fact, the skin ought to be consider'd only as a membranous and nervous veil covering the whole surface of the body, whose points of re-union are in the diaphragmatic centers.

Every violent effort, or long continued exercise, is in general followed by a manifest contraction in this part of the exterior organ. Hence we consider the skin as one continued tendon, or aponeurotic muscle, composed of many irregular fibres, but whose mechanism is peculiar to itself,—For it is in a great degree sustained and directed by the efforts of this aponeurotic muscle, at the pit of the stomach.

We have already mentioned that the exterior parts of the diaphragmatic centers are covered over by certain tendinous

dinous prolongations communicating with the *rectus* muscles of the abdomen. We find that the diaphragm may be consider'd, likewise, as having several muscular fibres near its circumference, and tendinous ones near its center.—This mechanism seems intended by nature to afford it a more peculiar connection with the exterior organ.

The effects of external agents never fail producing some degree of irritation in the exterior organ by their impulse, so likewise the exterior organ will have a continued influence on the diaphragmatic centers, and expose them to more or less frequent contractions. the intestinal canal becomes more violently agitated in return, and affords a due equilibrium to the increased action of the exterior organ.—These contractions are continued on, likewise, from the diaphragm to the brain.

The mechanism of the human sensations consists, therefore, in different modifications of active influence, or harmony of action, between the exterior organ, opposed to the impulse of external causes, and the interior region of the body, comprehending the intestinal canal, the diaphragm, and brain.

The birth of children is probably the first moment in which the brain becomes affected by the impulse of external causes. The agitations of the child, its tears, and inattentive examinations of objects, are so many proofs of an existing impulse from these external causes and their necessity in promoting the action of the various organs. But we are to consider that these primitive impulses are as gentle as such tender organs are capable of receiving. For the soft and pulpy fibres of the child

diminish every active impulse,—We are not therefore to consider the tears of children as always expressive of pain, but as the consequence of that one same cause, which is to put the diaphragm in motion for respiration, and to disclose as it were the various necessities of its existence.

It often happens that children remain for some moments after birth in a state of inactivity, but at length by a kind of general agitation, the diaphragm begins its efforts, and completes the first function of the animal œconomy in respiration,—This agitation, the effect of a rarer element, and a powerful contraction of the diaphragm, is one of the most evident proofs, that this muscle is the principal and primitive cause in determining the action of every other part of the body.

During the state of Fætus, the diaphragm seems susceptible only of a few irregular spasms, produced by its own tonick movements, or some slight offending cause. But in consequence of those irritations which the air produces on the child, and principally by its passage through the nostrils, the diaphragm often enters into such rapid contractions as to put the whole body into convulsive motions.

The diaphragm which in children seems to fill up the whole cavity of the breasts, when it contracts itself, must consequently occasion a space within the lungs; into which the air will throw itself by its weight and elasticity.—The inspiration is consequently produced by such contractions, for the air fills up nearly the same space in the breast of the child, which the diaphragm had left

by its contraction. But as these contractions of the diaphragm, are and ought to be considered as necessary (though contrary to the welfare of the animal œconomy, when too long continued) it must follow, that this muscle should subside, and become as it was before the inspiration. By this mechanism the pectoral muscles, which had been forced by the contraction of the diaphragm, will, in their turn, cause that necessary pressure on the lungs, (as the muscle subsides) to force out the air accumulated within their cavity, and to complete the first expiration.—These gentle agitations of the diaphragm then, are the primitive sketches of the human sensations.

We are likewise to consider that these efforts are by no means limited to the diaphragm alone, for they are found to extend their influence, even to the

most remote organs of the body. When this muscle, for example, contracts itself in inspiration, it must evidently follow that the whole intestinal canal, participates in these contractions: the consequence of which will prevent the peristaltic motions of the intestines,—For as the diaphragm contracts itself for the offices of inspiration, it must force the whole intestinal canal which is connected with it into a smaller space; but when once the offices of expiration are completed, it throws it off again with greater violence towards the inferior parts of the abdomen. The muscles of the lower belly act at the same time in concert with the diaphragm,—The offices of respiration, are therefore by no means to be considered as limited to the lungs, since we find that every viscus of the lower belly must participate in these motions.

Before

Before we quit this subject, we must not forget to mention, that the colon, appears not only formed but situated in such manner as to serve both as a reservoir, and at the same time as an *appuy* to the whole intestinal canal. It seems to modify the active powers of the diaphragm by restraining the liver, spleen and stomach; for as the two first have but little action in themselves, and the space occupied by the latter is less considerable than when it is filled with aliment, it might happen that by their weight and inactivity they would restrain the power of the diaphragm, did not the colon, (which at this time receives the aliment from the stomach) supply that re-action, which the stomach loses.

Our next step is to consider the action of the diaphragm, as influencing the nervous system of the whole body.

A great plexus extends all along the spine and is to be consider'd as connected with the nerves of each viscus in the abdomen. Hence it follows, that the nerves of the intestinal canal, when put in action by the efforts of the diaphragm, will communicate their actions in part, to every viscus of the abdomen; and again by means of those nerves which reach along the spine, to their general origin the medulla oblongata, or the brain.—This plexus is found to have an intimate connection with the grand sympatic nerves, and with that plexus on the breast (which are partly derived from the sympatic) as also with the eight pair of nerves when irritated by the swelling of the lungs; from all these circumstances duly considered it should follow then, that every nerve of the human body must participate in the motions of the diaphragm.

Animal

Animal life consists chiefly in the active impulse of an elementary principle which is contained in the atmosphere surrounding animal bodies, and irritates the diaphragm; communicating itself also from thence to the whole intestinal canal, and re-acting again from the intestinal canal to the diaphragm; and from this last to the whole Exterior Organ. By these agents that due harmony of action and re-action is completed between the exterior and interior parts of the human structure; which constitute the true criterion of health, and exquisite sensations,—For we are to consider, that an undue action or re-action of either of these parts, must unavoidably occasion an unproportioned effort in the various organs of the body, and soon throw us into a state of illness and infirmity.

Unamquamque

Unamquamque vero, says Hippocrates, corporis pars altera alteri, cum hinc vel illinc proruperit statim morbum facit.

Hoffman has said something to the same purpose, which, as it will serve to confirm our opinion on the influence of the diaphragm and intestinal canal with the whole nervous system I shall beg leave to mention.

Ex omnibus partibus, nulla majorem communicationem cum capite & universo nervorum genere habet, quam ventriculus & intestina.

Such are the human sensations considered in the theory.—Uninstructed and without a master every Animated Being feels in alternate measures, the pleasing or displeasing emblems of his existence. At one time his
 E sensations

sensations lift him above the world in an exquisite idea of happiness. At another period, life becomes a burthen, and marks in iron characters, a severe and painful existence.

Thus from two very different and opposite causes, the scene of human life is variously chequered by pleasure and infirmity.—Every individual who exists is sensible of these changes, tho' he knows not their origin.—This circumstance is the next matter for consideration: we begin therefore by dividing the human sensations into two parts, *viz.* into

Pleasing and Painful Sensations.

Pleasing sensations may be defined by all those causes, whether accidental or acquired, which increase the sentiment of our existence, or forcibly en-

chain us in the possession of those objects which may be called the idols of human happiness,—These sensations can only depend on the causes already mentioned which comprehend a due harmony or concert of actions, acting with equal and proportioned efforts between the exterior organ of the body opposed to the impulse of external causes, and the interior region including the intestinal canal, the diaphragm, and brain.—This point is to be examined.

The five senses ought to be considered as so many different mediums, thro' which the brain becomes affected by external causes.—If the impulses which they produce upon that organ are gentle and unruffled, the diaphragm will soon participate in these pleasing ef-

forts, and continue them on through the whole intestinal canal.

The brain in such case becomes as it were an intermediate center between the impulse from external causes and their actions on the interior structure of the human body. For every nerve reaches to the common sensory, from whence (when the brain is perfect and unhurt) the impulses of the different external agents, are communicated to the diaphragm, and describe on that muscle, or the phrenic centers, the increased action of the brain.—For it was asserted in the beginning of this essay, *that no one organ of the body, could either exert a greater degree of action, or be put in motion, without an apparent diminution of the power of some other connected part.*

When the brain is put in action by the impulse of an external agent, its spring and efforts are apparently increased,—The diaphragm as the most essential organ, and having the most intimate connection with the brain, is peculiarly affected, and either so suspended or increased in its contractions, as to become descriptive of either the pleasurable or painful sensations.

In some cases it happens, that the brain, being hurt, still receives the influence of its object, but remaining in an inactive state cannot continue on its efforts to the diaphragm,—The sensations in this respect are torpid and undescribed, and are only called the apperceptive ideas of the soul.

We have frequent examples of this apperception of objects in those cases
where

where the brain, (either from a wound or too great an afflux of the fluids) is in a state of absolute compression, and consequently incapable of any reminiscence of ideas, or of any influence upon the motions of the diaphragm. The individual in this case,* sees the persons assembled round his bed, hears the consultations of the physicians, or observes the chirurgical apparatus for the trepan: but has not the least idea, that either the anxieties of his friends, or the preparations of the surgeons, in any way concern himself.

We have proofs on the other hand, of the debilitated and inactive powers of the diaphragm.—In many persons the faculty of reason has not apparently been injured, if we might have judged

* Vide Berlin memoirs, on the apperceptive powers of the soul, by M. Sulzer.

so of them, from the perfect continuance of every accustomed function of the brain. Such persons, however, though possessing every seeming degree of reason have at the same time lost all apparent remains of a just and due sentiment.—The loss of the dearest and most intimate friends and relations gives no degree of affliction—mothers have seen their own children torn from their arms and murdered before their eyes, without shedding a tear, or shewing the least sensible emotion.—These uncommon phenomena have been chiefly observed to happen at or near the first attacks of certain malignant fevers,—The same has been discover'd in the last stage of the consumption, when the lungs and the pleura have been filled with ulcers, or in certain paroxysms of the hypochondriac affection.

Can

Can we possibly account for these uncommon phenomena by any other cause, than the reciprocal actions between the brain and diaphragm? In the first case the diaphragm is unhurt and performs its accustomed functions, but the brain being incapable of acting, the reminiscence of ideas are but slightly traced out, and penetrate no farther than the limits of its own sphere of action.—The brain in the second case seems to possess its own degree of action, and receives the impulse of external objects on the common sensory; but the diaphragm being oppressed, (as it certainly is in malignant fevers and the consumption) is incapable of confirming the ideas of the brain. For in those persons where the reasonable faculties seem perfect, it must appear erroneous to assert that there can be any vicious defect in the brain, that is capable

of extinguishing the proper degree of sentiment.

From this supposed harmony of active impulse between the brain and diaphragm, it will appear, that the reasonable faculties consist chiefly in a certain reminiscence of ideas. Now it is very probable that the relative action of the brain may describe the active impulse of external objects in itself without the aid of the diaphragm. But the true and perfect sentiment cannot be accomplished without the sensations are confirmed, which never can happen unless the ideas formed in the brain are determined and fixed within the phrenic centers or the diaphragm.

It may easily be comprehended that the due re-actions of the diaphragm are often defective, and interrupt, if not ab-

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solutely

folutely defstroy, the relative functions of the brain. It is manifeftly the cafe in thofe fevers which have a malignant character, but particularly in the catalepfy,—This diforder (with thofe juft mentioned) confifts in fuch dangerous convulfions of the diaphragm that they are fometimes capable of abolifhing every ray of human fentiment, and are often as proportionably dangerous as the diforder appears to have either a great or lefs degree of malignity.

The effects produced upon the body by the primitive fenfations, are to be confidered as a neceffary influence caufed by external objects upon the brain,—The different fenfations are caufed in confequence, by the various degrees of impulse which external objects excite upon the principal fource of the nervous fyftem in the brain, and the reciprocal action of this organ upon

the diaphragm, precordial region, or what was called the phrenic centers.

Add to this, likewise, that there are other sensations proceeding from an internal cause, which may be called secondary, to distinguish them from the first or primitive sensations.—The primitive sensations have been considered as proceeding from an external cause upon the brain.—The secondary are generally produced from an internal cause, affecting the intestinal canal.

This division of the sensations into *primary*, or *secondary*, will not in the least destroy the former opinion, which distinguished them as pleasing and painful sensations: for whether they proceed from either an internal or an external cause, they are equally affected in pleasure or in pain.

After what has already been asserted concerning the reciprocal harmony of active impulse between the brain and the diaphragm,—And after the established axiom just mentioned, *That no organ can be put in motion, or become active, without diminishing the apparent and relative action of some other,** Will it, I repeat, from all these circumstances duly considered seem improbable that the sensations should depend on various modifications of existence in the several organs of the body?

If, for example, the brain and diaphragm were uniformly to preserve each their due degree of action in themselves, no real sensations could possibly ensue. For, in this case, tho' the various landscapes of surrounding

* See Lord Bacon's Natural History, Cent 8. Exp. 722.

nature should paint themselves on the retina, or the just and pleasing concords of harmonious sounds should burst through the vibrating air to the auditory nerves, yet these impulses would all be so concentrated within the brain, that the Being would scarce receive more than a passive and undetermined influence from each.—It is absolutely necessary, therefore, that the various objects which are conveyed to the common sensory, should not only stimulate, but by this stimulus should likewise increase the relative action of the brain.

The brain increased in its action by the influence of external causes, must deprive some other organ of part of its accustomed proportion.—The diaphragm as the nearest and the most active, will be that which the soonest participates in the various changes which

which happen in the brain,—From this very circumstance a disgregation and diminution of the animal forces must evidently follow.—The increased efforts in the brain deprive the diaphragm of part of its action, so that the powers of the phrenic centers must consequently be in some degree suspended.

These disgregations* in the organical forces must have either a greater or less

* By the word disgregation I mean a division of a certain thing into any given number of parts which added together form a sum equal to the whole. For example, let the brain be equal to three parts, the diaphragm five, the stomach four, and the intestines four, the aggregate of these sums amount to sixteen.—Now a disgregation of these parts will happen if the stomach has five, the intestines two, the brain five, and the diaphragm but four, for although the aggregate be the same, yet there is an undue proportion of parts, as the brain has more than its own quota, and the diaphragm less. All this I mean to signify in the word disgregation.

influence upon the animal œconomy relative to their continuance.

Such vicissitudes of action from the brain to the diaphragm, or from the diaphragm to the brain, will still have a more dangerous tendency when too long continued in a state of muscular exercise. For as the diaphragm has been proved (not only by Borelli but by several other persons) to be the center of *appuy* for all the muscular movements of the body, it will evidently follow, that as the brain, in the act of thinking and occupied by its object, deprives the diaphragm of some degree of action, it must suffer much more in a state of exercise, which demands a considerable augmentation of forces in the phrenic centers to aid the various efforts of the muscles.—Animal life would therefore
be

be but of very short duration deprived of that pleasing state of oblivion in which the brain ceases to perpetuate the impulse of external objects, and the body tired out with toil, reposes itself in a decumbent posture, inattentive, and inactive.

The pleasing sensations of animal existence are, as mentioned before, the result of that equal and due harmony of action between the several organs of the body when agitated by external causes, and aided by the efforts of corresponding parts without injuring them.—Painful sensations are consequently produced by the relative actions of certain organs being increased, when the corresponding parts are too weak to support their action: or when the acting organs are in such a state of spasm as to become incapable of perpetuating the impulse. Such is the

case when the eye perceives such objects as from the horror they excite in the brain, cause it to act so sudden, and with such influence towards the diaphragm, as to throw this center into a state of absolute spasm.—When this happens the motions of the diaphragm are so curbed, that life seems almost extinguished, respiration is suspended, and the pulse becomes imperceptible.

Painful sensations may likewise be produced from certain spasms of the exterior organ* (the skin) whether occasioned by the constrained efforts, or suspension of the diaphragm, or from various changes in the surrounding atmosphere.—When this happens, the different fluids which circulate through

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* Vide Essay on the Circulation on the Blood.

the cellular-substance of the body, towards the exterior organ* of it, are driven in greater abundance towards the interior region, and oppress the tender blood-vessels (by distending them) through the whole intestinal canal. It is not possible to explain by any other reason, why certain persons are constantly troubled with pains in the stomach, in north-easterly winds and a damp state of the atmosphere,—Or why

* Lord Bacon in his observations and experiments on animal bodies, seems to have known this fact, for what this author calls the *parts*, means the same thing with what is here called the exterior organ of the body. See his natural history, Cent. ix. 877. or his experiments concerning frictions. How can every friction or active power applied to the external surface of the body, make the exterior organ more active in its whole extent? unless the agents are so violent as to throw it into a spasmodic state. For what can I mean more, by promoting the action of the exterior organ so as to draw the current of the fluids to-

other persons are troubled with sickness and vomitings on dipping their hands in cold water, or laying them upon a cold marble slab.—These two last examples, tho' they do not come within the natural effects of the atmosphere, are yet produced from a similar cause. For cold of any kind will corrugate the skin, and by occasioning those small elevations (which we call *goose-skin*) shew it to be in a state of spasm, and

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consequently

wards the surface of the body, than what Lord Bacon has already noticed, when he says that frictions make the parts (exterior organ) more fleshy? (i. e. more active, by which means the current of the fluids are directed towards it, as they always tend to the most active organ.)—"the cause" according to his Lordship's definition is, "*for that they draw greater quantity of spirits and blood to the parts.*" We must observe however, that the sensations in this case are agreeable, for the intestinal canal is always less oppressed when the fluids circulate externally.

consequently unable to promote the
*external circulation of the fluids.

The convulsive state of the diaphragm has likewise been found to have produced a similar effect. There are certain accords or discords in music which have that peculiar influence upon the body, that they make what some persons term, *the blood run cold*. It is certain that some pieces of music seem as it were to †chill us, or to give us at least a less perfect sensation of warmth, than we probably felt before their performance.—I have known several persons faint on hearing certain passages in

* Vide Essay on the nature and Circulation of the Blood.

† Lord Bacon's Natural History, Cent. 8. Exp. 793. Old edition, by W. Rawley, printed in 1631.

Handel's music. How can we account for these effects, but by the mechanism just proposed? The brain collects certain sounds with more pleasure than others, and consequently irritates the diaphragm with a greater or less degree of influence. In the cases just mentioned the diaphragm must have been so suspended as to become irregular in its elevations and depressions. If these regular efforts of the diaphragm are suspended, the exterior organ by its intimate connection must equally suffer, and consequently become incapable of receiving the fluids which would circulate through its whole extent when unconstrained.—But it is certain that the state of spasm and contraction which it evidently suffers render it improper for its accustomed functions. In this case the circulating fluids are driven internally, and oppress the interior parts of the

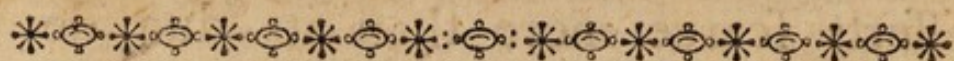
the body by their too great quantity.—The blood-vessels lining the whole intestinal canal, render the interior region of the body so inactive through its whole extent, as to become incapable of counteracting the spasms of the exterior organ and the person faints, and loses his motive powers.

The secondary sensations are chiefly produced by internal causes. We observe this peculiarity in the sensations: if the fluids circulate towards the brain they are not displeasing, but when they tend too abundantly towards the bowels they produce that most disagreeable of all sensations, called horrors and sinking of the spirits. These sensations, however, are generally the result of undue efforts in some peculiar organs.—If the brain has been too long in action it may perhaps have produced a mania, or phrensy, but where it

affects scarce more than its due degree of action, the circulating fluids produce no disagreeable sensations.— But when the bowels are affected, be it from whatever cause it will, life is embitter'd and the sensations are painful.

The intention of the present essay is to shew the mechanism of the human sensations in the state of health, and consequently can take no cognisance of painful sensations from unnatural causes, such as pains of the gout, stone and rheumatism, &c. For as these sensations are the consequence of an imperfect state of existence, it must follow that their descriptions would amount to nothing more than a theoretical description of diseases.

F I N I S.



☞ This pamphlet was just finished, when the Review of March was brought to me by a friend to let me see how severely I had been criticised, by the learned body of the Monthly Reviewers.

Tortured and vexed, I was going to throw all this theory into the fire if it had not occurred to me, that two heads are oftentimes better than one,—Pleased with the thought, I called up my cook-maid, and bid her run her eye very carefully over the whole.—She liked it, and approved of my publishing.

Under the sanction then of her *great authority* I boldly venture once more to request *your great* decision: I flatter myself I shall please you, for tho' my cook-maid is not so learned as a Reviewer, she is as excellent an *old woman* as the best——.

