Development and structure of the brain

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Inside the womb we start out as an egg, but one of the first major structures that begin to form is the brain. The brain itself is a complex structure that leaves much to be learned from it. It controls a person’s entire body function and movements whether it be walking, talking, or even going to the bathroom. What most people do not know is that there are five major structures of the brain. The first of the five is the myelencephalon (the Medulla). The Myelencephalon (or medulla) is the posterior portion of the brain stem.

Not surprisingly then, the medulla is composed largely of tracts carrying signals between the rest of the brain and the body. An interesting part of the myelencephalon from a psychological perspective is the reticular formation. It is a complex network of about 100 tiny nuclei that occupies the central core of the brain stem from the posterior boundary of the myelencephalon to the anterior boundary of the midbrain. It is so named because of its netlike appearance (reticulum means " little net").

Sometimes the reticular formation is referred to as the reticular activating system because parts of it seem to play a role in arousal. The various nuclei of the reticular formation are involved in a variety of functions, however — including sleep, attention (definitely important for language), movement, the maintenance of muscle tone, and various cardiac, circulatory, and respiratory reflexes. Accordingly, referring to this collection of nuclei as a system can be misleading.

Generally, the myelencephalon does not play an important role in language production or comprehension. The second major structure is known as the metencephalon. The Metencephalon houses many ascending and

descending tracts and part of the reticular formation. These structures create a bulge, called the pons, on the brain stem's ventral surface. The pons (" bridge" in Latin) is the bridge to the cerebellum. It has many millions of neural fibers which cross the base of the brain stem, connecting to locations in the cerebellum.

The cerebellum (meaning " little brain") is the large, convoluted structure on the brain stem's dorsal surface. The cerebellum is an extraordinarily complex structure which though smaller than the cerebral cortex probably has even more neurons. It has long been believed to function primarily for motor coordination, but recent studies indicate that it also is an important sensorimotor structure. Cerebellar damage eliminates the ability to precisely control one's movements to adapt them to changing conditions.

Although the metencephalon surely plays a role in the precise movements of the tongue and lips required for language production, it is generally an unimportant structure with regard to the study of language and the brain. The third major structure inside the brain is the mesencephalon. The Mesencephalon has two divisions- the tectum and the tegmentum. The tectum (" roof") is the dorsal surface of the midbrain. In mammals, the tectum is composed of two pairs of bumps, the colliculi (" little hills").

The posterior pair called the inferior colliculi, have an auditory function; the anterior pair, called the superior colliculi, have a visual function. The tegementum is the division of the mesencephalon ventral to the tectum. In addition to the reticular formation and tracts of passage, the tegmentum contains three colorful structures- the periaqueductal gray, the substantia nigra, and the red nucleus. The periaqueductal gray is the gray matter

situated around the cerebral aqueduct, the duct connecting the third and fourth ventricles. The periacqueductal gray plays role in mediating the analgesic effects of opiate drugs.

The substantia nigra (" black substance" and the red nucleus are both important components of the sensorimotor system. The mesencephalon is generally an unimportant structure in the study language and the brain. The fourth structure is named the deincephalon. The Diencephalon is composed of two structures: the thalamus and the hypothalamus. The thalamus is the large, two-lobed structure that constitutes the top of the brain stem. One lobe sits on each side of the third ventricle, and the two lobes are joined by the massa intermedia, which runs through the ventricle.

Visible on the surface of the thalamus are white lamina (layers) that are composed of myelinated axons. The thalamus comprises many different pairs of nuclei, most of which project to the cortex. Some are sensory relay nuclei — nuclei that receive signals from sensory receptors, process them, and then transmit them to the appropriate areas of sensory cortex. For example, the lateral geniculate nuclei, the medial geniculate nuclei, and the ventral posterior nuclei are important relay stations in the visual, auditory, and omatosensory systems, respectively. The thalamus seems to be a relay for sensory input as well as an important part of other pathways, including motor and sensory pathways and those between different parts of the cortex and the cerebellum and other subcortical structures. The thalamus and the cortex are profusely interconnected by reciprocal connections, which play an important role in the generation of rhythmic patterns in the brain and in attention, and may also be involved in top-down effects in perception.

By virtue of bidirectional connections between the thalamus and every region of the cortex, these rhythmic patterns sweep regularly and rapidly through the cortex. They, therefore, provide a possible source for the rapid pacemaker hypothesized for high-speed inner sequencing. The rate of speed of these thalamocortical rhythms ranges from twenty to eighty Hz (Hertz: cycles per second) in the waking state and as slow as from four Hz to less than one Hz in deep sleep. The hypothalamus (Greek hypo-, cognate to Latin sub- " under") lies under the thalamus.

It plays an important role in the regulation of several motivated behaviors. It exerts its effects in part by regulating the release of hormones from the pituitary gland, which dangles from it on the ventral surface of the brain. Two other structures appear on the inferior surface of the hypothalamus — the optic chiasm and the mammilary bodies. The optic chiasm is the point at which the optic nerves from each eye come together. The mammillary bodies are a pair of spherical hypothalamic nuclei located on the inferior surface of the hypothalamus, just behind the pituitary gland.

The hypothalamus apparently does not play much of a role in language. The fifth and final structure is the telencephalon. The Telencephalon (the cerebral hemispheres) is the largest of the divisions of the human brain, and it is what subserves language — at least the aspects of language which are of interest to linguistics and most other people. In fact, the same can be said of the just the cerebral cortex, only one of the four parts of the telencephalon according to the traditional division given previously.

Of the subcortical and interior portions of the telencephalon, the basal ganglia, which partially surround the diencephalon, participate in motor

functions, including articulation of speech, and the hippocampus and the amygdaloid nucleus, which lie deep within the lower part of the cortex, are very important in emotional expression. As stated previously, the brain is a complex structure. It also performs many functions for the human body such as walking, talking, running and even writing.