

MECHANISM IN THE BRAIN, BY WHICH ALTERNATING STATES OF SLEEP AND WAKEFULNESS ARE PRODUCED.

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*I. Definition of Consciousness. Structural Conditions Attending Its Appearance.*

According to Swedenborg, *consciousness*, which may be defined as the intelligent perception of ends or designs with discriminative apprehension of measure relation and bounds, is in every instance the function of and associated with a distinct specialized structure. This specialized structure occupies a relatively small space in that larger organism of which it is a part. The functional activity of this structure is periodic, and is governed by "letting in" or "turning off" the stream of that particular fluid-protoplasm which constitutes its "blood supply."<sup>1</sup>

In each instance also this specialized structure exists as it were paired or in consort with another structure which governs the stream of that fluid-protoplasm which constitutes the "blood supply" of both. The associate or consort structure possesses in itself two channels for the fluid-protoplasmic circulation. By one channel the stream of the fluid-protoplasm is sent into and through the delicate mechanism of the specialized tissue forming the other member of the pair. By the other channel the stream is returned to the general circulation from which it came, without going to the specialized structure in mention at all. The current of fluid-protoplasm or blood going through this specialized structure is thus alternately turned on or shut off,—much as water is now sent through the mill-race to the mill, and now let go over the dam. This alternate turning on or shutting off, of the stream produces in the structure thus acted upon alternating states of expansion, tension, functional activity,

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<sup>1</sup> Appendix. Note a.

and of flaccid collapse. A structural mechanism thus operated which exists in the brain and the fluid-protoplasm or blood supply of which is the white or "intermediate" blood of the neuro-lymphatic circulation, is the anatomical and physiological fact at the basis of the phenomenon of alternating states of sleep and wakefulness occurring in all living, breathing creatures.

Consciousness consists in the perception of ends and designs, and it is invariably associated with the interaction of two specialized structures occupying but a small portion of that organized body of which they are part. In considering this structural mechanism upon the action of which consciousness depends, we have thus to deal with two members coupled in functional partnership. These two members are always in juxtaposition. One member of the duplex organization told off for this especial function is a structure receiving and handling the "blood supply" for the partnership. In this member there are two channels for that blood supply. By the one channel it can send the "blood supply" boldly on to the other member of the partnership organization, the erectile expansible member; filling its tissues, expanding it, putting it in tension and potency of function.<sup>2</sup> While by the other channel there is a direct passage through its own structure, so that when the stream goes through this passage it finds exit again into that general circulation from which it came, without going at all through the other half of this twin organization. Which half falls flaccid and collapsed in consequence: and so long as this state of flaccidity and collapse continues its function intermits.

Such a pair of twinned organisms are the lungs and heart. The truth of what has been said when applied to them can be seen by a comparison of their interactions in the prenatal state and the postnatal state. In the prenatal state the blood which the heart receives from the body does not go to the lungs at all. It passes by an especial way, the *foramen ovale*, directly from the right side of the heart to the left and is sent directly out

<sup>2</sup> For no living structure is in potency of function unless its tissues be tense: and tissue is put in tension by the fluid-protoplasm or vital liquids of the organization. Coarser tissues are put in tension by the red blood, finer tissues, by the finer fluid-protoplasm or "bloods." *On the Infinite*. Swedenborg. Chap. II, Sections IV., IX. *On Tremulation*. Swedenborg.

again to the body circulation. During this period the lungs are collapsed and without potency of functional life. In postnatal life, the blood passes by the other channel going into the lungs: which organ it thus infills, expands and supports in potency of function. The immediate result of thus bringing the lungs also into action is to usher in the conscious life of the larger integrated organism of which it is a part; to which conscious life it always afterwards acts as a common physiological plane or fulcrum, by placing all that coarser tissue, chiefly muscular tissue, which the red blood keeps in tension and potency of function, under control of the determining activities of that specialized tissue chiefly concerned in and appropriated especially to this consciousness, or perceptivity of ends.

In like manner, when the two parts of that twin structure we have been considering, the twin-structure engaged in functioning consciousness, act together, each performing for the other its special office, there and then the "conscious life" exists. There can be no "consciousness" where one alone is active. Although it is perhaps worth remembering that the "heart" side of this duplex-organism performs other functions than that of "consciousness" to the common body, which functions are without intermission.

But to return, this dependence of consciousness upon the action of a special duplex organism is true not only of the lungs and heart which operate upon that most general external or lowest plane of fluid-protoplasm in the body, the red blood, but on the higher planes also. Whenever we find such a structural mechanism exists, thus twinned with another structure to which it is, as it were, coupled and in partnership, the impletion, tension, animation and functional power of the one being thus based upon the intimate association of the two members of the partnership, and directly dependent upon and according to the entrance of the full tides of blood from the other member; which blood supply is not under its own power, but is now turned off and now turned on, the sequent intermittent variation in its own state and powers being figured by the prenatal and postnatal condition of the lungs, here consciousness, perceptivity of ends, exists.

Perception of ends, then, in some degree or other, is found wherever there exist, and only where there exist, and is conditioned by the interaction or functional conjunction of, two especial structures. This is true for all levels, physical and spiritual. On the lowest, most general physical plane, it is illustrated by the functional inter-relations of lungs and heart, pre-natally and after birth. On the spiritual plane we call it the interaction or conjunction of will and understanding in their several degrees.

In the physical life itself three grades or planes exist: the plane of the red-blood circulation, the plane of the nervo-lymphatic or "purer-blood" circulation, and the plane of the spirituous fluid or "purest blood," the highest fluid-protoplasm, the formative and reformatory protoplasm of the body, which carries the species, type or "image of creation" in all its activities. Indeed, there are four planes, counting in that of the most gross and ultimate body. For as the forces or *ethers* of the universe are four, the spiritual soul when embodying itself descends by four steps<sup>3</sup> or grades of substance faculty and sensation. But the fluid-protoplasms or bloods of the animate organism are but three, the red-blood, the nervo-lymphatic or white blood, and the spirituous fluid or formative fluid.

In order, however, to understand the action of that specialized structure with which consciousness or perception of ends is invariably associated, upon the next higher physical plane, that of the nervo-lymphatic, the intermediate or purer blood, it will be necessary to premise something of Swedenborg's teaching in reference to the nature of the pure or simple cortex, and the cortical glands of the brain, and the circulation of the purer blood.

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<sup>3</sup> *Economy Animal Kingdom*. Swedenborg, Part II, Nos. 273, 281.

This is true only of the *human* body, however.

The bodies of animals possess only the last three steps or grades of substance; beginning with the second ether as their first and highest plane.

Insects and other low-type organizations generally, with the entire vegetable kingdom, possess only the last two.

II. *Nature and Relations of the Pure or Simple-Cortex, and the Cortical-Glands or Cells of the Gray Matter of the Brain.*<sup>4</sup>

*The Circulation of the Intermediate or Purer Blood Throughout Body and Brain.*

According to Swedenborg, the pure or simple cortex consists of cells which are purer and finer than the gray matter cells, true *corpuseular* forms indeed, so that a very great number of them exist within each cell of the gray matter. They are subtler and softer, moreover, so that they exist, as individuals, indistinguishable to the microscope. These cells of the pure or simple cortex are the organic beginnings or priors of the brain. They are arranged according to the interior form of the paternal species-type and act as a body and instrument of the spiritual organism. That mass of the cells of the pure cortex within each cell of the gray matter bears the same relation to this cell and its fibre that the mass of gray matter in the brain itself, bears to the brain and all the body.<sup>5</sup> For the cortical glands or gray matter cells are each like a brain in miniature, "and would seem also to consist of substances which are similar or analogous to those of the larger brain, viz. : of a purest cortex, a purest medulla, and likewise of exceedingly small cavities."

Let us illustrate these constructive and vital relations of the pure or simple cortex to the gray matter cell by that which is more generally understood, i. e., the constructive and vital relations of the gray matter of the cortex to brain and body. From each gray matter cell or cortical gland proceeds one nervous fibre called by Swedenborg, "simple fibre,"—and one only. Part of these cortical glands have long "fibres" going to the body and ending in finest terminal structures, which unfold the "uses" of the cortical glands from which they come, and are the vital

<sup>4</sup> The gray nervous substance also enters into the spinal cord and is scattered throughout the body, and wherever the gray matter is, there also are the cells of the pure cortex within. The presence of gray matter and simple cortex in other parts of the body must not on this account be forgotten, for everywhere the gray matter is of one stock and nature. "*The Fibre*, No. 60."

<sup>5</sup> *The Brain*. Swedenborg, No. 58. *The Fibre*, Swedenborg, Nos. 201-4, 249-254. *Posthumous Tracts*, Swedenborg, Chap. VIII,—Animal Spirits. *The Soul or Rational Psychology*, Nos. 121, 123-8. E. A. K., Part II, No. 204.

nuclear centres of the units or "leasts" of the body. <sup>6</sup> Here at the very nuclear centre of these "units" of the body, the nervous juice which Swedenborg terms the Animal Spirit, is expressed from the fibre at every contraction of the cortical gland from which it issues. For where the "fibre" goes, there goes the nervous fluid, or animal spirit: and where the fibre terminates, there its fluid is poured out. <sup>7</sup> Other of the brain cells or cortical glands <sup>8</sup> have fibres which go no further than to the great blood-lakes and into the blood, making it nervous and vital.

This blood then goes its rounds till it reaches the general red-blood capillary system of the body. There the animal spirit or pure nervous juice *resolves itself*, by vital osmosis, through the tissue walls, from its "entangling connections" and "compoundings" in the red blood, and passes into the body spaces as lymph or white blood. <sup>9</sup> Here it enters into the individual body-cells at the time of their diastole, which, as it were, attracts or draws it in: and within the cells it meets that nervous juice or animal spirit which has come down into their nuclear centres by the interior way of the "simple fibre." Something like a vital marriage seems here to take place between these two streams of nervous fluid thus entering the cell,—the one from within being the pure nervous fluid direct from the cortical gland through its fibre, the other from without,<sup>10</sup> bringing adjoined with it, something from the nature and the heterogeneity of the red blood, as well as sundry modifications from those tissues through which it previously may have passed.<sup>11</sup>

It is by means of this marriage that out of the two elements, "simple fibre" and blood, all the body is compacted. <sup>12</sup>

After this functional meeting and marriage, all the nervous

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<sup>6</sup> *Animal Kingdom*, Nos. 315 (note e) 539. *The Fibre*, Nos. 133, 219.

<sup>7</sup> *The Brain*, Swedenborg, Nos. 69, 689. *The Fibre*, No. 147.

<sup>8</sup> *The Brain*, No. 659. <sup>2</sup>

<sup>9</sup> *Economy Animal Kingdom*, Part II, No. 222. *Animal Kingdom*, Nos. 167, 169, 181.

<sup>10</sup> This meeting in the cell, of the two streams of what is thus intrinsically the same animal spirit,—one stream coming from without, one from within, has its analogy to the meeting of the mediate and intermediate influx in the human being, everywhere, upon every plane.

<sup>11</sup> *Animal Kingdom*, Swedenborg, No. 541.

<sup>12</sup> *The Fibre*, No. 156. *The Brain*, No. 83. *Divine Love and Wisdom*, No. 370.

fluid or purer blood which the cells themselves neither appropriate nor need for their "uses," is gathered carefully into the general lymphatics and returned into the red blood.<sup>13</sup> This red blood, carrying thus that vital nervous juice or purer blood which has performed services in the ultimate texture of the body, and been modified thereby, goes to the heart, and is by the heart sent again to the cortical glands.<sup>14</sup> Here, in the cortical glands, exists an especial mechanism. From the inner coat of the red blood capillaries, all along their course in the brain, delicate fibres arise, called by Swedenborg "emulous fibres." These "emulous fibres" are the channels by which the nervous fluid in the red blood tides, resolving itself a second time from such red blood connections as it may have formed, passes into the cortical glands as lymph. No red blood ever enters a cortical gland.

These emulous fibres, the channels of the fine lymph-vascular circulation in the brain, are knitted and contextured together to form a certain portion of the circumferential layer of each cortical gland.<sup>15</sup> A certain portion of each cortical gland is thus a true erectile and expansible tissue, being woven entirely of the vessels of the purer or intermediate blood, the lymph.

The stream of the resolved purer blood or lymph passes through this net-work of "emulous fibres" which are "its own" vessels, filling all their channels full and making the tissue of their net-work tense, and firm; and its stream is then emptied into a sort of central cavity or ventricle of the cortical gland. From which cavity or ventricle it is again at every contraction of the cortical gland, impelled along the nervous or "simple" fibre issuing from that gland.<sup>16</sup>

This is the round of the white or purer blood circulation, the intermediate blood, which according to Swedenborg is a nervo-lymphatic circulation; the "juice" of the nerve fibres and the lymph of lymph spaces and lymphatics belonging to one and the same "circulation." From this also it will be seen that (1)

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<sup>13</sup> *Animal Kingdom*, Nos. 167, 169, 181. *The Brain*, No. 661. *Economy Animal Kingdom*, No. 222.

<sup>14</sup> *The Brain*, Swedenborg, No. 58.

<sup>15</sup> *The Fibre*, Swedenborg, Nos. 129, 163, 168-171, 201, 209. *The Brain*, No. 58.

<sup>16</sup> *The Fibre*, Swedenborg, Nos. 197, 202. *The Brain*, No. 56.

the lymph is a nervous fluid; <sup>17</sup> (2) that the nervous juice or "animal spirit" of the nervous or "simple" fibre, is related to the lymph of the lymph vascular-system as arterial blood is to venous; <sup>18</sup> (3) that while the circulation of the red blood is a mechanical-vital round which makes its circuit by an unbroken continuity of open vascular channels, the circulation of the white or purer blood is a chemical-vital circulation: in the return round of which, on its way from peripheries to centre again, vital osmotic passage through tissue and cell is part of its regular path; and chemical alterations are concomitant to every step of its progress. <sup>19</sup> (4) And of this white or purer-blood circulation, it will be seen that the gray matter cells or cortical glands are the headquarters and heart. <sup>20</sup> For there are as many forces of the animal life and kingdom, "as many little brains, eyes, internal sensories and animatory hearts, in a word "as many active principles and origins of vital modes" as there are cells in the gray matter; <sup>21</sup> and every cell of it is a brain in miniature.

Yet the principles of these motions, these forces, these faculties, of the cortical glands or gray-matter cells, must be sought for in the interiors of the cortical glands in those finer cells of the pure cortex which are within. <sup>22</sup> For in all this, what the mass and sum of the cells of gray matter is to brain and body, the cells of pure cortex within each cell of gray matter are to that cell itself and its fibre. For the pure or simple cortex is the nervous matter of the nervous matter, cortex of the cortex, and the constructive operative vital relations of the cells of the

<sup>17</sup> *The Brain*, Nos. 58, 69, 659-2. *Animal Kingdom*, Nos. 167-9, 181. *Economy Animal Kingdom*, Part II, No. 222.

<sup>18</sup> *The Fibre*, Nos. 133, 168. Especial note should be made right here of the fact that Swedenborg terms the whole nervo-lymphatic circulation when he speaks generally, the "intermediate or purer blood," and sometimes the "animal spirit." But when he is speaking exactly with all the distinctions, he always reserves the term "animal spirit" for the *nervo*-side of it, and calls the lymph or venous side, the purer blood, or simply the lymph. Still, they are simply as the arterial and venous sides of one circulation.

<sup>19</sup> *Economy Animal Kingdom*, Nos. 82, 93. *Animal Kingdom*, Nos. 169, 179-80. *Posthumous Tracts*, Chap. XXIII.

<sup>20</sup> *The Fibre*, Nos. 135, 141, 163, 168, 197, 202. *Economy Animal Kingdom*, Part II, No. 124.

<sup>21</sup> *The Fibre*, No. 59.

<sup>22</sup> *The Brain*, No. 58. *The Fibre*, Nos. 249, 250. *The Soul, or Rational Psychology*, Nos. 121, 123-8.



pure cortex are to the gray matter and its fibre, as are the relations of that gray matter and fibre to the body at large. Without fibre, no body; without cortical gland, no fibre; without simple cortex, neither gland nor fibre; and thus no body.

The cells of the pure cortex within each cortical gland constitute, as has been said, a complex organism. This is patterned according to the form of the paternal species, and bears stamp not only of the species type, but of all its particular hereditary modifications as well. Thus it can serve as both the body and the instrument of corresponding spiritual forces and endeavors.

In case of animals, the cells of this pure cortex within the cortical glands are relatively simple and uncomplex. Nor is their substance other than that of the gland itself; for they are formed from the same *ether*, the second or magnetic-ether, which reigns in the gland: the cortical glands both in animals and human beings being framed to the characteristic vibrations and actually made as to the larger part of their very substance of the molecules of the second ether,<sup>23</sup> (termed by Swedenborg, the Second Aura),—with perhaps something of the next lower ether circumferentially adjoined.

Now, as the simple cortex is in substance and force, so also is the purest blood, called spirituous fluid, which flows in and from the “finest fibrils” of the simple cortex, and is the formative protoplasm of the body.<sup>24</sup>

Thus in case of animals their pure cortex and their formative protoplasm may indeed be regarded as the vital nuclear centre of the cortical gland; but yet both wholly belong, as to substance and force, to the same plane as that gland: instead of standing, as in human beings, as to their very substance an entire and discriminated grade above the cortical gland.<sup>25</sup>

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<sup>23</sup> *Leaflet Corpuscular Philosophy*, Swedenborg. *Post. Tracts*, Chap. XIII. *Economy Animal Kingdom*, Part II, Nos. 272, 338, 344-2.

<sup>24</sup> *Economy Animal Kingdom*, Part I, Nos. 165, 221-45. Part II, No. 204.

<sup>25</sup> *The Soul*, Thesis XI., (From E. A. K.). The animal spirit and the spirituous fluid are thus in the case of animals *intrinsically* one and the same thing. Because this is so, Swedenborg, when treating of animals, frequently used the one term, “animal spirit,” to cover the ground of both. For while human beings have three bloods or fluid-protoplasms discretely discriminated both as to substance and force, animals cannot be said to have truly three: for the spirituous fluid of animals but

The cortical glands formed of the substances and according to the modes of motion of the second or magnetic *ether*, thus constitute, as it were, a ground or plane common to animals and human beings; at least they bear such a common ground or plane as to substances and force, but not as to form. For the cortical glands themselves are woven by and according to the simple cortex,<sup>26</sup> and this is entirely different in the two.

In the human being the cells of that pure cortex within the cortical gland are exceeding complex in arrangement; they are not formed of the same *ether* that the gland is formed of, but of an *ether* of discretely higher grade; nor are they simple uncompounded cells as with animals, but they are cells within cells in a three-fold composite.<sup>27</sup> So that each cell is composited in such order that aggregates of the first or finest units constitute a second larger-unit or whole; and aggregates of these again constitute a *third* still larger unit or most-general whole, which *third* is the very cell of the aforesaid simple cortex. For human beings have an interior spiritual organism of three degrees which finds form in the three-fold cell of the simple cortex,<sup>28</sup> while animals have a spiritual organism of but one degree or plane.<sup>29</sup>

Now in the human being this pure cortex is framed, as to its active "natural" substance, from the very molecules and according to the native movements of the First or Universal ether, the "First Aura," as Swedenborg termed it; that Aura which is universal indeed both as to substance and force; and prior to all: and which in its own substance and force would remain uninjured although the suns of the starry heavens were destroyed. And the human spirituous fluid or purest blood

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emulates a true spirituous fluid, since in them the spirituous fluid is no other or more than the pure and homogeneous form of their animal spirit itself.

Thus animals may be perceived to have in verity but *two* bloods, the purer or nervo-lymphatic, and the red blood; although their purer blood in its unadulterated homogeneous form as conceived in the cells of the simple cortex *acts the part* of the spirituous fluid in their body: emulating thus both its offices and its powers.

<sup>26</sup> *The Soul*, No. 121.

<sup>27</sup> *The Divine Wisdom* (A. Ex.) II., III.-2, III.-4. *Divine Love and Wisdom*, No. 345. *Spiritual Diary*, No. 3148.

<sup>28</sup> *Divine Love and Wisdom*, Nos. 315, 346.

<sup>29</sup> *A. C.*, 4141-2, 4224. *The Soul*, No. 128-8.

which is the veritable human formative protoplasm, and the universal formative and reparative substance and force in the human organism, is formed purely of the same Universal Aura.<sup>30</sup>

Therefore it is that Swedenborg says the human spirituous fluid hardly can be said to partake of materiality.<sup>31</sup> And it is this spirituous fluid which is the *prior* of all things else in the body; and it forms and enters into two things, the simple cortex with its produced finest fibrils, and the animal spirit; by means of and through which the successive lower planes of the body are vitally framed. But always and always it is *itself* universal through the body, and always it is the soul's correspondent and other self therein;<sup>32</sup> and everywhere universally in the body *it* is the active force, operating, ruling; while the simple cortex and the cortex, secondarily produced, constitute, as one might say, but "a province" of this its living kingdom.<sup>33</sup>

Alike with animals and human beings, however, the cells of the pure cortex embody and instrument the species-type and the heredity; and they constitute the vital nuclear centres of the cortical glands or gray-matter cells, acting apparently into these latter as they in turn act into the body; so that we may call them truly cortex of the cortex, and nervous substance of the nervous substance.<sup>34</sup> While the spirituous-fluid, the "other self," and vicegerent of the soul in the body, is as the very and immediate glove through which works the forming hand of the correspondent high spiritual and living force. For from the cells of the most pure cortex, themselves formed of spirituous-fluid composited with inert particles,<sup>35</sup> there proceeds a finest and purest fibril. In these finest purest fibrils flows the spirituous-fluid; highest fluid protoplasm of the body, and immediate

<sup>30</sup> *Organs of Generation*. Swedenborg, No. 54. *Athanasian Creed* (A. Ex.) page 8. *Economy Animal Kingdom*, Part I, Nos. 52, 635. Part II, Nos. 165-6, 199, 200, 228, 272, 312-3, 338-9, 344, 348.

<sup>31</sup> *Economy Animal Kingdom*, Part I, No. 638. Part II, No. 166.

<sup>32</sup> *Economy Animal Kingdom*, Part I, Nos. 171, 247, 340, 600, 634-8. Part II, Nos. 205, 219, 269, 275. *The Fibre*, No. 250-4. *Post. Tracts*, Chap. VIII., Animal Spirit.

<sup>33</sup> *Economy Animal Kingdom*, Part II, Nos. 110, 204, 228 (296-7 especially). *The Fibre*, No. 261. *The Brain*, No. 58. *The Soul, or Rational Psychology*, Thesis VI. (taken from E. A. K). *Post. Tracts*, The Animal Spirit.

<sup>34</sup> *The Brain*, No. 58. *The Fibre*, No. 59. *The Soul*, No. 124.

<sup>35</sup> *Economy Animal Kingdom*, Part II, 296-7. *The Fibre*, No. 261.

plastic other self of the whole soul in the body.<sup>36</sup> From part of these cells of the pure cortex within each cortical gland, long "fibrils" proceed, and these long "finest, purest and most eminent fibrils" by their circumgyre form and weave that simple or nervous fibre which issues from the cortical gland and carries the Animal Spirit,<sup>37</sup> or pure unmixed and vital nervous juice. From other of the cells of pure cortex within each cortical gland short "fibrils" proceed, which go to the little central cavity or ventricle of the cortical gland itself,—that same ventricle or cavity which also is the receptacle of the stream of lymph or resolved-blood, coming back through the "emulous fibres" from the red blood.<sup>38</sup> Thus this highest blood, this most pure spirituous-fluid, carrying and embodying thus the living paternal species-type, or image of creation," enters into the Animal Spirit, or pure nervous fluid,<sup>39</sup> even as that in turn enters into the red blood, making it nervous and vital. And thus this spirituous fluid reigns supreme in the lower bloods, as well as in that fine "tissue plane" of the body, which its own finest fibrils pattern and contexture, when themselves forming the simple fibre and blood vessels.

III. *The Gray Matter Cell or Cortical Gland is Played Upon by Vital Fluids Coming from Two Directions; One of a Higher Nature and Power, One of a Lower.*

Through the cortical glands there is thus seen to be a circulation of active nutrient fluid-protoplasms entering them from two directions. From *without* comes the stream of lymph, the white or purer blood, itself resolved from the red blood or grosser fluid-protoplasm of the body. From *within* enters another fluid-protoplasm, that pure and subtle fluid-protoplasm expressed from that most fine simple cortex inside each cortical gland.

This is the highest protoplasm or living substance of the

<sup>36</sup> *The Fibre*, No. 250.

<sup>37</sup> *The Fibre*, Nos. 249, 250, 253, 254.

<sup>38</sup> *The Fibre*, Nos. 129, 163, 168, 197, 201-2. *Economy Animal Kingdom*, Part II, Nos. 165, 204.

<sup>39</sup> *Posthumous Tracts*,—Animal Spirit,—Chap. IV., 5; XVI.

body; it is the first living fluid formed, and is itself formative of all the rest. Swedenborg calls it the purest-blood, the most active blood, the spirituous-fluid, the formative-substance, the corporeal-soul, the soul's other self, and sometimes simply "the soul."<sup>40</sup> This is the protoplasmic-fluid which carries into effect the species type in formation, growth, restoration. It is a living substance and reigns universally in the whole body.<sup>41</sup> In mankind it is the anthropoplasmic-substance indeed. And as it was the "instrumental means" in the first formation, it is the "instrumental means" in growth, modification and restoration; and thus the very and inmost active agent in "nutrition."

Into the cortical glands then these two inflowing streams enter, one of a higher nature, one of a lower. The first, the human spirituous-fluid, coming from the cells of that simple cortex within each and every cortical gland, and ultimating and embodying the human-soul itself, thus enters the cortical gland centrally or by an interior way; being expressed into a certain cavity or ventricle in the substance of the cortical gland.

The lymph or purer-blood resolved from the red blood, enters the cortical gland from without; flowing into a wonderful and complex structure woven of "emulous fibres" which by their contextured network form a true "erectile tissue." This structure the inflowing purer-blood fills to impletion, expansion, sensitive-tension and potency of function. Passing through this network thus, it is then expressed into that *same cavity* or ventricle into which the spirituous-fluid, the high generic protoplasm, the anthropoplasmic and highest-blood, is expressed from the simple cortex. Thus in the same ventricle of the gland as in a little common chamber these two streams, coming from different directions, one from the pure cortex and the soul, one from blood and body, meet and mingle and or-

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<sup>40</sup> When he calls the spirituous-fluid simply "the soul," however he always somewhere in the context guards such use of the term by explaining that as the spirituous-fluid is in the body the immediate instrument and body and organ of the *soul*, and thus the soul's other-self and active presence and operation in the body, he in this sense used the one term for both. See "*Economy Animal Kingdom*," Part II, No. 245.

<sup>41</sup> *Economy Animal Kingdom*, Part I, Nos. 173, 600. Part II, Nos. 205, 219, 221-2, 269, 275.

ganically unite.<sup>42</sup> And it is this mingled vital fluid, this union of these two protoplastic-fluids, which is at every contraction of the cortical gland expressed along the simple fibre issuing from that gland, to those offices in the blood, and the body-cells, of which we have treated. And by this means both the blood and the cells of the body have given them continually the vital nervous juice<sup>43</sup> or animal-spirit, into which fresh supplies of the highest formative generic protoplastic-fluid thus perpetually enter.<sup>44</sup> forming its own inmost and most active element; for that which is highest and purest is always inmost.

It is to be noted especially, moreover, as of important significance to the practical results of this "meeting and mingling" and organic conjunction of this resolved red-blood thus returning as lymph to the cortical gland from its bodily sojourn, activity and "experience," and entering the chamber or ventricle of the gland to be there organically united with the pure high generic protoplasm, that this resolved blood thus returning as lymph now represents and actively and potently carries the humors of the blood, the states of blood and body; their poisons, their variations. And this not only in obvious meas-

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<sup>42</sup> It is to be especially noted right here that there is in addition one other passageway from without, entering each cortical gland. It is, however, of the nature of an alimentary canal, and connects with certain imbibing pores of the outside skins, and by these canals enter those supremely subtle volatile particles carried by the air, and ether, and purer ethers still,—particles derived from the floating "spheres" or surrounding cloud of effluvia about all matters, and more especially all living matter, whether vegetable, animal or human. For the airs and ethers are full of such substances, and they and they only are the appropriate and appropriated "food stuffs" of the "higher protoplasms" of the body, "the terrestrial food" of our feast tables never by any degree of sublimation, Swedenborg says, attaining that high honor and service. The action of these little feeding pores of the skin is under special governance of the soul itself.

*Adversaria*, 1457-12; *Animal Kingdom*, 406-7, 504, 509, 512, 517, 519, (note m) 540. *Spiritual Diary*, 1035, 1738. *The Soul*, 37, 48.

<sup>43</sup> The general nerve is a rather heterogeneous assemblage. All sorts of fibres go into it. But here we refer to the pure active nervous fluid or animal spirit.

<sup>44</sup> Perhaps this intermediate position of the animal spirit as thus consisting of a mingling of two protoplastic fluids led to its name of intermediate blood. On this see *Posthumous Tracts*, Chapter on Animal Spirits, *Economy Animal Kingdom*, Part II, Nos. 204, 305. *Divine Love and Wisdom*, Nos. 370, 423.

urable chemical variations, but in unobvious-vital operative powers and tendencies.<sup>45</sup> It is a simplest known fact that generally, throughout the body, this is true. Not less true, more true is it, when as the summed result of the "bodily life" or activity on the corporeal plane it returns as lymph or resolved blood<sup>46</sup> to the cortical gland, the sensitive "receiving room" of all the "modes and manners" of the breathing, feeling life and operation.

Thus what this returning stream of the purer-blood which went forth as Animal Spirit, through the "artery"-fibres, to the blood and the corporeal-units, and comes back resolved as Lymph through the "veins" of the "emulous" fibres,—what this returning living stream brings with it, and what it adds to the stream of the purest blood when mingled with it, is something individual to itself, more external, heterogeneous, and possibly full of the fevers and poisons of the blood and the gross bodily life.

IV. *Mechanism of the Cortical Glands Immediately Concerned in the Phenomenon of Alternating States of Sleep and Wakefulness in Living Breathing Creatures; and How That Mechanism is Operated by the Stream of the Purer-Blood or Nervo-Lymphatic Circulation to Produce Intermittency of Functional Potency and Action.*

To recapitulate briefly;—this then is the round of the "intermediate," the purer-blood or nervo-lymphatic circulation.<sup>47</sup> At each contraction of the cortical glands, the animal-spirit or "arterial-purer-blood" is driven from the glands along "the fibres" to their outlets; attaining thus, apparently, two diverse goals. For part of the animal-spirit finds itself at last at the peripheral or end-organs of the fibres, in the heart of the "corporeal units" of the body; and part of the animal-spirit finds

<sup>45</sup> *Animal Kingdom*, No. 541.

<sup>46</sup> *The Brain*, No. 58.

<sup>47</sup> *Posthumus Tracts*. Red Blood, Chap. III.

itself in the red-blood tides. But the goal is the same in the end. The animal-spirit borne on in the red blood vivifies it, keeps it fluid, mobile, alive, builds red blood corpuscles, and forms and reforms it continually into a literal fluid-structure, only less marvelous than its own. So that the red blood with its stores of "foods" and ærial "salts" gathered from the outside world by the alimentary-canal and lungs, and with also this *vital builder*, the animal-spirit, within it, is, as it were, the complex and sum of the body and the world also, in liquid form.

For wherever the animal-spirit may be, it likes nothing more than to be building structures. It is the very conatus and life of the vital fluids of the body to be at structure building; and they throw their very selves into the work they build as if they desired perpetually to see themselves in the other selves they form, and to work, as it were, with a new pair of hands.<sup>48</sup> Thus it is that their work is a true formation and growth, and is "alive," for they themselves are also within it.

With the red-blood tides, the busy animal-spirit is borne thus along to the peripheral circulation. Here it freely resolves itself, by vital osmosis through the capillary wall, and entering the general tissue of the body, comes at length, as its own ultimate goal, to the *outside* of those "corporeal units" *within* which, in the very centre and heart of which, there is already that other portion of the "generated-animal-spirit" which has come down into them more immediately from the glands, through the fibre weaving their very nuclei.<sup>49</sup>

At this point, entering the cells and corporeal "leasts" as they alternately expand and contract, these *two streams* of the purer-blood coming thus, the one from within and the other from without, are united and re-united with something like a marriage; fertile in constructive uses to the cell itself, and further functional uses to the general economy.

Afterward, all of this living busy purer-blood over and

<sup>48</sup> *Animal Kingdom*, No. 183 (note 1).

<sup>49</sup> *The Brain*, No. 69, 689. *The Animal Kingdom*, No. 315, 539.



above the requirements of these uses,<sup>50</sup> is carefully gathered into the lymphatics, and through the great lymphatic duct, restored to the heart and the red blood circulation; busy all the way also, so that of the very chyle poured at intervals into the great lymphatic-duct, along with it, it begins to organically build red blood cells as it goes. Until the chyle which near its entrance into the Thoracic-duct has no red-corpuscles, by the time it nears the heart begins to show them, Gamgee says, and generally to manifest characteristics and properties resembling those of the blood itself. By the heart this red blood, carrying thus the whole lymph of the body, is in turn sent to the brain again; and in the brain, a second time resolving itself as lymph or purer blood from the red blood of the capillaries, it goes through the channels of the delicate and complex network of the "emulous fibres" and enters again the little chamber of the cortical gland from which it went out,<sup>51</sup>—in "this progress" the "vessels emulous of fibres" thus constituting the very channels through which this resolved red blood,—this venous blood of the "purer blood circulation" enters the cortical gland on its return round from the body. Here in the chamber of the cortical gland it is itself renewed and revived by the spirituous-fluid entering that chamber by way of the simple cortex,<sup>52</sup> and is then sent forth again upon its round, as "animal spirit."

This is the great bioplastic-round of the purer-blood, or nervo-lymphatic circulation.

Now the general round of this purer blood circulation as it is carried on in the extremes of the *body*, the ultimate "corporeal units" of tissue and cell, seems to be carried on pretty much the same, sleeping or waking; with some weight in favor of its better nutritive activity during sleep. But the round of this purer blood or intermediate circulation in the cortical glands is not carried on the same, asleep and awake. During

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<sup>50</sup> *The Brain*, No. 661. *Animal Kingdom*, Nos. 167, 169, 181. *Economy Animal Kingdom*, Part II, No. 222.

<sup>51</sup> *The Brain*, No. 58.

<sup>52</sup> *Economy Animal Kingdom*, Part II, No. 165.

sleep, the resolved blood or lymph does not enter the channels of these "vessels emulous of fibres" at all.<sup>53</sup>

In the first instance, when the purer blood flows through them, the whole network of emulous fibres is filled to impletion, tension and functional potency by its stream, as an erectile tissue is with red blood, as the tissue of the lungs is when the torrent from the pulmonary artery pours into them. When the stream of purer blood does not pass through the "emulous" fibres, they fall all flaccid, collapsed and emptied.<sup>54</sup>

During the time of the impletion, expansion, tension and functional potency of this network of "emulous fibres," *consciousness exists*. When the stream of purer blood is turned away from them, and the whole fine structure they form falls flaccid and collapsed as a lung without blood in it, *consciousness is lost*. The perception of ends disappears,—and the man

<sup>53</sup> *The Brain*, No. 79. *The Fibre*, Nos. 168, 172.

<sup>54</sup> There is an interesting question here as to just what and where is the heart-structure part governing the fluid protoplasm or "blood-supply" of this specialized cortical mechanism of "emulous fibre."

In a general way the cerebellum has a good deal to do in producing states of sleep. Anything which strongly excites the cerebellum tends to produce the state of unconsciousness in the cerebrum. (For this see *Diseases of Fibres*, No. 429. *The Brain*, chapter on the cerebellum.)

This does not really cover the case, however; there must be an individual and separate structural governance of the purer-blood supply entering the "emulous fibre" tissue-structure belonging to the individual and separate cortical gland. Not only does "the analogy" require it, and the principle of the interaction of the parts of a twin organism as the accompaniment and organic premise of consciousness, but it is required also by the phenomena of dreams, as well as by many pathological states.

Concerning the lung-side of this mechanism, Swedenborg has given us many and unmistakable particulars: but concerning the heart-side, almost none at all; at least to the best of my present study and recollection. It would be worth while for students of Swedenborg to watch out for particulars on the subject dropped in somewhere in his rich and voluminous note-books, perhaps merely as a comment or side-issue to the topic in hand.

In my present knowledge I incline to the opinion that the heart function or governance of the "purer-blood" supply to the emulous fibres of the cortical gland, is performed by the eminent fibrils of the inner coat of the arteries, the ramifications of the pia-mater, and probably the outmost covering of the gland itself, under the direction and by the motion of the spirituous fluid or soul. Following in this the analogy of the *Soul's* immediate rule over the action of the "imbibing mouths" of the corporeal fibres in the skin. (For generals concerning the "imbibing mouths" of the skin, see foot-note second in the third chapter of this paper.)

*sleeps.* This especial fine tissue—network in the cortical gland, woven thus of “emulous fibres,” the blood supply of which is thus intermittent, and the varying state of which depends on its “blood supply,” is so absolutely and synchronously associated with the immediate appearance or disappearance of *consciousness*, indicate it as the specialized structure upon the plane of the purer blood appropriated to the function of perception of ends,—as the lungs are, more generally, upon the red-blood plane. With their impletion and functional tension, the perception of ends being present, with their collapse this perception of ends being shut off. From this point of view, the network of emulous fibres in each cortical gland may be called the lung of the cortical gland; and the whole sum and mass of such emulous fibre structures in the brain be regarded as constituting the lungs of the cortex. Its alternations of state being illustrated by the prenatal and postnatal conditions of the lungs of the body.

The whole plane of this emulous fibre would appear to belong quite particularly to the apperceptive faculty.<sup>55</sup> At any

<sup>55</sup> It is a pertinent question here how far and with what modification the “emulous fibres” enter into the structure of the gray matter of cerebellum and spinal cord. For the cerebellum is in greatest functional activity when the cerebrum sleeps, so that it is said to wake when the cerebrum sleeps and sleep with the cerebrum’s waking. (*Diseases of Fibres*. No. 429.) Yet the gray matter cells are said to be of similar stock and nature everywhere. (*The Fibre*, No. 60.) Although they differ freely in their function. (*Economy Animal Kingdom*. Part II, No. 193-5.)

Still, there is *one instance* in which upon *one point* a whole class of gray matter cells is distinguished and, as it were, set apart by themselves. The gray matter cells of the *cerebrum* and the *corpora striata* are said in the case of “embryos, young infants, and the young of animals,” to be “not entirely formed:” but to grow up “by education at once to their solidity or consistency, and to their degree and series.” (*Economy Animal Kingdom*, Part II, No. 194.) In view of what Swedenborg says of these “emulous fibres” and their place and use, in view also of the statements of *The Brain*, No. 79, and *Diseases of Fibres*, Nos. 422, 427, that in sleep the red blood and purer-blood do not approach the individual cortical glands and the cerebrum is collapsed,—and that in sleep the cerebrum returns to the state in which it was in the womb (*Diseases of Fibres*, No. 421),—and also considering the law that parts develop according to their use, a law which is in especial force in the nervous system, there would certainly seem to be some inference that it is precisely this net-work of emulous fibre tissue which is in the cells of cerebrum and corpora striata so undeveloped and frail at birth.

Possibly this is why infants sleep so much, and the “apperceptive life” is slow to develop.

rate, the presence or absence of the individual consciousness as varied by sleep or waking absolutely attends the turning on or the shutting off of the stream of purer blood going through the specialized tissue of emulous fibres existent in the cortical glands.

Also,—as the student will not have failed to notice, two ends at once are served by this mechanism in the cortical gland.

When the man sleeps, the lymph tide bearing the humors and fever and poison of the blood no longer enters the central chamber of the gland, and thus no longer mingles there with the pure high generic protoplasm of the body, having ingress into that chamber from the pure cortex existent within each cortical gland. Then that pure human spirituous fluid within the gland, taking up the next lower *ether* and the delicate atmospheric and *ethereal* chyles brought to the chamber of the gland by the fine alimentary canals of the corporeal fibres,<sup>56</sup> with them weaves by fine compactures its proximate fluid body of the next lower plane, the animal-spirit; without interference from the reactivity of blood and body, and the introduction of heterogeneous or fevered matters by the resolved blood or lymph. Acting thus in its pure activity, the animal-spirit which it prepares during sleep, is “obedient,” “complying;” a true and “correspondent” body of the high-spirituous-fluid; and thus adequately and effectively expressive in all its conatus, trend, endeavor and organic structure building, of the directing endeavor of the high pure spirituous fluid itself. In consequence, *during sleep* the cortical glands send a more “uncontaminated” and fine animal-spirit through their fibres to the cells of the body and to the mass of the blood; for now the animal-spirit is simply the “other self” of the spirituous fluid come down and active upon a lower plane of substance and force.<sup>57</sup> Thus the human-spirituous-fluid, proximate embodiment of the soul and formative substance, by means of which the body was first formed and which always is restorer of its hurts, now passes according to its own free order and almost in homogeneous purity to the heart of every cell in the body,

<sup>56</sup> *The Brain*, No. 79.

<sup>57</sup> N. B.—*Economy Animal Kingdom*, Part II, Nos. 273, 281, 305.

and every least drop of blood. And as it framed the body pre-natally, so now in sleep it restores that fabric without hindrance from the heterogeneities and fevers and poisons of the returning lymph stream. Thus it is that

“Sleep knits up the ravelled sleeve of care.”

A very beautiful parallel exists between the state during that prenatal sleep during which the Lord first formed the human body, operating in and by means of that higher spirituous fluid, and this sleep reoccurring each twenty-four hours when the “limited perception of ends,” the inaccurate practice work of slowly developing apprehension of measure and relation, the mistaken and mischievous activities of the conscious life, are all dropped out with the loosening of tension in this specialized tissue of emulous fibre in the cortical glands; and the individual conscious apperceptive life of the man is quieted, stopped in its play, laid to rest; while the high spirituous fluid restores the fabric of that body which it wove.

This parallel is something more than a beautiful likeness and illustration. It probably closely approaches the literal fact; for Swedenborg says that in sleep the cerebrum veritably returns to that state in which it was in the mother’s womb.<sup>58</sup>

This, then, is the mechanism in the cortical glands and the varying course of the purer-blood circulation, invariably associated with the phenomenon of alternating states of sleep and wakefulness in living, breathing organisms.

A profound question arises here, based upon the fact that the human organism possesses three distinct fluid-protoplasms, discretely discriminated from each other. It is a question thus formulated by Prof. Mann, “According to general principles, there must be a third degree of unconsciousness which should correspond to those depending on red blood and white blood respectively. It should be connected with the purest blood. Query: Has this anything to do with death? i e., is the simple cortex a heart whose lungs first come into function upon birth into *the life*?”<sup>59</sup>

<sup>58</sup> *Diseases of the Fibres*, No. 421,

<sup>59</sup> *Appendix*. The appendix referred to in the notes, to be printed in a later number of the *New Philosophy*.