

224 This then shows that the several operations de-
pend upon the Brain. Now the operations of
vision are equally connected with the Brain.
The soul is not taken in toto, & taken in quar-
ter parts, according to the unintelligible cant
of the schools; we must not talk so vaguely.
If there is then such a seat of our mental
operations external ones must be communica-
ted to the extremity of the nerve, and from there
propagated to the sensorium commune. Others
have placed the soul in the glandula ~~pituitaria~~
pituitaria but without authority. This I wanted
to settle as a source of muscular motion. All
this is a commentary upon the 365 & 366 para-
graphs of Haller to whom I must now return
and follow close hereafter. P. 372nd "I amime
side &c" I hope I have given them under an
order that will contribute to our understanding
them better. Now as to muscular motion small
elasticity seems to take place; on the one hand
loose cohesion appears, such as in the medullary
substance of the Brain, and on the other the hard-
ness of bones precludes our conception of elas-
ticity. we call this elasticity. The extremity of the

Nerve on which this experiment is made must 225
be fixed otherwise it cannot be stretched. This is in
common with Vegetables & in the contractility that
Haller calls the vis mortua; as in the 393 & 394th
he explains; nam & a frigore &c. Doubt if that be-
longs to the vis mortua: At the same time in se-
veral parts of the living animal Body, there is
a contractile power very different from this elas-
ticity, when it is excited by stretching, however its
contraction is much greater than the force of
the stretching power. No body can find that the
contraction of expelling the blood from the heart
is in any proportion to the force of the venous
blood; and it takes place without the extremities
of the parts being fixed, as in the circulation of any
part cut out of the Body; thirdly, it is excited by
various applications that have no such analo-
gous effects on other elastic Bodies; thus the prick-
ing of a needle will produce convulsions in vis-
ceral parts of animal Bodies. Also the stretching
power produces contractions in very different
circumstances, from those in which it pro-
duces them in other elastic Bodies. This con-
tractile power is varied in the organs of life, &c

226 called Irritability, & by Haller *vis inscita*. Look
at his 400 P. & following one, where he distin-
guishes three different powers. "*Porro manifeste*"
and as to the particular application he says
11. I say this con-
tractile power, *vis velata* or *veva*, of *fibres*
is peculiar to muscular Fibre. It is in them,
especially, the fibres in the middle & softer parts
that have this contractile power; and we speak
of muscular fibres in seemingly very different
circumstances. And we discover them by their
irritability and contractility, altho' there should
be a difference in their colour and appearance.
Tershuus says this power is not every where the
same; this however difficult to say this; for
we have not yet perceived any different grounds for
thinking of a different organ of motion. There
may be a difference of organization that deserves
to be distinguished by the degree of irritability.
so in tendinous and muscular fibres it is a
dispute whether the latter is not a continuation
of the same structure, the difference being in
the cellular membrane being diminished in
the tendons. I thus say they are not a continuation.

Haller discusses this point pretty fully without 229
a certain Conclusion; tho he leans toward the side
of denying tendinous fibres to be a continuation
of the muscular; But in 309 P. of his later work he
is still less confident; he puts it by way of ques-
tion. Anatomists are by no means agreed in
this point; but it is enough for me that *Aldrovandus*
stands for the continuation I speak of. If there
is a continuation here, and the arguments adduced in
favour of it be true, viz: that the tendinous fi-
bres hardly appear in the Testis, & are constantly
growing; If this be so, say, there is a gradual
passage of fleshy muscular fibre into tendons
in this last we find the continuity entirely dis-
appears. Having explain'd what Irritability
is and shown its seat, I proceed to say that mus-
cular fibres are the *Fibra motrices* of *Baglivi*.
The ultimate fibre of a muscle is so extremely
minute that we have had no possibility of arriv-
ing at its structure. M^r Maice has resolved
the whole into this that they are perfectly uniform
cylindrical figures; but we must still think
they have a peculiar organization; You must
know that many of the various conjectures on this

228 head are founded upon false or doubtfull facts
& such as do not solve the phenomena. All that
that are founded upon the motion of the heart
are not to be so derived because many of them
are without the heart's action. Give the heart
any extent that any body has conceived; the mi-
nuteness of muscular fibre goes so far beyond
that, that we must say it is beyond the heart's
action. The arteries then are not concerned and
muscular motion is independent of these.
see 330 It just now spoke of; see also 311, where
he shows, that muscles may have their arteries
tied without affecting them, unless after a long
time by putrefaction & gangrene. If there is
the experiment of the inferior extremities, be-
coming paralytic he has in another place
shown it to be false & inaccurate. Next they
have had recourse to a fluid derived from the
nerves for the cause of muscular motion. The
proof is in short this; that every muscle we
can examine has a large proportion of nerve;
a very moderate muscle say they has a much
larger proportion than that bulky viscous of the
liver. Then secondly every means of destroying con-

tinuity destroys the contractile power immediately 229
in part, and a little after wholly. Thirdly appli-
cations to the Brain have the power of exciting,
or suppressing, or entirely destroying muscular
actions. If a muscle is taken out of the body &
a portion of its nerve along with it, it is equal
whether you make your application to the bo-
dy of the muscle itself, or to the extremity of the
nerve; you can by the prick of a needle equally
excite contraction in both. Here I must add that
as the whole operations of thinking are in the brain
& depend on it; so I think that every modification
of thought, suppressing muscular motion & so it
by some thing propagated to the Brain from the
extremity of the Nerve. If there is any such commu-
nication of motions as is independent of perception,
it applies equally well to that motion being brought
back to the extremity of the Nerve. If I provide a mo-
tion from the sentient extremity to the common
origin and that that excited motion in the mus-
cle, the communication must be allowed

LECT. LIV. Sept. 5th

Having talked of the contractility common to o-
ther Bodies, & that peculiar to living animals

300 I called this last Irritability, and said that it depended on muscular motion, which depends on a particular organization. There have been two opinions ~~of~~ concerning this; the first is that muscular motion depends upon the force of the part, and that I refused; The other depends upon the power being derived from the Brain. The first presumption arises from every muscle having a Nerve; and it would be a further proof if we could show that tendons are continuations of Muscles. There is a presumption arising from the continuity of the whole course of the nerve, that the experiment of the nerve separated from its origin seems to destroy every effect of the muscle. Further as various modes of thought act on muscles they are thought to do so by propagating a motion to the extremity of the nerve or muscle. Compressions made in the organs of sense excite the action of muscles with which they have no other contiguity than what is thro' the common origin; and we will allow that the motion may be continued thro' the Brain to the motory extremity. But the Italians would all

those arguments, and transport the soul to 301 the motory extremity, there to act. It was observed that on tying an artery the irritability of the muscle might be excited by applying between the muscle and the ligature; stripping it down ward excited motion & a contrary ^{application} ~~motion~~ had no effect; but this is not true see Hallers 377 P. 22

n. This has the appearance of the reasoning was fair; but I do not see that it is conclusive. While the muscles receiving nerves from another branch of a common trunk are not affected, in answer, in answer to this I say the muscles proceed distinct & separate from the common origin; If an impression was communicated to every nerve of the same bundle we should have very indistinct impressions. No wonder then if their motion is not produced upwards along the same Branches of a common trunk. There is no distinction between motory and sentient Nerves; and every nerve is sensible to sentient impressions; for particular impressions there must be a particular apparatus; as in the Eye and Ear; but whether of a per-

302 peculiar or common organization, all these will be sensible to the pricking of a needle. According then as the extremities of the nerves are adapted their motion may be upwards or downwards. — However tho' in these two views we fail of our proof we have it in another way. We said yesterday that communication might be avoided. Here all suspicion of the soul's action is removed in a cut out part; no volition here has the least effect, and therefore the soul is out of the question in nerves tied or cut through. But the same stimulus that would have excited contraction in the entire nerve excites it in its tied or cut state, & therefore I think it is even more clear than in the former case, that there is a muscular motion from the common origin along the course of the Nerves. see P. 364; 368, & 369, of Haller where he forms this conclusion"

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"and add a singular expression" "nigae aliter

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"comprobat". This comprehension will affect his own doctrine in another place; in the 403 P. — Now we have shown

that a nervous power depends upon a motion 303 propagated from the common origin along the course of the nerves; but this does not go far to explain muscular motion; The motion is still in the organized fibre. Haller spoke of the Laquei of nerves surrounding the blood vessels, but he himself and all others have asserted that opinion, therefore nothing needs be said of it. There is a peculiar organization ^{which} by the assistance of the nervous power exhibit these phenomena. Haller is of opinion that it may be independent of the nervous power though excited by it. This last he calls the vis innata of muscles, and he supposes this to be something residing in the gluten; I find no other foundation than one set of experiments to support this opinion, that muscular Fibres separated from the state of the Brain, have still their irritability not depending upon the common laws of irritability. see P. 400 & 404. I say this opinion is chiefly founded on these facts I mentioned that it may be some thing belonging to the muscle itself. We can not only form another supposition

308 but one very admissible. If then there is a
nervous power that excites muscular motion, it
adheres to the nervous matter while the condi-
tions of heat &c remain the same, and it is highly
probable that the muscles are always fed with
this power derived from the brain to a certain
degree; All the different impressions mentioned
before, are constantly acting, and on a matter
of the greatest mobility, and therefore there must
be a constant determination from the origin
to the extremity, giving them their common pow-
er; and a presumption is that if such a power
be destroyed muscular contraction ceases, and that
even tho the heat, humidity, and other necessary
conditions remain. We say the nervous power is
constantly diminishing, therefore it may for
some time remain to show the phenomena of
irritability. This last, as I have said, goes on con-
stantly diminishing, & therefore wants its con-
stant supply. And still further these actual proofs
of nervous power acting even on separate muscles.
If we have a portion of the Nerve adhering it is
all one whether we apply stimuli to the portion

of the muscle or the cut of extremity of the 309
nerve. Will any body doubt then whether or
not to excite this motion by an impulse com-
municated, or will any body seek any other
impulse than that derived from the brain?
This atleast takes off all the proof of a vis in-
sita which is an opinion depending upon see-
ing one other cause. Also if we acknowledge
that the nervous power acts occasionally it es-
pecially arises from hence that the same im-
pressions that produce irritability are all such
as act upon the nervous power and produce
sensations, therefore the contractile power
of muscles depends intirely on the nervous
power, and there arise no other proofs of a vis
insita. And yet in the P. 402 Haller has two
other arguments "

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" If the "nihil valde" I would
refuse. He goes on "

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" From what appears

306 in insects and plants "says he" it must de-
pend upon their structure. I acknowledge that
irritability with all its circumstances appears
in plants, and I own it to be a like irritabi-
lity to that of animals, tho' there may be a
difference in the stimuli. Let us see how it
affects our question. There is some thing in
plants that seems to be very analogous to the
system of animals; there are distinct fibres pro-
ceeding from a common origin, as in the so-
litarious system; you will see a ramification
exactly resembling the vessels in an animal.
But now we know that that is a separate con-
nection and that each of them is a bundle of fi-
bres distinct. Further late experiments shew
that these distinct fibres of Vegetables are not
tubular or hollow cylinders, as we supposed and
that they are spongy humours filtering along them.
Now let us see if this irritability is a vis insita
residing in the separate parts, & unconnected with
the whole. We find them in the most sensitive
plant that when a part is separated it is no longer

sensitive; it depends upon a principle of life 307
diffused over the whole, and every part supported
by a communication with the rest. Whether
there is a Brain in Plants is very uncertain,
but granting that there is no such thing, can
we limit the operations of nature & say that a
subtile fluid is not contained in a common
origin. It was made an universal axiom that
two animals of different sexes were necessary
to generation but Baumeist has shewn that a
single animal can propagate the species; 'Twas
also a universal persuasion that only vegeta-
bles could be propagated by cuttings, but we
now see that Polypi can be propagated by this
means as well as vegetables. Now there may
be an irritability depending upon the nervous
power diffused over the whole system. As to
insects his arguments are fallacious. We have
found several insects supposed of a Brain, which
we thought to be without; and we may find
the same thing in the rest. We may be too limiti-
ed in our notion of Brain; it may be in differ-
ent shapes in different animals, still exist =

300 ing though it escapes us and answering the purpose of a common origin. As to nerves not being discovered I answer if a Brain escapes us so may Nerves. There are animals that seem to approach to vegetables in having a nervous structure without a Brain. Natura non facit saltum. It is probable that there are on the one hand, animals that approach, in small degrees to vegetables, & on the other there may be vegetables that have a vascular system & approach nearer to the animals. Therefore still there is no presumption of a vis insita. It shunts upon a nervous power concurring no doubt, also with the assistance of the organization of muscular fibres. —

Lect. IV. Feb. 9th. —

We shall reap no small advantage if we can reject several errors that have crept in to this subject. So I have rejected the vis insita of Haller. Having done so and confined muscular contractility to the nervous power as one necessary circumstance, we ought next to say what further is necessary from organization.

As to the nervous power there are two opinions. The one is what we have expressed by an inelastic fluid moving through the tubes of the nerves; The other is that it is by an elastic fluid adhering to the nerves. We reject the first of these opinions, as an inelastic fluid can not account for the velocity or force excited in nervous motions. The other seems at present grounded and is resolved again into two opinions: The first is the motion of such a fluid as we know to be the foundation of tremors of elastic chords; the other supposes it to be an elastic fluid but such as may be propagated along soft chords. Again we reject the first of these opinions which turns upon elasticity and tension, as there is not tension enough to support the opinion of the motions depending on elasticity. I therefore embrace the last. There is difficulty in admitting even this opinion which would have been greater 100 years ago but since Newton established an Aether as the foundation of attraction of cohesion; and since, the Phenomena of Electricity and magnetism have both presented us with

310 Different species of subtle elastic fluids, we can have less difficulty in admitting; it in animal Nerves; and the Phenomena of the nervous system such as that of titillation confirm this; and further the several impressions upon our organs of sense ^{producing} all these make for the opinion of a nervous elastic Power. And if the motions consist in an oscillatory motion, the probability is that it is performed by an oscillating fluid. However to say of what nature it is more particularly, we shall find it difficult to say.

It has been common to suppose the nervous fluid of an electrical nature; but I must own I find no proper foundation for this supposition. With regard to all of these elastic fluids it is manifestly related to them all, as all of them are remarkably related to each other. But they may all be considered as distinct & the elastic fluid of the nerves may be looked on as one. Before I leave the subject I must take notice of what Haller says on it in the P. 379. cc

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tamen". In P. 308. he says

oriundi".

These are all the several proofs of its being a liquid or elastic fluid; only adding that there is supposed a secretion of it, and the nerves considered as the secretory organs.

Haller puts by way of question cc

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cc

by this last Paragraph it is the Phenomenon of the Sympheoanatomicus by which any single drop of water may be made to move any given weight. The force by which nervous motions are performed may be explained by it. But the celerity by which they are performed and which shows the inverse proportion of the cause to the effect serves to refute it. Haller goes on in the next paragraph to add cc

cc

cc

cc

haberi". In that we perfectly agree with

312 him and what he further adds "that it is
"air" subtle and absolutely invisible, without
"taste and smell," this is probable; but with
regard to his other conjecture we meet with
considerable difficulties " & irreparable," we
shall take up this when we talk of the laws
of this fluid. It is more probable that like elec-
tricity, magnetism or election of cohesion, it
depends upon mixture and state of aggregati-
on, & always the same when that mixture or
aggregation is found in vegetables or in ani-
mals to be the same. I say that that being
given, it is always the same. I have a word
or two more to remark on Do? Haller where
he seems to favour its being of the electric na-
ture " *electrica materia*

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vi sua regunt". Whether elec-
trical matter penetrates the whole substance
of Bodies or only enters their surface may
be a question. He concludes " *oportet adeo*

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posuit". There is the cir-

cumstance that I would willingly dispute, 312
that it is confined within hollow tubes. He
can not conceive how it should be otherwise
& therefore fixes upon this opinion. But the
circumstance of electricity, explains that, which
will without hollow tubes, be propagated 1000
miles if the surface is homogeneous; That
these are circumstances which determine elec-
tric matter to adhere to the surface of Bodies
is what we may admit, and like the Aether
it may be confined to form an atmosphere
around the Nerves only; and I think the ner-
vous fluid is an elastic fluid peculiar to the
nerves, having a free oscillation to any part of
them under modifications. The first modifi-
cation is, that, it suffers in muscular struc-
ture & excites muscles into contraction. sup-
posing the fibres a continuation of the medullary
fibres of nerves, we can see, it should produce no
contraction while enveloped in the membranes, be-
cause there would not be that room for a circulation
that would bring the muscular parts nearer toge-
ther; And as we maintain the equal continuity of

the medullary fibre, there is no occasion for accumulation, & the propagation should be from one end to the other. But we can suppose that muscular fibre acts like electric per se, and confines the propagation of the fluid; We can go so far and find that the nervous power may be stopt at the two extremities of the muscular fibre, and is accumulated about it, if the circumstances are such as admit of it. You understand how the action of a subtle fluid upon the stretching of elastic chords, has the power of making them contract, and of bringing them into their former situation. It is but supposing that the muscular fibre has its parts at some distance from one another, & that the accumulation is around its parts; and we may only suppose that there is some other state of organization, that is little more favourable to give the contraction I speak of. I go on to consider the various modifications of this nervous power; It may be excited by various causes, applications, impressions, perceptions, and with various circumstances which ^{may} call stimuli. The most remarkable are impressions of external Bodies. And as I

have said there may be impressions made upon 313
the Nerves that do not excite perception, so now I mention it to be the case. I need not say we have no perception without consciousness; also that consciousness may be entirely obliterated. And accordingly with regard to many impressions that just now are not attended to with any consciousness, I must say that they never were with consciousness. There was a time in the progress of life when impressions giving perceptions existed before there was any memory, which happens at a certain time of infancy. Haller has even condescended on the time when memory begins, which I would find more difficult. I can conceive that all impressions made at that period may be obliterated since. But when our memory is in full vigour and also our sensibility, if then and in that case there are impressions made without consciousness, I must say that as often as that happens, so often there is no perception. A perigative may operate without giving consciousness till it comes to the rectum. Gooping is not a perception of the operation of

316 the purgative, it is merely the irritation of a shasm producing pain. Therefore I conclude that there are impressions which excite various motions, in all the different parts of our system without our being conscious of them. Now all that I say is, that sensibility only takes place when we have been originally or are at present conscious of impressions. But some have extended the term sensibility to every impression made on the nervous power. They may so if they please and keep to nervous power & sentient principle being the same. In a cut out part if I touch the body of the muscle so as to cause contraction some will call that irritability & some, sensibility. But if I touch the extremity of the adjoining nerve I think it would be improper to call it sensibility. And to apply the sentient principle cut out of the body as White does is highly improper. Now all the different causes exciting the action of muscles may be reduced to four Heads. First the purely mechanical stimulus; they are the effects of impulse of motion communicated from one part of matter to another. The second is where there is Volition, propensity,

without any consciousness of the action produced, as in sneezing. Thirdly when they are accompanied with propensity and determination to particular action without any view of the end. Fourthly when there is propensity to action but with a view of the end; to this last the Physiologists have confined the signification of voluntary. —

— End of the first Volume —