Appendix A Riew Gender Differences in Human Brain by Zeenat F Zaidi

NO	TEXT	PG	TYPES
1	**Size & Weight** The adult human ***brain weighs*** on average about 3lb (1.5kg) with a ***size*** of around 1130 cm3 in ***women*** and 1260 cm3 in ***men*** although there is substantial individual variation. ***Male brains*** are about 10% ***larger*** than ***female brains*** and ***weigh*** 11-12% more than that of ***a woman***. ***Men's*** heads are also about 2% bigger than ***women's***. This is due to the ***larger*** physical stature of ***men***. ***Male's larger*** muscle mass and ***larger body size*** requires more neurons to control them. The ***brain weight*** is related to the ***body weight*** partly because it **increases** with ***increasing*** height. This ***difference*** is also present at birth. ***A boy's brain*** is between 12-20% ***larger*** than that of ***a girl***. The head circumference of ***boys*** is also ***larger*** (2%) than that of ***girls***. However, when ***the size*** of the ***brain*** is compared to ***body weight*** at this age, there is almost no ***difference*** between ***boys*** and ***girls***. So, ***a girl baby*** and ***a boy baby*** who ***weigh*** the same will have similar ***brain sizes***.	***37***	***Repetition*** ***Antonymy*** ***Synonymy*** ***Hyponymy*** ***Meronymy***
2	**Brain Volume** ***Sexual*** dimorphisms of adult ***brain volumes*** were more evident in the cortex, with ***women*** having ***larger volumes***, relative to cerebrum ***size***, particularly in frontal and medial paralimbic cortices. ***Men*** had ***larger volumes, relative*** to cerebrum ***size***, in frontomedial cortex, the amygdala and hypothalamus. There was ***greater sexual*** dimorphism in ***brain*** areas that are homologous with those identified in animal studies showing ***greater*** levels of ***sex*** steroid receptors during critical periods of ***brain development***. These findings have implications for ***developmental studies*** that would directly test hypotheses about mechanisms relating ***sex*** steroid hormones to ***sexual*** dimorphisms in humans.	***37***	***Repetition*** ***Antonymy*** ***Synonymy*** ***Hyponymy*** ***Meronymy***
3	**Grey Matter *vs* White Matter** Ratios of grey to ***white matter*** also ***differ significantly*** between the ***sexes*** in diverse regions of the ***human*** cortex [5]. Variations in the amount of ***white*** and ***grey matter*** in the ***brain*** remain ***significant*** [6-8]. ***Men*** have approximately 6.5 ***times*** more ***gray matter*** in the ***brain*** than ***women***, and ***women*** have about 10 ***times*** more ***white matter*** than men do [3]. At the age of 20, a ***man*** has around 176,000 km and a ***woman***, about 149,000 km of myelinated axons in their ***brains*** [9]. ***Men*** appear to have more ***gray matter***, made up of active ***neurons***, and ***women*** more of the ***white matter responsible*** for communication between ***different*** areas of the ***brain*** [10]. In ***women***'s ***brains***, the ***neurons*** are packed in tightly, so that they're closer together. Some ***women*** even have as many as 12 percent more ***neurons*** than ***men*** do [10]. These ***neurons*** are densely crowded on certain layers of the cortex, namely the ones ***responsible*** for signals coming in and out of the ***brain***, and these ***differences*** were present from birth	***37***	***Repetition*** ***Antonymy*** ***Meronymy*** ***Hyponymy***

	[10]. When controlling for total cerebral volume, women had a ***higher percentage*** of ***grey matter*** than ***men***, and **men** had a ***higher percentage*** of ***white matter*** [6, 8] and ***both gray and white matter volumes*** correlated with cognitive performance across sex groups. The average ***number*** of neocortical ***neurons*** was 19 billion in female ***brains*** and 23 billion in male ***brains***, a 16% ***difference***. In a study, which covered the ***age*** range from 20 ***years*** to 90 ***years***, approximately 10% of all neocortical ***neurons*** are lost over the life span in both ***sexes***. ***Sex*** and ***age*** were the main determinants of the total ***number*** of ***neurons*** in the ***human*** neocortex, whereas body size, per se, had no influence on ***neuron number*** [11]. Gender ***differences*** in precentral, cingulate, and anterior temporal ***white matter*** areas were also found, suggesting that microstructural ***white matter*** organization in these regions may have a ***sexual*** dimorphism [12].		
4	**Hypothalamus** Hypothalamus, where most of the basic functions of life are controlled, including hormonal activity *via* the pituitary gland also shows gender ***differences***. The volume of a specific ***nucleus*** in the hypothalamus (third cell group of the interstitial ***nuclei*** of the anterior hypothalamus) is twice as large in heterosexual ***men*** as in ***women*** and homosexual ***men*** [13]. The preoptic area, involved in mating behavior, is about 2.2 times larger in ***men*** than in ***women*** and contains 2 times more cells. This enlargement is dependent on the amount of ***male*** sex hormones or androgens. ***Apparently***, the ***difference*** in this area is only ***apparent*** after a person is 4 ***years*** old. At 4 ***years*** of age, there is a decrease in the number of cells in this ***nucleus*** in ***girls***. The neuropil of the preoptic area is sexually dimorphic [14]. Gender-related ***differences*** were found in 2 cell groups in the preoptic-anterior hypothalamic area (PO-AHA) in human ***brain***. Both nuclei were larger in ***male*** and appeared to be related in ***women*** to circulating steroid hormone levels [15]. The suprachiasmatic nucleus of the hypothalamus, involved with circadian rhythms and reproduction cycles, is ***different*** in shape in these two sexes. In ***males***, this ***nucleus*** is shaped like a sphere whereas in ***females*** it is more elongated. However, the number of cells and volume of this nucleus are not ***different*** in ***men*** and ***women***. It is possible that the shape of the suprachiasmatic ***nucleus*** influences the connections that this area makes with other areas of the brain, especially the other ***areas*** of the hypothalamus. In most hypothalamic ***areas*** that stain positively for androgen receptor (AR), nuclear staining in particular is less intense in young adult ***women*** than in ***men***. The strongest ***sex difference*** is found in the lateral and medial mamillary nucleus [16]. The mamillary body complex is known to receive input from the hippocampus by the fornix and to be involved in cognition. In addition, a sex ***difference*** in AR staining is present in the horizontal diagonal band of Broca, the ***sexually*** dimorphic ***nucleus*** of the preoptic area, the medial preoptic area, the	***38***	***Repetition*** ***Antonymy*** ***Hyponymy***

	dorsal and ventral zone of the periventricular ***nucleus***, the paraventricular ***nucleus***, the supraoptic ***nucleus,*** the ventromedial hypothalamic nucleus and the infundibular nucleus. No ***sex differences*** were observed in AR staining in the ***bed nucleus*** of the stria terminalis, the ***nucleus*** basalis of Meynert and the island of Calleja [16].		
5	**Anterior Commissure** It connects several regions of the frontal and temporal lobes and is 12 %, or 1.17mm2 larger in ***women*** than in ***men*** [17].	***38***	***Antonymy***
6	**Massa Intermedia** ***A structure*** that crosses the third ventricle between the two thalami, was present in 78% of ***females*** and 68% of ***males***. Among subjects with a massa intermedia, ***the structure*** was an average of 53.3% or 17.5 mm2 larger in ***females*** than in ***males***. ***Anatomical sex differences*** in ***structures*** that connect the two cerebral hemispheres may, in part, underlie ***functional sex differences*** in ***cognitive function*** and cerebral lateralization.	***38***	***Repetition*** ***Antonymy*** ***collocation***
7	***Cerebellum*** An area of the ***brain*** important for posture and balance, and the pons, a ***brain*** structure linked to the ***cerebellum*** that helps control consciousness, are larger in ***men*** than in ***women*** [18].	***38***	***Repetition*** ***Antonymy*** ***Hyponymy***
8	**Cerebral Hemispheres** According to the majority of studies, ***men*** possess larger cerebra than ***women*** of the same age and health status, even if the body size ***differences*** are controlled statistically. ***Male brains*** were larger than ***female brains*** in all locations, though ***male*** enlargement was most prominent in the frontal and occipital poles, bilaterally. ***The male differentiated brain*** has ***a thicker right hemisphere***. This may be the reason ***males*** tend to be more spatial, and mathematical. ***The left hemisphere***, which is important to communication, ***is thicker*** in ***female*** oriented ***brains***.	***38***	***Repetition*** ***Antonymy*** ***collocation***
9	***Cerebral Cortex*** ***Men*** have 4% more neurons than ***women***, and about 100 grams more of ***brain*** tissue. Women have a more developed neuropil, or the space between cell bodies, which contains synapses, dendrites and axons. This may explain why ***women*** are more prone to dementia (such as Alzheimer's disease) than ***men***, because although both may lose the same number of neurons due to the disease, in ***males***, the functional reserve may be greater as a larger number of nerve cells are present, which could prevent some of the functional losses [20]. In the temporal neocortex, a key part which is involved in both social and ***emotional processes*** and memory, ***men*** had a one third higher density than ***women*** of synapses, and had more ***brain*** cells, though the excess was slight compared with the excess in the number of synapses. Sexual dimorphism has been reported in the cortical volume of the Wernicke and Broca areas [21], as well as in the frontal and medial paralimbic cortices [5, 19, 22, 23]. Differences have been reported in	***38***	***Repetition*** ***Antonymy*** ***collocation***

	the ***thickness*** and ***density*** of the grey matter in the parietal lobes [19] in the density of neurons [10, 11, 20, 24] and in the complexity of the dendritic arbors as well as in the density of dendritic spines in several cortical areas [25]. In ***female brains***, the cortex is constructed ***differently***, with neurons packed more closely together in layers 2 and 4 (which form the hard wiring for signals coming into the brain) of the temporal lobe, and in layers 3, 5 and 6 (which carry the wiring for outbound signals) of the prefrontal cortex [10]. Widespread areas of the cortical mantle are ***significantly*** thicker in ***women*** than in ***men*** [26]. Studies have shown greater cortical thickness in posterior temporal and inferior parietal regions in ***females*** relative to ***males***, independent of ***differences*** in ***brain*** or body size. Age-by-sex interactions were not ***significant*** in the temporoparietal region,suggesting that sex ***differences*** in these regions are present from at least late childhood and then are maintained throughout [19]. In a study it is shown that ***men*** have a ***significantly*** higher synaptic density than Gender Differences in Human Brain: A Review The Open Anatomy Journal, 2010, Volume 2 39 women in all cortical layers of the temporal neocortex [27]. ***Differences*** in ***brain*** anatomy have included the length of the left temporal plane, which is usually longer than the right. The sex ***differences*** in cellularity of the planum temporale involved an 11% larger density of neurons in several cortical layers of females, with no overlap between ***males*** and ***females*** [10].		
10	**Orbitofrontal to Amygdala Ratio (OAR)** The ratio between the orbitofrontal cortex, a region ***involved*** in regulating ***emotions***, and the ***size*** of the ***amygdala***, ***involved*** in producing ***emotional reactions***, was significantly ***larger*** in ***women*** than ***men***. One can speculate from these findings that ***women*** might on average prove more capable of controlling their ***emotional reactions***. ***Women*** have ***larger*** orbital frontal cortices than ***men***, resulting in highly significant ***difference*** in the ratio of orbital grey to amygdala volume. This may relate to behavioral evidence for sex ***differences*** in ***emotion*** processing.	***39***	***Antonymy*** ***Repetition*** ***collocation***
11	***Limbic Size*** ***Females*** have a more acute sense of smell, and on average, have a larger deep limbic system including hippocampus [4] and anterior commissure, a bundle of fibers which acts to interconnect the two amygdales [17], than ***males***. Due to the larger deep limbic brain ***women*** are more in touch with their ***feelings***, they are generally better able to express their ***feelings*** than ***men***. They have an increased ability to bond and are connected to others. On the other hand larger deep limbic system leaves a ***female*** somewhat more susceptible to depression, especially at times of significant hormonal changes such as the onset of puberty, before menses, after the birth of a child and at menopause. ***Women*** attempt suicide three times more than ***men*** [29].	***39***	***Antonymy*** ***Repetition*** ***synonymy***
12	***Straight Gyrus (SG)***	***39***	***Antonymy***

	A narrow band at the base of the frontal lobe, involved in social cognition and interpersonal judgment is about 10% bigger in ***women*** than in ***men*** [36] (***men***'s ***brains*** are about 10% larger than ***women***'s ***brains***, so measures were proportional). In addition, the size of the SG also correlated with a test of social cognition, so that people who scored higher in interpersonal ***awareness, male*** or ***female***, had larger SGs. A similar study in children between 7 and 17 years of age showed different results. The SG was larger in boys as compared to girls. And this time, a smaller SG correlated with better "interpersonal ***awareness"***—the opposite of the results were seen in adults. This could be due to a reduction in grey matter volume, or pruning, which generally happens to ***girls' brains*** two years earlier than ***boys***'. There does seem to be a relationship between SG size and social perception and ***femininity***. Higher degrees of ***femininity*** were shown to be correlated with greater SG grey matter volume and surface area [36].		***Repetition***
13	***Hippocampus*** Sex ***differences*** exist in every brain lobe, including in many 'cognitive' regions such as the hippocampus, amygdala and neocortex [37]. Extensive evidence demonstrates that ***male*** and ***female*** hippocampi ***differ*** significantly in their anatomical structure, their neuroanatomic make-up and their reactivity to stressful situations [38]. Imaging studies consistently show that hippocampus is larger in ***women*** than in ***men*** when adjusted for total brain size [4].	***39***	***Antonymy*** ***Repetition***
14	***Visual Processing and Language Memory Area*** The regions of the brain that play a key role in visual processing and in storing language and personal memories appear to ***differ*** between the sexes at the microscopic level. The frontal and the temporal areas of the cortex are more precisely organized in women, and are bigger in volume [54]. The density of synapses in the temporal neocortex was greater in ***men*** than in ***women***. Fewer synapses to other regions may represent increasing specialization of the temporal cortex for language processing in ***females***, and this may be related to their overall better performance on language tasks [27]. Sexes use ***differen***t sides of their brains to process and store long-term memories [49] and a particular drug, propranolol, can block memory differently in ***men*** and ***women*** [55].	***40***	***Repetition*** ***Antonymy***
15	**Emotions** ***Male*** oriented ***brains***, hardly ***express feelings***. It is due to the use of the ***right hemisphere*** only. ***Male brains*** separate language, in the ***left***, and ***emotions*** in the ***right***, while the ***female's emotions*** are in both ***hemispheres***. It helps explain why the ***male brain*** has a hard time ***expressing*** its ***feelings.***	***41***	***Repetition*** ***Synonymy*** ***Antonymy***
16	**Thinking** ***Men*** seem to ***think*** with their grey matter, which is full of active neurons. ***Women think*** with the white matter, which consists more of ***connections*** between the neurons. In this way, ***a woman's brain*** is a	***41***	***Antonymy*** ***Repetition*** ***Hyponymy***

	bit more complicated in setup, but those ***connections*** may allow ***a woman's brain*** to work faster than ***a man's***. The parts of the frontal lobe, ***responsible*** for problem-solving and decision-making, and the limbic cortex, ***responsible*** for regulating emotions, were larger in ***women***. In ***men***, the parietal cortex, which is involved in space perception, and the amygdala, which regulates sexual and social behavior, was large. ***Men*** and ***women differ*** in accessing ***different*** sections of the ***brain*** for the ***same*** task. In one study, ***men*** and ***women*** were asked to sound out ***different*** words. ***Men*** relied on just one small area on the left ***side*** of the ***brain*** to complete the task, while the majority of women used areas in both ***sides*** of the ***brain.*** However, both ***men*** and ***women*** sounded out the words equally well, indicating that there is more than one way for the ***brain*** to arrive at the ***same*** result. (Paragraph 20:41)		
17	***Lateral Ventricle*** 3-Tesla magnetic resonance imaging (MRI), including diffusion tensor imaging (DTI) in unsedated healthy newborns showed ***differences*** in ***male*** and female brains. The ***left*** ventricle was ***significantly*** larger than the ***right***; ***females*** had ***significantly*** larger ventricles than ***males*** [69]. There was ***significant*** ventricular asymmetry at birth, with the ***left*** ventricle being larger than the ***right***. This ventricle asymmetry is present in older children [46] and indicates that lateralization of the brain is present at birth. Interestingly, ***female*** newborns had larger lateral ventricles than ***males***, even in the face of similar intracranial volumes and birth weights. Studies in older children have found no gender ***difference*** [46] or that ***males*** have larger ventricles than ***females*** [70].	***41***	***Repetition Antonymy***
18	***CAUSES*** ***Sexual differentiation*** of the human brain is a multi-factorial process. The ***differences*** are not thought to be only consequence of the influence of ***sex*** hormones on brain organization during development but also of genetic factors [2, 160, 161].	***45***	***Repetition***
19	**Sex Hormones** During the ***development*** of the embryo in the womb, circulating hormones have a very important role in the sexual ***differentiation*** of the ***brain***. Depending on the type of hormone and the level of hormonal activity during the embryonic stage of ***development*** can produce ***brains*** with male or ***female*** traits. The presence of ***androgens*** in early life produces a ***"male" brain***. In contrast, lack of ***androgens*** causes feminization, and the ***female*** sex is ***developed*** by default in a passive mechanism. However, studies have shown that ***estrogen*** plays an active role in ***differentiation*** of the ***female brain*** [168-173] and that the sensitive period for ***estrogen*** related processes occurs at a later time than that of ***testosterone*** related processes [174]. It is known, at least, in rodent ***brains***, estradiol and not ***testosterone*** is responsible for the	***46***	***Repetition Antonymy***

	masculinization of the ***brain***. ***Testosterone***, secreted from the testes in ***male*** fetuses is transported into the ***brain***, where it is converted into estradiol by cytochrome P450 aromatase, locally expressed in ***different*** parts of the brain. While ***female*** fetuses are not exposed to testosterone from their gonads, they are still exposed to estradiol from their mothers. To prevent masculinization of the ***female brain***, large amounts of alpha-fetoprotein are present in the blood of ***female*** fetuses, which could bind estradiol and thus preventing it from entering into the ***brain***.		
20	In sexual ***differentiation*** of the human ***brain*** direct effects of testosterone seem to be of primary ***importance*** based upon evidence shown e.g. from subjects with mutations in the androgen receptor, estrogen receptor or in the aromatase gene. In transsexuals, reversal of the sex ***difference*** in the central nucleus of the bed nucleus of the stria terminalis was observed. The size, type of innervation and neuron number agreed with their gender identity and not with their genetic ***sex*** .Various structural and functional ***brain differences*** related to ***sexual*** orientation have now also been reported. Levels of circulating ***sex*** steroid ***hormones***, during development and in ***adulthood***, play a critical role in determining physiology and behavior in ***adulthood***. Since the morphologic characteristics of neurons have been shown to influence the functional properties of the neurons, it is likely that these ***hormone***-induced structural changes contribute significantly to the activation of neural circuits necessary for certain. Recent findings suggest that manipulation of ***sex*** steroid ***hormone*** levels may induce dramatic ***macroscopic*** and ***microscopic*** structural changes in certain regions of the central nervous system, such as neurons of adult avian song system ,corpus callosum and anterior commissure bulbocavernosus spinal nucleus, spinal motor neurons rat Purkinje cell , sexual dimorphic nucleus of preoptic area of hypothalamus (SDN-POA) of hypothalamus, hippocampal pyramidal cells, bed nucleus of humanstria terminalis nigrostriatal dopamine neurons, rat arcuate nucleus, human median raphe nucleus,and substantia nigran. Dorsal raphe nucleus (DRN) is the largest of all raphe nuclei in rat ***brain*** stem, and a part of serotonergic system. Studies have also indentified many areas of the ***brain*** that are altered during ***development*** due to exposure to sex steroids, not only areas closely connected with reproduction, but also in the areas ***important*** for ***emotional responses*** such as amygdala and even other areas such as hippocampus and cerebellum. Substantial evidence indicates that ***sex hormones influence*** learning and memory processes, and interact with stress ***hormones*** to do so. In humans, the menstrual cycle significantly ***influences*** performance on both verbal and spatial tasks, and modulates the neural circuitry associated with arousal [4]. Menstrual cycle ***influences*** have even been detected on the degree of hemispheric asymmetry associated with various cognitive tasks. Menstrual cycle ***influences*** also exist on ***brain*** responsiveness to	***46***	***Repetition*** ***Antonymy*** ***Hyponymy*** ***collocation***

	addictive drugs such as cocaine and amphetamines,factors that will probably help to explain ***sex differences*** in addictive processes. In addition, sex hormones such as oestrogen can alter the excitability of hippocampal cells strongly influence their dendritic structure and augment NMDA (N-methyl-D-aspartate) receptor binding. Intrahippocampal oestrogen infusions modulate memory processes. Finally, ***sex differences*** exist in hippocampal long-term potentiation, a phenomenon that is widely viewed to be related to memory processes. Human behavior is also subject to the activational effects of androgens. Transsexuals treated with cross-***sex hormones*** display sex reversals in their cognitive abilities, emotional tendencies, and libido and ***sex*** offenders are sometimes treated with antiandrogens to reduce their ***sex*** drive		
21	Several studies have suggested that ***sex*** steroid hormones might not be the whole answer to ***sexual*** differentiation and that ***sex*** chromosomes could influence sex specific ***development***. ***Sex hormones*** are crucial for many ***sex differences***, but, equally, cannot explain all observed sex ***differences.*** For example, a recent study reported several sex ***differences*** in cocaine-seeking behavior in rats and, in addition, found that these ***differences*** were unaffected by oestrus state [223]. Many of such sex ***differences*** described in the ***human brain*** arise during ***development*** by an interaction of ***sex hormones*** and the developing neurons, although direct genetic effects are probably also involved [181]. Factors influencing structural [43] and ***functional sex differences*** in the brain are genetic factors like mutations or polymorphisms in the ***sex hormone*** receptors, abnormal prenatal hormone levels and compounds such as anticonvulsants, Diethylstilbestrol (an estrogen-like com-pound) and environmental endocrine disrupters. When given during pregnancy they interact with the action of ***sex hormones*** on the fetal ***brain***.	***46***	***Repetition collocation***
22	***Evolution*** The fundamental neurological substrate that forms the basis for complex cerebral asymmetries in Homo sapiens may have been established remarkably early in anthropoid evolution. In ancient times, both sexes had very defined role that helped ensure the survival of the species. Cave-***men*** hunted while Cave-***women*** gathered food near the home and cared for the children. Brain areas may have been sharpened to enable each sex to carry out their jobs. In evolutionary terms, developing superior navigation skills may have ***enabled men*** to become better suited to the role of hunter, while the development by ***females*** of a preference for landmarks may have ***enabled*** them to fulfill the task of gathering food closer to home [54]. The advantage of ***women*** regarding verbal skills also makes evolutionary sense. While ***men*** have the bodily strength to compete with other ***men***, women use language to gain social advantage, such as by argumentation and persuasion [54]. Morning sickness, for example, which steers some	***46***	***Antonymy Repetition collocation***

	women away from strong tastes and smells, may once have protected babies in utero from toxic items. Infidelity is a way for men to ensure genetic immortality [224]. Tendency toward cortical lateralization has been greatly elaborated in ***human*** evolution, such that at least 90% of extant ***humans*** are right-handed. Numerous data support an association of the left ***human*** hemisphere with time-sequencing, language skills, certain neurochemical asymmetries, and specific psychiatric disorders. The right hemisphere, on the other hand, is associated with holistic processing, visuospatial and musical abilities, ***emotional processing***, and its own neurochemical and psychiatric properties. Significant sexual dimorphism in certain skills associated with cortical lateralization has been reported in ***humans***. ***Females*** excel at language and fine motor skills, as well as ***emotional*** decoding and expression; ***males*** are relatively adept at composing music and exhibit visuospatial and mathematical skills [225]. Evolution can also produce adaptive sex differences in behavior and its neural substrate .		
23	***Culture and Socialization*** Postnatal social factors are generally presumed to be involved in the ***development*** of sexual orientation [227, 228]. ***Females*** of all ages are better at ***recognizing emotion*** or relationships than are ***men***. These sex-determined ***differences*** appear in infancy and the gap widens as people mature. When such ***differences*** appear early in ***development***, it can be assumed that these ***differences*** are programmed into our ***brains***- “hardwired” to use a computer analogy. Sex ***differences*** that grow larger throughout childhood however, are probably shaped by culture, lifestyle and training. Studies of ***brain*** plasticity have shown us that experience changes our brains structure.	***47***	***Repetition*** ***Antonymy*** ***collocation***
24	At birth, the human ***brain*** is still preparing for full operation. The ***brain's*** task for the first 3 years is to establish and reinforce connections with other neurons. As a ***child*** develops, the synapses become more complex, like a tree with more branches and limbs growing. After ***age*** 3, the creation of synapses slows until about ***age*** 10. Between birth and ***age*** 3, the ***brain*** creates more synapses than it needs. The synapses that are used a lot become a permanent part of the ***brain***. The synapses that are not used frequently are eliminated. This is where experience plays an important role in wiring a ***young child's brain***. The ***child’s experience***s are the stimulation that sparks the activity between axons and dendrites and creates synapses. Clearly the social ***experience*** of a ***young*** baby is limited, but even then it is interacting, soaking up ***experience*** like a sponge. In an astonishingly short time it becomes proficient in a complicated, not entirely logical language. Even before an infant begins to talk, it understands sentences containing quite complex sequences. It is believed that nurturing one's ***brain*** can enhance what nature has provided. There is a lot of evidence that we build up our ***brain's*** representation of space by moving through it.	***47***	***Repetition*** ***Antonymy*** ***Hyponymy*** ***collocation***

	Boys tend to get a lot more practice "moving through space" than ***girls*** do. This ***difference*** could possibly be erased if the ***girls*** are pushed out into the exploratory mode [97]. There is evidence that learning uses long-term potentiation (LTP) in the ***cerebral*** cortex as a way to strengthen synaptic connections between ***brain*** cells that are necessary to acquire and store new information [229]. Even with laboratory rats, it has been shown that those reared in a stimulating ***environment*** develop a much more intricate cerebral organization than those reared in nothing more than a bare cage. The more prominent sex differences were seen when the rearing ***environment*** was varied, with females showing less susceptibility to ***environmental*** influences in some neuronal populations [230].		
25	***GENDER DIFFERENCES AND LEARNING*** Research on the ***differences*** between ***male*** and ***female*** brain structure and function has huge implications for educational theory. ***Male*** and ***female brains*** are wired ***differently*** and that is why they learn, feel and react so ***differently***. Studies have shown that ***girls*** tend to use the areas of the brain devoted to verbal and emotional functioning, while ***boys*** generally use the areas of the ***brain*** geared toward spatial and mechanical tasks [275]. The ***male brain*** needs to recharge and reorient by entering what ***brain*** scientists call a rest state. ***Boys*** may naturally drift off or "space out" during a lesson. However, they are able to stay engaged in visual or hands-on learning that involves symbols, objects, diagrams and pictures but zone out when too many words are used [276]. Active learning strengthens neuronal pathways, builds new ones and improves memory skills, reasoning and visualization efficiency.	***49***	***Repetition Antonymy***
26	CONCLUSION The ***male*** and the ***female brains*** show anatomical, functional and biochemical ***differences*** in all stages of life. These ***differences*** begin early during development due to a combination of genetic and hormonal events and continue throughout the lifespan of an individual, and are involved in many functions in heath as well as in diseases. Mental and emotional health is extremely ***important*** to healthy aging. Sex ***differences*** need to be considered in studying brain structure and function. It may raise the possibility of early diagnosis and precise treatment and management for neurological diseases, and may help physicians and scientists to discover new diagnostic tools to explore the brain **differences**. Understanding the development of normal brain and ***differences*** between the sexes is ***important*** for the interpretation of clinical imaging studies.	***49***	***Antonymy Repetition***