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## The Cerebral Circulation.

The theories on this most important subject have now for some time divided Medical opinions. For a long period it was almost universally believed, that the Cranium was a Sphere, whose interior was exactly filled by its Contents. - that the encephalon, its membranes and blood vessels so exactly rep the interior that no substance could be introduced without. Some equisalents to vessels occupied the vacated space - that the openings in the Sphere were only those, which were necessary for the maintenance of its integrity, and through which the blood vessels, nerves and spinal cord passed. - that owing to this and the firmness of its opaque walls it was capable of resisting all atmospheric pressure.

Hence, proceeding on this assumption, Dr. Meuro, as Dr. Keilke states, was much to illustrate his arguments by exhibiting to his students a hollow glass ball filled with water and asking his <sup>young</sup> students to observe, that not a drop of fluid

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escaped from the Vein, when it was inverted  
with the aperture downwards ~~without~~ <sup>unless</sup> air  
or some other substance took its place.

Dr. Kellie of Leith, in two papers read  
before the Med<sup>l</sup> Chirurgical Society of  
Edinburgh next proceeded to test experimen-  
tally the value of this hypothesis and to answer  
the question

"Is it true or consistent with experience,  
that we cannot lessen to any considerable  
extent the quantity of blood within the  
Cranium, by arteriotomy or venesection."

To determine the point numerous experiments  
were performed. Some animals were allowed  
to bleed to death by opening the  
Carotid Arteries - others by opening the  
jugular Veins. In some the carotids  
were tied with the view of arresting the  
supply of blood to the Brain and the  
jugulars were opened for general  
depletion, and with the expectation of  
voiding the Cranium to its greatest  
possible extent. In others again the  
jugulars were tied with a view of obstructing

the return of blood from the head and then  
one of the Carotids was opened.

The Summary and general result of  
his careful experiments may be thus  
stated in his own words.

"That though he cannot by any means  
of general depletion, entirely or nearly  
empty the Vascular system of the brain.  
As he can the vessels of the other parts of the  
body, it is yet possible by a profuse  
hemorrhage to drain it of a sensible portion  
of its red blood. - that the place of this  
depletion seems to be supplied both by  
extra and intra vascular serum, and that  
watery effusion seems to be a pretty constant  
Concomitant or Consequence of great  
Sanguineous depletion."

Taking it then for granted that this  
was the case, that Nature had so provided  
for the Cerebral Circulation, that it was  
impossible to open the Amount of fluids  
within the Cranial Vault, so long as its  
opious walls remained unimpaired. Dr  
Kellie proceeded to make still farther

experiments and to show the difference which took place when a portion of the Skull was removed and the pressure of the atmosphere allowed to act on its contents.

Having therefore performed this he observed a very marked difference. In the Brain appeared shrunken and pallid, and no longer presented its former aspects. The Membranes and the brain itself were pale and bloodless. No blood was found in any of the sinuses, except at the termination of the Lateral at the base of the Cranium.

As a necessary deduction from experiments so different in their nature and result Dr. Kellie came to the conclusion "that the Brain continued to fill the Cranium in the one set of experiments and subsides in this in the other."

Thus then we have the hypothesis of Munro defended and confirmed by the experiments of Kellie, and convinced of the truth of these observations, and their application to the point in question, Dr. Abercrombie did not hesitate to

lend to them the weight of his influence and  
 Name. He may consider, therefore, that the  
 views of Mouru, Kellie and Abercrombie, were  
 generally received by English Physicians as  
 correct and their inferences as to the great  
 pecuniarity of the Cerebral Circulation  
 - logical and satisfactory.

Twenty years however after this a new  
 and opposing theory was presented to the  
 Medical world. Dr. Burnouf in 1842 was  
 induced to doubt the truth of Dr. Kellie's  
 experiments principally as he says.

"because they appeared to be tacitly  
 acquiesced in without any one taking the  
 trouble to satisfy himself as to their  
 accuracy."

He accordingly instituted other experiments.  
 He opened the jugular vein and carotid  
 artery in one rabbit and allowed  
 it thus bleed to death, while in  
 another he killed the animal by  
 strangulation. Comparing afterwards  
 the two brains, what was the difference

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detected?

In the 1<sup>st</sup> experiments he discovered the brain to be pallid and scarcely the trace of a blood vessel to be detected on its surface.

The Brain in fact was generally <sup>as sanguine</sup> as usual.

In the 2<sup>o</sup> exper<sup>t</sup>, on the other hand, every vessel appeared to be turgid with blood, the sinuses were loaded and the whole surface of the brain and its membranes appeared to be of a dark reddish hue.

Dr Burrows concluded from these exper<sup>t</sup> that it was quite possible not merely to diminish the momentum of blood by depletion, but actually to decrease the amount.

Posture, also which Dr. Kellie affirms to have little influence on the quantity of blood within the cerebral vessels was next taken up by Dr. Burrows.

To determine this point, he suspended animals poisoned by Prussic A. in one set of exper<sup>t</sup> by the ears in another by the hind legs. With what result? He found in the one case "that there was a complete state of anaemia

in the internal as well as the external parts of the head,"

While in the other

"there was most intense hyperaemia and Congestion."

And he therefore concluded that the Brain is not the perfect sphere described by Mours and his supporters, but that the subsidence of fluids after death operates on parts contained within the Cranium, as well as upon those situated in the Thorax or abdomen.

Attaching further Dr. Bellis views he affirms

"that Congestion of the cerebral vessels is found after death has taken place by strangling, suffocation, drowning and other means of causing apnoea."

He adduces in support of this view the evidence of Dr. B. Prodie, Dr. Hooper and Mr. Pott, all of whom had seen Brains of persons hung and who state "that in such cases they had found Congestion and extravasation of Blood."

And with regard to Dr. Kellie's <sup>4</sup> <sup>th</sup> <sup>ass</sup> <sup>umption</sup> that  
if the quantity of Blood be diminished in one  
set of vessels, it must be increased in the other  
Dr. Burrows states

"that this argument proceeds on false premises"  
Since he thinks the results of his experiments  
previously mentioned negative the holding  
of the assumption that the quantity of  
Blood must be at all times the same.

Having now laid down as fairly as  
possible the opposite conclusions, and con-  
flicting theories thus promulgated, it may not  
be out of place before proceeding farther,  
to review for a moment how these theories have  
been received by the Medical Profession.  
It has been mentioned before, that for some  
time faith was unhesitatingly placed  
in Dr. Kellie's arguments and experiments  
and none questioned their accuracy. But  
since the publication of Dr. Burrows' view  
there has been a great revolution of opinion  
effected. Thus is no longer the same  
unanimity; but statements the most

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divers are circulated through the Medical  
Text Books. Many convinced by the  
Arguments of Dr. Burnouf, have been vic-  
tured, in editions of their Text Books published  
since then, to rewrite and change the views  
they previously advocated. Thus we find  
that in the first edition of his Practice of  
Physic Dr. Watson was an out and out  
supporter of Dr. Keil's views and explained  
by means of them various cerebral  
Pathological changes. Since the pub-  
lication of Dr. Burnouf's Book he has  
renounced these. Thus we find him stating  
"Dr. Keil's theory has been completely overthrown  
of late by Dr. George Burnouf."

And again,

"By the reputation of a pre eminent man  
Dr. Burnouf has done the service of  
Medicine an essential service."

Dr. Watson adopts in full all  
Dr. Burnouf's experiments and conclusions,  
and stamping with his approval  
all of the propositions Dr. Burnouf has  
laid down. Of these experiments of

D<sup>r</sup> Munow he further states:

"that D<sup>r</sup> B, distrusting the whole theory  
and distrusting the experiments with  
which it was fortified, determined to repeat  
these with care, as much as was possible  
to exclude every conceivable source of error,  
and he has shown most convincingly  
that D<sup>r</sup> Rellie's conclusions are erroneous."

To make his belief still more unshakable  
and his recantation still more complete  
he concludes by wondering  
"how any sensible man can still  
advocate the views of D<sup>r</sup> Rellie."

Dr. Todd, also in his Cyclopaedia of Anatomy and Physiology, at first held the opinions of Dr. Haller but in extracts from his larger work afterwards published he appears to forget this and to wonder "how distinguished men could have ever advocated them" and gives his support to the views of Dr. Broussais on all essential points.

Dr. Milneus likewise in his "Principles of Medicine" and Dr. Budd in his "Reports of the Progress of Anatomy and Physiology" speak favourably of Dr. Broussais' theory.

These examples, and many more that might be mentioned sufficiently show that a very great and manifest change has been inaugurated since 1842 in regard to the question. — a change which has revolutionized not merely theoretical but also practical treatment as well as doctrine. All medical authorities have not however unhesitatingly adopted Dr. Broussais' theory. But many such as Dr. John Reid, Bennett and others still adhere to the statements and opinions held by what may be

termed the older Pathological School.

Both sides cannot be right is the first thing which must strike any one who considers the Subject and attempts to form an independent Opinion. The theories proposed are diametrically opposed. And the question therefore resolves itself into this "are we to conclude that the matter is thoroughly settled by Dr. Burnouf and to say with Dr. Watson.

"that the theory of Dr. Kellie and his supporters is demolished." or is there not in the Subject as in many others truth to be found both in the one side and the other.

We find in some points, a marked similarity in others of course this cannot be detected and it is the endeavour of the present Thesis to point out more especially where this similarity exists and where it is absent - when the two views completely clash with one another to form an independent opinion as both may be the most consistent and correct.

We shall endeavour, therefore to attain the object, to consider separately the Propositions

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of Dr. Burrows.

(1) <sup>1st</sup> Prop. The 1<sup>st</sup> Proposition taken up by Dr. Burrows is this "that man can sensibly alter the Amount of Blood within the Cranium by external or venesection." Dr. Burrows experiments on this head appear to be accepted as correct observations by his opponents. The difference to be detected in the Brains of rabbits that have perished the one of Hemorrhage and the other by strangulation have been repeated and confirmed by Dr. Bennett, so that we may take for granted that to a certain extent the Phenomena he observed are in the main essentially true. But Phenomena observed and theories there deduced are totally different things. Many, almost every one, before the time of Newton, had at some time or other in his life observed, that an apple or stone when launched into the Air necessarily fell to the ground, kept remained for the Great Philosophers to describe the principles on which this was founded and thence to deduce the

law of Gravitation. So also in this case, granted that Dr Burrows facts are substantially correct, is the inference he there draws equally so? The rabbit, killed by Kemontayo, when opened, exhibited palepus on the surface of the Brain but the question still remains was there on this account a smaller proportion of fluids than formerly. It is well known, that the effects of a copious Hemorrhage tend to diminish the amount of red corpuscles in the blood. These red corpuscles, according to physiological doctrines, have per se an intimate relation to the colour of the blood and knowing that their function is the elaboration and preparation of the Liquor Pinguis, it will be evident that according, as they are more numerous at one time than at another, so also will the Phen<sup>a</sup> observed differ and the appearance which the blood presents will vary just as their relative proportion varies! Thus both primarily by themselves and secondarily in their function they are most undoubtedly

Connected with the Colour and general aspect of the Blood. What effects therefore will their diminution exercise on the appearance of the Brain in a case of Death by Hem. ap? Simply this, that we cannot and must not expect the Brain to present the hue of other periods when they existed in their normal amount. The facts detailed by Dr. Burrows verify the truth of the supposition.

Yet the aspect of the Blood does not necessarily indicate that the real amount of the fluid is diminished. The inference to be drawn from such a phenomenon rather is this, that the fluid is diminished in quantity more than in quality - that the excessive depletion has effected a change in colour but not necessarily a change in the actual amount - that the real amount on the contrary has not been shown to have undergone such a marked decrease as Dr. Burrows would lead us to infer from the mere paleness of the surface.

In addition to this we have other

Causes also which may come into play to influence the result. It is quite conceivable as Cannon suggests, that the serum fluid which at all times the ventricles of the Brain is also increased - that the blood now through inequality will more readily suffer absorption, and moving with diminished velocity will give greater opportunities for exhalation through its coats - and the vacated space formerly filled with blood may thus to a certain extent be replaced by serum.

D. Burrows himself so far admits this hypothesis for he said him saying further on in his m.R.

"that, when abstraction of blood from the cranium is effected, there is a tendency to spreading of the cerebral map; but the vacated space is immediately occupied by a certain quantity of serum."

Now this serum may come we have already in part indicated. But there are other sources whence it may be derived.

The Cerebro spinal fluid as is well known communicates by means of the ventricles

Cavities, not only with the whole amount of Serum in the brain, but also through an Aperture in the Pia mater, extending between the Cerebellum and Medulla oblongata with the subarachnoid space of the spinal Cord (Gray.)

How it is quite conceivable also, that this spinal fluid, when there is diminished flow of arterial blood, will be enabled through the greater room for expansion thus afforded, to flow up by Physical laws and expand the ventricular cavity. Somewhat in the same way as we see water rising in a Pump. Under the influence of these various circumstances the deficiency of one fluid is supplied by the excess of another, and although the relatively proportional quantity of the fluids at normal periods is altered the aggregate amount remains very nearly the same.

It may with all truth be suggested that Dr. Keelie and Penzance are wrong on this point if we but follow Dr. Keelie's Proposition and say

"that not the amount of blood but the amount of fluids within the cranium is by a law of nature at all times the same."

Considering it in this light, the familiar numerical illustration of Dr. Abercrombie mis- still poses its well known adaptation and peculiar significance.

If further proof was necessary, that there is no diminution of fluids, it is found in the phenomena seen by the two observers. When the rabbit was killed <sup>without</sup> by depletion, the brain appeared to be of its normal bulk, although there was greater vascularity. Again when they were killed by depletion there was the same appearance of undiminished size but it wanted the vascularity evident in the former case.

Halle calculates, that the brain receives not less than  $\frac{1}{15}$  of the whole of the fluids of the body. This as well at once be perceived is a large amount. It has been acknowledged before that in death by depletion there is relatively less than the normal quantity of blood. But at

the same time, it is also evident that had  
 the large amount of Blood which goes to  
 the Cranium, been sensibly interrupted  
 without some equivalent taking its place,  
 there must on a *prima facie* view have been  
 not merely differences in colour but also  
 shrinkage and diminution in actual  
 bulk. Dr. Kellie's experiment of kept  
 living, and allowing the atmospheric pressure  
 to act on the Cranium contents, shows that  
 there was shrinkage of the cerebral  
 mass in a very marked degree. This  
 experiment has not been called in question by  
 Dr. Brouncker nor does he, in his theory, give  
 any explanation why this should be  
 the case. If his theory is correct - if grav-  
 itation and atmospheric pressure act  
 at all times on the Brain, in the same way  
 as they do on other parts of the Body, there  
 ought to have been, not merely pallidity  
 of the Brain for that proves nothing,  
 but the shrinkage appearance described  
 by Dr. Kellie ought also to have been  
 manifestly observed.

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Upon receiving, therefore, the whole field of con-  
roversy opened up by these experiments how  
does the question stand? Has it been  
that the experiments and consequent deductions  
of Dr. Kellie have been overthrown? Has  
Dr. Watson's assertion been supported by the  
facts of the case? Is there no medium  
line very distinctly apparent, at all  
events on this the first point taken up  
by Dr. Burns? It appears to us that there  
is.

But in order to prove this we must  
first admit the fact of the pallidity of  
the hair as described by Dr. Burns  
and not contradicted by Dr. Kellie.  
In admitting this pallidity however we in-  
deed may detract from the real question at  
issue - which is the amount of fluids  
within the Cranium. In as we have  
shown the pallidity mentioned may be  
due to many causes, - to the diminution  
of the normal quantity of red Corpuscles  
- to the blood becoming paler and thinner  
- to the serious portion of its constituents  
forming its chief ingredients and to the

fact that to a certain extent the Brain  
Shares the general pallidity of the Body,  
and consistent with all these Causes presents  
a more blanched and colourless aspect.

Both parties as the following extracts  
will show acknowledge ~~acknowledge~~  
almost the same Phenomena although  
attempting to explain them on different  
grounds. Dr. Kellie in all his experiments  
acknowledges depletion. Dr. Bunnous but  
appears to confirm this.

Thus Dr. Bunnous says, in the rabbit, which  
he bled to death. He found.

"that upon removing the upper portion of  
the Cranium, the membranes of the Brain  
were found pallid"

Dr. Kellie says with regard to the Post mortem  
examination of an anæmic patient.  
He found.

"that upon removing the upper portion  
of the Cranium, the dura mater was  
uncommonly pale, bloodless and trans-  
parent."

Dr. B says. "The longitudinal sinus was

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Nearly empty of Blood and their Course was  
Not denoted by any colour of Blood."

Dr. Kellie says.

"The Course of the longitudinal Sinus was  
distinguished by only a pale pink tint."

Dr. B says.

"Upon making sections of the Brain the  
Ventricles appeared equally sanguineous."

Dr. K says.

"The medullary part of the Brain was  
uncommonly white and the Cerebration part  
of the pale grey colour."

If then these experiments be then result be  
compared with one another we find a  
degree of uniformity as to actual facts  
rarely to be observed in Physiological  
experiments. Laying aside for a moment  
the different theories, it appears as if  
Dr. Burrows had vindicated his observations  
merely to confirm what had been formerly  
stated by his opponents.

Upon one or two points only do they appear  
to have any essential difference.

Dr. B says "Scarcely the trace of a

blood vessels was to be detected on the surface of the Brain, while Dr. Kellie states,

"that the larger vessels ramifying over the hemispheres and between the convolutions of the Brain were conspicuous from the colour given to them by the same pale pink coloured fluid with which they were filled though not distended."

Dr. Burrows, further makes no mention about the covering any serum. While Dr. Kellie states that he considered "there was an unusually large quantity of the fluid."

Had Dr. Kellie therefore instead of stating as he does in the resume of his experiments that the amount of blood within the cranium is at all times nearly a constant quantity so long as its osseous walls remain uninjured, but interposed the hind fluids we do not see how succeeding experiments, considered as experiments, could have in any measure invalidated the correctness of his theory. Indeed those other experiments would have but lent additional force to his previous observations. Dr. Burrows

It must be remembered we argue not the truth of Dr. Kellie's deductions but bases his arguments entirely on the mere effect of the experiments themselves. Thus we find him stating at the 33<sup>d</sup> page of his m.R. that "It is maintained that when hemorrhage takes place from the general system it does not affect the quantity of blood in the brain. The experiments I have performed lead me to the opposite conclusion."

Whatever may have led him to the opposite conclusion, it is impossible as we have shown from the facts given, that the mere experiments per se can have done so, for these experiments are almost identical, with some trifling exceptions, with those made years before by the very man whose theory he attempts to overthrow.

II

It comes now to the 2<sup>d</sup> point taken up by Dr. Burrows, viz that posture influences the amount of blood in the brain.

As previously stated, Dr. Burrows experiments on the head consisted in suspending rabbits poisoned by Prussic Acid in the one case by the neck, in the other by the necks. And the Phenomena he observed in dissection, here in the first case, marked hyperaemia both externally and internally.

"The longitudinal and lateral sinuses were engorged with dark blood - the substance of the Brain being at the same time much congested. While in the latter the opposite effect was observed.

"The sinuses and other vessels being unobscured" Upon first considering the subject, it appeared to my mind very probable, that this would be the case under circumstances so favourable for different results. And I was inclined fully to adopt the experiments of Dr. Burrows, although I might not accept his deductions. Subsequent consideration however induced me to believe that there must have been some exaggeration here.

The difference detected is explained by Dr. John Reid on the principle of the subsidences

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of the red corpuscles, sinking in the case of  
Suspension by the heels, to the more dependent  
part, consequent on their greater Sp. Gr.  
But, accepting this explanation so far  
as correct, it appears insufficient  
materially to alter the Phenomena observed  
at least to the great extent required by  
me regarding Dr. Brunon's experiments.  
He has according to him the most opposite  
results - in the one case most intense and  
marked hyperaemia - in the other the  
very reverse. The normal amount of red  
Corpuscles in the Blood is 130 parts in 1000.

Now admitting to the full extent the  
force of their Subsidence in a case of suspension  
it yet must appear that this alone would  
be insufficient to account for the wide  
and glaring differences Dr. B. speaks  
of. The red Corpuscles may subside, but  
still it may be questioned whether or not  
their greater or less proportion would  
account for everything. It was therefore  
resolved to repeat the experiment before the  
Mind was too much balanced either

I accordingly obtained two full grown healthy rabbits and after poisoning them <sup>by Burrows</sup> suspended them in the two diff. positions for 24 hours. Upon examining them again at the end of that time. I found the rabbit (A) suspended by the heels.

1<sup>st</sup> Most intense and marked hyperaemia of the external vessels. They were fully distended by a dark black blood.

The eyeballs appeared suppurated and prominent. Upon opening the cranium it was immediately observed that the engorgement referred to did not affect in a degree half so marked the vascular system here. The course of the sinuses was well marked and the vessels appeared filled. But I could not discover that they were filled with the "dark and tinged blood" referred to by Dr. Burrows.

The appearance of the brain was certainly not congested. Upon making a section of the brain, some red points were certainly observed, but I looked in vain for the "staining of the tissues" and

"Uniform Vascularity." The white substance was not at all mottled or in any degree

"Uniformly dark and Congested" as Dr. Burrows State.

In the opposite experiment (B)

I found the integuments and external parts pale and exsanguined. But in the interior there was not a similar state of matters.

I could still easily detect the sinuses and blood flowed from them on section

The appearance of the substance of the brain was very similar to that of experiment A with the exception of the red points which I observed in the former case, and which I could not discover here.

What more particularly struck me was - that the brain in the latter case was much firmer in its consistence and very like a brain which has been hardened in spirits.

The marked distinctions I had been led to expect I certainly was unable to detect.

These two experiments which were conducted exactly as Dr. Burrows

says he has done. Completely convinced me of the fact that there was exaggeration in his reports. And further, that the state of the external vessels, by no means indicate corresponding phenomena internally. But the supposition that the state of the external vessels is no indication of that of the internal?

cannot be held if I accept the opinions of Dr. Burrows. It appeared to me therefore of what importance that this point should be ascertained. and I proceeded to investigate this as follows.

Exp(C)

I obtained another rabbit and after it had been fastened in a similar way, I suspended it only for 10 minutes, and at the expiry of that period, I took it down, removed the Rullecap, taking care at the same time that the head should always be more dependent than the other parts of the body.

I found that the vessels of the vitreous were filled with blood, not so dark as in experiment A, but yet in respect to quantity being as congested and turbid.

The blood flowed freely forth on dividing them. The Brain itself and its membranes were found to present an appearance very similar to that of cap. (A). In neither case were they at all turgid or congested, although the effects of gravitation had been fully tried and though externally all the appearance of hyperaemia were observed, internally nothing of a similar kind could be detected.

The results therefore of these two aspects of A. v. C. show that there were two laws in operation. By the one law gravitation was counteracted by no opposing circumstances and as a natural consequence there was vascularity and hyperaemia - by the other law, the osseous walls of the cranium, protected its cephalic contents, regulated the amount of fluids it should receive and adjusted everything so that in no way it might be interfered with in its important functional use.

Let us consider for one moment what

would have been the consequence had the  
 not been the case. Had the internal and  
 external aspects been in both cases sim-  
 ilar as Dr. Broun's would lead us to  
 imagine they were. Had the same laws  
 regulated them both, then indeed the  
 most disastrous results might have been  
 anticipated. If we accepted Dr. Broun's  
 theory and expect as correct and right we  
 saw hyperaemia internally, we would  
 necessarily be led to expect a similar  
 state of matters in the interior. Perhaps  
 and to eruptive catarrhs cause most  
 intense flushing of the face - increased  
 vascularity - and a loaded state of the  
 external vessels. Now the same results  
 occasioned internally, then indeed no one  
 could doubt, but that a serious and fatal  
 result would be occasioned <sup>injected</sup> to a most  
 important organ. Conception is but an  
 aggregated congestion and we know  
 how long it is before its effects pass  
 away and how often they lead to  
 numerous complicated and fatal issues.

So too in the examples we have mentioned, if the Congestion, so app arently external, was Any Anterior of the Circulation in the interior we would in almost every case be led to anticipate a cerebral lesion. It needs scarcely be mentioned that this does not occur.

Further, if Dr. Broun's theory holds good, we would be led into a perfect Chaos of in deductions. It is no uncommon thing for a schoolboy or professional tumbler to stand on his head, as it is termed, for a minute or two either for amusement or profit. Here likewise we observe the effects of gravitation. The face gets full and red - the veins turgid and congested - the eyeballs suffused and prominent - if this was continued 5 minutes more we would have a similar state of matter to that of capsa. C. If there was a like Congestion in the interior, this almost impossible to imagine, but that such freaks would lead to the most disastrous Consequences. It is impossible to imagine that if persons such as we have indicated was existed

On the Cranial Circulation, that the Brain could so easily accommodate itself to circumstances, and within a minute or two adapt itself to new & different effects. He would expect, that every boy who indulged in this amusement, would be to say the least of it, dull, heavy, spiritless, & totally unfit for study, and would soon be carried off by some cerebral malady. He would expect the tumbler to be a diction to Hydrocephalus, a heavy, obtuse, phlegmatic being. Whereas in both cases the scenery keeps any to add the very opposite is the result. The romping schoolboy is generally the very picture of vigorous health, and the tumbler is a type of active, very muscular activity. Again if we look at the face of any one who stoops for a short time we see it become flushed and red to an unusual degree. If there was a corresponding plethora in the cerebral vessels, it may well excite surprise, how very rare apoplectic effusions are. And how any one almost could survive the simple process of unlacing his boots.

Again, what do we often observe in an Anæmic patient when opposite Phenomena exist? We frequently see, such a one to be in full possession of all his faculties, & capable of a consecutive train of thought up to the very last, although his pale and languid and very other part of his body, except his mind, shares in the general and universal debility.

Thus and many many more examples, which might be mentioned, totally unexplained by Dr. Brown's theory, are the may be true but legitimate result from the peculiar laws which regulate the Cerebral Circulation.

### III.

Dr. Brown in his 30 proposition says "It has been attempted to prove that when individuals die of asphyxia or apnoea, there is no excessive congestion of the Cerebral Vessels, numerous Observations show that in the different kinds of death by apnoea there is great Congestion of the Cerebral Vessels. And that when it is absent, it may be

accounted for on anatomical and physical principles." In the proposition we have thus quoted no decision can be arrived at unless we carefully consider the amount and value of the evidence adduced on both sides. It is not rarely happens, that an opportunity is afforded, to observe the state of the cerebral vessels in cases such as Dr. Burrows has alluded to, so that the experience and opportunities of others must guide us in the verdict. We must look to the facts which are stated and the respective merits of those who detail them.

What then do we find? In favour of Dr. Bellis theory, we find Valisabro, Magagni and other eminent observers, detailing the appearance of the Brain of executed Criminals. The testimony of Valisabro and Magagni must not be lightly laid aside for at the time they wrote they were ignorant of the peculiar bearing of the theory as to the Cerebral Circulation, and in stating the result of their observations, they were merely detailing Physiological facts

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and could have no possible object in  
making any partial statement. Haustations  
from the original Latin we find these statements the  
following as the conditions of parts.

"The Skin covering the external parts of the face  
and head was swollen with bloody vessels.  
The Cerebrum so far as sight was able to judge  
appeared to differ little from its natural  
appearance."

Dr Haen also states, that in 13 out of 15  
dogs, which were hung or drowned for the  
purpose of ascertaining the morbid appear-  
ances, he could find no signs of apoplexy,  
neither fulness, nor Congestion nor signs of  
rupture of vessels within the Head.

Dr Monro Professor of Anatomy  
the bodies of most of the executed Criminals  
in Edinburgh were sent and who Con-  
sequently had great opportunities for  
coming to a decision on this point says.  
"He failed to detect in any case an unusual  
appearance of internal Congestion. In fact  
he sometimes found the very opposite to be  
the state of matters. Thus he says of one

instance

"The brain was rather softer and of a paler colour than usual."

And in another instance he says.

"I examined the brain of a person hung and found no internal Congestion, but a great deal of blood accumulated in the depths of the integument"

Further it is stated, in the report made upon the pirates who were hung at Leith and who were subsequently examined by Meuro and Kellie

"That there was great and ample Congestion of vessels <sup>extern</sup> ~~within~~ the Cranium. Internally however the Cerebrations and medullary portions of its substance, exhibited as to colour or vascularity nothing characteristic or remarkable. The pia mater was upon the whole, paler and less vascular than usual. The sinuses all contained blood but in no unusual quantity."

Soaring then to what has been stated by these observers, it necessarily appears that I compute them satisfactorily very

Complete and strong evidence must be adduced.  
 Now then does Dr Burrows attempt to overthrow  
 them? He first of all admits the fact, that  
 the Cerebral Vessels are not always found loaded  
 under conditions so favourable for such an issue.  
 After doing this however he cites other examples  
 "where the brain and its membranes appeared  
 to present the other appearances of apoplexy  
 to a striking extent. These cases cited by Dr  
 Burrows appear however, to be more like cases  
 of apoplexy which have occurred during the  
 state of apnoea than anything else, and are  
 due most probably to the rupture of some  
 vessel in the uterine of the cranium. Whether  
 this explanation is or is not correct, yet these  
 examples of Dr Burrows appear to be so very  
 far fetched in their nature and so few in reality  
 that they evidently do not satisfy even Dr Burrows  
 himself. It appears to put them up merely as  
 counter examples, but evidently the B. m. to  
 the poverty of the result, he sticks upon a fresh  
 line, and endeavours by hypothetical  
 reasoning to answer and account for the  
 phenomena observed in antagonists

inquiries. The absence of central congestion may  
 He says be accounted for  
 "By the subsidence of the blood which is facilitated  
 by its fluidity and the posture of the Body after  
 death."

This of course it may at once be observed is a mere  
 Assertion requiring necessarily very convincing  
 proof before it can be accepted. What proof  
 then does he adduce and what is his sup-  
 position? His supposition does not suffice  
 so he brings forward three. Let us look at them  
 Seriatim.

1<sup>st</sup> He says "owing to the position of the Root of the  
 Vape on one side of the M.C.R, sometimes resting  
 on the mastoid process, and not compressing  
 the jugular veins sufficiently allows the  
 blood to escape down through the channel  
 without obstruction"

This supposition may be dismissed at once by  
 the fact, that in none of the examples mentioned  
 by Dr. Pelli and others, is the stated to be  
 the position of the rope, nor in medico legal  
 books generally is the statement of Dr. Perna's  
 confirmed.

Dr. Burrows in his second supposition states that  
 "the occasional absence of congestion in the Cerebrals  
 Vessels after death by hanging, may perhaps  
 be due to the subsidence of the fluid flood  
 after death, owing to the principle of grav-  
 itation coming into play and to the fact  
 that some of the Cerebral Vessels may not  
 be completely obliterated by the pressure  
 of the Cord."

This appears to be a mere *petitio principii*  
 for if it occurs in one instance, though  
*Ceteris paribus* to occur in all and the  
 value of Dr. Burrows' previous examples  
 go for nothing. He supposes they occur  
 only in those cases, which do not tally with  
 his own theory, and it remains for him to  
 show why they do not also similarly  
 occur in those which he cites. More than  
 this, the supposition alluded to is rather  
 an argument against himself. His theory  
 is based very much on the idea that Gravitation  
 is a law from which the Cerebral Vessels are  
 not exempt. Supposing we grant this  
 for the sake of argument, ~~it~~ then upon his

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theory the Cerebral Vessels should be depleted  
rather than congested. If the Cerebral Vessels were  
not exempt from the law of the Subsidence  
of fluids, there are various Channels by which  
the Blood may pass downwards. The  
Vertebral Sinuses and the venous plexuses  
of veins in Prostrata has shown commun-  
ications with the Veins of the Body - the Cervical  
, intercostal, lumbar and sacral. Dr B  
himself admits (Page 26) "that the sinuses  
of the Cranium may be drained through the  
Vertebral Sinuses." Now supposing, that the  
jugulars are so compressed, that blood  
cannot be returned by them, what prevents  
the Blood here from seeking out this new  
Channel and leaving the lateral expan-  
sion. If the Circulation of the Blood  
is diverted from its original Channel, by  
the ligature of the main Vessel, the well  
known fact soon this change is counterbalanced  
by the various anastomotic communications.  
So also here, if gravitation would make  
the Blood subside Dr B must show, how  
it happens when on his own admissions

"The sinuses of the Cranium may be drained  
through the Vertebral sinuses: that he do not  
find the evidences of this drainage or depletion  
having taken place. What other law now comes  
into play? It would consequently appear  
that the line of argument here adopted by  
Dr. Keen is not merely fallacious in itself  
; but is another additional proof of the  
fallacy of his own doctrine and the truth  
of the peculiar laws which regulate the  
Cranial Circulation.

117 Dr. B. in his anxiety to account  
still farther for the absence of Cerebral congestion  
adopts as a last resource a still more  
startling hypothesis than any hitherto  
mentioned. He supposes, that the true state  
of the Cerebral vessels is sometimes not  
detected, from the anxiety becoming the  
Heart and Lungs - that this anxiety prompts  
the investigators to neglect the vessels of the  
Brain and lead to the examination of the  
thoracic organs first - that in doing thus the  
great vessels of the neck are cut and that  
then the blood gravitates down and

flows from their divided loyalties into the  
 Chest." Dr. John Reid in almost one sentence  
 demolishes the whole of the superstructure when  
 he says: "That at the period referred to Bodie  
 has too valuable to allow of these unthinking  
 actions being easily made."

May we not however go a step further  
 and ask how it came that those who conducted  
 the dissection in the case of the Duke of Bourbon  
 were so eminently careful as to leave no  
 room to doubt the truth of their experiments.  
 How does it come that Dr. Manno, Kellie and  
 Reid were so exact and over zealous while  
 M. M. Marc, Marpelin Pasqua and others  
 in conducting their dissections were so very  
 cautious as not to engender a similar  
 state of matters also. He must also know  
 if this argument is to amount to overthrowing  
 Dr. Kellie's theory, what proofs there are of  
 Dr. Kellie and Manno having acted  
 as has been reported. There are no facts  
 to prove this and Dr. John Reid denies  
 that such zeal was ever manifested.  
 He must also know and be satisfied how

and in that manner the Skull cap was raised - the Body was placed - the Brain examined in the <sup>experiments</sup> ~~experiments~~ adduced by Dr Burrows to support his own views. and until all these points have been satisfactorily explained, we must decide in favour of that theory which Dr Belli promulgated, for the weight and value of the testimony of those he has brought in its favour are decidedly superior to the ~~Counters~~ opinions advanced by Dr Burrows, and are certainly not overthrown by the audely famed explanations which have been considered.

IV.

Dr Belli's 4<sup>th</sup> Proposition is "that if there is repletion or depletion of one set of vessels in the Cranium there will be an opposite condition of the other set of vessels."

Dr. Belli asserts that relatively the Veins and Arteries <sup>may</sup> contain more or less blood at different periods - that

the veins may be full the arteries less so or  
 vice versa. This proposition is attacked by  
 Dr. Burrows who asserts the very contrary  
 to be the case and affirms that such  
 changes as have been alluded to cannot  
 take place. His reasons for this opinion  
 are based mainly on the value of  
 those arguments and experiments which  
 have been detailed in a former part of  
 the Thesis. The whole of his counter  
 statements to Dr. Keil's proposition

under this head are based upon them  
 and if they in any measure have been  
 shown to be untenable, so also must  
 his assertions here be. Had they been  
 true the deductions, which he thinks  
 spring from them would be such as  
 he makes us to believe, but if they  
 are false so also must be the ~~superstitions~~  
 which he has reared. If on the  
 other hand, Dr. Keil's exper<sup>s</sup> have  
 been in any measure confirmed by  
 the preceding arguments and facts  
 - then his 4<sup>th</sup> Proposition is a natural

sequences. But that these deductions may gain greater force, we must also take into account, here as elsewhere, the varying amount of the laticular serum. And according to this we again find a remarkable analogy between not so much the facts this time as the actual conclusions of the two theories.

Now supposing, accordingly, the fluid for blood, we cannot detect any error in the elements, of which Dr.

Abercrombie's Algebraical equations are formed, and the sneers, which Dr. Belli Burnom. has assailed it with, fall upon the head, not of the man who attacked it but on the man who attacked.

In Dr. Burnom himself admits that the amount of fluids within the Cranium must be at all times nearly a constant quantity, if he take it.

"the serum as an important element of the contents of the Cranium."

As previously mentioned the amount of serum is between 11 to 1 oz, and remembering

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this, it will be easily seen, how its  
greater or less proportion, will materially  
influence the amount of fluids within the  
Cranium and will help greatly to confirm  
the deductions which Dr. Abercrombie has  
hence drawn.

### General Conclusions

Having now as fully entered, as time would  
permit, into the interesting controversy, I may be  
held in conclusion, to give a summary of  
what has been considered, and state  
briefly why we may venture to assert that  
a rash adoption of Dr. Munro's views, should  
not as yet be entertained.

In his first proposition Dr. Munro states  
"that his experiments show that we can  
sensibly alter the amount of blood within  
the Cranium by arteriotomy or venesection."  
In attempting to show that this Proposition  
is fallacious, we have stated the following  
arguments

1<sup>st</sup> that Dr. Munro does not take into account  
the principle of generation, operating on the blood

And decreasing <sup>and</sup> the amount of the red corpuscles.  
 - 2<sup>o</sup> that furthermore the appearing seen in his experiments  
 on the brain may be accounted for still further by  
 the blood, here as in all other hemorrhages be-  
 coming pale and thin - to the serious  
 parting of the constituents forming its chief  
 ingredients - to the brain showing to a certain  
 extent the general pallidity of the body.  
 3<sup>o</sup> and then especially that the real  
 question sub judice is not the amount  
 of blood, but the quantity of fluids in the  
 the Cranium - that hence we must also  
 take into account the extra vascular serum  
 And that if we do this we then find  
 the phenomena related by the two ob-  
 servers, presenting an analogy as to actual  
 facts nearly to be seen in Physiological  
 investigations.

Second Propos<sup>th</sup>  
 In opposition to Dr. Brown's 2<sup>o</sup> Propos<sup>th</sup>  
 "that posture influences the amount of  
 blood in the brain." We have ventured to  
 state that the experiments of Dr. Brown

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are fallacious, - that posture now found  
or attempting to repeat, those experiments in  
a similar manner to those which he did, in no  
material degree to influence the phenomena  
observed, whether the animal was hung up  
by the ears or the heels as shown in Expts. 12 & 13  
page 21<sup>st</sup> of this Thesis - that further Expt.  
C. Shows that external Congestion forms  
no Criterion of internal Vascularity - that  
the interior and exterior of the Cranium  
are regulated by two separate and  
distinct laws, as shown not merely  
by this Expt. but by various arguments  
which can be brought forward in its  
favour, from natural and everyday  
Phenomena.

### Third Propos<sup>tn</sup>.

We have attempted to show under this  
head, that the weight and relative  
value of the evidence, as to the "appearance  
ill or dissection in cases of hanging &c,"  
are entirely in favour of Dr. Keilies views  
- that the explanations offered by Dr.

Burrows trusts the evidence, so far from  
being able to do so, are luther potter real  
in the notes and contain in them clear  
plain and palpable contradictions.

### 4<sup>th</sup> Fourth Propos.<sup>th</sup>

We have attempted to show, that if the  
preceding arguments, against Dr. Burrows  
previous propositions, be correct, then the  
4<sup>th</sup> last Propos.<sup>th</sup> falls to the ground,  
because it is entirely founded on the  
supposition, that he had proved his  
point, in the prior statements he  
had made.

Yours

Matthew Charteris