Issues in Brain/Behavior Control

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Introduction

I wish to commend the contributors to this volume for their courage in participating in this conference, especially in the light of the highly controversial nature of the subject. Unfortunately, the very nature of this topic, brain/behavior control of violence, often makes it difficult for many to separate medical and scientific issues from political, social, and personal biases.

You will note in the following papers that individual attitudes are specifically expressed by the scheduled participants. Not noted was the demonstration by an unscheduled group of college students who displayed their objections over the meeting topic itself. Fortunately, as to the meeting, all went well and ended well. The symposium, I might add as its permanent chairman, was the fifth of an annual series on cerebral function and was held in Coronado, California, last year. This yearly event is a multidisciplinary gathering of neuroscientists who share common interests in brain/behavior correlates. We express our sincere gratitude to Hoffmann-La Roche, Inc. and Ives Laboratories, Inc., whose generous support made this meeting possible.

As a clinical neuropsychologist, I will try to place the problem of the neural regulation of aggressive behavior in perspective. Since the advent of modern neurophysiology, many of the most respected workers have been concerned with elucidating the anatomical,

physiological, and biochemical substrates of aggressive behavior. One only has to recall the contributions of Reanson, Magoun, Bard, Mountcastle, Hess, Klüver, Rioch, Fulton and McLean, to recognize that there has been continuous research interest in this subject. Thus, we already know a good deal about the neural pathways and anatomical areas underlying the elicitation of aggressive behavior in sub-human species. To be sure, we may have only scratched the surface, and many of the older concepts and results will be re-evaluated in the light of more sophisticated techniques and understanding of behavioral mechanisms.

Before and during the early experiments on temporal lobe, the frontal lobotomy era began and ended, stimulated by the pioneering experiments of Fulton and Jacobson. It is probably true that the reason for the abrupt decline in frontal lobotomy was not entirely the disenchantment with the results but the advent of the major tranquilizing drugs as well. Had the introduction of these powerful psychotropic agents been delayed a decade or so, we would quite likely have seen continued use and refinement of those surgical procedures.

My co-editor of this volume, Professor Kling, as you may know, has been carrying out basic research on the function of the amygdaloid nucleus for over twenty years. It was Dr. Leon Schreiner and Dr. Kling who first demonstrated that the "Klüver-Bucy" syndrome, called temporal lobectomy, could be produced by lesions of only the amygdaloid nucleus. A score of years ago no thought was given to applying the results of these experiments to human neurological or psychiatric problems. Since these early studies, however, a great deal of research into the functions of limbic system structures was conducted and continues, here and abroad.

Interestingly, the discussion in this volume has largely ignored the continuing use of selective lesions of the frontal lobe in man and has focused on the amygdalotomy procedure and more particularly on the 13 cases reported by Drs. Mark and Ervin, as if the amygdala, by virtue of its location deep in the medial surface of the hemisphere, is somehow closer to the abstract concept "soul". However, what has emerged from the study of the human split-brain series is that the "soul" is not likely to be found in any one location. Early studies in commissurotomized patients led one neurosurgeon to believe that the splenium might well be the seat of the soul, since patients in which it was spared did much better post-operatively. Yet with further cases, an almost hierarchical involvement has been noted which now includes the splenium as well as the reticular activating system and the limbic system, although the RAS undoubtedly remains at the top of

the heap. Most of us are relieved that we need no longer entertain the pineal body. So much for soul searching.

One of the major themes of this conference is the question of the control of aggressive or violent behavior. Few would disagree today that "aggressive behavior", in the broadest sense, is built into the nervous system and is required for the survival of the species. A lack of "aggression", or striving, is coincident with individual and social deterioration and eventual dissolution of the group or society.

Given an opportunity in appropriate circumstances, Dr. Kling reminds us, all primates including man will utilize a variety of distance communication to avoid direct physical combat. Disturbances in brain function which may result in inappropriate and increased aggressive or violent behavior may be the result of increased discharges from brain areas facilitating aggressive behavior (amygdala, hypothalamus, brain stem). Critical damage to inhibitory structures or disturbances to brain areas resulting in disordered communication lead to physical means of communication and frequent combat.

Any of these groups of disorders may be facilitated or attenuated by social, environmental factors as well as by personality disorders interacting with the above. Thus there is a dire need for research into the influence of these factors on established brain dysfunction.

Perhaps the most beneficial result of this conference will be the generation of research into these vitally important problems.

In introducing this conference, Dr. Bogen has raised a number of knotty questions of definitions, or responsibility for treatment, as well as quality and appropriatness of treatment programs for individuals suffering from behavior disorders with varying etiologies. Each of these questions would require far more extensive discussion than was available within the scope of this conference. While some of these issues were ably discussed by the contributors, it is obvious that we are a long way from closure.

In this symposium, Dr. Valenstein has pointed to problems inherent in utilizing electrical stimulation. While lesion studies also have inherent problems, they should not hinder further investigation, but be a stimulus for better solutions. Continued and increased research by neuroscientists and clinicians is essential and should not be deterred by those who see possible misapplication of this information. Dr. Grimm has discussed this potential as well as the misuse of drugs and other forms of psychiatric intervention. As knowledge of brain mechanisms expands we will be able rationally to evaluate proposed experimental procedures applied to man instead of having only opinions and beliefs based on inadequate data. We need vastly im-

proved methods of evaluating human behavioral function related to brain mechanisms, especially those concerned with behaviors occuring in a social context. Dr. Plutchik has presented the results of an attempt to develop a research methodology to identify factors related to violent behavior as well as a set of psychometric tools for further research.

Dr. Ervin has described a sub-population of individuals who are repeatedly involved in acts of personal violence and who have symptoms suggestive of an epileptic disorder. Dr. Plutchik's findings tend partially to support this contention in that he finds a high probability of people with focal epilepsy suffering from dyscontrol syndromes; however, their behavioral disorder does not involve violence. Rather, the high incidence of violence occurs in those who are already identified from prison populations and who have a history of family violence and who are schizoid or frankly psychotic. Dr. Grimm regards rage as being largely independent of the temporal lobe or limbic system paroxysmal disorders.

In the planning stages of this volume I had several inquiries regarding the person with XYY chromosomal abnormality, especially in reference to violence. One common misconception was in the Speck case. Although this genetic anomaly is not directly related to the topic of brain/behavior control, the interest is such as to necessitate a definitive discussion by a leading authority in this area. Dr. Shah has critically examined the XYY chromosomal abnormality as a predisposing genetic defect in aggressive behavior. His results point out the lack of evidence for relating this defect to violent behavior.

The papers in this book are multidisciplinary, overlapping and somewhat difficult to integrate, but several major questions emerge concerning technology, ethics and social responsibility.

Who is responsible for treatment of violent-aggressive persons? Are neurosurgical procedures, although still innovative, an appropriate treatment, even in specifically selected patients? What are the possible side effects of iatrogenic brain damage? On which patients should such procedures be conducted and under what conditions? What legal safeguards are necessary or desirable? What are the implications for future research and treatment of seriously ill people in light of the recent court rulings? Who will decide these issues in our society? Those who will ultimately decide these issues will be the ultimate controllers. Then who will control the controllers?

Answers to these questions will affect not only those directly associated with neurosurgical procedures and behavior, but also

electrode implantation, psychopharmacotherapy and all other forms of psychologically induced methods of behavior control.

As Dr. Grimm put it so well, "As we approach our 200th birthday as a nation, brain control should be an 'open agenda', a public issue, informed, argumentative, with all being heard". Amen.

W. Lynn Smith, Ph.D.

Contents

Some Questions, Assumptions and Problems Involved in Associating Dyssocial Behavior with Disorders of Cerebral Function.

JOSEPH E. BOGEN
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Like the rest of you here, I have been embroiled in a good many discussions over the past few years on such subjects as giving amphetamines to the child who misbehaves in the school room, using large doses of phenothiazines for the adult who is flagrantly schizophrenic, or advising psychosurgery for those of any age who are recurrently assaultive. Several conclusions seem to be inescapable: First, that most of us harbor very strong convictions, or at least intense feelings, on such subjects; second, that the differences of opinion among us stem both from differences in our experiences and from differences in how we understand the words with which we argue; and third, that it is usually quite difficult to reach agreement even on a precise specification of what it is we are arguing about. It is a fact of my own recent experience, for example, that many of those who are opposed to psychosurgery are also opposed to any attempt to define it (1).

If we can make only a little progress in the direction of definition and particularization, this symposium will probably have been justified.

Therefore, I should like to suggest at the start what some of the more sticky issues, questions or problems might be. Hopefully, as the symposium unfolds further, it will become clearer to us which of these problems are amenable to constructive discussion and which are not.

What do we understand by "cerebral function"? Does all speech depend upon cerebral function? I suppose so; but is this true of *any* behavior? Surely not, for we know that many a relatively simple form of behavior—for example, immediate withdrawal from a noxious stimulus—occurs about as often, and in the same way, with or without the cerebrum. On the other hand, when behavior is more complex, when it involves sizable delays in responding or involves responses whose form seems related to previous experience, then we usually conclude that the cerebrum *is* involved. Can we consider it a general rule that the more complex or less stimulus-bound an activity is, the more important is the cerebral contribution? When we come to what are often considered the highest functions—as, for example, imagination, foresight, altruistic love, creativity and the like—have we concurrently come to those functions which are the most dependent on the cerebrum? Most of us here would probably say yes. But we must admit that this is an unproved faith. And we must recognize that higher mental activity which is in some way independent of cerebral function is an aspect of the faith of some very eminent neuroscientists (2,3). Does this difference between two unproved faiths underlie some of the arguments which purport to concern more mundane matters?

Let us pass on to a question that is hardly any easier: What is "dyssocial behavior"? Is it any behavior which you or I individually find disagreeable or threatening? Or shall we take a vote, and then define as "dyssocial" any behavior which is disapproved by a slim majority temporarily existing at the time of balloting? Or should we depend on the individual himself? Perhaps we do not have to vote or otherwise define what we mean, so long as the particular individual himself considers his own behavior to be undesirable. But this is no solution—we must still form an opinion of our own before we can consider the inevitable issues of whether the individual in question is being self-punitive or self-deluding.

How about the individual who is self-destructive? Where self-destructiveness is as flagrant as in the Lesch-Nyhan syndrome,* a diagnosis of cerebral dysfunction is hardly arguable—but is it correct

*A combination including gout, mental retardation and self-mutilation (including the eating of one's own lips) which results from an hereditary enzyme defect (hypoxanthine-guanine phosphoribosyltransferase). See reference 3a.

to call such behavior "dyssocial"? Is it either dyssocial or mentally abnormal to self-mutilate in order to obtain some secondary goal, such as avoiding a military draft? If not, how about the self-mutilation of the Munchausen syndrome,* where the goals are poorly if at all defined?

What we mean by "dyssocial" is in some respects related to what we mean by "illegal." What do these two have in common, and—more interesting—how are they different? Hopefully Dr. Roger Johnson will help us with this among other questions.

Well, let us suppose that we have momentarily satisfied ourselves as to what constitutes "dyssocial behavior" and that we are also prepared to grant the brain a basic role in behavioral control. We would still be far from concluding that a particular dyssocial act is *best* understood in neurologic terms. Even when the brain is obviously diseased, it is often far from obvious that this disease is an important cause of the dyssocial behavior.

When there is a big earthquake and lots of people start running around like headless chickens, we suppose that their nervous systems are less stable or less adaptive in some way than the brains of people who are still acting purposefully in spite of the disaster. But we do not emphasize this brain difference so much as we emphasize the external cause. In most clinical practice, such persons are said to be suffering from a "transient situational reaction." Although mild tranquilizers might be in order, we mainly believe that the best solutions are to be found in some social remedy, perhaps even in something as simple as giving them hot food or a place to sleep or someone to talk to who is less frightened then they are.

What if the social dislocation is more chronic, such as being kept in a threatening environment interminably? Who was crazy in *Catch-22*—Yossarian or the system in which he was stuck? Perhaps Dr. Arthur Kling will provide us with some pointers on how to ascribe a proper proportion of causation to whatever is inside an individual rather than to what is outside of him.

Let us suppose that we have all agreed (some supposition!) that there are instances when an individual has indeed acted dyssocially, and that it is mostly because his particular brain is not functioning optimally. How vigorously he should be treated would then depend upon the severity of his disorder. How many acts of self-destruction

*A comprehensive account of this complicated syndrome (4) is not possible in a single sentence. Briefly, the patient presents repeatedly at different hospitals with ingeniously contrived, self-inflicted and difficult-to-diagnose disabilities; he does this presumably to obtain the food, lodging, narcotics and attention often made available for extended periods to "interesting cases."

must he commit to finally reach the magic number? Perhaps we can analogize with epilepsy: one seizure *does not* make a person epileptic. There must be, by definition, *recurrent* seizures. How many does this mean? At least four? Six? A dozen? It is the practice of some to say that surgery for epilepsy should be considered when, under the best medical management, the patient continues to have at least one daytime seizure per month for at least six months. Is this number appropriate for assaultive behavior? That is, shall we only make the diagnosis of "intractable episodic assaultive behavior" when an individual commits at least one seemingly unprovoked assault per month for at least six months? Should we really wait that long while the victims accumulate? If not, what number shall we use? Or is it sensible at all to look for a particular number as a measure of the propensity for dyssocial behavior? Perhaps Dr. Frank Ervin can suggest some criteria for this sort of problem.

Let us suppose that we have all agreed that something should be done without waiting much longer. Which procedure we advocate will probably depend upon which procedure we happen to have learned. Surgeons are gung ho for surgery, the psychotherapists love to listen (and talk), the behavior therapists have their thing, and so on. Therapeutic conferences are often reminiscent of the old story that if you give a little boy a hammer, it is absolutely amazing how almost everything in sight seems to need a healthy hammering! Would it really be any better to give him a screw driver? What if we gave our hypothetical child an extensive and diversified toolkit—would he then do less damage? Or maybe even more?

Perhaps, if we are sufficiently eclectic and simultaneously well-balanced (and aren't we all, those of us here?), our choice of treatment will not depend upon accidents of education or upbringing, or upon local logistic convenience. Perhaps what we should do is to choose the procedure which seems least irreversible. That seems sensible. In other words, having agreed that there is a problem needing action, we should do the simplest things first. Then if necessary we can progress in some systematic fashion to the more costly, then to the more unpleasant, then to the more risky, and then to the more definitely damaging. And all the while we will be hoping that some impressive success will soon appear and thus obviate the need for going further down the line.

In order to try various remedies in their proper order, we must first order them by some measure of their hazards. For example, when we consider how much cerebral damage a procedure can cause, surely our evaluation of the results should include thorough, skilled psycho-

logical testing (5, 6).* But as a prominent psychologist (not of the present company) recently said to me with respect to psychological testing, "No matter who does what tests, somebody will find them wanting." What can we do about that? Has Dr. Robert Plutchik some answers for us here?

And have any of you had the experience which I have had, that those who are the most insistent that therapy should await truly scientific evaluation of results are often persons with little or no therapeutic responsibility?

Let us move along, having assumed for the moment that we can assign costs and risks with a sufficient confidence. Nowadays, most persons with a severe pain problem would choose analgesics before acupuncture, alcohol injections before cordotomy, and cingulotomy before frontal lobotomy. But such an ascending series should hardly include *everything* for *every* problem. Nobody would interpose cordotomy before doing a cerebral operation if the problem were assaultive or other compulsive behavior. Even when the risks are restricted to loss of time, who wants to waste time trying acupuncture for a suicidal depression? Perhaps I exaggerate. But the general point is surely correct: if something does not work, an estimate of its risks and costs is irrelevant. If my advance information is correct, Dr. Elliot Valenstein will be addressing himself to this question of the efficacy, if any, of various procedures.

What do we mean when we say that something "works"? Do we mean that it usually makes people better? Well, then, what is "better"? More docile? Less complaining? When someone with widespread spinal metastases screams in pain every time he tries to turn in bed, docility seems heaven-sent.

But more generally we take a different view—the view that an individual is better, not when his behavioral repertoire has been reduced, but rather when it has been expanded. A conditioning procedure which eventuates in some stereotyped response is *not* what we are looking for. Consider *Clockwork Orange*, in which the protagonist is conditioned to retch whenever he sees the bare bod. This is considered preferable to what he used to do, which was to consider rape whenever he was in that situation. That he is accidentally conditioned at the same time to retch when he hears

*In this connection we may note that failure to report psychometric results has brought scathing criticism from his colleagues (7) on at least one neurosurgeon. And failure to consider relevant neurologic aspects has brought sharp criticism from a fellow psychoanalyst (8) on another author. Such examples do indeed suggest a need for a broader eclecticism.

Beethoven completely misses the point and is in fact a serious novelistic flaw, because it confuses the issue. What if this side effect had not occurred? Would the treatment then have been a success? I think not. Retching is less dyssocial than rape, but what a puny solution in which the patient's behavioral repertoire is no richer after treatment than it was before!

To be a better person one should be *more*, not less, differentiated (9). An automatic retching response to bare breasts is about as minimal a cerebral function as one can conceive. What one does who is really using his cerebrum in the presence of bifurcated beauty usually depends on *other* things—such as "Whose are they?" or "why are they bare?" (Or as one member of a group of nurses said when I used this example in a talk, "Yes—and how much time is there?").

Surely an essential measure of successful treatment is that it should usefully increase the patient's repertoire—that is, his capacity for choice.

When an individual is afflicted with some form of stereotyped behavior, its elimination may then provide him with an opportunity in which to consider other alternatives. But this will only be true if he has, somewhere along the line, accumulated a variety of different activities among which to choose.

No doubt the elimination of some repetitive, compulsive act will help to free the individual for the subsequent acquisition of alternative behaviors. I recall that when I decided some years ago never to strike my children for a trial period of one year, I subsequently felt almost powerless, especially in the beginning. Then, as time passed, it turned out that there are dozens of ways to cope, ways which came to me gradually over the months. By the end of the year I had such a large "armamentarium," as medical men are wont to call it, that I never again felt the need to resume corporal punishment. And now, in fact, I consider it a symptom of pedagogical impoverishment, or maybe even downright simple-mindedness.

But I want to emphasize that my new behavior pattern required not only forgoing an habitual solution, it also required the acquisition of other solutions. Trial and error alone will not suffice. The fact is, I had a lot of help in the form of advice from persons who already knew other ways to cope with children.

So shall we conclude that no doctor should ever undertake to eliminate a compulsion or any form of uncontrollable impulse unless he simultaneously commits himself to the subsequent rehabilitation of the patient? Where are all of these psychotherapists, occupational therapists and social workers going to come from? And how shall *they* be screened for competence?

It is easy to say that psychotherapy or social reform, either one, has fewer immediate risks than surgery or electroshock or radical pharmacotherapy. But there is a problem—and I speak to you now in the most candid way I can. The problem is that whereas the errors of surgeons are soon recognized, the mistakes of psychotherapists and social reformers are less often apparent. This difference is not difficult to understand. Throughout his career a surgeon operates under the constant surveillance of many persons, but it is a rare psychotherapist who retains even a single permanent control. If the social reformer makes a mistake, it may take generations to be recognized, and may well be completely irreversible. Surgeons who often err soon find their referrals drying up; they find themselves shunted into other full-time roles (such as testifying in court), or they restrict their activities to the teaching of medical students, or they go into politics. Perhaps today or tomorrow we will be told where the incompetent social reformer should go. And we would like to know how such a miscreant can be identified, if at all.

Let us suppose that a therapy has a reasonable chance of success and tolerable risks, and that we are confronted with a suitable patient. Then, finally, we may be entitled to offer this procedure to that patient. For a patient to agree in any meaningful way, however, his consent must be "fully informed" (10). But if he has never seen, felt or smelled the complications about which we warn him, how can he be fully informed?

The puzzled patient's usual best recourse is to his own trusted personal physician, the doctor who is on *his* side, who knows *him*, and who has no significant stake in the procedure itself—neither money nor self-esteem nor academic advancement nor scientific achievement. This is surely an important safeguard. But does each of us have a personal physician to whom we can turn for such independent guidance? Do you?

No prisoner has a personal doctor whose allegiance is to him alone. Does this mean that no prisoner should ever have electroshock, behavioral conditioning, or treatment with dangerous drugs? And how about the even more irreversible case of brain surgery? Perhaps with respect to brain surgery at least, we should conclude that prisoners should never have it (11). But what if they want it? Is this not just another infringement on their capacity to choose? Perhaps one solution here would be to say that conviction of a felony carries with it not only the loss of certain civil rights, such as voting or holding office, but also the right to get certain kinds of medical care of the high-risk type. In this way we would inflict an injustice on a few persons in order to safeguard a far greater number. This may seem a