

SEPTAL STIMULATION FOR THE INITIATION OF HETEROSEXUAL BEHAVIOR IN A HOMOSEXUAL MALE*

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Summary—A 24-year-old male, overt homosexual, repeatedly hospitalized for chronic suicidal depression and found to have temporal lobe epilepsy, underwent a program of septal stimulation which resulted in subjectively reported and behaviorally observed states of pleasure, euphoria, relaxation, confidence, and sexual motivation. These responses were subsequently used to initiate heterosexual arousal and behavior. The findings have important implications for the treatment of some psychological disorders.

PLEASURE has long been known to be a primary reinforcing condition for acquiring and establishing behavior in animals and man. They develop the particular responses that are followed by states of pleasure. The knowledge that these states can be important positive reinforcers has led to significant applications in psychotherapy, as witness the large number of studies reporting the effectiveness of various operational forms of pleasure in altering or "counterconditioning" undesired human behaviours. Over the past several years considerable interest has also fastened on the fact that a pleasurable response can be induced by direct activation of the brain and raised hopes that this might be applied to the treatment of disordered human behavior.

In 1952, at a symposium on depth electrode studies in animals and man, investigators at Tulane University School of Medicine first described 26 patients' pleasurable responses to stimulation of specific deep regions of the brain, initially observed with electrical stimulation to septal region (Heath, 1954). Subsequently, techniques were developed for intracranial self-stimulation and the study of what appeared to be reward and aversive areas of the brain in animals (Olds, 1960; Olds, 1962; Olds and Milner, 1954; Olds and Olds, 1964). These

were incorporated and modified by the Tulane researchers in human studies, enabling them to extend their scope to man (Bishop *et al.*, 1963; Heath, 1954, 1963, 1964; Heath and Guerrero-Figueroa, 1968). Following an initial observation that there were pleasurable experiences accompanying electrical stimulation of the deep structures of the brain, they found that there were positive and negative reinforcing properties of such stimulation and that there were effective stimulus parameters and brain "reward" areas in man. In particular, they found that stimulation of the septal area consistently resulted in a pleasurable response and frequently induced an associated sexual motive state. Considering the findings of these investigations it seemed logical to employ pleasure-yielding septal stimulation as a treatment modality for facilitating the initiation, development and demonstration of new and adaptive behaviors. The purpose of this study, therefore, was to explore the possibility of using it to bring about heterosexual behavior in a fixed, overt homosexual male. This was but one phase of the therapeutic program undertaken to deal with the complex symptomatology of this individual who had consistently failed to respond to other treatment approaches and was a most serious suicidal risk.

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CASE HISTORY

Background. Patient B-19 is a 24-year-old single, white male of unremarkable gestation and birth whose immediate family consists of parents, age 55, and a sister, 19. The father, described by the patient as a tyrannical, abusive and demanding individual given to excessive drinking and episodic anger and violence, reportedly considers his son to be a deeply disappointing young man who was a failure and coward during childhood and adolescence. The mother is characterized as an extremely withdrawn, rigid and emotionally controlled woman, whose embrace B-19 cannot recall. Rather, she serves to mediate between him and his father, is given to excessive complaining about her surroundings and circumstances and consistently approaches the patient for solutions to her marital conflicts. In contrast, he reports considerable affection for his sister, with whom he states he can share his confidences, anxieties and disappointments.

The educational background of B-19 is characterized by nine major residential and school changes and by the early manifestation of behavioral and disciplinary problems which resulted in three expulsions from school and two examinations by child specialists by age 11. From first grade on, he consistently experienced difficulties in interacting with other boys and actively sought to avoid contact and competition with them, while becoming increasingly aggressive and punitive toward his female peers. These behaviors resulted in his being teased, picked on and ostracized by his classmates. In desperation, he was sent to an all-male parochial school where he experienced further rejection and isolation and turned to individual pursuits, interests and reveries. High school began with a psychiatric referral because of an inability to get along with his peers and increasingly poor grades. He dropped out after 3 years and took a part-time job as a stock clerk before military enlistment, which resulted in a psychiatric discharge after 1 month due to "homosexual tendencies". Seven months were then spent working in a factory followed by 2 years

as a "drifter" travelling idly around the country, engaging in numerous homosexual relationships and being supported financially by homosexual partners.

Symptomatology. The patient exhibits a distinct preoccupation with his body image and is given to extreme somatization characterized by multiple vague and fluctuating complaints regarding suspected changes in facial dimensions, loss of libido and hormone imbalance, agitation and fatigability, and various conditions of discomfort in his head. In addition to these hypochondriacal traits he demonstrates considerable paranoid ideation, which often exceeds the limits of reality. Such thinking is highlighted by a marked fear of the future, a dramatic dread of inflicted physical pain, a daily expectation of dying and deliberate avoidance of people, especially men. Hypersensitive to criticism and unreasonably self-conscious in public, he feels sealed off and alienated from society in general. Paradoxically, however, he cannot tolerate being ignored and is generally disdainful, arrogant and grandiose in his presentation of knowledge and expresses hostility for gaining attention and recognition. Regarding the discomforts of these conditions, he conceives of himself as a "special" person who will be rewarded by God for the endurance of present hardships. The extent of his paranoia fluctuates situationally, but is often of true psychotic proportion.

B-19 is also distinguished by marked apathy, chronic boredom, lack of motivation to achieve and a deep sense of being ineffectual, inadequate, worthless and inferior. He avoids making any plans, has no meaningful feelings for others, and complains of having no talents worth mention. He is a severe procrastinator, gives up easily and obsesses on his personal problems to the point of incapacitation. Depression and suicidal rumination are reportedly his daily companions. Further, he feels that he will never find happiness or peace of mind and that his lack of masculinity and intellectual power cause him to want to end his life. Complaints are also present of an alteration in his ability to

experience pleasure, where he states that he is bored by everything and left constantly blasé. Having initially turned to alcohol, drugs and sexual acting out for pleasure and stimulation, drugs no longer produce a high or euphoria and he gets no "kick" out of sex—"not even masturbation". He does have a three-year history of drug abuse, which ran a course punctuated by alcohol, amphetamines, barbiturates, major and minor tranquilizers, the sniffing of chemical agents and solvents, marijuana, and nutmeg. Addiction and preference were for amphetamines, which gave him a "lift", confidence, energy and elation. With continued usage, however, alcohol and drugs, even in greater frequency and dosage, failed to produce the desired effects and resulted in severe depression and a state he referred to as "brain pollution".

For the past 5 years he has exhibited fixed, overt homosexual behavior but has never in his life experienced heterosexual relations of any kind. He prefers to be the dominant individual in anal intercourse, with fellatio being tolerated but not necessarily sought. He is most attracted to and jealous of handsome, well-built and -dressed, intelligent and masculine men; though, he is far more comfortable when lovemaking is with effeminate males. Those with whom he has had sexual relations over any consistent period of time have been several years older than he and characteristically of marginal emotional stability. He describes himself as having been "sexually precocious", experiencing erotic feelings toward his sister when bathed together as children, having begun "wet dreams" at age 5 or 6 (which he elaborates as a sense of pleasurable relief when he wet the bed), and having very actively indulged in masturbation since age 12 (still a preferred behavior). Homosexual encounters began at this time, as well as wide reading in the area of sexual deviations and perversions. There has never been an active interest in females, though he admits that he is somewhat aroused by pictures of women in various degrading and pitiable positions. In no way does the patient himself physically manifest effeminate mannerisms,

gestures or movements.

Hospitalizations, Evaluations and Examinations. Following two previous psychiatric hospitalizations of approximately 5 months each and initiated by suicidal depressions, B-19 was examined and admitted to the Tulane Service of the Department of Psychiatry of Charity Hospital of New Orleans. Physical and neurological examinations were within normal limits, as were the results of urinalyses and blood chemical determinations. Psychological evaluation indicated bright normal intellectual functioning (WAIS Verbal Score 118, Performance Score 104, Full Scale Score 113) and an unusually hypersensitive and obsessive-compulsive individual who experiences chronic depression of a degree which leaves him functionally disorganized, confused, discontent and bitter. His tolerance for frustration is extremely low, and he responds quickly with suspicion, anger, impatience, querulousness and vindictiveness. Psychiatric examination indicated that the symptom complex exhibited by the patient was consistent with temporal lobe epilepsy. Conventional scalp EEGs showed an abnormality characterized by bitemporal slow-wave activity, maximal on the left. Paroxysmal delta activity also appeared over the right temporal region, with Chlorolose activation. Pneumoencephalogram was normal.

TECHNICAL PROCEDURE AND APPARATUS

Operative procedure and stereotaxic implantation of electrodes followed techniques previously described (Heath *et al.*, 1968). The patient was under general anesthesia, with visualization of the ventricular system by air and pantopaque. Stainless steel Teflon-insulated electrodes 0.003 in. diameter, each with three to six leads separated by 2 mm, were implanted into the following brain regions: right mid septal, right hippocampus, left and right amygdalae, right anterior hypothalamus, right posterior ventral lateral thalamus, left caudate nucleus, and at two subcortical sites within the left lobe of the

cerebellum. Cortical leads were placed under the dura at sites in the left and right frontal regions, left and right parietal areas, and right temporal region. Triple-lead silver ball polyvinyl chloride acetate-insulated electrodes were implanted into the left anterior and left posterior septal region. The silver ball contact points were 0.5 mm in diameter, each 2 mm apart. Intracerebral cannulae were implanted into the septal region bilaterally and into the hippocampus (Heath and de Balbian Verster, 1961; Heath and Founds, 1960).

EEG recordings were obtained on two Grass Model VI electroencephalographs, one 12-channel and one 8-channel, synchronized by the use of a time code generator. EEGs from various sites indicated that all artifacts due to anesthesia and brain trauma incurred at operation had disappeared 3 weeks after surgery. At this time B-19's responses to passive electrical stimuli (Heath, 1954) delivered to all deep brain sites where electrodes had been implanted were carefully examined and indicated that only stimulation of the septal region resulted in a pleasurable experience, with stimulation of other sites being either neutral or aversive. The range of stimulation was 0.5-7.5 mA. The present study, being but one part of an overall treatment program and dealing with the effects of the pleasure responses upon behavior, concerns only those electrodes implanted in the septal areas specified. Figure 1 shows the placement of electrodes where stimulation induced the most consistent and intense pleasure response.

A later phase of the treatment procedure involved equipping the patient with a three-button self-stimulating transistorized device (Bishop *et al.*, 1963; Heath, 1963; Heath, 1964) attached to electrodes in the septal region and permitting him to stimulate any of the sites *ad lib*. Each depression of a button delivered a 1-sec stimulus whose count was automatically registered.

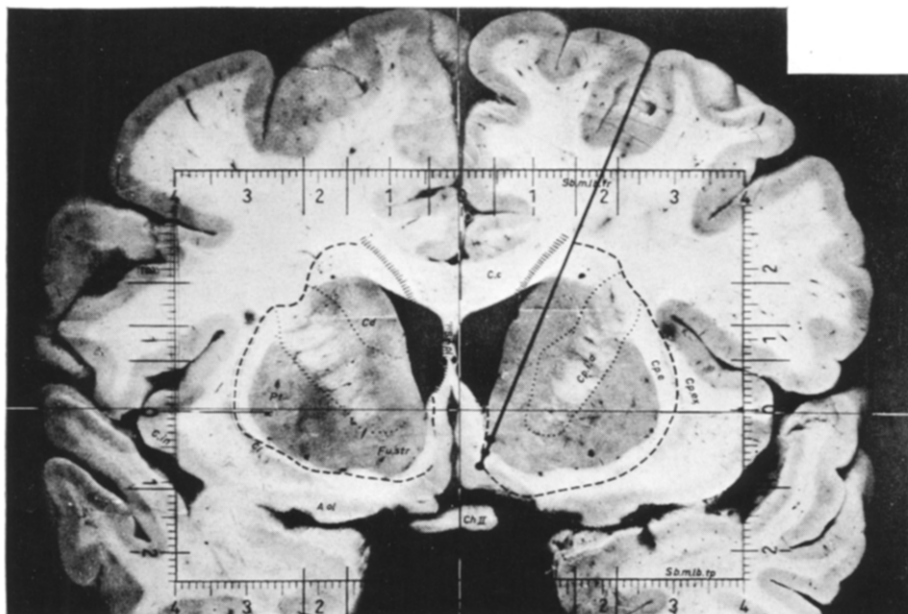
TREATMENT PROGRAM

The present procedure was but one phase of

the total therapeutic program for this patient and was consistently coordinated with his attitude and disposition, his physical and emotional well-being, and the requirements of other aspects of treatment. Although this, at times, resulted in a weakening of experimental design, attention to the overall welfare of the patient was justifiably placed before exploratory investigation and analysis.

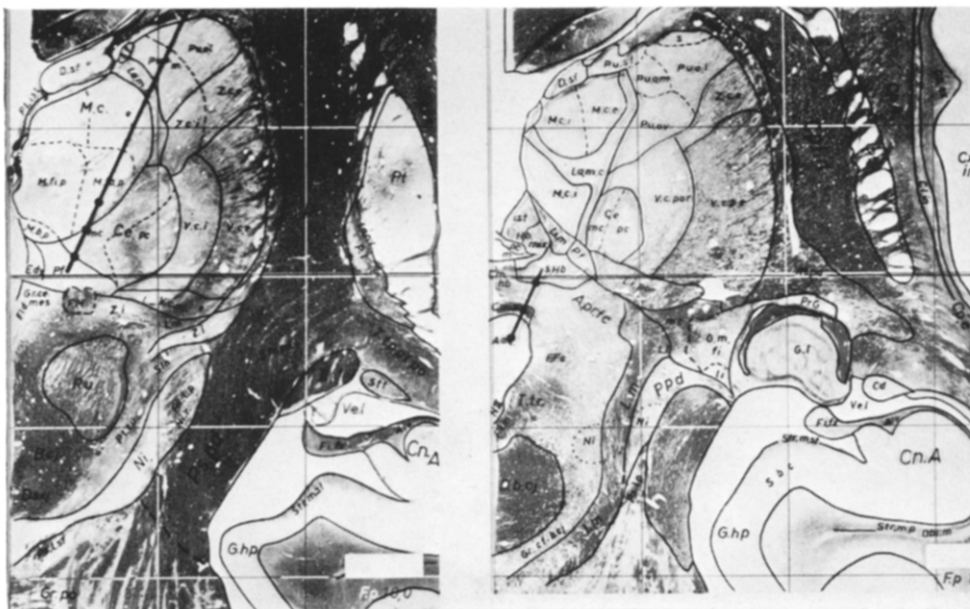
Initiation of the procedure took place 3 months following surgery for electrode implantation and 4 weeks after the determination of the parameters of subjectively pleasurable septal stimulation. At this time, B-19 viewed a 15-min 8 mm. "stag" film featuring sexual intercourse and related activities between a male and female. There was continuous EEG recording of the patient, as well as observation through a two-way mirror. He showed no obvious verbal or gestural response during the presentation but was highly resentful, angry and unwilling to respond at its conclusion. Base rate (pre-film) EEG indicated the presence of tension and hyperalertness prior to viewing, reflected by low voltage, low amplitude activity. No significant changes in EEG were apparent during the time the patient watched the film; but high amplitude alpha activity was noted at the end of the session, indicating some relaxation because the movie was over. There were no focal changes seen during this procedure. Detailed EEG findings throughout the entire treatment program are reported elsewhere (Heath, 1971).

A program involving both passive (other-induced) and self-stimulation of the septal region was begun the following day. A summary of the stimulation sessions is presented in Table 1. During and following the initial three periods of passive stimulation B-19 exhibited an improved mood, smiled frequently, stated that he could think more clearly, and reported a sense of generalized muscle relaxation. He likened these responses to the pleasurable states he had sought and experienced through the use of amphetamines. Moreover, he reported an associated state of sexual motivation. EEGs



PT B-19
LT ANT SEP

a



PT-19
RT CEN NUC THAL

b

FIG. 1. (a and b) Electrode placements in the brain of Patient No. B-19. Diagrams modified from *Introduction to Stereotaxis with an Atlas of the Human Brain* (Edited by G. SCHALTENBRAND and P. BAILEY, Grune & Stratton, New York (1959)). Placements are shown in the left anterior septal region (pt a) and right central nuclei of the thalamus (includes the centro-median) (pt b) brain sites from which the most pronounced changes were recorded during orgasm. The bottom three leads of the six-lead electrode (right half of pt b) are not apparent because the angle of implantation differed from the orientation of the Atlas.

obtained between periods of stimulation were unremarkable.

On the next two occasions the patient was allowed free access to the buttons of the self-stimulator which activated the left anterior and right mid-septal leads. While activation of both resulted in reports of positive and pleasant experiences, mid-septal stimulation was obviously preferred over anterior at a ratio of 2:3 : 1 (Table 1). During these sessions, B-19 stimulated himself to a point that, both behaviorally and introspectively, he was experiencing an almost overwhelming euphoria and elation and had to be disconnected, despite his vigorous protests. His post stimulation EEGs were unremarkable. Over the next 4 days there was no septal stimulation, either passive or self-, because of an intervening weekend and other of the patient's commitments. However, during this time B-19 did show a notable improvement in disposition and behavior, was less recalcitrant and more cooperative both at the laboratory and his hospital ward, and reported increasing interest in female personnel and feelings of sexual arousal with a compulsion to masturbate. The next afternoon he agreed without reluctance to re-view the stag film and during its showing became sexually aroused, had an erection, and masturbated to orgasm. At the conclusion of

this session the patient stated that he "felt great" and was highly pleased with himself. EEG immediately before the movie was not unusual; and no specific activity was later present to be linked with any events during the film. The behavior of the patient over the ensuing 4 days showed increased self-satisfaction, preoccupation with sex, and a continued growing interest in women. At this time, and throughout all phases of the present procedure, no attempt was made to instigate any formal psychotherapeutic program. The patient was, however, given encouragement and support in the development of heterosexual interest and was directly counseled when he solicited information regarding sexual technique and behavior.

Stimulation was resumed with passive activation of various combinations of electrodes at several sites within the septal region (Table 1). It resulted in the patient reporting feelings of alertness, elation and being quite "high". Consequent self-stimulation through other septal electrode combinations (Table 1) produced an experience of warmth, a flushing sensation, and sexual arousal.

At this time, the patient was maintaining an active interest in females, culminating in an expressed desire to attempt heterosexual activity in the near future. Therefore, arrangements

TABLE 1. SUMMARY OF SEPTAL STIMULATIONS IN PATIENT B-19

Stimulation Day	Type of Stimulation	Locus	Stimulus Magnitude	Stimulus Duration	Self-Stimulations
1	Passive	Rt. Mid-Sept.	2 mA	2 min	—
3	Passive	Lt. Ant-Sept.	6 mA	8 min	—
7	Passive	Lt. Ant-Sept.	3-7.5 mA	5 min	—
8	Self	Lt. Ant-Sept.	7.5 mA	3 hr 5 min	350
		Rt. Mid-Sept.	2.3 mA	3 hr 5 min	850
		Lt. Ant-Sept.	7.5 mA	3 hr 30 min	432
9	Self	Rt. Mid-Sept.	2.3 mA	3 hr 30 min	927
		Lt. Ant- and Rt. Mid-Sept.	0.5 mA	1 min	—
		Lt. Ant- and Lt. Post-Sept.	4.25 mA	1.5 min	—
17	Passive	Lt. Ant-Sept.	3.25 mA	1 min	—
		Lt. Post-Sept.	2.25-2.50 mA	1 min	—
		Rt. Mid-Sept.	0.5 mA	3 hr	134
		Lt. Ant- and Lt. Post-Sept.	0.5 mA	3 hr	58
		Lt. Ant- and Lt. Post-Sept.	0.5 mA	3 hr	69
21	Passive	Rt. Mid-Sept.	1-1.5 mA	20 sec	—

were made for a 21-year-old prostitute to spend 2 hours with him in a laboratory specially prepared to afford complete privacy. B-19 was receptive to the plan, and the woman agreed after being apprised of the circumstances. On the afternoon of their meeting, the patient's electrodes were attached to the encephalograph via an extension cord for increased mobility, and recordings were obtained for 45 min with an interruption for delivery of passive stimulation of the septal region for 20 secs (Table 1). B-19 was then introduced to the prostitute, and EEGs were obtained throughout his relationship with her (Heath, 1971).

Separate interviews with the patient and the prostitute provided information about their time spent together. Both reported that B-19 was initially anxious and reluctant when they were left alone, though his apprehension gradually subsided. The first hour of the session was essentially spent in conversation about the patient's experiences with drugs, his homosexuality and his personal shortcomings and negative qualities. Such material was seemingly presented as a defense on his part against progressing too far too quickly. During this time, his partner was most accepting and reassuring and gradually moved closer to him in an attempt to arouse his interest in her. He responded by trying to avoid eye contact, but at no time did he move away or express a desire to discontinue. She proceeded to remove her dress, but not her underclothing. B-19 did not respond with any advance though he did report feelings of interest and sexual arousal. As the second hour began, she relates that his attitude took an even more positive shift to which she reacted by removing her bra and panties and lying down next to him. Then, in a patient and supportive manner, she encouraged him to spend some time in a manual exploration and examination of her body, directing him to areas which were particularly sensitive and assisting him in the initial manipulation of her genitalia and breasts. At times, the patient would ask questions and seek reinforcement regarding his performance and

progress, to which she would respond directly and informatively. After about 20 min of such interaction she begun to mount him, and though he was somewhat reticent he did achieve penetration. Active intercourse followed during which she had an orgasm that he was apparently able to sense. He became very excited at this and suggested that they turn over in order that he might assume the initiative. In this position he often paused to delay orgasm and to increase the duration of the pleasurable experience. Then, despite the milieu and the encumbrance of the electrode wires, he successfully ejaculated. Subsequently, he expressed how much he had enjoyed her and how he hoped that he would have sex with her again in the near future.

During this session, EEG recordings from the deep leads (Heath, 1971) indicated that delta waves appeared at several of these sites as sexual arousal increased and that immediately prior to orgasm striking changes in recordings from septal leads occurred resembling epileptiform discharge. These changes were characterized by spike and slow wave activity with considerable numbers of superimposed fast frequencies. This pattern was essentially unchanged at the moment of orgasm. However, shortly after its onset the recordings were overwhelmed by the effects of movement; and, although it was impossible to separate the meaningful from the artifact, septal seizure activity seemed to endure throughout the orgasmic response. Such data emphasize the relationship between activity in the septal region and a pleasure reaction.

CURRENT STATUS

For nearly 11 months following termination of the treatment program described, the patient has been receiving counseling on a regular basis at the outpatient clinic of a community mental health center and returning to the Tulane Department of Psychiatry for periodic progress reports. He has held various part-time jobs and been tentatively approved for vocational rehabilitation job training. While he looks and

is apparently functioning better he still has a complaining disposition which does not permit him readily to admit his progress. However, he did meet and form a close sexual relationship with a married woman for almost 10 months. Their interactions consisted of sexual foreplay, oral-genital contact, mutual masturbatory activity, and intromission during which he refrained from orgasm because the girl insisted that he withdraw and complete ejaculation extra-vaginally. Being married she was somewhat fearful and guilty about intercourse and the uncertainty of the relationship. This circumstance led to an increasingly untenable situation, so that they finally stopped seeing one another. He reports that homosexual behavior has occurred only twice, when he needed money and "hustling" was a quick way to get it when he was out of work. However, he states that such acting out was not intended to be a replacement for sex with females, which he indicates he is definitely motivated to continue. There will be further contact with the patient in the future to assess his progress and to assist him when he encounters obstacles or setbacks which he reportedly needs help in resolving.

DISCUSSION AND IMPLICATIONS

The purpose of the present study was to explore the potential of pleasure-yielding septal stimulation for facilitating the development of new behaviors—in specific, the initiation of heterosexuality in a homosexual male. The history of this individual prior to stimulation was highlighted by chronic, severe depression, a bitter and complaining disposition, gross interpersonal difficulties, fixed homosexual behavior and increasing failure to experience pleasure. However, the septal stimulation procedure described resulted in an improved mood, self-confidence, generalized muscle relaxation, euphoria, elation, interpersonal warmth, tension release, and sexual arousal. The patient became progressively more invested in his treatment and increasingly more cooperative and self-satisfied. It was during subjectively pleasurable states such as these that he became sexually

motivated and masturbated on viewing a heterosexual film and later participated in sexual intercourse with a female.

The desirable and pleasant conditions which B-19 experienced as a result of septal stimulation, and which reportedly lingered for considerable lengths of time, apparently produced a state or mood which facilitated his exposure to stimuli and situations previously antagonistic, anxiety inducing or negatively laden, and for which he had indifference, contempt or revulsion. Moreover, the pleasurable states seemed clearly sufficient to counter his anxieties regarding heterosexuality and allow him to experience this totally new behavior, while gaining enough satisfaction from it.

Certainly, septal stimulation is a novel treatment for human psychological disorders, and requires continued investigation and elaboration. Of central interest in the case of B-19 was the effectiveness of pleasurable stimulation in the development of new and more adaptive sexual behavior. There was no attempt to eliminate the homosexuality through aversive stimulation of other areas of the brain. The success reported points toward future effective use of septal activation for reinforcing desired behavior and extinguishing undesired behavior. Because of the nature of the patient and the overall treatment plan in the present study, the pleasurable stimulation was not dependent on any given behavior. However, contingency programs could certainly be designed to use such pleasurable reinforcement most efficiently to alleviate or alter psychological distress. Plans for such treatment programs are under way by the Tulane staff and will be activated in the near future.

Further investigation of the applications of septal stimulation to psychotherapeutic endeavors might well be through using its resulting states of pleasure in variants of desensitization or other forms of counterconditioning. Or, externally controlled shaping of appropriate behaviors might be accomplished through using pleasure-yielding stimulation as a positive reinforcement for wanted responses.

In addition, the use of the self-stimulator might be expanded, through careful design, to maintain new response styles and continuous reduction of feelings of tension, anxiety or agitation. It is important to note, however, that implanting electrodes for septal stimulation has been undertaken only in patients who failed to show any response to any previous psychiatric treatment; and that it is not being recommended for cases that can be effectively dealt with in other ways. Also, septal stimulation requires considerably more investigation by other researchers to establish its function and possible application to such problems as chronic depressions, character disorders, anhedonia, and autistic and other psychotic reactions.

Another target of research would be to identify chemical agents which might produce pleasure-yielding stimulation of the septal areas. Investigations already undertaken (Heath, 1971; Heath and Founds, 1960) have involved introducing acetylcholine or levarterenol bitartrate through intracerebral cannulae implanted in the septal region. This treatment induced strong feelings of pleasure and a sexual motive state in both a male and a female, resulting in repeated orgasms in the woman but not in the man. EEG recordings from the septal region during the sexual arousal were similar in these two patients. Continued study may lead to the identification of septally activating pleasure-inducing drugs that are administered orally or parenterally. Such drugs would conveniently

elicit selected pleasurable responses for psychotherapeutic use.

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