

The ROUND ROBIN LETTER of

THE AMERICAN ACADEMY OF NEUROLOGICAL SURGERY

The fifteenth annual meeting of the Academy in Santa Barbara has left its memories in our neurosurgical history. Your California hosts have happy recollections of a gay time and an excellent scientific program as well as the genuine pleasure of entertaining our distinguished group on our Western shores.

We congratulate our Rupert in the new honor of President and wish him success in his difficult but nonetheless enjoyable office. Few have the understanding and interests of the Academy more at heart than he.

We are happy to be able to include our Past President's Presidential Address in the Christmas Edition. Your editor employed some coercion to obtain it before he misplaced it on one of the transcontinental airlines en route home.

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NEUROSURGERY AND THE MIND

The choice of my topic, "Neurosurgery and the Mind" has truly been a desperate one, not only because of the great store of knowledge possessed by this august company, but also because of the magnificent range of previous presidential addresses which has left so little else to discuss. Finally, the very span of the subject is so overwhelming that, as you can see, only the most foolhardy would venture it.

Courage to proceed stemmed from the thought that we live in an age devoted more and more to the science of the mind, and might therefore look more closely at what we mean by the mind. This applies in particular to us neurosurgeons, who have both the opportunity and the responsibility for contributing to this science of the mind, as Penfield and his many distinguished colleagues have so clearly shown. Only by a better understanding of the anatomy and physiology of mind for example can we hope to remedy some of the



"The gathering of the clan."

brain disturbances that lead to mental illness.

Today it is of course easy enough to say that the mind is a product of the brain. But this was not always so. Only five years ago Warren McCulloch, undoubtedly with tongue in cheek, gave a Hixon lecture entitled, "Why the Mind is in the Head." The ancient Greeks, with Hippocrates dissenting, believed that mind and intelligence resided in the diaphragm, whence come the terms phrenetic and frenzy. And as you well know, the heart, spleen, womb and pineal gland at various epochs have all been thought to represent the mind or some of its components. Perhaps though it was never the brain at all but actually the thumb that first initiated the development of mind, as suggested by the old jingle:

"Man was as ape in days that were earlier;
Then Centuries passed and his hair grew curlier.
Centuries more and his thumb gave a twist
So that ape became man and a positivist."

As a positivist I recently asked my barber what the brain was for. "Why to make your hair grow, Doc!" Perhaps after all he was not too far behind the times, when one considers that cerebral dominance was not recognized until 75 years ago. To be sure, over 3000 years ago, according to the Smith papyrus, it was known that one side of the brain controlled the opposite extremities, while in 400 B. C. Hippocrates, and in 1492 our first modern neurosurgeon Berengario da Carpi were also aware of this fact. Hippocrates, Celsus, Shakespeare and a few others also knew that a diseased brain meant a diseased mind. Otherwise however practically nothing was known of brain functions until just about a century ago when modern neurology and electrical stimulation began. Up to that time studies of brain and mind were pretty much retarded by the religious and intellectual climates of the times, resulting amongst other things in a rather sterile debate on the nature and location of the soul that lasted nearly 2000 years.

Superstition also played a retarding role. In ancient days for example it was thought that man's mind could govern his actions only to a limited extent, and that by and large, God or the gods intervened.

Supernatural influences on mind and body were of course believed in by primitive tribes. Likewise Homer for the Greeks and Plutarch for the Romans indicated that while divine beings did not literally turn our bodies or direct our hands and feet, they

nevertheless actuated our behavior by images and thoughts they presented to the imagination or mind. Even St. Luke described an epileptic as possessed of the devil, while some of our Pilgrim fathers spent their weekends burning witches.

Yet there were some early efforts to define various attributes of mind beginning with the Old Testament which distinguished between wisdom and knowledge, while Plato was the first to separate knowledge from perception. Emotions however were not generally considered as an integral part of mind or even as related to the brain, but as independent functions stemming from various parts of the body. Hardening of the heart, venting of the spleen, melancholy bile and hysteria are familiar illustrations. Shakespeare was apparently the first to express clearly the idea that while emotions might be independent functions they were nevertheless under the control of the brain.

"I have a heart as little apt as yours" he wrote in Coriolanus III:2, "but yet a brain that leads my use of anger to better vantage". (How fortunate the neurosurgeon possessed of such a brain.)

A few years after Shakespeare died, Spinoza clearly defined the relations between the emotions and the intellect in his treatises "Of Human Bondage or the Strength of the Emotions" and "Of Human Freedom or the Power of Understanding".

Despite such early efforts at clarification of terms an element of confusion still prevails regarding words like heart, mind, knowledge, consciousness and soul. Only four months ago for example a distinguished neurologist publicly referred to psychiatry as "an abstract contemplation of the disembodied soul". Current concepts of consciousness and intelligence, as well as of soul, have also been misty and subject to various interpretations. Thus the philosopher Robinson inaccurately says that consciousness is the same thing as intelligence and knowledge; McCulloch says consciousness is simply the capacity of another person to bear witness to what he, McCulloch, experiences, while Wechsler defines consciousness as a variable state of awareness plus the ability to react. As we shall presently see, it seems preferable to consider consciousness as a state of awareness; and to reserve for intelligence the ability to react by making as Porteus puts it: "planned responses to relevant stimuli."

Consciousness has been ascribed to the corpus striatum

by Dandy, to the diencephalon and cerebral cortex by Penfield and by Gellhorn, and to the reticular substance and cerebral cortex by Magoun and French.

Intelligence or mind has also been variously defined, having been considered a motor phenomenon by Watson and a sensory function by Brickner. While Bailey states that mind is a function of the entire cerebral cortex, Halstead says no definition of mind is agreed upon, and Gerard despairingly remarks that as far as mind is concerned the head might just as well be stuffed with cotton. Lashley has suggested that mind is dependent on mass action of the brain as a whole, Köhler speaks of brain function in terms of electrical fields, and Eccles mentions the possibility that each individual mind functions because of its participation in a world mind. Let us discard these concepts, however, erudite, as being too broad and too vague for purposes of neurosurgical research and therapy, and strive for a more specific idea of the mind.

Several neurosurgeons have supplied definitions of mind pretty much as follows: "Mind is the ability to deal with internal and environmental stimuli and with abstract thoughts". Is this concept sufficiently broad? Those of us here at dinner tonight are all dealing with internal stimuli of a highly pleasant character, while the assembled ladies constitute a most gorgeous array of environmental stimuli. But do these stimuli, together with any resultant abstract thoughts, necessarily signify that our minds are at work? Or can we say more of the mind?

Of the many efforts to define mind I consider Stanley Cobb's the most cogent and comprehensive, wherein he says that mind is the integration or product of four main functions of the brain: consciousness, attention, memory and emotion.

It is of interest to note that 300 years ago Descartes also included both consciousness and emotion or "feeling" in his concept of mind, and that Kant included "animal impulses" (emotion again) along with "traditional knowledge" or memory among his requisites for mind. Freud of course gave special emphasis to the power of emotions in coloring our thinking and supplying drive or motivation. In a word, emotion is now considered an essential ingredient of mind.

Let us now consider Cobb's major attributes of mind in the following order: consciousness, attention, memory and emotion.

1. Consciousness. Physiologically speaking consciousness appears to be a compound of two separate functions: being awake and being aware. That there are degrees of consciousness is illustrated by the fact that while not fully awake Coleridge composed his famous poem Xanadu, and while drowsing Kerkule conceived the carbon ring theory.

In terms of brain function the waking element of consciousness depends primarily on the reticular substance, diencephalic and thalamic relays, and the cerebral cortex.

Awareness is another important element of consciousness. Shaw once wrote that "without a brain you would enjoy yourself without knowing it." One might equally well say that without awareness you could be awake without knowing it. On close scrutiny awareness implies being aware not only of environment but to some extent of self. Environmental awareness is a function of well known sensory pathways and their cortical end stations. Awareness of self on the other hand is more complex for it depends on appreciation of three factors: awareness of body image (parietal cortex); awareness of visceral stimuli (sensory, frontal intermediate, temporal and insular cortex); and awareness of self as a whole (principally but not exclusively a function of prefrontal cortex). In a word, consciousness represents the function of several separate though related neural systems of the brain. As just described moreover it cannot be considered synonymous with mind or intelligence, but rather as an attribute thereof. A man may be aware and awake and hence conscious, without being intelligent.

2. Attention. Our next attribute of mind, attention, is the power of concentration or persistence so well defined by Halstead. Its positive element appears to be a capacity for sustained directed nervous activity, its negative element a capacity for inhibiting or rejecting irrelevant stimuli and memories. As far as inhibition is concerned special parts of the brain are capable of this type of phenomenon under certain conditions. As far as attention is concerned, lateral frontal cortex seems preeminent in importance.

3. Memory. Neurosurgical experience, fortified by the recently elaborated studies of Penfield, indicates that the temporal lobes are intimately concerned with a basic mechanism of memory. Lesions of other parts of the brain such as frontal cortex do not produce actual loss of memories though they may lead to difficulties in memory storage and recall. Nor does stimulation of any part of

the brain other than temporal cortex evoke formed memories.

Although temporal cortex and its related subcortical nuclei therefore appear to be critical parts of the brain serving memory, there is no evidence that this or any other single part of the brain actually stores our memories. Clinical and experimental data suggest that there is a temporal lobe system which makes memory recall possible by means of some special sort of scanning mechanism or "set", while the actual storage of memories has widespread representation throughout the brain.

4. Emotion. Although psychological factors play a vital role, the driving force of the mind derives ultimately from such basic forces as hunger, fear, anger, and of course sex as illustrated by Dr. Kinsey in his latest book that could be called "For Whom the Belles Told." From these basic emotions in the last analysis comes motivation or the power factor that Halstead has also called biological intelligence. Laboratory and clinical efforts directed at "hunting the animal behind the eyes" have shown how these basic emotions are largely represented by neural patterns deep in the primitive parts of the brain (brain stem, diencephalon and limbic system) and how special parts of the brain can modify these patterns in special ways. For example, loss of frontal cortex tends to impair the control of emotions; loss of temporal cortex the extression of emotions.

Before concluding this sketchy history of the mind two points are worthy of mention. First, we must not overlook the role of brain stem participation in most of the functions and nerve systems just discussed, as first indicated so brilliantly by von Economo and more recently by Yakoklev, Hamlin and Sweet, by Meyer and McLardy, by Magoun and French, and perhaps by Scoville's report of psychotic patients who improved after operative intervention upon the midbrain during temporal lobe surgery. In a word, the study of mind and the treatment of its aberrations hinges on a knowledge of nerve systems or neural circuits reaching from brain stem to cortex. This seems a broader and more practical approach to the problem than consideration of the mind solely in terms of mass action of the brain or of restricted pinpoint localization of function in a single part of the brain.

Secondly, mind or intelligence seems something more than just a mere product of the brain functions that have been so briefly mentioned. Mind implies a synthesis of something new that enables man to advance beyond the scope of purely reflex

behavior to creative and abstract thinking. This is the most important characteristic of the mind and seems to derive principally from the prefrontal cortex and its subcortical links, that last system of the brain to develop in the long process of evolution.

May I also point out that one of the highest achievements of the human mind, according to Judge Hand, is forbearance. May I now thank you for yours.

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"Santa may distribute the toys but father holds the bag."

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Your editor would like to congratulate the new members, Arthur Ward of Seattle, Washington and John Green of Phoenix, Arizona on their election to our neurosurgical family. He trusts they will enjoy "The Neurosurgeon" and contribute to it in the coming years.

Congratulations on a difficult job well done over a long period of time goes to Ted Rasmussen, our retired and hard working Secretary-Treasurer. His important position falls to the lot of Eben Alexander of Winston-Salem, N. C., and we are sure he will handle this problem admirably.

Congratulations are in order to Catherine and Ted Rasmussen on the recent birth of a baby girl.

We are also happy to learn of Emmy and Ted Erickson's new baby boy's arrival on September 2nd. We are indeed sorry this prevented them from enjoying the Santa Barbara meeting.

Recently the membership received announcements of the marriage of Byra Mitchell to Keith Bradford. Those of us of the Academy wish them every happiness.

The first letter of the Christmas Edition is from John Raaf which unfortunately did not arrive in sufficient time for the last Neurosurgeon.

John Raaf - Sept. 14, 1953

Life this last summer has been so hectic I have neglected