Arch.Neurol. 6, 71-72 (1962). LSD 965/(PSI)



around 5 minutes, and the accuracy is around 90%. That is 90% agreement with the subjective awareness. The percentage of false positive, that is, the error you get on your sound control, drops to 5%.

DR. OLDENDORF: Actually, this is the same technique used to get the radar bounced off Venus.

DR. LOWELL: Exactly.

DR. OLDENDORF: It is very interesting that these applications of this technique are appearing in 2 widely divergent fields of scientific research about the same time.

DR. I. REIFF, Los Angeles: Is it possible to get continuous readings, rather than periodic sampling?

DR. LOWELL: Yes. At present, we have a 4-Channel Offner and are reading out 3 of the 5 channels at a continuous integration on the EEG. In approaching this study, we asked ourselves, "What are the changes in the characteristics when we arouse a child who has not been attentive previously? What happens to the average integration value if we suddenly change the intensity or other characteristics during the middle of the run?" We can then get ideas about the nature of the phenomenon.

DR. REIFF: Another possibility is to record a baseline level and then electronically subtract from your experimental value.

DR. CHARLES H. MARKHAM, Los Angeles: I want to ask if you have any present information on the fewer positive evoked responses at the higher-decibel level? Am I interpreting your data correctly?

DR. LOWELL: Yes, but before this group I hesitate to speculate as to the cause. We simply do not know. On the basis of these data, it was convenient only to work up to 30 decibels. Our speculation would be that at these higher levels some of the defensive operations of the auditory mechanism come into play.

DR. MARKHAM: What potential would there be for differentiating between functional and organic deafness?

DR. LOWELL: This would be one of the major uses for which we developed this instrumentation. It is our hope that we may differentiate between those children who appear to be deaf, but who may not be deaf in the classical sense of an organic loss, and to pick out these at an early age. We hope that different types of patterns may be demonstrated.

DR. OLDENDORF: Is it possible that by getting a sufficient improvement on the signal-to-noise ratio that you might directly detect the cochlear potential through the skin, that is, get the Weaver-Bray phenomenon right through to the electrode attached to the skin?

DR. LOWELL: I really don't know. There are some things that bother us about this. Is the signal coming from primary auditory cortex or from some other region? There is a very funny location of the electrode with regard to maximum pickup which has concerned us considerably. We checked these electrodes all over the head, including inside the ear canal. Maximum pickup was found at a point 5 cm. above and 5 cm. forward from the inion. The reference electrode was placed at about 2 cm. above and 5 cm. forward from the preauricular notch. There is a great deal more to be understood. I want to point out that this same extremely well-localized site applied for vision, touch, and other types of stimulation, and has much greater generality than just for the auditory modality.

DR. BERCEL: Did you do any animal work?

DR. LOWELL: No.

DR. BERCEL: Dr. Lowell, any concluding remarks?

DR. LOWELL: The only general comment that I have is that when we came into this field we were frightened of the word computer. Computers are very generally thought of as being very large and owned by IBM, and they are rather frightening in their complexity. I think that a whole new era of this small, special-purpose computer is upon us. These items I anticipate will be available quite inexpensively, and can, I believe, give us not only information about specific problems of auditory functioning, but, hopefully, will eventually give us some better idea of functioning of the brain, in general.

**What Have We Learned from LSD?** NICHOLAS A. BERCEL, M.D., Los Angeles.

The original idea of Lewin, 60 years ago, that drug-induced psychotic-like states with preservation of consciousness is the royal road to study the biological basis of mental illness, was catapulted into popularity after the discovery of lysergic acid diethylamide (LSD-25) by Hoffman in 1943. Looking back over more than a decade of experience, the following results can be boiled down at the moment:

1. LSD-25 shares an indole nucleus with other hallucinogenic substances. Cross-tolerance exists between LSD and other lysergic acid derivatives and similar drugs, such as psylocybin and mescaline. Autonomic nervous system changes relate directly to LSD whereas neurotic and psychotic manifestations seem to depend on the bond between LSD and some serum proteins. The greatest advances triggered by LSD are in the field of biochemistry.

2. LSD experiments contribute substantially to the understanding of certain psychotic symptoms by drawing the observer into the subjective setting of psychosis. The LSD state closely resembles an acute undifferentiated schizophrenic reaction or a manic or depressive reaction.

3. While LSD caricatures some basic personality traits, the direction can go toward either increase or decrease. The distortion, however, is too great to allow for reliable psychodiagnostic inferences.

4. The controversy about the usefulness of LSD as an aid in psychotherapy is far from settled. Some consider LSD a therapeutic catalyst; yet, others produce LSD-states with tap water. Others, like me, find no difference between a LSD-activated psychotherapeutic session and a 4-hour session without LSD in the same permissive, oversolicitous setting. Large-scale control sessions of this kind have not yet been tried. Suggestion appears to play a large role in the "transcendental" experiences reported by some. Defects in patient selection and unpredictability of results reduces considerably the safety of LSD-activated psychotherapy. Irreversible psychotic after-reactions are a serious liability, and are more common than LSD-induced suicides. There is lack of agreement on clinical therapeutic indications. There is great need for evaluation by those in between the evangelical and nihilistic extremes. Experimentation with LSD in therapy should remain in the hands of experienced and qualified personnel.

DR. JAMES T. FERGUSON, Los Angeles: With regard to LSD, I would like to comment regarding the psychological implications. I am reminded that there is a promise in the use of LSD which is actually an old promise, namely, that of a device by which one may break through and penetrate or in some way disorganize the psychological defenses of a person, and the end product of all this would be that something of value would come out. I am reminded of the tremendous interest that there was in barbiturates immediately after World War II, and the glowing promise of the widely popular drug therapy popularly known as "Amytal therapy." I am also reminded of the fact that the British used ether to produce ether jags which were every effective for eliciting an abreaction. Just as with these drugs, I think LSD has presented something of a false and misleading promise, as Dr. Bercel pointed out. I am aware that there have been a number of difficult complications, as Dr. Bercel also has related, particularly in those persons who are sometimes called pseudoneurotic schizophrenic or ambulatory schizophrenic, who have taken the drugs and have become disorganized, and unfortunately for a length of time. So I would like to second Dr. Bercel's warning with regard to the use of this for therapy or as a diagnostic tool. From my limited knowledge, it seems to me that physiologically this drug has the capacity to disorganize the defensive mechanism of a person for a moment, or for an hour or two, or longer. Beyond this I have failed to see, from my limited knowledge, any real improvement from the use of this drug in therapy. I wish to second Dr. Bercel's comments in this regard.

DR. CARLO P. DE ANTONIO, Los Angeles: Among older adolescents seen in a psychiatric practice, I have observed that some of them are shying away from the goof balls and Benzedrine lately, and are getting more into mescaline and different types of medications for the brief period of depersonalization and getting a temporary jag, but without much interest in setting up any kind of addictive pattern.

**Measurements of Cerebral Blood Flow by Radioisotopes.** WILLIAM H. OLDENDORF, M.D., Los Angeles.

A technique has been developed that studies the appearance in the cerebral hemispheres of the radioisotope $I^{131}$ as hippuric acid following its intravenous injection. The radioactive bolus appears in the brain about 8 seconds later. The amount of material in each cerebral hemisphere as a function of time is detected by a dual crystal scintillation detection system driving dual rate-meters. The output of the 2 hemispheres is automatically plotted on a dual servorecorder. As the radioisotope bolus arrives in the brain, the curve rises rapidly. The rate at which the total quantity is increasing in the hemisphere is a direct function of the rate at which the blood is carrying in the radioisotope, and a relative measure of blood flow into the 2 hemispheres. As the most radioactive portion of the bolus enters the brain, the curve rises at a maximum rate and thus produces a maximum slope and can be used as a point of reference. If this maximum slope is measured and compared on the 2 sides, an accurate comparison can be made between the flow to the 2 hemispheres.

The isotope is very rapidly excreted by the kidney and is entirely out of the blood in about one hour. The calculated total body radiation is less than 5 milliroentgens and the kidney and bladder wall radiation is less than 0.2 per test.

In 30 normal patients, the maximum upgoing slopes were equal within our limits of measurement in 15 cases. Ten cases showed less than 10% difference, 4 cases were between 10% and 20%, and 1 case showed over a 20% difference. When one common carotid artery was compressed in 8 cases, less than a 30% drop was noted in 3 cases, and more than a 30% drop was noted in 5 cases. The greatest consistent reduction of hemisphere flow rate is noted in middle cerebral artery occlusion. In one verified arteriovenous malformation, the flow rate was 2.1 times higher in the involved hemisphere. Further work is in progress to determine the usefulness of a brain circulation transit time. It may be possible by this means to obtain an absolute estimate of the volume of blood circulating in brain.

### Discussion

DR. ROBERT N. BAKER, Los Angeles: Dr. Oldendorf's approach appears to me to be extremely