References and Notes

1. G. C. Esh, *J. Proc. Inst. Chemists (India)* 30, 21 (1958).
2. S. P. Niyogi, N. Narayana, B. P. Desai, *Indian J. Med. Research* 19, 1041 (1932); M. Swaminathan, *ibid.* 25, 381 (1937); G. C. Esh and J. M. Som, *Indian J. Physiol. and Allied Sci.* 6, 61 (1952).
3. L. A. Maynard, *J. Am. Med. Assoc.* 143, 807 (1950).
4. K. J. Frey, *Cereal Chem.* 28, 123 (1951); R. C. Miller, L. W. Aurand, W. R. Flach, *Science* 112, 57 (1950); L. D. Rodriguez, C. H. Hunt, R. M. Bethke, *Cereal Chem.* 27, 67 (1950).
5. H. H. Mitchell, T. S. Hamilton, J. R. Beades, *J. Nutrition* 48, 461 (1952); H. E. Sauberlich, Wan-yuin Chang, W. D. Salmon, *ibid.* 51, 241 (1953).

6. This study was supported by the Indian Council of Medical Research, Government of India. We are also indebted to all state agricultural authorities for their kind cooperation in supplying pure strain samples of pulses.

28 July 1958

Changes in Psychological Test Performances of Brain-Operated Schizophrenics after 8 Years

Abstract. Long-term effects of topectomy showed statistically significant losses not present shortly after psychosurgery in eight of 14 psychological test measures. Site of operation, length of postoperative interval, age, and nature of the measure were factors determining the effects of brain damage.

Increasing and differentiated populations of brain-damaged subjects have become available for studies by neurologists and psychologists as a result of developing techniques in brain surgery, first in cases of brain wounds and tumors and later with the advent of "psychosurgery." In both fields of study there are sources of ambiguity, and the contradictory findings that have been reported (often in apparently similar investigations) are not surprising.

The New York State Brain Research Project, 1948–1950 (*1*), the last of three related projects that sought to control some of the variables in earlier studies, reported conclusions of no "permanent" decrements in "intellectual function" following psychosurgery (topectomy). This finding was based on comparisons of psychological test scores from preoperative and postoperative (within 120 days following surgery) examinations of 45 operated and 33 nonoperated schizophrenics. The conclusions were in agreement with findings of no losses in the two related projects [Columbia-Greystone I (*2*) and II (*3*), which also included control subjects] and of numerous other studies. Early postoperative losses were interpreted as transient in the Columbia-Greystone studies because of increasing scores by the operated subjects in successive postoperative tests; in the New York State Brain Research Project, because of smaller decrements in the single examinations administered after greater postoperative intervals. The "drop and rise" pattern was considered a reflection of temporary physiological conditions in the brain.

In 1957, after a postoperative interval of 8 years, 28 operated and 24 nonoperated subjects of the original New York State Brain Research Project were retested with the same psychological instruments. These 52 subjects had been originally grouped according to age (as of March 1957) and symptom complex into a C group—older (mean age 57.5 years, with primarily a retarded hebephrenic symptom complex)—and a D group—younger (mean age 41.9 years, with primarily a paranoid symptom complex). Controls had been drawn from the same pool of patients satisfying the selection criteria of several cooperating disciplines. The present follow-up study was restricted to subjects still at Rockland State Hospital, Orangeburg, New York; the remaining subjects were not available, due to transfers, deaths, and parole of four controls and three operated patients.

Surgery consisted of either an orbital topectomy [bilateral excision of Brodman's areas 11 (sometimes including portions of 47) and 10, and of Walker's area 13, from the lower regions of the forebrain], or superior topectomy [bilateral excision of Brodman's areas 9 (sometimes including parts of 10), 8, and 32, from the upper regions of the forebrain]. The amount of cortical tissue excised in either operation was reported to be 30 to 35 g from each hemisphere of the forebrain.

Following procedures of the original study, the 11 subtests of the Wechsler-Bellevue Form I, the revised Capps Homographs, the Porteus Maze, and the Weigl Sorting test were readministered twice to each subject, with an interval of 30 days between the two administrations. Comparisons of the 8-year postoperative and preoperative mean scores showed poorer performances by the operated subjects in all 14 different measures, intelligence quotients, and composite scores (sums of 13 standard scores). Differences among operated and control subjects were further analyzed and tested for significance by the analysis of covariance in comparisons of groups on the bases of operation (operated and nonoperated subjects), site of excision (orbital and superior topectomy), and age (younger and older subjects). Losses by the operated groups among the 14 different measures showing poorer performances were statistically significant in several measures for each of these three factors, as shown in Table 1.

Differences between the two operative sites are shown in the table by the direct comparisons of the superior and orbital groups, as well as by comparisons of each operated group with its appropriate control. The greater losses resulting from superior topectomy when compared to orbital topectomy are in agreement with results of early postoperative studies of cases with superior lesions by Malmo (*4*), Penfield (*5*), and Petrie (*6*).

Differences in the effects due to age of the subject are shown in the table by the statistically significant losses by older operated groups (C groups). These differences appeared also when preoperative, early postoperative, and 8-year postoperative scores were compared. The older operated group showed a gradient of successive postoperative losses in seven of 13 measures. This gradient of increas-

Table 1. Table of significant differences. Comparisons of preoperative and 8-year postoperative test scores for C-group (older) and D-group (younger) and for superior-group and orbital-group topectomized patients, with appropriate controls (Weigl shift or nonshift performance is omitted). DSp, Digit Span subtest; Arith, Arithmetic subtest; PA, Picture Arrangement subtest; BD, Block Design subtest; OA, Object Assembly subtest; DSbl, Digit Symbol subtest; FS, Full Scale IQ; VS, Verbal Scale IQ; PS, Performance Scale IQ; PM, Porteus Maze test; CH, revised Capps Homographs; CS, Composite Score.

Groups	No.	Test											
		Wechsler-Bellevue Examination Form I									PM	CH	CS
		Dsp	Arith	PA	BD	OA	DSbl	FS	VS	PS			
All operated All control	28 24	10.36*	9.63†				6.96†					5.13†	14.79*
All superior All control	17 24	4.82†	6.97†				14.44*	6.49†	4.12†		4.93†		17.33*
All superior All orbital	17 11	6.14†											
D superior D control	12 11	4.59†		4.58†	5.81†		8.89†				4.51†	7.22†	
D superior D orbital	12 7			6.57†									8.36†
C operated C control	9 13		6.69†							4.48†			
C orbital C control	4 13					7.77†							
D operated D control	19 11									6.33†			9.81*

* Significant at the .01 level. † Significant at the .05 level.

ing losses was not shown by the younger orbital group or by the younger or older controls.

Among all the measures used, the discriminating capacity varied from practically no difference between operated and nonoperated subjects in the Picture Completion subtest to marked and statistically significant differences in eight measures. The nature of the task presented is clearly an important variable in brain-damage studies.

The marked and definitive losses by operated subjects after a postoperative interval of 8 years are in sharp contrast to the conclusions of no "permanent" decrements reported by the original and two related studies. Our results also differ from reports of long-term studies by Weinstein and Teuber (*7*) of "frontal lobe lesions" due to "penetrating brain wounds" and by Scherer *et al.* (*8*) of "lobotomies." Population ambiguities in the latter studies may have obscured losses for lesions in specific areas which might have appeared if more careful differentiation among subjects had been possible.

Our findings of differences in psychological performances due to specific site, age, and length of the posttrauma interval are in agreement with reports of clinical findings by von Monakow and Mourgue (*9*) and Goldstein (*10*) and with neurological studies of cerebra with psychosurgical lesions by Yakolev (*11*), Meyer (*12*), and Le Beau (*13*). This unusual consonance of psychological and neurological findings in unrelated studies suggests that the changes in psychological test performance of operated subjects observed in the present study may be corollaries of changes in brain structure due to neurological degeneration following brain insult (*14*).

AARON SMITH
ELAINE F. KINDER
Topectomy Follow-up Project (Psychology), Rockland State Hospital, Orangeburg, New York

References and Notes

1. N. D. C. Lewis, C. Landis, H. E. King, *Topectomies* (Grune and Stratton, New York, 1956).
2. Columbia Greystone Associates (first group), *Selective Partial Ablations of the Frontal Cortex*, F. A. Mettler, Ed. (Hoeber, New York, 1949).
3. Columbia Greystone Associates (second group), *Psychosurgical Problems*, F. A. Mettler, Ed. (Blakiston, Philadelphia, 1952).
4. R. B. Malmo, "Psychological aspects of frontal gyrectomy and frontal lobotomy in mental patients," *Proc. Assoc. Research Nervous Mental Disease* 27, 537 (1947).
5. W. Penfield, "Symposium on gyrectomy," *ibid.* 27, 519 (1948).
6. A. Petrie, "A comparison of the psychological effects of different types of operations on the frontal lobes," *J. Mental Sci.* 98, 326 (1952).
7. S. Weinstein and H. L. Teuber, "Effects of penetrating brain injury on intelligence test scores," *Science* 125, 1036 (1957).
8. I. W. Scherer, C. J. Klett, J. F. Winne, "Psychological changes over a five year period following bilateral prefrontal lobotomy," *J. Consulting Psychol.* 21, 291 (1957).
9. C. von Monakow and R. Mourgue, *Introduction biologique a l'étude de la neurologie et de la psychopathologie* (Alcan, Paris, 1928).
10. K. Goldstein, *The Organism* (American Book Co., New York, 1939).
11. P. I. Yakolev, "Fronto-pontine bundle and associated projection fibers of the frontal lobe following frontal leucotomy," *Trans. Am. Neurol. Assoc.* 78, 286 (1953).
12. M. Meyer, "A study of efferent connexions of the frontal lobe in the human brain after leucotomy," *Brain* 72, part 3, 265 (1949).
13. J. Le Beau, "The surgical uncertainties of prefrontal topectomy and leucotomy," *J. Mental Sci.* 97, 480 (1951).
14. This work is being continued with other subjects and with other tests. The study reported here was partially supported by a research grant (M-1191) from the National Institute of Mental Health, National Institutes of Health, and by funds and assistance of the Research Foundation for Mental Health, Inc., of the New York State Department of Mental Hygiene.

8 September 1958

Taste Thresholds for Phenylthiourea among Ashkenazic Jews

Abstract. Taste thresholds for phenylthiourea were measured for 244 Ashkenazic Jews. The frequency of nontasters was 27.86 percent. In the sample, 102 individuals were of pure Polish ancestry, and the frequency of nontasters among these was significantly different from the frequencies of nontasters among Europeans and Mongoloids.

Investigations on taste dimorphism in sensitivity to phenylthiourea are of interest for population genetics and racial research, since it is possible to employ a relatively objective phenotype classification of the individuals. The populational distribution of individual taste thresholds is bimodal, and tasters can be discriminated from nontasters by use of the antimode. A racial variation in the frequencies of nontasters to phenylthiourea has been recognized (*1*) with the aid of the sorting technique described by Harris and Kalmus (*2*). Chinese (*3*) and Japanese (*1*) showed a clearly lower frequency of nontasters than the white groups (*2, 4*), and the frequencies found among American Indians (*5*) and African Negroes (*3*) are strikingly low. However, studies in many populations, including European and African ones, will have to be made before the general picture of genetic relations of human populations can be determined.

Since, on the grounds of blood-group data (*6*), Jewish populations suggest interesting evolutionary problems, we have chosen those groups for our studies. European, or Ashkenazic, and Mediterranean, or Sephardic, Jews have constituted interbreeding isolates, intermarriage with the neighboring populations probably having occurred to a relatively low extent, although to varying degrees at different times.

The purpose of the present report (*7*) is to present the distribution of taste thresholds for phenylthiourea among Ashkenazic Jews and to determine to what extent the frequency of nontasters among them differs from that in other populations. By means of the sorting technique of Harris and Kalmus and with the same concentrations of the phenylthiourea solutions as those employed by them (*2*), the taste thresholds of 244 Jewish individuals within the age range of 7 to 23 years were determined. The sample is composed of students from a Jewish school and members of a Jewish organization, both in São Paulo (Brazil). No parent-child pair was included in the sample, as can be seen from the age limits for the group. The percentage of sib pairs was 15.2 percent, and the exclusion of such pairs had no appreciable effect on the frequency of nontasters (the percentage becomes 27.05 instead of 27.86 percent). There was no blood relationship among the different families. All the individuals in the sample descend directly, without admixture, from immigrant Jews from Central Europe. For these reasons this sample can be taken as representative of the Ashkenazic Jews. The distribution of the taste thresholds, classified by sex, is presented in Table 1.

To separate tasters from nontasters, the antimodal value was taken as falling between the thresholds 5 and 6. Table 2 shows the number of tasters and the number and percentage of nontasters among Ashkenazic Jews. The frequency of nontasters is slightly lower than that found among other European populations (*2, 4*), as determined by the sorting technique. It was determined that 102 individuals of the sample were persons both of whose parents were born in Poland. The frequency of nontasters among Polish Jews, who represent the typical European Jew, is clearly lower than that among other white populations. The difference in frequency of nontasters between Polish Jews and the remainder of the Jews (Table 2) was not significant ($\chi^2 = 3.46$; $P = 0.06$). This, however, could be due to the small size of the samples and to the fact that some individuals of the remainder group had one parent born in Poland. A more detailed investigation among Jews of Central Europe will clear up this question.

Mourant (*6*) has discussed the genetic relationships of Ashkenazic Jews with respect to their ABO and Rh blood-group systems. With regard to the ABO frequencies, Ashkenazic Jews in Central Europe resemble fairly well their neighbors, showing, like Poles and Ukranians, a high *B* gene frequency (about 14 percent). Their Rh chromosome frequencies, however, are very different from those of Central Europeans. Like Medi-