

### INTRODUCTION

Thousands of years ago, King Solomon loved the Lord and earnestly prayed: “Therefore give to your servant an understanding heart to judge Your people, that I may discern between good and evil” (I Kings 3:9). Clearly he wanted a balance of thoughts and emotions that would give him the wisdom needed to be an effective leader of his people. The phrasing of Solomon’s prayer to God suggests an assumption that a good conscience would be located in his heart, that this is where he would receive the Lord’s influx. To this day, people speak of feeling love in their hearts, while they consider the brain to be the location of human thoughts. But where does the Lord actually conjoin Himself with us? Does He meet us in the conscience, where we “discern between good and evil,” and is that the same as the seat of the soul? “Conscience is a new will and a new understanding received from the Lord and so is the Lord’s presence with a person” (AC 4299).

Over 270 years ago, Swedenborg was analyzing the notes of medical research scientists and coming to his own conclusions about the location of the seat of the soul. He made some amazing assertions, but did not complete his work of exactly identifying the specific part of the brain

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<sup>\*</sup> This article is based in part of the author’s intensive study of the conscience during the Bryn Athyn College Professional Development Research Project, in the summer of 2009. This was both a secular and a Swedenborgian analysis. The author would like to express gratitude to Linda Simonetti Odhner for advice during the editing process, and for her medical illustrations.

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where God conjoins to the human being in thoughts, affections, and judgment. Now we have the benefit of modern tools to help us map the brain.

My thesis is that the anterior cingulate cortex is active when a person is monitoring errors in feelings, actions, and decisions, so this is the location of the human conscience, and could be the seat of the soul.

## BACKGROUND

For many years before Swedenborg's spiritual eyes were opened in the 1740s, he was deeply involved in a search for the location of the soul in the human brain. During this time he analyzed the anatomical findings of many scientists whom he visited in Europe while on a leave of absence from his work with the Board of Mines. At the beginning of *Rational Psychology* he stated his plan:

I have undertaken to search out with all possible zeal what the soul is, what the body, and what the intercourse between them, and also what the state of the soul is when in the body, and what her state after the life of the body. (*R. Psych.*, 1).

He seemed to come to various conclusions at different times. According to Morley, "Swedenborg speculated on the physiological nature of the soul and deduced...the soul...was everywhere in the body...the mind, the handmaiden of the soul was located in the cerebral cortex" (Morley, 158). However, at another point, Swedenborg stated:

... [I]n the cerebrum ... there the soul resides, clad in the noblest garment of organization (b), and sits to meet the ideas emerging thither and receives them as guests. This high and noble place is the innermost sensorium, and it is the boundary at which the ascent of the life of the body ceases, and the boundary from which that of the soul, considered as a spiritual essence, begins. (*AK II*, 428)

On closer examination, one can see that he was speculating on the distinction between the soul and the mind, as he investigated their loca-

tions. This is a very useful distinction to make, and even today many psychologists and theologians are confused about the differences.

Swedenborg was well-read in all the latest anatomical descriptions that he could gather from research laboratories across Europe. (The study of human anatomy was especially difficult because the Catholic Church tried to restrain scientists from actual dissection of the human body in autopsies or lab experiments, for fear that it would interfere with the resurrection of souls in the Last Judgment.) But Swedenborg gathered what lab notes he could and then made the astonishing assertion that the cortex of the brain functioned as far more than just another protective layer, like the bones of the skull. In fact, "cortex" is the Latin word for "rind," meaning the outer skin of a fruit. In the 1700s most scientists thought that the cerebral cortex was just another layer of tough fibers, protecting the more central parts of the brain (Norrving and Sourander 1989).

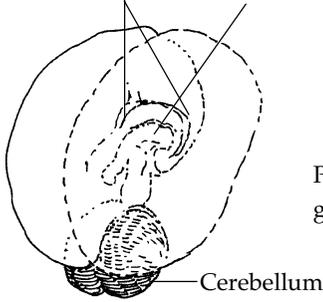
According to Wetterberg, "Swedenborg regarded the most significant parts of the brain as being the frontal lobes and cortex areas of the parietal lobes" (Wetterberg, 434). Swedenborg seemed especially intrigued when he read scientists' notes about patients who had specific brain injuries to certain lobes, causing observable paralysis or speech disorders, which were confirmed during autopsies. This focus on the importance of these lobes of the cortex of the brain was quite different from the conclusions of René Descartes in the seventeenth century. According to Descartes, it was the pineal gland that was the soul, which is located much closer to the back of the brain, above the cerebellum (Wetterberg, 429). Therefore, Swedenborg departed from others with his assertion that the front and top of the brain's cortex was the most likely seat of the soul.

### **SWEDENBORG'S DISCOVERY OF THE TRUE FUNCTION OF THE CEREBRAL CORTEX**

Previous scientists (Leeuwenhoek and Malpighi) had considered the cortex of the brain to be made up of many tiny spheres, or cortical glands. After his extensive analysis of the scientists' notes of their dissections of the brain, Swedenborg came to his own conclusion: "The cortical substance is the unit of the whole brain; in this unit or substance, then, we

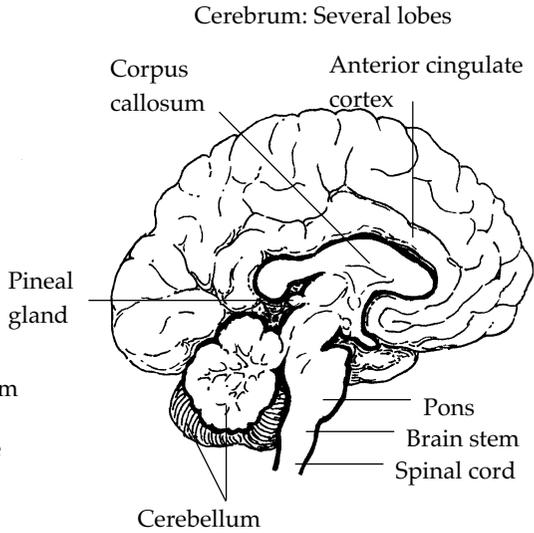
LOCATION OF THE ANTERIOR CINGULATE CORTEX

Anterior cingulate cortex, right and left, around corpus callosum

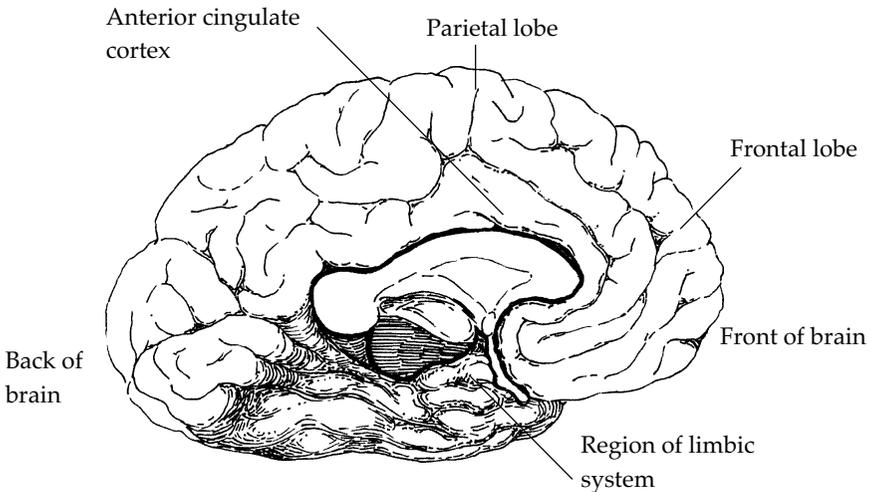


Oblique posterior view of the brain: solid lines indicate left cerebral hemisphere, while dashed lines indicate right cerebral hemisphere

CROSS SECTIONAL SIDE VIEW OF HUMAN BRAIN



CROSS SECTIONAL SIDE VIEW OF HUMAN BRAIN  
(Without Cerebellum)



Drawings by Linda S. Odhner

ought to find that superior power of which we are in quest. Therefore in this, and not in any ulterior unit, because the cortical substance is the ultimate unit of the brain, we ought to find the soul's faculty of understanding, thinking, judging, willing" (Swedenborg, *EAK*, 304). Swedenborg wrote this in the early 1740s, but his subsequent focus on the theological works prevented him from publishing his scientific works in a timely manner so that they could be distributed to other scientists. Since he was not affiliated with a university or medical research lab there was no assistant to publish his discovery on his behalf, either. Therefore, hardly any of his contemporaries were even aware of Swedenborg's assertive conclusion since it did not appear in published form nor was presented in any speech.

According to Very (2005), a modern day scientist and historian, there were other people who correctly identified the cortex as the location of all mental and moral activity and that this might be the seat of the soul. However, most of them published in the 1800s nearly 150 years after Swedenborg made his notes. One of these scientists was Julius Althaus (1833–1900).

In 1903, Swedish Professor Gustaf Retzius gave Swedenborg the credit he deserved for the amazing discovery of the "seat of the psychical functions of the cortex, and the localizations of the motor functions . . . Swedenborg was not only a learned anatomist and a sharp-sighted observer, but also in many respects an unprejudiced, acute and deep anatomical thinker" (Retzius quoted in Toksvig, 1948, 99).

### **CURRENT APPRECIATION OF SWEDENBORG'S PRE-THEOLOGICAL NEUROSCIENCE**

In 2008, a nationally acclaimed neuroscientist published an article claiming that three neuroscientists made remarkable early discoveries that their contemporaries failed to appreciate. In this article Dr. Charles Gross of Princeton University focuses primarily on Swedenborg, of whom he writes:

[His] inference was actually a radical and total departure from the contemporary literature he had just reviewed. Swedenborg then goes on to

argue that the cerebral cortex is the most important substance in the brain for sensation, movement and cognition . . . Where did Swedenborg's amazingly prescient views come from? There is no evidence that Swedenborg ever carried out any empirical investigations or visited any of the laboratories of the day. Rather his ideas came primarily if not entirely from a careful reading and integration of the anatomical, physiological and clinico-pathological literature that was available to him and that was so copiously quoted in his works . . . He paid particularly close attention to detailed descriptions and observations rather than simply to the authors' own interpretations and conclusions. (Gross 2008, 322)

A decade ago, an article by Gross was reprinted in *The New Philosophy* on this same subject, so Swedenborgian scholars are likely to be aware of this neuroscientist's appreciation of Swedenborg's anatomical conclusions (Gross, 1999, 429). But this 2008 article by Gross was printed in the professional literature for the much broader audience of neuroscientists. It was made public so recently, (only appearing on the internet in January 2009), that most secular neuroscientists and psychologists have not yet had a chance to react publicly to Gross's recognition of Swedenborg's work. It would be wonderful if they came to appreciate Swedenborg's pre-theological contributions to our understanding of the functions of the human brain and mind. Some might even be inspired to read Swedenborg's theological works on the same subject.

To take this quest to the next level, we can synthesize concepts from neuroscience, theology, and psychology. Perhaps, with neuroscientists' current methods of mapping the human brain in great detail, we can actually identify the specific part of the brain which manages moral thinking and even our capacity to communicate with the Divine, as we request His help in improving our ethical behavior. But if most scientists still avoid such theological ways of thinking, maybe Swedenborgian psychologists who do not consider spiritual topics taboo can take on the responsibility for this task.

## CURRENT DISCOVERIES OF THE SPECIFIC MORAL FUNCTIONS OF THE CEREBRAL CORTEX

During much of the twentieth century, most psychologists and neuroscientists kept theology out of their conversations. Any discussion of the soul, or its location, was handed over to philosophers and clergy. "Because the existence of the soul has resisted empirical verification, science has generally ignored the concept . . . Despite this, the term survives in the general language to mean the deepest center of a person's identity and the seat of his or her most important moral, emotional and aesthetic experiences" (*APA Dictionary of Psychology* 2007, 876).

Most psychologists felt it was simply not their problem to find the seat of the soul. They focused on what was visible and tangible. However, since developmental psychologists Jean Piaget (1932/1965) and Lawrence Kohlberg (1963) began discussing morality in a social context, interest in ethical behavior has increased during the past forty years. Kohlberg was adamant about his atheistic beliefs as he described and explained the stages of moral judgments across the life span, so his theory was considered an acceptable topic among most secular psychologists. However, theistic psychologist James Fowler built on Kohlberg's atheistic theory of moral development, and established his own God-centered theory of the stages of faith (Fowler 1980). Psychologists and theologians cautiously began talking to each other. They were not searching for the location of the soul, exactly, but they were describing, explaining, and predicting how people acquired a conscience and acted on it in their relationships with people and their God.

Kohlberg and Piaget passed away before the next era that involved discussions between medical researchers and psychologists. So they did not get the chance to integrate their psychological theories about moral development with the work of modern neuroscientists. Kohlberg and Piaget might have really enjoyed the interdisciplinary discussions stimulated by recent findings.

Some amazing discoveries came about that changed almost everything we know about the brain. In the 1970s the MRI (Magnetic Resonance Imaging) diagnostic technique was invented, which enabled research sci-

entists to form three-dimensional images of the living brain, rather than relying solely on the postmortem autopsy. Then in the 1990s the functional MRI (fMRI) was invented, which allowed scientists to localize areas of brain activity while the person was engaged in certain tasks and exercises. During the past twenty years neuroscientists have done a remarkable amount of work in mapping out the functions of the brain, based on these studies using the fMRI on people of different ages, cultures, and disabilities. They have also done extensive work on animals' brains, generalizing applicable findings to humans (Ruark 2008).

In the past decade, neuroscientists have done hundreds of studies on people making moral decisions while their brains were being imaged by fMRI. When people are monitoring their own errors, restraining their wild impulses, anticipating rewards, feeling empathy, making the effort to follow rules, or combining input from their thoughts and their feelings in order to make moral decisions, a very specific part of the brain is active while other parts are in more of a resting state. Although most neuroscientists hesitate to use the words conscience and soul, they do concur that we now know exactly where the brain manages these functions which collectively make up the conscience. It is located at a crossroads in the brain between the places:

- 1) where we feel our emotions,
- 2) where we thoughtfully decide what to do, and
- 3) also where we guide our actions.

**WE MAY HAVE FOUND THE CONSCIENCE:  
IS THIS THE SAME AS FINDING THE MIND AND SOUL?**

In the human brain, the ACC (anterior cingulate cortex) appears to be the location of the human conscience. It is wrapped around the corpus callosum, which connects the left and right cerebral hemispheres. It is behind the prefrontal cortex, and above the limbic system, and below and in front of the parietal lobes. Thus, it is the meeting place between the parts of the brain which manage careful thinking (prefrontal cortex), feelings (limbic system), and physical movements (parietal lobes). The ACC is active when people remember their past errors and carefully avoid future

mistakes, when they imagine life from other people's perspectives, put a check on their impulses for immediate gratification, and balance their thoughts and feelings during problem-solving. Therefore, it seems to be that part of the brain in which people consider their moral emotions and judgments and then plan their moral behaviors (Bechara 2007; Bush 2000; Mulert, 2005; Ladoucer 2006; Taylor 2007).

Interestingly, these findings are so new that they are not even discussed in most textbooks of psychology, even those published as recently as 2007. Judging by this indicator, psychology students at thousands of secular colleges are still *not* being taught anything about the soul, which is described as "deepest center of a person's identity and the seat of his or her most important moral, emotional and aesthetic experiences" (APA *Dictionary of Psychology* 2007, 876). Nor are they learning very much about the conscience, which is defined as "an individual's sense of right and wrong" (APA *Dictionary of Psychology* 2007, 218). In fact, if you go to most of the current textbooks for Introduction to Psychology courses taught in colleges across the United States, and you investigate their Index or Glossary of Terms, you will still not find any of the following terms mentioned: God, soul, conscience, morality, ethical decision-making, or even the neuroscientific term anterior cingulate cortex. As even stronger evidence, a major book was just published, entitled *The Development and Structure of the Conscience* (Koops 2010), and there is no mention of the soul or the anterior cingulate cortex as the neurological center of the conscience. Atheistic psychologists continue to dominate the field and avoid these important aspects of the human being, and they continue to resist synthesizing ideas from the fields of neuroscience, theology, and psychology. As a result most future psychologists are not even learning about how the ethical and spiritual brain works.

As a New Church psychologist, I want to continue Swedenborg's search for the seat of the soul with an interdisciplinary approach. I acknowledge that the soul itself is immaterial, but the conscience may be the physical receptacle of influx from heaven. Is it possible that just as Swedenborg analyzed other scientists' descriptions of neural anatomy, back in the 1740s, and came to his own conclusions about the overall function of the cerebral cortex, that we could do the same? We can analyze the published results of neuroscientists, connect them to theological con-

cepts, and then do our own deductive thinking. Therefore, after reading dozens of very recent discoveries about the brain, and coming to my own conclusions, I assert that the ACC is the conscience and could possibly be the seat of the soul. I invite others to read these studies and come to their own conclusions, and synthesize theological, psychological, and neurological concepts for a more comprehensive view of this question.

### THEOLOGY MEETS PSYCHOLOGY

When we bring the theological works of Swedenborg into this discussion, which he scribed after his spiritual eyes were open beginning in the 1740s, we see that the Lord distinguished us from other mammals by His influx into our souls and minds.

Since the soul, as to its very being [Esse], is love and wisdom, and these two faculties exist in man from the Lord, two receptacles have been created in man which also are the Lord's dwelling-places with him; one is for love and the other for wisdom; the receptacle for love is called the will, and the receptacle for wisdom is called the understanding. (*DLW* 395)

Man has two faculties, one which is called the will, and the other the understanding. Those two faculties constitute the very man. The quality of man is according to those two faculties with him. By them also man is distinguished from beasts, by reason that the understanding of man may be elevated by the Lord, and see Divine truths, and in like manner his will may be elevated and perceive Divine goods; and thus man may be conjoined to the Lord by those two faculties, which make him; but that the case is otherwise with beasts. And since man may thus be conjoined to the Lord, he cannot die as to his interiors, which are his spirit, but he lives forever. Man is not man from his form, but from good and truth, which are of his will and understanding. (*NJHD* 35)

Therefore, the Swedenborgian perspective provides us with the doctrine that people have an opportunity for a truly human conjunction with

the Lord through the mind's will and understanding.<sup>1</sup> We meet the Lord in our mind's conscience, as we monitor our mistakes and shun evils as sins against Him. The Swedenborgian perspective also explains that there are two levels of this conscience: the exterior conscience is more concerned with moral and civil goodness, while the interior conscience is more focused on sincerity and justice (*AC 139*). Therefore, perhaps it would be best to say that the anterior cingulate cortex is the location of the exterior conscience, as measured by neuroscientists. The interior conscience is harder to measure in any tangible manner, but the Lord can read our sincerity as we shun evil tendencies and try to regenerate. This interior conscience, or soul, is what we take with us after our earthly bodies die.

According to Ruark (2008) and Dingfelder (2009), now is the time for a more interdisciplinary conversation regarding the study of the conscience and the seat of the soul involving theologians, neuroscientists, psychologists, and philosophers, and I would agree. Swedenborg attempted to master each of those fields in his own time, and this enabled him to make his remarkable discoveries about the general function of the cerebral cortex, alone. Today we need specialists in each of these fields to respectfully converse with each other so as to develop a more comprehensive understanding of the moral functions of the specific regions of the cortex, such as the anterior cingulate cortex.

If we are actually getting closer to finding the exact location of the conscience and the seat of the soul, the next step for Swedenborgian psychologists would be helping people welcome the Lord's spiritual influx into their interior conscience, as a preparation for their eternal lives. □

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<sup>1</sup> We can assume that the term "will" means what neuroscientists call the limbic system, which manages human emotions. Further, we can assume that the term "understanding" means what neuroscientists call the prefrontal cortex, which is where most executive decisions are made.

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## RESPONSE TO "SEARCH FOR THE SOUL" BY SONIA SONESON WERNER

I have enjoyed reading Sonia's article on a "Search for the Soul." It confines itself to the brain, and suggests in particular the anterior cingulate cortex (ACC) as a possible seat of the soul. She quotes Swedenborg where he says that "the cortical substance is the unit of the whole brain; in this unit or substance we ought to find that superior power of which we are in quest . . . the soul's faculty of understanding, thinking, judging, willing" (*DSD*, 304).

The tenor of the article is to define the soul as "conscience," the source of discernment between good and evil, the source of morality. She says that previous scientists such as Leeuwenhoek (though his main job was as a linen draper and he used a lens to count threads in linen) and Malpighi considered that the cortex of the brain to be made up of many tiny spheres. There is good picture of this from Bidloo's *Anatomical Atlas* produced in 1685 and reproduced in Alfred Acton's translation of *The Cerebrum*, Volume.<sup>1</sup> Post mortem preparation of the brain in those days involved boiling it in olive oil, and the spheres are artefacts due to this process. Apropos this, fMRI scans of the brain and other modern methods are also artefactual. Their exact relationship to the subjective understanding and will of the subject's brain is very puzzling, even if they indicate activity in say the ACC while the subjects are "monitoring their own errors, restraining their wild impulses," etc. These things and how they relate to the soul will always remain unknowable to an outside observer. A nice illustration is from the contemporary of Swedenborg, Christopher Polhem, who watched his own funeral through Swedenborg's natural eyes and, as he says to Swedenborg, was puzzled by what he saw (Benz 2002<sup>2</sup>). He was as much

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<sup>1</sup> E. Swedenborg, *Three Transactions on the Cerebrum*. A Posthumous Work by Emanuel Swedenborg. Translated by Alfred Acton (Philadelphia: Swedenborg Scientific Association, 1940).

<sup>2</sup> Ernst Benz, *Emanuel Swedenborg, Visionary Savant in the Age of Reason* (West Chester: Swedenborg Foundation, 2002), 395.

puzzled by the relationship between his soul and the funeral artifacts as we are by the soul's relationship to fMR images. The nearest I can get to verbalizing the puzzle of brain studies/soul link is that they are some kind of functional metaphor or correspondence in the Swedenborgian sense. The content of mental awareness is simply invisible to science or scientific as Swedenborg calls it.

My reaction to the suggestion that the ACC may be involved in the discernment between good and evil is that it is not by any means the origin or sole player in this activity. It is true that damage to the anterior cingulate cortex produces such features as "apathy, inattention, dysregulation of autonomic functions, akinetic mutism and emotional instability" as Bush et al. say in their article, but this is because the ACC forms a part of a much *larger circuit* (my emphasis) that serves to "regulate cognition and emotion" quoting the introduction to Bush et al. The Bush (2000) and Mulert (2005) articles consider the role of the ACC using simple psychophysical methods of stimulating the brain, such as Stroop like puzzles involving pressing buttons in front of a computer screen that indicate that the ACC is involved in various cognitive and emotional activities. However, real life situations, such as the one faced by King Solomon are immeasurably more complicated. Cognition and emotion, or understanding and the will in Swedenborg's nomenclature, involve the whole body/brain unit.

### **Effects of Damage to the Frontal Lobe on the "Soul"**

Evidence for the importance of "soul-like activity" of the ventromedial portion of the frontal lobe, which is part of a brain/body circuit which includes the ACC and many other players, comes from Antonio Damasio's book.<sup>3</sup>

Damasio describes in great detail in this book the case of Phineas Gage who, in 1848 while building the Rutland & Burlington Railroad in Vermont, had his anterior and medial aspects of both frontal lobes destroyed in an accident with explosives, with the loss of what can be described as

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<sup>3</sup> A. Damasio. *Descartes' Error: Emotion, Reason and the Human Brain* (London, Basingstoke & Oxford, UK: Papermac, 1996).

his conscience or soul. "From being a shrewd smart businessman, very energetic and persistent in executing all his plans of action, after the accident he became [like a] child in his intellectual capacity and manifestations, [having] the animal passions of a strong man." His foul language was so debased that women were advised not to stay long in his presence.<sup>4</sup> Hanna Damasio, Antonio's wife, in a thorough piece of detective work on Gage's skull has shown that the anterior cingulate cortex was unlikely to have been damaged by the accident. He seems to have lost his soul in a "Wernerian" sense, but I am sure found it again at his resurrection, which just adds to the puzzle of what the soul is.

The anterior cingulate gyrus, including its cortex, wraps round the front of the corpus callosum as Soni says, and as she suggests it is a meeting place between the parts of the brain which manage careful thinking (prefrontal cortex), feelings (limbic system) and physical movements (parietal lobes). I think it is more accurate to conceive the cingulate gyrus as a link between the unconscious limbic system and the organ which gives us consciousness, which is the cerebral cortex. Akinetic mutism as described by Bush et al. could be due to the important link it forms to the rest of the cortex. Bodily movement is, however, not a direct function of the parietal cortex but more closely involves the precentral gyrus of the frontal cortex. The parietal cortex, particularly the right one in right handed people, is involved in consciousness of the body's place in the world, including the parts of the body in relationship to the body itself.

### **The ACC is part of a larger circuit**

To enlarge on what I mean by a *larger circuit*, the cingulate gyrus forms part of the Papez ring or circuit. In Kandel et al.<sup>5</sup> there is a section entitled "The Search for Cortical Representation of Feeling," and a great deal of my information is taken from this book. In 1937 Papez suggested that the cortical machinery for feeling (not consciousness or conscience) involves the limbic lobe, which involves a ring of phylogenetically primitive cortex

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<sup>4</sup> Damasio, *ibid.*, 8.

<sup>5</sup> Kandel, Schwartz and Jessel (eds.), *The Principles of Neural Science* (McGraw Hill, 2000), 986.

around the brain stem and includes the paleocortical part of the cingulate gyrus, which is therefore unlikely to be alone the seat of human conscience as we know it, as it is present in much more primitive creatures than man, although man possesses a neocortical part of the cingulate cortex as well, as described in Bush et al.'s article. The cingulate cortex or its homologues are present in all vertebrate brains, from the pea sized, 450 million year old brain of the Tiger salamander<sup>6</sup> to that of man's million year old, melon sized brain. The brain of all vertebrates has the same basic structures, but with a development of complexity and function, without the loss of pre-existing structures. As Swedenborg says in *Arcana Coelestia* §§ 39–42, animals correspond and share in some prophetic sense to the way man understands the facts of life, because as we know now we share a good deal of the anatomy of our brain and behavior with them.

The amygdala, a part of the limbic system, also part of the *larger circuit*, mediates both the autonomic expression and the cognitive experience of emotion. Autonomic expression is produced by the amygdala's action on the hypothalamus, and the influence on conscious feeling is mediated by the amygdala's projections to the cortex via the cingulate gyrus. There is a clear diagram in *The Principles of Neural Science* (Kandel et al., 1987).

### The Somatic Marker Hypothesis

The brain does not exist without the body. There is an anatomical explanation, called by Damasio the Somatic Marker, as to why King Solomon could use the heart as a metonym for his soul, or, for that matter, why the Lord could say such things as "Now is my soul troubled" in John 12:27. The English translation of this could have equally well used the word "heart," or even "psyche" which is the Greek word used in this verse.

Antonio Damasio describes what he calls the Somatic Marker hypothesis in chapter eight of his book<sup>7</sup>; we all know what a "gut feeling" means when we have to decide a question with too many unknown variables for

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<sup>6</sup> C. Judson Herrick, *The Brain of the Tiger Salamander* (University of Chicago Press, 1948).

<sup>7</sup> Damasio, *ibid*, Chapter 8.

our limited reasoning powers to encompass. The more primitive parts of the brain have dealt with very complex problems for a much longer time than the cortex of man, and can act as a guide to action by other means than reason; as Pascal says, "the heart has its reasons which reason knows not of." The central nucleus of the amygdala has connections, among many others, to the lateral hypothalamus which modifies sympathetic activity, such as tachycardia (increased rate of the heart beat), increased sweating, and a rise in blood pressure, and parasympathetic activity to the dorsal nucleus of the vagus nerve which modifies gastric and intestinal or gut function, e.g. nausea and bowel looseness, when one is emotionally disturbed. In deciding a course of action the body as well as the brain is involved, and conscious note is taken of this as King Solomon obviously recognized. He therefore attributes the origin of his wisdom to the heart rather than to the amygdala or the ACC. The brain in itself has no "feeling," and the soul seems to me to be a metonym for the somatic marker of the brain's activity, in which the ACC has an important integrating activity for emotional and cognitive aspects. That however is its limit.

### **Swedenborg's Search for the Soul**

Swedenborg never found an anatomically discrete seat for the soul. In my opinion this is not because he was distracted by his focus on theological works, but because he found the totality of his being, his soul, in a love relationship with the Lord, a transcendental experience which cast the definition of the soul in an entirely new light. Swedenborg's theological works can perhaps be described as an account of his soul's activity, the way he saw how the facts of this life, including the brain, integrate with those of heaven and hell. The soul of Jesus, the Divine Human, was an involvement of His entire body and brain with His Father. It was not confined to the His anterior cingulate cortex, His amygdala, or even His heart acting alone.

Lastly, Soni bemoans the lack of knowledge of Swedenborg's work on the brain, but I think perhaps he is better known than she thinks. For

example, I have recently read a book called *A Portrait of the Brain*,<sup>8</sup> the author, Adam Zeman, being Professor of Cognitive and Behavioural Neurology at the Peninsular College of Medicine and Dentistry in Cornwall, UK. He writes that Swedenborg, “Swedish scientist, philosopher and mystic . . . developed ideas” on the localisation of cortical function. Zeman writes that Swedenborg’s “systematic survey of the knowledge available at the time reached conclusions unexpectedly close to current views.”

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<sup>8</sup> A. Zeman, *A Portrait of the Brain* (Yale University Press, 2008), 146.