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SOME THOUGHTS ON BRAIN-MIND, AND ON RESTRAINT AND ISOLATION
OF MENTALLY HEALTHY SUBJECTS

(Comments on "Biological Roots of Psychiatry" by Clemens E. Benda, M.D.)
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Dr. Benda's major thesis that some, if not all, mental disease has roots in developmental pathology is pleasantly acceptable to one of my background and research efforts, and, I believe, is not as radical as may appear at first sight. Whether some persons like it or not, the brain is the organ of the mind, and the mind does exist in the brain. No matter how we approach either the brain or the mind, through development, history, ontogeny or phylogeny, through physiology in its broadest sense, or through classical psychoanalysis or psychotherapy or everyday conversation, we find that we are ignorant of the fundamental laws. Despite the fact that the basic laws of mind operations and development have a long history, psychodynamics is only about 60 years old. Similarly, basic modern brain physiology is still young -- an offspring of spinal physiology, it is still only about 30 years old, and has yet to establish itself in full maturity and independence of its parent discipline.

Assuming the interdependence of brain and mind, and examining the operations of each closely, intensively, and in great detail, one is impressed by the extreme complexity, delicacy, and sensitivity of both. If one studies the brain neuroanatomically and developmentally, one wonders how such a magnificent structure ever grows in such a way as to generate a

"normal" mind. It seems as if there must be billions of ways that such an organ could grow which would not generate a healthy mind: at each stage, from neural tube to full size in the adult, there must be thousands of ways in which its growth and operations could take paths other than the healthy ones. The truly marvelous and astounding result of nature is the mentally healthy individual; the mentally ill one is a far more probable result of all these complex processes.

If we expose a healthy adult brain to minute, localized trauma, we have ways of demonstrating that local function is disordered. If we expose a healthy whole person to certain stresses, such as physical isolation from patterned stimuli, it can be demonstrated that mental symptoms develop. Thus, even at the adult level, both brain and mind can be forced into "unhealthy" paths.

Luckily for us, some of the non-healthy paths are reversible ones, even though in a limited sense in many cases. Many therapists have found that some of the younger individuals are more easily set on the path of mental health than are older ones. If it seems surprising that brain-mind pathology is reversible in any cases at all, let us remember that we do not yet know what subtle and intricate changes in brain structure and brain operations are involved in any brain during its everyday continuous operations through its normal inputs and outputs. And, as a parallel, we do not know, and can not yet know fully, the simultaneous deep changes in the mind resulting from everyday events.

On the mind side, there is evidence from hypnosis, psychoanalysis, and experimental psychology that by far the greatest fraction of our experience comes into us through paths unbeknownst to our consciousness.

Consciousness and attention are limited in their scope, and are limited, as it were, to the important matters at hand. On the brain side, we know nothing of the simultaneous processes occurring with these phenomena -- we know only that the conscious state (in the most general sense) depends on an intact, functioning mesencephalon: lesions here cause lasting coma, but how, in detail, this relates to subjective consciousness is beyond our present understanding.

Conversely, we know that even in deep surgical anesthesia, afferent activity still penetrates up the paths as far as cerebral cortex -- yet, obviously, we do not know what effect this has in the mind, either unconsciously or consciously. The usual technique of conscious recall is obviously an unfit tool to explore this question: if we knew how, where, and when to look, an answer might be found in psychoanalytic work.

My own work is devoted to studying brain processes on the one hand and mind processes on the other. (I am sorry I am unable to pursue the developmental aspect of these processes in detail in the light of Dr. Benda's paper -- the adult organism seems to absorb 100% of my time). By new and fairly subtle electrophysiological techniques, we explore the electrical activity of the brains of unanesthetized monkeys. By psychophysical techniques and psychoanalytic insight, we explore a small bit of the human mind. In each case, insofar as is practical, we try to limit the work to intact, uninjured brains and to "healthy" minds: we feel that baselines are needed before we can account for the pathological aspects.

In these endeavors, we have found that brain function is extremely delicate -- that a very fine needle pushed briefly into unanesthetized cortex causes pathological activity to start and be maintained for 24 hours

and then disappear; on post mortem, no sign of a lesion can be found. In these studies on the intact unanesthetized brain, we feel that we have demonstrated that local functional lesions can exist temporarily with complete reversal and no permanent visible microscopic signs. In other studies on the effects of certain types of electric currents on local regions, we are obtaining a more quantitative picture of the relation between dosage and visible microscopic damage of the irreversible type.

The only generalization we care to make about these studies is that this region of investigation is full of vast areas of ignorance -- and any generalizations about the absence of lesions in mental disease is premature and unfounded in fact. I add parenthetically that there is no strictly behavioral test by which we could pick up the presence of these functional lesions -- our testing procedures in this area are also inadequate. The physiological tests involved recording local electrical activity and determining the local thresholds for excitation -- these criteria are reliable and repeatable. But please do not mistake my meaning here -- I do not recommend such tests for human subjects nor for psychiatric research! I merely mean that the brain is yet to be explored for its real subtlety and complexity of operations: we are just barely getting a foothold on some of the variables involved.

On the mind side, we have been intrigued by the effects of isolation of healthy subjects from the usual levels of physical stimulation and necessities for action. It appears that if a person is freed of patterned physical stimuli in a restraining environment, phenomena occur which may be called "reversible mental symptoms". The longest exposures to isolation of the largest number of subjects has been done in Dr. Donald Hebb's De-

partment of Psychology at McGill University by a group of graduate students. We started a similar project independently with different techniques at Bethesda.

In the McGill experiments, a subject is placed on a bed in an air-conditioned box with arms and hands restrained with cardboard sleeves, and eyes covered completely with translucent ski goggles. The subjects are college students motivated by \$20/day for as long as they would stay in the box. An observer is present, watching through a window, and tests the subject in various ways through a communication set.

In our experiments, the subject is suspended in a tank containing slowly flowing water at 34.5°C., wears a blacked-out headmask for breathing and wears nothing else. The water temperature is such that the subject feels neither hot nor cold: the experience is such that one feels the supports and the mask tactually, but not much else. The sound level is low -- one hears only one's own breathing and some faint water sounds from the piping. It is one of the most even and monotonous environments I have ever experienced.

At McGill, the subjects varied considerably in the details of their experiences. However, a few generalities appeared. After several hours, it was found difficult to carry on any organized, directed thinking for any sustained period. Suggestibility was very much increased. An extreme desire for stimuli and action developed; there were periods of thrashing around in the box in attempts to satisfy this need. The borderline between sleep and awakedness became diffuse and confused. Somewhere between 24 and 72 hours most subjects couldn't stand it any longer and left the box. Hallucinations and delusions of various sorts developed, mostly in those who could stay longer than 2 days.

The development of hallucinations in the visual sphere followed the stages seen with mescaline intoxication; when full-blown, the visual phenomena were complete projections maintaining the 3-dimensions of space in relation to the rest of the body and could be scanned by eye and head movements. The contents were surprising to the ego, and consisted of material like that of dreams, connected stories sharing past memories and recent real events. The subjects' reactions to these phenomena were generally amusement and a sense of relief from the pressing boredom; they could describe them vocally without abolishing the sequences. A small number of subjects experienced doubling of their body images. A few developed transient paranoid delusions, and one had a seizure-like episode after 5 days in the box with no positive EEG findings for epilepsy.

Our experiments have been more limited both in numbers of subjects and duration of exposures. There have been 2 subjects, and the longest exposure has been 3 hours. We have much preliminary data, and have gained enough experience to begin to guess at some of the mechanisms involved in the symptoms produced. In these experiments, the subject always had a full night's rest before entering the tank. Instructions are to inhibit all movements as far as possible.

In the tank, the following stages have been experienced:

- (1) For about the first 3/4 of an hour, the day's residues are predominant: one is aware of the surroundings, recent problems, etc.
- (2) Gradually, one begins to relax and more or less enjoy the experience: the feeling of being isolated in space and having nothing to do is restful and relaxing at this stage.
- (3) But slowly, during the next hour, a tension develops which can

be called a "stimulus-action" hunger ("lust" might be a better term because of the high intensity it can reach): hidden methods of self-stimulation develop: twitching muscles, slow swimming movements (which give sensations as the water flows by the skin), stroking one finger with another, etc.,

If one can find and inhibit such maneuvers long enough, intense satisfaction is derived from these self-stimulations.

(4) If inhibition can win out, the tension may ultimately develop to the point of forcing the subject to leave the tank.

(5) Meanwhile, the attention is drawn powerfully to any residual stimulus: the mask, the suspension, each come in for their share of concentration -- such stimuli become the whole content of consciousness to an almost unbearable degree.

(6) If this stage is passed without leaving the tank, one notices that one's thoughts have shifted from a directed type of thinking about problems to reveries and fantasies of a highly personal and emotionally charged nature. These are too personal to relate publicly, and probably vary greatly from subject to subject. The individual reactions to such fantasy material also probably varies considerably, from complete suppression to relaxing and enjoying it.

(7) If the tension and the fantasies are withstood, one may experience the furthest stage which we have yet explored: projection of visual imagery. I have seen this once, after a $2\frac{1}{2}$ hour period. The black curtain in front of the eyes (such as one "sees" in a dark room with eyes closed) gradually opens out into a 3-dimensional dark, empty space in front of the body. This phenomenon captures one's interest immediately, and one waits to find out what comes next. Gradually, forms

of the type sometimes seen in hypnogogic states appear. In this case, they were small, strangely shaped objects with self-luminous borders: their shapes and movements are, to a limited degree, under ego control. A tunnel whose inside "space" seemed to be emitting a blue light then appeared straight ahead. About this time, the experiment was terminated by a leakage of water into the mask.

In both the McGill experiments and in ours, certain after-effects are noted: the McGill subjects had difficulty in orienting their perceptual mechanisms; various illusions persisted for several hours. Several transient paranoid reactions occurred. In our experiments, we noticed that after emmersion, the day apparently was started over, i.e., the subject felt as if he had just arisen from bed afresh; this effect persisted, and the subject found he was out of step with the clock for the rest of that day.

Experiments such as these demonstrate a fact well-known to solitary polar explorers: if one is alone, long enough, and at levels of physical and human stimulation low enough, the mind turns inward and projects outward its own contents and processes. Richard Byrd and Christiane Ritter give valuable accounts of such experiences. Apparently this is the way healthy minds act in isolation. What this means to psychiatric research is obvious -- we have yet to obtain a full, documented picture of the range available to the healthy, human, adult mind, and some of the etiological factors in mental illness may be clarified and sharpened by such research. Of course, this is a limited region of investigation -- we have not mentioned loss of sleep, starvation, and other factors which have great power to change healthy minds to sick ones. And finally, I think that

most of you can see the parallels between these results and phenomena found in children and in psychotics; we may be dealing with some phenomena which one may call "a reversal type of developmental pathology" if Dr. Benda will pardon the expression.