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1975 Eleanor Clarke Slagle Lecture

Behavior, Bias, and the Limbic System

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Human and animal behavior has always fascinated me. In my early years, Freud, Adler, Jung, Erickson, and others seemed to suggest the most plausible basis for understanding human behavior. However, during the 1930s and 1940s, scientific disciplines began to study behavior from a different perspective. Biochemistry, endocrinology, and neurophysiology studied behavior in relation to biochemical individuality, the function of enzyme deficiencies, and genetic defects and stimulation studies of the brain. In psychology, a number of individuals broke away from the Freudian school of thought in order to investigate behavior in relation to group interaction and environmental manipulation. Studies were extended into such areas as architectural design, color phenomena, crowding of populations, the effects of sensory deprivation, and other areas too numerous to mention. A number of neuroanatomists began to take a renewed interest in the organism they were studying, especially in regard to the functional implications of various systems, instead of just their structural and mechanical aspects. Paralleling this upsurge of interest in behavior, another group decided to study animals in an entirely new light. These scientists, who called themselves ethologists, realized that animals living in their own environment behaved quite differently from animals confined to a laboratory or an enclosed area. Therefore, the ethologists went out into the field in order to study animals in their natural habitat. By the 1960s a great deal of new and fascinating information had been accumulated from all of these different scientific disciplines concerning animal behavior. Because of my interest in this area, I began to look at man's nervous system, and especially the limbic system, in an entirely new way. Animal research seemed to provide a great deal of insight into the complexities of the limbic system in relation to man's behavioral mechanisms. Where is the limbic system in the brain, and what are the principal functions of this area?

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The Location of the Limbic System

Picture a target with a gray bull's eye and several alternating white and gray bands surrounding the central area (Figure 23.1). The gray areas represent the location of specific groups of nerve cell bodies. The white areas represent the fiber connections between these gray areas. In actual numbers, the target has only three gray areas with two white ones interposed. The first gray area, or the bull's eye, represents the diencephalon or the thalamus, the next gray area represents the basal ganglia, while the outermost area represents the cerebral cortex. These concentric circles graphically depict the basic pattern of the gray and white matter of the brain. The lower parts of the nervous system—that is, the brain stem, cerebellum, and the spinal cord—have been removed in order to use this target concept to understand the structural and functional aspects of the brain in relation to the limbic system.

Returning again to the target concept, the bull's eye represents some of the oldest evolutionary areas of the brain. The intermediate gray band represents the younger structures, while the most recent phylogenetically evolved area is located on the periphery. The same sequential pattern, from central to peripheral, also illustrates the functional hierarchy of the brain. As the newer and more peripheral structures develop, there is a tendency for these areas to control and regulate, to some extent, the older centers. Yet, due to the numerous white fiber tracts interconnecting all of these centers, the entire nervous system functions as a total unit.

The target illustration also aids in understanding the names of each of these gray areas. As previously mentioned, the central gray area is called the diencephalon or the thalamus. Diencephalon means "through brain." This implies that almost all of the information received by one's senses, from any part of the body, must pass through this area. The

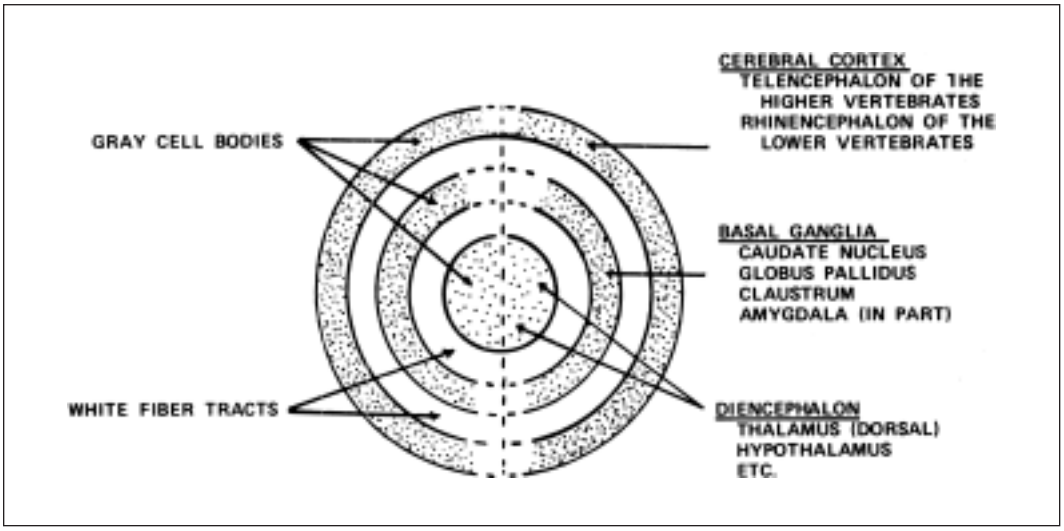

Figure 23.1. Target concept of the brain (brain stem removed).

diencephalon integrates and modifies this information before relaying it to surrounding structures. In addition, numerous components of the motor pathways of the nervous system are influenced by this area. Last, but not least, is the fact that part of this area is the master controller of the endocrine system and the autonomic nervous system. Thus the term diencephalon identifies some of the basic functions of this central gray area. But how about the other term, the thalamus? This word means a "bridal chamber." Perhaps the forefathers of anatomy chuckled when they applied this term to this centrally located part of the brain. After all, this area is hidden away in a rather secluded and relatively safe location. Maybe these anatomists were also thinking about the synapses that occur here, and the importance of this center in relation to homeostatic mechanisms in the preservation of the species. Nevertheless, the term thalamus is a rather apt word for remembering the location of this area.

The next gray circle surrounding the thalamus is known as the basal ganglia. During early development of the brain, the ganglion, meaning a mass of gray cell bodies, was located at the base of the brain, hence the term basal ganglia. As the brain matured these cells divided into several distinctive groups and migrated upward in a circular fashion to partially surround the diencephalon (Figure 23.2). The basal banglia were destined to become regulatory centers for many stereotyped reflexes, for sensorimotor functions, for some aspects of visceral behavior, and for a multitude of other functions too numerous to mention.

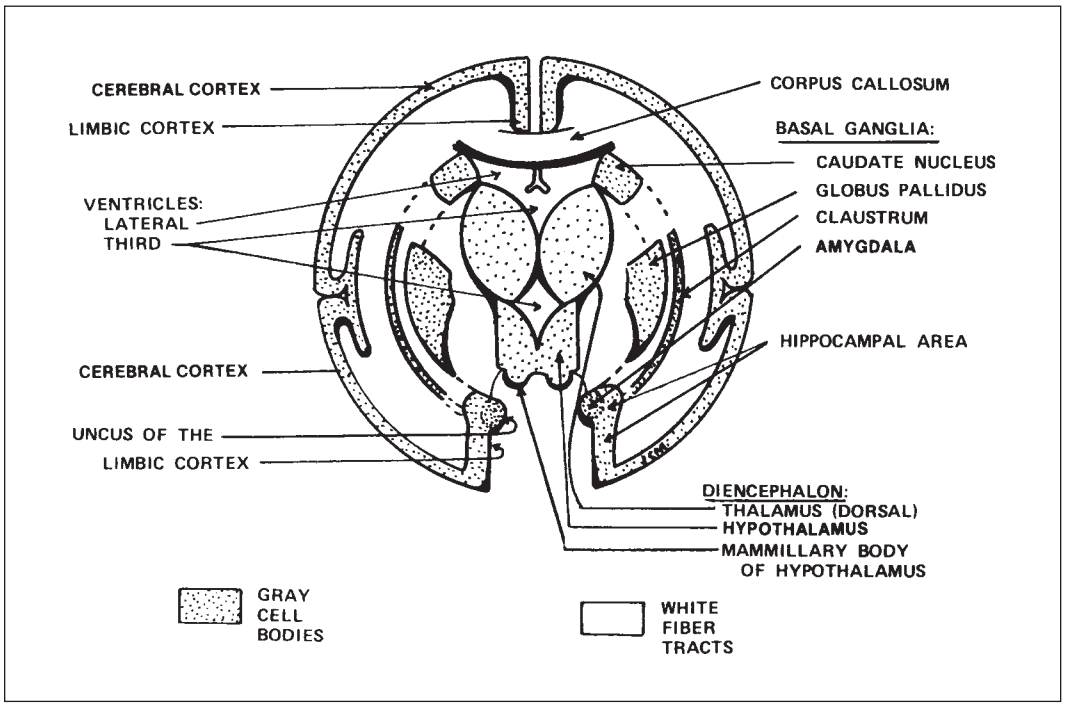

Figure 23.2. Modified target concept showing white and gray areas comprising the major structures of the brain.

The outer layer of gray matter represents the cerebral cortex or the bark of the brain. However, if one examines the brain of many of the lower vertebrates, having only a minimal amount of cortex, this outer gray ring represents the rhinencephalon or smell brain (Figure 23.1). The rhinencephalon is the oldest part of the cerebral cortex. As the higher vertebrates developed, this older cortical area was displaced medially and was eventually buried in a deeper location as additional cortex was added (Figure 23.2). In man, the exposed surface of the brain is still called the cerebral cortex, but the rhinencephalic cortex, which lies hidden from view, is now called the limbic cortex (Figure 23.2). What is the reason for this change in terminology? It is because this area of man's cortex is no longer concerned only with the sense of smell and survival mechanisms. As can be seen later, many other functions were incorporated into this area. However, the word *limbic* is a descriptive term, meaning border or the outside edge of a structure. If one examines the medial view of the human brain, the limbic cortex forms an almost complete ring or border of gray matter around all of the deeper structures of the brain (Figure 23.3).

This target concept is acceptable for understanding the very basic structural relationships of the brain, but it is limited when discussing different systems of the brain. What is a system in comparison to a structure? The easiest way to explain this is to compare the word nerve or neuron with the term nervous system. A nerve is a structural entity consisting of a neuronal cell body and all of the processes, whereas the term nervous system refers to all of the neurons and their processes, which function as a total unit and make up the entire nervous system. In other words, the term system denotes numerous components incorporated into one functional unit. In the same way the limbic lobe or limbic cortex is a limited structural area, while the limbic system comprises parts of the old and new cerebral cortex, as well as parts of the basal ganglia, thalamus, midbrain, reticular formation, autonomic nervous system, and on and on. It is not my intention to list in detail all of the structural and functional components of this system as volumes have been written on this subject. Rather, it is more important to understand a few concepts about this system. The *first concept* is that the limbic system ties together or integrates the newest cortical or cognitive centers of the brain with the older sensorimotor systems and the primitive visceral and reticular structures of the nervous system (1–5). The *second concept* is that several of the major structures which comprise man's limbic system evolved from the rhinencephalic cortex or the small brain of lower vertebrates (5–8).

In lower animals the small brain is the most prominent structure of the entire nervous system. In these animals it is regarded as the area which is primarily responsible for controlling and regulating instinctual drives and survival mechanisms. As the brain of the higher vertebrates evolved, the smell brain diminished in size in comparison to the newer evolutionary structures. However, the function of this area remains as a primary means of survival for the animal kingdom. For example, the sense of smell is necessary for hunting, for locating sources of food and water, and for tracking down distant prey. It is also used to recognize members of one's own group as opposed to those of the same species belonging to another group. It is important for knowing the boundaries of one's territory, finding a

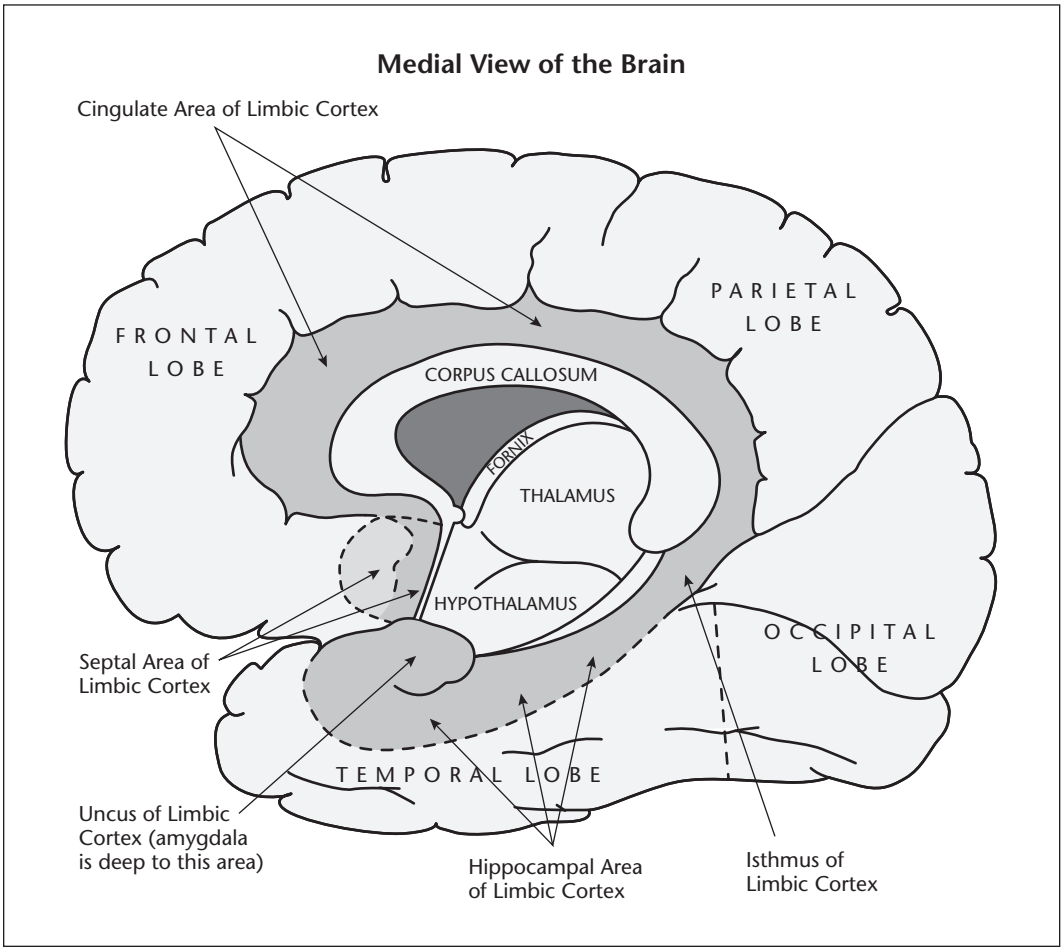

Figure 23.3. Major structures comprising the limbic cortex (brain stem and cerebellum removed).

den or shelter after a hunt, or for following others during migration. And naturally, smell is one of the primary senses used for procreation of the species. Smell also enables the animal to react defensively or offensively when threatened because this primitive cortical area has a direct influence upon the animal's autonomic nervous system. Thus many of the behavioral instincts of the lower and higher vertebrates are incorporated into this area of the brain.[5,6,7,8] Even though man's limbic system is much more complex than the animals', man still retains many of the behavioral instincts of the other forms of animal life (5–10). One of nature's basic laws is to retain and enhance behavioral traits which have proved to be effective survival mechanisms, especially those which have assured the preservation of the species. Therefore, the basic functions of man's limbic system are similar, with some exceptions, to that of the higher vertebrates. Let us look at these functions and identify their relationship to behavioral mechanisms.

Limbic System Functions

Perhaps the simplest way to understand the functions of the limbic system is to use the mnemonic word "M-O-V-E." The limbic system is believed to "move" or drive us so that we can survive as individuals and as a species.

M . . . of the word "move" stands for **m**emory.
O . . . stands for **o**lfaction or the sense of smell.
V . . . refers to **v**isceral or autonomic nervous system functions.
E . . . represents the **e**motional components of behavior.

First, let us look at the limbic system in relation to memory. Part of the limbic system appears to be involved with the organism's ability to have instinctual or genetic memory, as well as short and long-term memory. This does not imply that all memory is confined to the limbic system. Rather, parts of this system appear to contain vital centers through which information must be processed or retrieved in order that the entire nervous system can utilize memory for survival (1–3, 6, 7).

For example, in the medial aspect of the temporal lobe there is an area, known as the hippocampal formation, which is involved in one's ability to have new memory (1, 3, 11) (Figure 23.3). Two theories have been proposed concerning how this area functions in learning. One theory is that new information has to be processed through this center before it can be retained as memory. The other theory is that this area helps provide recall of memory, that is, this area is part of a memory retrieval system.

If this structure is destroyed on one side, the individual has a temporary loss of the ability to remember new information. Usually the person recovers and is capable of learning new facts. However, if the opposite side is subsequently lost, the individual is unable to learn anything new. Both short-term and long-term memory are permanently lost. Emotional memory, such as swearing, crying, or laughing, and basic defensive mechanisms usually remain and may, in fact, be enhanced or greatly exaggerated (1, 11).

A similar lesion at the base of the diencephalon, which destroys structures known as the mammillary bodies, may also cause this same syndrome (1, 11) (Figure 23.2). The reason for this is that both of these centers are relay stations along a major route or pathway that is necessary for either memory storage or retrieval of information. Therefore, destruction of either area interrupts circuitry, not only within the limbic system, but also between it and the newer areas of the cerebral cortex.

There is another area of the medial temporal lobe which is located slightly anterior to the hippocampal formation (Figure 23.3). This area and the surrounding tissue (the amygdala and surrounding cortex) can be destroyed unilaterally due to CVA (cerebral vascular accident) involving small branches of the middle cerebral artery. The interesting feature about the loss of this area is that no real predictions can be made concerning the behavior of an individual who has a lesion in this center (1, 11, 12, 13). One person might become docile. Another may be overly aggressive. Some may lose the ability to visually discriminate between different objects or be unable to recognize any object at all. Probably the most common syndrome

resulting from the type of lesion is the loss of the ability to recognize people. There are several reasons for the behavioral variations seen following this kind of brain damage. One is that this area of the limbic system is intricately interconnected with several different cortical and subcortical structures which are concerned with some of the more primitive behavioral mechanisms used for survival—such as fear, anger and submissiveness, and visual and olfactory recognition (1, 11). Another reason depends upon the exact location of the lesion, such as a relatively small lesion occurring in the more posterior and lateral structures of this center, as opposed to a larger lesion encompassing many adjacent structures (1, 3, 11). The third reason concerns individual differences, such as one's basic inherited personality, one's biochemical individuality, and the environmental influences which have been impressed upon each individual's nervous system (1, 3, 11, 13, 14, 15).

Though there are many other lesions of the limbic system which can affect memory, perhaps the most interesting one is Korsakoff's syndrome (1, 11). This syndrome can occur in chronic alcoholics, but it may also result from tumors of the 3rd ventricle or from CVAs (cerebral vascular accidents) in this area (Figure 23.2). Actually, several areas of the limbic system can be involved in this syndrome, especially if this results from long-term degenerative changes. However, the most common site is in the medial part of the thalamus. Following a loss of this area, these individuals are unable to retain new information, and may not be able to give a true history of past events. And even though suffering severe intellectual impairment, these people may retain the ability to spin fascinating tales which may be emotionally charged and thus extremely convincing to the listener. However, within a relatively short time these individuals are unable to repeat the story and begin making up new tales.

The olfactory system is next. Though this sense is more important for survival of quadrupeds, it continues to play an important, though not well-defined, role in modern man. The olfactory system has direct pathways into the limbic system and has numerous indirect connections with the hypothalamic centers, which control the autonomic nervous system and the endocrine system (Figures 23.2 and 23.3). It is also connected with the reticular formation, which functions as a mechanism for alerting the entire cerebral cortex (1, 2, 3, 11). One can understand why the smell of a sizzling steak or the scent of a freshly baked pie can cause saliva and digestive juices to be secreted and make a person feel hungry. Certain smells can also trigger off emotionally charged memories which may be accompanied by visceral responses such as an increase or decrease in heart rate, respiration, sweating, or dilation of the pupils. For example, the odor of burning pine logs may remind one of pleasurable events surrounding a wonderful camping trip. This person may become relaxed and drift into a dreamy state recalling past memories. Another individual might be aroused because the pine odor reminds him of a fire which destroyed a home. Thus, odor can be an effective stimulus for bringing back rather specific memories, alerting individuals, or calming them down. It can also be used to stimulate digestion and enhance taste sensations. The reason is that the sense of taste and smell and their central connections in the nervous system are intricately associated with one another as well as with the limbic and autonomic nervous system.

Certain smells also play a very important role in man's sexuality. Many of these odors are believed to be more effective as stimulants if they are perceived on a subcortical or

limbic level rather than at the level of cortical awareness. It is no wonder that the perfume and soap industries of the world have made billions of dollars a year catering to these behavioral mechanisms.

Lesions of the olfactory bulb and tract are not very common in man. When they do occur, especially if only one side is involved, they may not be noticed by the individual. However, there is one interesting area on the medial part of the anterior temporal lobe, called the uncus, which can be involved in irritative lesions and does present some rather specific symptoms having to do with olfaction (Figures 23.2 and 23.3). This area of the limbic system helps to integrate olfactory and visual sensations with emotional memories. A tumor or irritative lesion in this area can cause an individual to smell putrid odors which are not present in the atmosphere. This sensation may be accompanied by visual hallucinations associated with the unpleasant smell. As the lesion spreads, the person may have a focal seizure or "uncinate fit" following the sensation of the odor. Fortunately, this type of seizure tends to remain localized within the limbic system—it does not spread to the cerebral cortex. Thus the person usually remains conscious, even though he may not be aware of the seizure per se (1, 3, 11).

The next major limbic system function concerns the visceral components of behavior. It is now known that everything we do, that is, all behavior, is colored by concurrent changes taking place within our autonomic or visceral nervous system. This in turn modifies all future behavior. Thus the limbic system is believed to help integrate and coordinate visceral responses with cognitive, emotional, and sensorimotor behavior. In this way, the normal system maintains a homeostatic balance in favor of pleasurable rewards and away from painful or nonrewarding stimuli (3–5, 7–9).

However, there are occasions when this homeostatic balance goes astray. This is usually the result of excessive physical or emotional stress which is put upon a nervous system, which is unable to cope with these stresses (13, 16, 17). The resultant behavioral patterns which develop are many and varied and depend upon multiple factors. But usually the limbic system reacts with the most basic survival instinct known to mankind and this is fear (4, 5, 9, 13, 18–21). Once this behavioral mechanism is aroused, the entire nervous system is alerted, especially those areas of the autonomic nervous system which control our fight or flight response. If this arousal mechanism is allowed to continue for a long period of time, it may begin to dominate the other systems of the body. Homeostasis is lost, and eventually the entire nervous system can exhaust itself. Man has been trying to cope with this problem for ages. He has used a variety of methods to treat this syndrome, such as witchcraft, prefrontal lobotomies, electroshock and insulin therapy, psychotherapy, and more recently, drug therapy and biofeedback training. Unfortunately, no one method has been successful, or probably ever will be, for all individuals concerned. This is because of man's individual genetic and biochemical differences as well as his multiple and highly variable relationships with his environment (9, 13–15).

In the final analysis, no two nervous systems function alike, and this is especially true in regard to each individual's limbic system. Not only have each of us inherited our behavioral traits from different genetic pools, but no two of us have experienced the same environmental stresses. Because of this we have learned to cope differently. Therefore, the behavioral

mechanisms of each person are biased by one's individual emotional needs, in spite of the fact that all humans share certain basic limbic drives (4, 9, 10, 12–17).

This brings us to **E** of the word M-O-V-E, or our emotional tone or drives. These drives have long been referred to as the "3 Fs," that is, the feeding, fighting, and reproductive drives. Many believe today that these three basic drives are genetically endowed—that is, they are inherited (6–9, 16).

Probably the most important of all of the limbic system mechanisms, if one can rank any facet of survival as more important than any other, is found under **E,** the emotional drive. This is the feeding drive. Actually, this drive for sustenance consists of two very fundamental and slightly different components. The first and most important is simply called love or TLC (tender loving care). The second component is food. Food, of course, is rather vital for survival but it appears to be less necessary than the need for love (9).

In lower animal terminology, love is defined somewhat differently than for man. Basically, however, it consists of the same principal components, such as the need to be touched and fondled, to be communicated with and accepted. It now appears that the genetic drive for TLC must be fulfilled, to some unknown degree, in order to assure survival. Also, TLC is believed to be the primary drive of gregarious animals. It is not believed to be directly linked to the productive drive per se. Rather, reproduction results only if this first drive is adequately fulfilled (5, 7, 9).

Research is also showing that this drive "to love and to be loved," to belong, to be accepted, may be the very foundation upon which many higher animals, including man, strive "to be"; upon which some of their territoriality may be based; and upon which survival of normal individuals is assured or lost. Indeed, this drive may be the very reason for standards, laws or codes of behavior, and biases which are found within and among the societies of all gregarious creatures. This drive for love, if adequately met, assures survival of the individual, the family, and the society (4, 5, 7, 9, 16, 18–21).

Thus the limbic system appears to be the seat of our ability to have memory, emotions, genetic drives, and pre-endowed standards of behavior. Just as important, of course, is the fact that this system is strongly influenced by the environment. Interaction with the environment continually shapes, modifies and biases our memory, behavior, and emotional tone in relation to everything we do at any given moment.

This continual modification or change of one's behavioral mechanism is not just the result of learned behavior. A great deal of it is probably due to the fact that much of the sensory information received from the environment is handled or taken care of by the nervous system at a subliminal or subcortical level (3, 9, 22). In fact, much of our early learning is believed to be primarily subcortical, that is, we do not have to think about our basic actions and reactions. The nervous system functions adequately for us on the lower emotional, autonomic, and sensorimotor reflexive levels of behavior. In fact, memory circuits are formed in these lower centers long before cortical control is fully developed and integrated into the limbic and subcortical centers (1–3). Likewise, since man is an emotional animal, he continues to function on this level throughout life, especially when he encounters either positively or negatively charged situations, such as love or fear. Man's nervous system is also genetically

endowed or biased to gravitate toward rewards and away from that which is threatening. Likewise, as the nervous system matures, man, and the animal, quickly learns to reinforce or bias his drives toward pleasurable events, especially if he has received a normal amount of sensory stimuli from the environmental surroundings (3, 16, 22).

This biasing or reinforcement of the behavioral drives may be accomplished primarily at the limbic or emotional level of the nervous system. One of the most fascinating features of the limbic system is the complexity of the fiber connections of this area, not only with adjacent structures but within the confines of the system itself. It has long been known that electrical stimulation of the limbic system causes long-lasting after discharges—that is, a single stimulus can cause this system to continue to reverberate for a relatively long period of time after removal of the stimulus (11). This is not surprising if one examines the intricate connections of this system. In comparison to other areas of the nervous system, this center has a multitude of pathways which are circular in nature, that is, they feed back to themselves. Many of these are also reciprocal. Thus stimulation of any one area not only feeds to other areas of this system, but in turn these feed back both directly and indirectly into the same area which was initially stimulated. It has taken anatomists years to unravel the complexities of this reverberating circuitry, and even today many of these are not completely understood. In spite of this, man has experienced the reverberating nature of this system and has unknowingly used this circuitry for emotional learning. For example, following a stressful situation, these reverberating circuits may cause the entire episode, or particular aspects of the event, to keep coming back into the mind, over and over again. The event will continue to reverberate until it is resolved or forgotten. Likewise, a few notes of a song may be heard, and throughout the day the entire tune keeps repeating itself in one's mind. Undoubtedly the reverberating nature of this system is what enables the brain to learn, and store, emotionally charged memories much more rapidly and usually more permanently than nonemotional memory. This is also believed to be one of the reasons why emotional language, such as swearing, singing, crying, and laughing, is usually preserved when a cerebral vascular accident destroys either our cortical language center or its pathways within the nervous system.

Man and the Animal

We have discussed man and the animal in relation to the limbic system and behavioral mechanisms. Man, of course, is rather different from other species. Therefore, is it fair to compare him with animals, especially since he is endowed with a generous amount of cerebral cortex and has the most complex nervous system known to mankind? After all, doesn't man need to use all of this gray matter for learning erudite things he believes he must know in order to interact with and survive in this modern world? Yes, in some respects this makes man different. He is also different in that he seems to have lost some of the ability to function at a limbic or emotional level, that is he appears to use his intellectual pursuits to override his own needs as well as the needs of others. Could it be that man has not lost his emotional tone or ability to relate to others, but instead he is fearful of developing some kind of oral or anal complex? Perhaps he has also brainwashed himself into believing that he will be dominated

by his reproductive or sex drives instead of his primary drive for love. It is my belief that man could eliminate some of his biases and fears by studying the animal, not just intellectually, but also on an emotional or on a limbic level. If he did this, he might begin to see why he behaves as he does, almost instinctively, to various situations he encounters in life. He might even learn more effective, and perhaps simpler and more direct, ways of coping with life without fearing himself or his fellow man.

It is interesting to note that man has associated himself with the animal long before the dawn of history. He has shared his home, affection, and some of his livelihood with four-footed creatures, such as the canines and the felines, down through the ages. These animals were not always used as beasts of burden, sources of food or for protection. Rather the animal as a pet probably enabled man to relate on a limbic level to a creature which readily understands and accepts him for what he is. The animal usually offers unlimited affection in return for a friendly word, a morsel of food, and perhaps some shelter. This enables man to unleash his intellectual drive and express his primary emotional need for love and understanding without the fear of being challenged, dominated, or questioned. Just as important, of course, is the fact that primitive man learned from and understood many of his own behavioral mechanisms and drives from his close association with animals. For example, according to the Indian legend of the Sioux Nation, the wolf was considered as a brother and a teacher. The Indian and the wolf lived together in harmony, sharing the same territory. It is said that they did not fear one another and even helped each other survive, especially if one were wounded, trapped, or lost. Modern man, on the contrary, somehow drifted away from having respect for and a mutual understanding of his four-footed friends. He came to consider animals as beasts of prey, unlimited sources of food or economic wealth, or as threats to his very existence. It is true that man continued to keep animals as pets, but intellectually he divorced himself from them. He denied that their behavior and drives were in any way related to his basic needs. He became so biased that he even failed to use any of his senses to recognize the similarities between himself and what he called "the lowly creatures." This may have been the time when man began to lose a great deal of his ability to comprehend himself, his environment, and especially the animals which resided in it. Fortunately, in the last several decades, man has begun to reverse his opinions. He is taking a new look at himself and his fellow creatures especially in relation to his surroundings, his evolutionary heritage, individual differences, and emotional drives. Man knows, for example, that he is not the only animal with the capability of learning a language and communicating this to his offspring or to others. He knows that he shares the ability to use tools with many of the higher vertebrates, and that this ability can be taught to others. Likewise, man is not the only beast having emotional needs such as the drive for love, touching, acceptance, communication, and understanding. His reactions are now known to be very similar to that of the animal, especially when this need is threatened or fails to be adequately provided throughout the entire life span of the animal (4, 5, 7, 8). Likewise, man recognizes the need to form bonding pairs, family units, and social groups. He is just beginning to comprehend why he has territorial needs, and how he can cope with this kind of behavioral mechanism. He is understanding why there are and have to be natural laws which regulate societies of gregarious animals, such as rules

and standards of conduct which govern the behavior of all of the members and demands that individuals accept certain responsibilities if they wish to survive as individuals, as a family unit, and as a society.

Perhaps, through an indepth study of animal societies, man will gain additional insight and understanding concerning the differences between the emotional needs of the sexes. It is well known that the female and the male are genetically, biologically, and socially different from each other. It is theorized that, because of innate biochemical differences, the limbic or behavioral patterns of male and female are substantially different from one another throughout life (4, 7, 12, 14, 15, 17). Research in many scientific fields indicates that, among gregarious animals including man, the female of the species instinctively looks to the male for protection, security, and leadership (4, 7, 9, 10, 14, 16–21). This facet of behavior has never implied, either biologically, phylogenetically, or ontogenetically that the female is inferior to the male. It does say that she is different and has different needs and drives in relation to the opposite sex. This may explain why long ago the females of the human race recognized the need for and established many of the health care fields such as our own and numerous others, and why they have continued to be a major contributor and energy source behind societies which care for the needs of others. Also, it may explain why many of these "care organizations" have experienced rather turbulent histories trying to gain recognition and equality with fields that were established by and have been dominated by the opposite sex. If the male of the species does not or cannot fully recognize and understand the needs which the female recognizes, then it becomes rather difficult for the female to gain recognition, let alone equality, in those areas in which the male has less interest or limbic drive. Likewise, when intellectual beliefs are impressed upon these basic genetic differences, then it begins to look, especially from a man's point of view, and perhaps eventually the woman's, as if the female is the inferior individual. Is it not more accurate to say that the environment creates a feeling of insecurity, not inferiority, in the female of the species? It is well known that the female is neither inferior nor superior. Rather she is different, just as the male is different. Each sex has different drives in relation to one another. Likewise, each sex looks at and experiences the environment from a different biochemical and genetic perspective. This could be expressed as follows: the male drive is more concerned with the conquest of nature, while the female's is to nurture nature. However, both sexes have the same drive to be nurtured. All of these are of equal importance and are essential in the emotional preservation of the species. Animal societies recognize these differences and accept them for what they are. But the human primate has a tendency to forget or ignore them, because of his need to use his cortical gray matter for intellectual pursuits. Also, humans may be different, in that they have a built-in excuse for not understanding others on an intellectual level. It is theorized that the nervous system may not be capable of cortically comprehending that which it has not personally experienced. By the time the nervous system reaches maturity the intellectual brain is believed to be biased toward that which it can readily understand, and away from that which is different, strange, or unknown. It is no wonder then that man appears to be the only species among the higher vertebrates of the animal kingdom who sometimes fails to comprehend his fellow creatures and seems to spend a great deal of intellectual energy denying

his emotional needs and forever defending his own biased views, instead of listening to the needs of others.

Conclusion

In conclusion, it is my biased belief that humans need to understand their emotional or limbic brain before they attempt to comprehend their complex intellectual brain. Humans should pause several times each day during their busy lives to observe, study, and interact with a family of canines, felines, or other gregarious animals so that they can begin to understand themselves. It is only in recent times that man has allowed himself to see the similarities which exist between humans, the higher vertebrates, and the environment. Also I feel that man can learn more from observing the animal, rather than his own complex species, because the animal presents a simplified, nonthreatening, and rather rewarding model for comprehending behavioral mechanisms.

Through this avenue of understanding behavior, we might begin to take a second look at some of the comments we hear about our profession. Perhaps one of the most common remarks is that many of our treatment techniques are successful merely because we have the ability to motivate people. The intended implication is that no matter what we do, the individual seems to improve because of the motivation factor. Is this really what is being said? If it is, then the person is admitting that he or she has never listened to us with an unbiased mind. Also, it implies that the individual has failed to read the literature which substantiates many of our treatment techniques. Another implication might be that we, along with many other professions, need additional scientific research to verify some of our techniques. Actually, this remark could mean many things, but in reality the speaker is not listening to what he or she has said. It is a well-known fact that treatment of any kind may fail unless the individual being treated is motivated and has faith in those who are helping him. Thus a person who makes this kind of remark does not realize that he or she is actually giving us one of the highest compliments known to mankind. In effect, the person is defensively saying . . . "How in blazes can you motivate a person to do something when I can't?" Little does the individual know that certain kinds of motivation—or what might be called motivation at a limbic level—are of the utmost importance when working with those who need help. The ultimate expression of all of our limbic drives is the need "to be" . . . to be loved, to be understood, to be wanted and accepted for what we are, or just the need "to be." Unfortunately, this drive is an extremely intangible entity to measure and, of course, man must measure everything he does before he can accept anything as fact. Also, it is rather difficult to measure how quickly this drive "to be" can be lost or shaken when one is confronted with disease, injury, mental illness, loneliness, fear, loss of loved ones, radical changes in life, or any factor which upsets the routine of living. Persons who are not able to perceive the feelings of individuals who have lost some of this drive "to be" may not be able to understand others who have this perceptual ability. This initial lack of insight may also prevent these individuals from being able to comprehend the techniques which we utilize in patient treatment. Because of these factors, our profession and others like us

may never win many accolades or be understood and recognized as equals in the health community. However, this should never deter us from utilizing treatment techniques which we feel are appropriate for the individual needs of each person. Above all, we should continue to perfect our perceptual abilities which enable us to relate to others on a limbic level instead of functioning entirely at the level of a biased intellectual.

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