

TRAUMATIC EVENTS, SEXUAL ABUSE AND MENTAL ILLNESS

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SUMMARY

That 'Childhood Adversity', which includes many traumatic events but in particular includes sexual abuse during childhood, can cause changes in the brain, such as the finding of a smaller hippocampus is well established by the observations of such persons as Thomas Frodl (2008, 2013). That traumatic events in adulthood can also cause both clinical symptoms such as Post Traumatic Stress Disorder, with equivalent shrinkage of the hippocampus (Smith 2005), is also well known. In this article we apply these neurological findings to the particular traumatic event of sexual abuse at any age, first to demonstrate that such abuse can indeed cause a number of mental illnesses, and hence to produce a model of how different forms of mental trauma may cause different mental illnesses. Next we describe human sexuality as a form of language, whereby feelings ranging from love to indifference to exercise of power to hatred can be expressed. We suggest that the expression of these feelings can give rise to positive feelings or to the mental illnesses we have mentioned. We emphasize how free choice is central to the 'messages' that we give to our partners through our sexuality - and therefore that we are responsible for those messages and their consequences. We point out therefore that inappropriate choices by the couple may lead to the consequent neurological changes and mental health symptoms we have mentioned. We finally analyse the act of sexual intercourse into a number of component functions (or consequences) including the Generative Function - that of producing another human person, the Choice Function - that of choosing the other person, the Language Function - that of communicating that choice to the other person and the Empowering Function- that of empowering the other person. We propose a model of human sexuality in which these four functions are linked together, so that in normal circumstances they work together in complete harmony, however, numerous circumstances of modern life can cause these four functions to operate asynchronously, thus leading to the neurological changes which we have mentioned above. These neurological changes are associated with the changes in hippocampal size which we have described above. Thus in our model, we have linked the Neurological changes of Trauma with factors relating to Choice, psychological concepts, and consequent symptomatology of illness. We do this in the context of a model of the Human Person in which mind and body are linked so that the human person can be understood as an 'Embodied Spirit', rather than the Cartesian Model. This concept goes back to the model of the Human Person of Aristotle, and was re-expressed in Medieval times by Aquinas and Augustine, and is congruent with Phenomenology as expressed by Husserl and Stein. We have previously argued that such an 'Embodied Spirit' model of the Human Person is more congruent with modern neuroscience than a Cartesian Model (Agius 2017).

Key words: hippocampus – trauma - sexual abuse - childhood adversity - free choice - post traumatic stress disorder - embodied cognition – aquinas - cartesianism

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INTRODUCTION

That 'Childhood Adversity', which includes many traumatic events but in particular includes sexual abuse during childhood, can cause changes in the brain, such as the finding of a smaller hippocampus is well established by the observations of such persons as Thomas Frodl (2008, 2013). That traumatic events in adulthood can also cause both clinical symptoms such as Post Traumatic Stress Disorder, with equivalent shrinkage of the hippocampus (Smith 2005), is also well known.

NEUROSCIENCE CHANGES RELATED TO ABUSE AND CHILDHOOD ADVERSITY

Changes in the brain related to stress and depression are more widespread than only in the hippocampus. Thus Frodl finds that in patients with major depression who were also suffering from stress over a three year period, patients showed significantly more decline in gray matter density of the hippocampus, anterior cingulum, left amygdala, and right dorsomedial prefrontal cortex compared

with controls (Frodl 2008). These changes were considered to be related to ongoing stress (Frodl 2008). In a systematic review of the damage to brain structure and function caused by stress (Frodl 2013) it was shown that there was excessive stress exposure of the brain, mediated through the neurotoxic effects of cortisol and possibly neuroinflammation. There was evidence that prenatal stress and childhood maltreatment is associated with an abnormally developing HPA system, as well as hippocampal volume reduction. Smaller hippocampal volumes are associated with increased cortisol secretion during the day (Frodl 2013). Frodl and O'Keane concluded that a model integrating childhood maltreatment, cortisol abnormalities and hippocampal volume also needed to take other factors such as temperament, genetics or the presence of depression into account, in order to provide a cohesive explanation of all the findings (Frodl 2013). While there was evidence that early life maltreatment results in structural hippocampal changes and these are in turn more prominent in subjects with higher continuous cortisol secretion it was less clear what role early life maltreatment plays in HPA axis alteration (Frodl 2013).

Turning to Posttraumatic Stress Disorder in adults, a systematic review and meta-analysis of studies in which hippocampal volume was estimated from magnetic resonance images in adult patients with PTSD (Smith 2005) found that on average PTSD patients had a 6.9% smaller left hippocampal volume and a 6.6% smaller right hippocampal volume compared with control subjects. This is consistent with the notion that exposure to stressful experiences can lead to hippocampal atrophy (Smith 2005).

In this article we wish to relate what is known about brain changes caused by stress to what we know about sexual abuse, in order to discuss the consequences for mental health of such abuse. Unfortunately, reports of sexual abuse are not uncommon in Psychiatric Outpatients. In 1996, Lipschitz et al. reported that, out of 86 female and 34 male psychiatric outpatients aged 18-73 yrs, 70% of the Subjects reported experiences of abuse in childhood or adulthood (Lipschitz 1996). Surrey et al. reported that of 140 female psychiatric outpatients who completed a packet containing background questions and self-rating measures, 64% reported a history of sexual and/or physical abuse. Depression scores (SCL-90) were significantly higher in those reporting a history of recent or childhood abuse than among those reporting no abuse (Surrey 1990). Gibb et al, while reporting increased psychiatric morbidity in patients who had been abused, reported differences in the incidence of different conditions related to different forms of abuse, thus, diagnoses of major depression were significantly more strongly related to reports of childhood emotional abuse than to physical or sexual abuse disorder (Gibb 2007). However, the same effect was observed for social phobia disorder (Gibb 2007). In addition, patients with major depression reported equivalent levels of childhood emotional abuse as patients with social phobia, but lower levels of emotional abuse than those with post-traumatic stress disorder (Gibb 2007).

In this article we acknowledge the high incidence of sexual, emotional and physical abuse to be found within psychiatric outpatients and we attempt to develop a model which illustrates how the neuroscientific findings relate to the development of mental illness in our patients. We also wanted to suggest what can be done within human relationships in order to protect human persons from abuse, and thus promote good mental health within couples.

METHOD

We searched for papers in order to support our model. We were not attempting to prove our model, but we used the evidence of good quality papers in order help us build our model. This was therefore not a full review, but rather a theoretical paper to encourage further research.

DIFFERENCES BETWEEN MALE AND FEMALE BRAINS

We began our model by considering the gross anatomical differences between Males and Female brains and the possible functional implications of this. There are basic biological differences between the brains of women and men. When we first produced this presentation, we expressed these differences as follows:

- The Male brain is larger, but male body is larger than the female;
- The Interstitial nuclei of the Anterior Hypothalamus, are perhaps larger in men than women;
- The Corpus Callosum is perhaps larger in men than women. The posterior end of the Corpus Callosum (splenium) is larger in women than in men.
- In Women there are increased dendritic spines, and therefore sinapses in the hippocampus than in men. This finding is under the control of Oestrogen.

We took the opportunity to review these findings in more up to date papers.

DIFFERENCES IN ANATOMY

According to Cahill (2017), brain imaging studies demonstrate that the differences between the brains of men and women extend far beyond the purely reproductive area. When adjusted for total brain size (men's being larger), a woman's hippocampus, which is essential for learning and memory, is bigger and functions differently than a man's. In contrast, a man's amygdala, which is involved in the experience of emotions and the recall of those experiences, is larger than a woman's. Cahill's research has shown that it, too, works in a different way.

Another area of the brain which shows a difference between the sexes is the inferior-parietal lobule, which is usually larger in men. This area of the brain is concerned with mathematical issues, time estimation and gauging speed (Grant 2021).

According to Xin et al. (2019) 'The brain regions with greatest differences between male and female (highest classification accuracies) include the left pre-cuneus, the left postcentral gyrus, the left cingulate gyrus, the right orbital gyrus of frontal lobe, and the left occipital thalamus in the gray matter, and middle cerebellum peduncle, the genu of the corpus callosum, the right anterior corona radiata, the right superior corona radiata, and the left anterior limb of internal capsule in the white matter'.

Furthermore, Previous research has found a gender-related morphological difference in the corpus callosum, which could be linked to interhemispheric interaction (Sullivan et al. 2001, Luders et al. 2003, Prendergast et al. 2015). However, not all previous investigations have documented this difference, most likely due to limitations in the methodologies used (Abe et al. 2002).

The findings from, Xin et al.'s model confirm that there is likely a physical difference between men and women at the genu of the corpus callosum (Xin et al. 2019).

Moreover, Men have a higher cerebellum volume than women, according to Raz et al. (2001).

There is a relationship between the Cerebellum and the Thalamus because cerebellar cells release diffusible chemicals that aid in the survival of thalamic neurons. (Tracey et al. 1980, Hisanaga & Sharp 1990). Gender variations in basic glucose metabolism in the thalamus of young participants aged 20 to 40 have been found in previous investigations (Fujimoto et al. 2008).

BRAIN CIRCUITRY

In addition to the thalamus and cerebellum, the post-central gyrus was identified as a brain region of interest in Xin et al's findings (2019). This suggests that the cerebellar-thalamic-cortical circuitry is most likely gender-related. This gender difference could be linked to gender disparities in neurological degenerative disorders like Parkinson's disease (Lyons et al. 1998, Dluzen & Mcdermott 2000, Miller & Cronin-Golomb 2010), where pathological abnormalities are typically detected in the cerebellar-thalamic-cortical circuitry.

Xin et al.'s findings (2019) also revealed a gender-related difference in limbic-thalamo-cortical circuitry. The limbic-thalamo-cortical circuitry contains thalamic projections from the internal capsule to the prefrontal cortex, which are part of the anterior corona radiata. Many of the cognitive and emotion regulation abnormalities could be caused by white matter alterations in the anterior corona radiata (Drevets 2001). The frontal cortex gray matter regions of the orbital gyrus and the cingulate gyrus have also been linked to the emotion control system (Fan et al. 2005). As a result, gender differences in limbic-thalamo-cortical circuitry could explain gender differences in thalamic activation during the processing of emotional stimuli or unpleasant language information about interpersonal difficulties, as shown by prior fMRI studies (Lee & Kondziolka 2005, Shirao et al. 2005, Xin et al. 2019). This could explain men and women interpreting emotions such as depression differently.

In conclusion, the gender-related differences which have been demonstrated may account for the gender differences in cognition, emotional regulation, and neurological illnesses may be linked to these structural variances in the brain (Xin et al. 2019).

BRAIN FUNCTION

Regarding the Amygdala, Cahill (2017) examined the brains of men and women who watched either highly unpleasant or emotionally neutral films in 2000. Strong negative emotions and concurrent imprinting in the amygdala were expected to be triggered by the

unpleasant movie. As expected, activity in the amygdala during the watching experience predicted respondents' capacity to recall the video afterwards. However, this link was only detected in the left amygdala in women, while it was only in the right amygdala in men.

A woman's cerebral hemispheres appear to communicate with each other more than a man's. In a study performed in 2014, females' brains portrayed stronger coordinated activity between hemispheres, while the males' brains portrayed greater coordination within local brain regions (Goldman 2017). This conclusion is consistent with previous findings which show that the corpus callosum, the white-matter cord that connects the hemispheres, is larger in women than in men (Goldman 2017). Furthermore, women's brains have a tendency to possess greater bilateral symmetry than men's (Goldman 2017).

DIFFERENCES IN FUNCTION/SKILLS

According to Halpern (2000), as cited by Goldman (2017), women outperform males in almost every measure of linguistic aptitude, with the exception of verbal analogies. On average, women's reading comprehension and writing abilities outperform that of men. In assessments regarding fine-motor coordination and perceptual speed, women exceed men's abilities. Furthermore, women have a better ability to recall information from long-term memory (Goldman 2017). Overall, men are better at juggling many items in working memory. They have strong visuospatial abilities as they can visualize complex rotation in space of two- or three-dimensional shape, accurately determine angles at horizontal, track moving objects, and aim projectiles (Goldman 2017). Moreover, in both humans and rats, navigation studies demonstrate that females prefer using landmarks, whereas males prefer "dead reckoning," which involves the calculation of one's position by approximating the travelled direction and distance, rather than relying on landmarks (Goldman 2017). As stated by Grant (2021), in examinations of brain connections, it has been discovered that women have stronger side to side connections, which could lead to higher intuitive thinking, analysis, and conclusion making. On the other hand, men tend to have greater connections from front-to-back, which can lead to improved perception and motor skills (Grant 2021). Recent research has also revealed that the cerebellum, which was previously thought to just be involved in movement coordination, may differ slightly between the sexes and affect behaviour and thinking too. Men and women have varied brain chemistry as well as different processing tendencies. Both process the same neurochemicals, but they do so in distinct ways. Serotonin, for example, which is linked to happiness and despair, is processed differently in men and women. This may explain why women are more prone to anxiety and sadness than males (Grant 2021).

DIFFERENCES IN GREY AND WHITE MATTER

There is evidence that women's brains contain greater grey matter. Grey matter is made up of cell bodies that assist our bodies process information in the brain, and it is found in areas of the brain that control muscular control and sensory perception (Grant 2021). However, women have been discovered to utilise more white matter, which connects processing centers, than men. This could explain why males are better at task-oriented undertakings and women are better at language and multitasking (Grant 2021).

DIFFERENCES IN PATHOLOGY

Where pathology is involved, men are three times more likely than women to have alcoholism, three times more likely to be diagnosed with antisocial personality disorder, four times more likely to have autism, and twice as likely to develop Parkinson's disease when pathology is present, whereas women are twice as likely to suffer from depression, twice as likely to get Alzheimer's disease (in the United States), four times more likely to develop multiple sclerosis, and twice as likely to have a stroke as men (Grant 2021).

THE RELATIONSHIP BETWEEN BRAIN GENDER DIFFERENCES AND SEX HORMONES

On average, brain regions with different sizes in men and women (for instance the, amygdala and the hippocampus) have a higher concentration of sex hormone receptors, states Goldman (2017).

The chief additions in female mammals are a few members of the oestrogen family of compounds, as well as another molecule known as progesterone. In male mammals, testosterone and a few similar compounds are collectively referred to as androgens. Males who develop healthily in utero experience a large mid-gestation surge of testosterone, which permanently shapes not just their bodily parts and dimensions, but also their brains (Goldman 2017).

Moreover, Goldman (2017) explains that the sex chromosomes, which make up one of the 23 pairs of human chromosomes in each cell, are another crucial component in the composition of men and women. Males have one X and one Y chromosome, while females have two X chromosomes in their pair. The sequence of developmental events that drive bodies and brains to take on male features is controlled by a gene on the Y chromosome. Other Y chromosome genes may play a role in brain physiology and cognition.

All of this contributes to the idea that at least some sections of the brain are made up of modules. Each

module is made up of a neural or genetic pathway that controls one aspect of a complex behaviour and responds to hormonal and genetic inputs. The early testosterone rush, or its absence respectively, masculinizes or feminizes these modules, or at least part of them. This type of module can be found in abundance in the mammalian brain, resulting in complex behavioural patterns (Goldman 2017).

SOME CONSEQUENCES OF THE DIFFERENCES WHICH WE HAVE DESCRIBES

It seems that all the differences which we have described are likely to have important consequences in the relationship between men and women, although it may be difficult to explain the mechanisms by which these consequences come about. On the one hand, it might be that men and women may interpret the same event in somewhat different ways, with different emotional colouring. Further it seems clear that memory will, in both the cases of men and women, include not just the event but its context and emotional colouring. Also, it seems clear that men and women are 'tuned' to excel in different things- men in navigating complex problems, while women in nurturing others. This does not, of course mean that all the possibilities of human action are not open to each individual, but that in fact there is a situation where men and women's preferences in acting are complementary to each other.

BASIC CONCEPTS

Before moving forward in our investigation we wish to include two further concepts. The first one is that of the concept of morality, of human beings deciding what is right and wrong. There is a fundamental rule of morality which was quoted by Pope John Paul II, it is 'When considering whether doing something is right or wrong, see whether in doing it you are using someone; if you are using someone, then your plan is wrong, if you are not, then your plan may be right' (Wojtyła 1975, 1981).

We will refer to this concept later as a key concept in developing our ideas.

Another key concept in our enquiry is that of Sexual Intercourse. Sexual Intercourse is obviously essential to the natural procreation of new human beings and therefore to the survival of the species. It is a normal human behaviour. However it is the circumstances in which intercourse occurs which determines its meaning and thence, its value from a moral point of view. What we will attempt to do is determine whether there are neurological consequences to the experience of sexual intercourse, and how these relate to the meaning and thence moral value of this experience.

A final concept in this enquiry is Free Choice. As human beings we make judgements by exercising free choice. Free Choice is obviously central to our behaviour as human beings. How we are able to make free choices is one important thing which gives us our dignity. Using free choice in order to make judgements provides us with the context in which we make decisions, and thus also creates a context in which actions, including sexual intercourse, take place. Thus we choose whether to engage in intercourse with one person or another and indeed to form a relationship with one person or another. That choice depends on many factors, ranging from personal preference to social mores to various issues of convenience, which might include using the other person in some way. There are social and moral constraints to free choice in this context, and all this can lead to different interpretations by the person of the meaning of the act of intercourse; it may be interpreted as an act of love, or of submission, or of abuse among other possibilities, and it is in fact this interpretation which is linked with the neurological consequences which we described above.

RELATIONSHIP BETWEEN MEANING AND CONTEXT OF THE ACT OF SEXUAL INTERCOURSE, NEUROLOGICAL EFFECTS AND MENTAL ILLNESS

Thus it comes about that the act of sexual intercourse has a meaning for the individual person depending on the context in which the individual person experiences it, which gives it meaning, each of the two persons having their own context depending on their motivation and circumstances when carrying out the act, and it is this context and meaning which can cause the neurological effects on the brain, which may lead to the anatomical effects described above and also to the psychological conditions described above (such as the smaller Hippocampus in PTSD or Borderline Personality Disorder). Put in a slightly different way, Sexual Intercourse is part of a Body Language which can have several Meanings, given to it by the participants. Also the persons who participate in the relationship choose how they relate to others. This is because we choose to modulate biological drives in order to relate appropriately to others by exercising free choice as to how we relate to other persons. Thus, for example, if a person is attracted to another person he could choose to help or support the other person, so that his relationship with the other person is appropriate and useful. In such a situation there would be no abnormal response in the Hippocampus. Persons make such choices all the time.

One can describe a number of situations when sexual intercourse is abusive and therefore traumatic. Thus, cases of Sexual Abuse of children (leading to Childhood Adversity) can lead to borderline personality disorder, and the Hippocampus in such cases can be

smaller than usual. In cases of rape, where one person imposes his will on another, post traumatic stress disorder is likely to result, again with a Hippocampus being smaller than usual. We accept that these abnormalities such as the reduction in size of the hippocampus are abnormalities which are generalizable to many diseases, but here we only wish to point out that there is a link between sexual intercourse in the context of abuse, mental disorders, and neurological changes in the brain. The causal link appears to be excessive stress (Goh 2010).

On the other hand, when the context of sexual intercourse is the mutual love of the couple, then there is no stress, the act is seen as an expression of love, and there are no neurological changes in the brain, particularly the hippocampus.

The consequence of this is that it is of extreme importance that sexual intercourse should only occur between two persons who wish to express mutual love for each other.

ANALYSIS OF PROCESSES INVOLVED IN SEXUAL INTERCOURSE

Sexual Intercourse can be analysed into a number of different Processes, all of which happen at the same time, some physiological, some psychological some anthropological. We wish to propose a model which describes these different processes and their interrelationship, and thence how they interrelate in the human person. We can thus also see what happens when the relationship between these processes changes.

These processes may be listed as the following:

- Generative Function;
- Choice Function;
- Language Function;
- Empowering Function.

THE GENERATIVE FUNCTION

As a result of Intercourse, Impregnation and hence conception of a new human being occurs. Man is impelled by a biological drive to unite with woman in this way. Woman is also impelled by a biological drive to accept intercourse with man.

CHOICE FUNCTION

Man chooses the woman in terms of several criteria; Man is said primitively to choose women [e.g. big hips] who may bear children easily and safely. This choice is essentially subconscious, in the sense that a man may choose a woman with an attractive figure, but not know why he actually makes the choice. Intellectually he will choose a person who he feels will be capable of looking after the children.

Women will also chooses an appropriate mate, in whom she has confidence that he will support her and look after the children, thus satisfying her own criteria.

LANGUAGE FUNCTION

The act of Intercourse is not simply biological, but is a form of BODY LANGUAGE which expresses the link [LOVE] between the couple.

EMPOWERMENT FUNCTION

The fact of choosing and being chosen is greatly empowering to the two persons of the couple. Hence the consequent children are also an expression of the love between the couple.

Hence Since this is an act between human beings, it is entirely dependent on free choice by each member of the couple. Thus intercourse becomes a very important (though not the only) bodily language expression of love between the couple, which expresses itself in the conception (and later the bringing up) of children.

Thus Children become within the family the greatest expression of the love between the couple. Such children will not suffer from 'Childhood Adversity'.

RISKS INHERENT IN THE SEPARATION OF THESE FOUR FUNCTIONS

However, the four functions we have described for Intercourse are linked in one act but they are also separate ... hence they can, and are separated in different circumstances.

However if these acts, which are usually perceived as one by humans, are separated, they cease to have the meaning of love between the couple and family which we have described. There is therefore an imperative to keep all the functions we have mentioned together.

Examples of how these four functions can be separated include:

- Taking contraception removes the generate function from intercourse;
- A woman who is raped may conceive but not experience love;
- Children in a marriage which exists for reasons other than love may not experience the full love of the couple ('childhood adversity').

Clearly, Human Choices and Actions lead to things and actions becoming significant to humans. It is this significance, which lasts long after the act (in this case of intercourse) is over which is important and leads to the ongoing relationship. Thus if the various components we described are separated, the significance and hence the relationship changes.

What we have proposed is a schematic diagram of the biology and psychology, not the whole complex picture. We have just described some underlying mechanisms.

CONCLUSION

Clearly, the discussion of sexual relations between men and women goes far beyond the issue of sexual abuse and is of fundamental importance in describing normal relationships between human beings.

We have previously argued that the most useful model of the human person for modern neuroscience is the model, espoused by such Christian Philosophers as Aquinas and Augustine of man being an embodied spirit (Agius 2017). We have used science, including psychology, anthropology, and neuroscience in order to explain aspects of the relationship between the sexes, however in our model a complete understanding of this relationship can only be obtained by the study of the whole human persons involved (Wojtyła 1981).

Part of the consequence of this is that regarding the male/female relationship in the loving family which we described, the feeling of choosing and being chosen in a loving relationship is extremely empowering for the two individuals concerned; and this extends to all aspects of their lives. Furthermore the same feeling of empowerment also extends to their children, who are the symbol of that love and experience being loved, so that they grow in the best possible way.

Choices in the relationship between men and women extend far beyond the area of sexual intercourse. Choices can be taken in the context of many different conditions, including our other choices (e.g. whether we are married or single, what our goal in life is, whether we are religious etc.). These conditions can modulate how we choose to express our new choices, which can even be based on metaphor and imagination.

Thus, how men and women may relate to each other, given their circumstances, can become a way of acting together and supporting each other for good, Indeed using the biological differences and drives which we have discussed but in a way which is completely changed by their circumstances and other choices of their life, but equally for the good of the other person and humanity. Thus, for example, a male teacher may share knowledge, wisdom, and experience of life with younger female pupils, perhaps re-enacting a father/daughter relationship.

Some such relationships between persons may even become heroic. An example could be Florence Nightingale holding dying soldiers in her arms, being their wife, mother and sister, or Mother Teresa of Calcutta's commitment to the poorest persons of that city, both being great examples of the female nurturing we described above.

We would like, in this context, to salute the new Blessed, Sandra Sabattini, beatified less than a month ago while we were writing. This young 22 year old is the first Medical Student to be Beatified. Her commitment to the disabled and the addicted' those are people I will never leave' follows the nurturing tradition of the women we have mentioned above. She is an excellent model for young women who study medicine, but our experience is that she is not unique, one of us, who has taught many medical students, knows many of his young colleagues who do medicine to help others rather than for personal gain.

Sometimes the collaboration between a man and a woman has led to such influence on other human beings that they both become perceived as heroic, as in the diads of saints, for instance Saints Francis and Clare or Saint Teresa of Avila and Saint John of the Cross. The collaboration between so many men and women who we see as being so productive for the good of humanity is such that it has led a colleague of one of us to end a book with the following sentence 'I wonder why when God wishes to do great things, He always brings together a man and a woman?!' (Sammut 1996).

Acknowledgements: None.

Conflict of interest:

Mark Agius and Michaela Agius jointly conceived and drafted the paper, based on an earlier powerpoint presentation presented at a Malines Conversations presentation by Mark Agius at Clare College Cambridge in 2018.

Michaela Agius in particular contributed the section on male and female brains. Neither Mark Agius nor Michaela Agius have any Conflicts of Interest to declare.

They are both practicing Catholics.

Contribution of individual authors:

All Authors have worked together and contributed equally to this manuscript.

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