centrations, such as 0.06 ppm, the p,p'-DDT isomer and the methoxy analogue showed higher toxicity than did the technical DDT.

Summary. The p,p'-DDT isomer is several times as toxic as the o,p'-DDT isomer to both goldfish and mosquito larvae. The methoxy analogue equals DDT in toxicity to fish, but is less toxic to mosquito larvae. On the other hand, the DDD analogue ranks about as high as DDT in toxicity to mosquito larvae, but appears to be less toxic to goldfish.

Reference

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The Functions of the Intercortical Neurones in Sensorimotor Coordination and Thinking in Man[1]

KARL U. SMITH

Bureau of Industrial Psychology and
Department of Psychology, The University of Wisconsin

The manner in which the association pathways of the brain of man integrate the effects of stimulation to cause verbal and motor response represents a central problem of physiological psychology. Some aspects of this problem have been investigated experimentally by the study of individuals in whom the intercortical pathways were sectioned with the objective of controlling convulsions (*1*).

METHODS

Response times of three major types of reactions were measured before and after section of the principal nerve bands which connect the two cerebral cortices: (1) simple reaction to visual, auditory, and tactile stimuli; (2) visual discrimination reactions; (3) verbal reactions in free-word association, opposites association, and part-whole association. The discriminatory reactions studied consisted of reactions involving presumably uncrossed relations between the two cerebral hemispheres (stimulation of one hemiretina, excitation of one hemisphere, motor response originating in the excited hemisphere), and crossed relations between the two cerebral hemispheres (stimulation of one hemiretina, excitation of one hemisphere, motor response originating in the unexcited hemisphere). The anatomical relations which may be assumed to be concerned in these crossed and uncrossed reactions, four each of which were measured, are shown in Figs. 1A and 1B.

Suitable reaction time equipment consisting of timing devices, manually operated keys, voice keys, and essential electrical circuits were devised to make the measurements.

Six subjects were used in the principal part of the experiment. The responses of these individuals were measured preoperatively and postoperatively under the best obtainable conditions of their health and cooperation. The operative procedures concerned, as described in the neurosurgeon's notes taken at the time of operation, were as follows: (Subject 1) complete section of the corpus callosum; (Subject 3) complete section of the corpus callosum, and about one year later, section of the anterior commissure; (Subject 13) section of the corpus callosum except for 1 cm. at the tip of the splenium; (Subject 16) section of the corpus callosum except for a few fibers at the tip of the splenium and section of the left limb of the fornix; (Subject 19) section of the anterior two-thirds of the corpus callosum and bilateral section of the limbs of the fornix. Fig. 2 indicates the maximal and minimal extent of the section of the corpus callosum in these subjects.

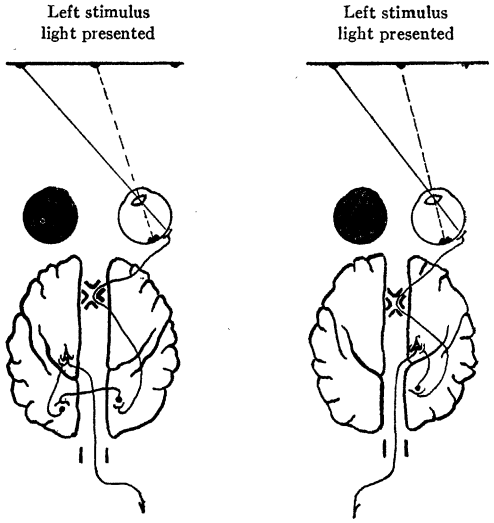

FIG. 1. The hypothetical difference between crossed (A) and uncrossed (B) visual discrimination reactions. (Instructions—A: respond to left light with right hand and to right light with left hand; B: respond to left light with left hand and to right light with right hand.)

THEORY

The extensive nerve connections between the two cortices make up, anatomically, a major part of the total associative mechanism of the brain. If this mechanism consists of a network of discrete neural paths for conducting impulses related to verbal activity and thinking, it seems reasonable that cutting the intercortical fibers would disturb numerous verbal associations. Furthermore, one would suppose that cutting these connecting fibers would disrupt specifically the crossed sensorimotor reactions, as described above, whereas the uncrossed reactions would not necessarily be disturbed.

RESULTS AND DISCUSSION

The results of the experiment are given in Table 1. Column 6 in the table presents the means of the differences between the preoperative and postoperative tests, and Column 7 gives the values of the *t*-ratios for these means.

The results show that the cortical association neurones connecting the two sides of the brain have a significant role in determining direct responses to visual, auditory, and tactile

[1] The present experiments were made possible by the cooperation of Dr. William P. Van Wagenen, who performed the neurosurgical operations, and by Dr. Andrew Akelaitis, who aided in some of the observations on the patients.

stimuli, each of which is more or less similarly affected by the operations concerned. Since quite divergent types of reactions were involved and because the patterns of response were unaltered by the operations, one may deduce that this role

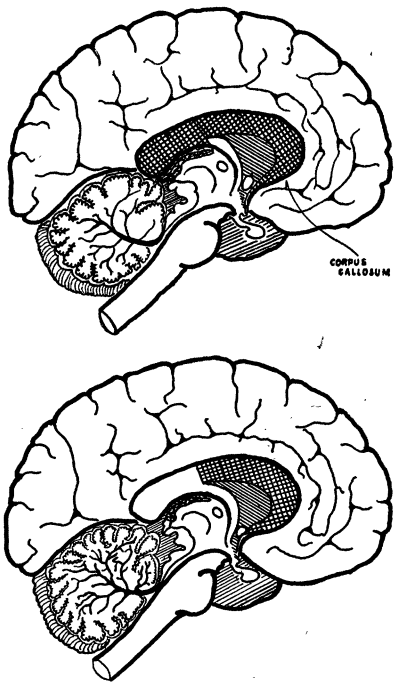

FIG. 2. The extent to which the fibers of the corpus callosum were cu in cases with complete section (top) and in a case with the least extensive lesion (bottom).

is one of dynamic regulation rather than discrete participation in the essential nerve channels of the responses.

TABLE 1

RESPONSE TIME (HUNDREDTHS OF A SECOND) IN DIFFERENT PSYCHOLOGICAL REACTIONS BEFORE AND AFTER SURGICAL SECTION OF THE COMMISSURAL PATHWAYS

Psychological reactions	Preop.		Postop.		M_d	t	Level of confidence	Diff. (%)
	M	σ	M	σ				
Simple reaction time	.18	.042	.29	.078	.11	4.68	.01	+61
Visual discrimination reaction time	.38	.074	.44	.062	.06	1.85	*	+16
Word association	1.62	.372	1.82	.507	.20	1.10	*	+12
Visual discrimination reaction time (uncrossed)	.37	.076	.43	.066	.06	1.88	*	+16
Visual discrimination reaction time (crossed)	.39	.076	.45	.067	.06	2.17	*	+15

* Indicates a value below an acceptable level of confidence.

Crossed sensorimotor reactions and verbal associations are not significantly affected by the surgical section of the commissural neurones. These are the functions which should be radically disrupted by lesions of the intercortical nerve bands if the cortex, in fact, functioned as an array of specific association pathways. Accordingly, the results tend to support the view that the associative mechanism of the cortex acts in terms of generalized patterns of excitation rather than as a system of specific pathways between sensory and motor centers. Such patterns of neural activity evidently include the subcortical centers, at which level integration between the two sides of the brain can be made when the cortical commissural paths are destroyed.

The results found for simple response times appear to explain the persistence of inertia in patients with surgical lesions of the commissural pathways of the cortex. This defect in response time is the only well-established disturbance resulting from destructions of these pathways.

A more detailed statistical treatment of the present results is in preparation.

Reference

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Penicillin Site of Action

C. J. CAVALLITO

Sterling-Winthrop Research Institute, Rensselaer, New York

In a recent article, C. S. Leonard (*3*) has criticized some views postulated by our group on the mechanisms of antibiotic action, particularly with reference to the action of penicillin.

A principal fallacy in Leonard's arguments is that he apparently presumes that all agents which inhibit growth of microorganisms by interaction with sulfhydryl groups should demonstrate more or less equal toxic manifestations in animals and should inhibit the same types of organisms. For this to be true, one needs to assume that there is only one type of sulfhydryl-active enzyme present in all species of organisms. It could also require that only one type of chemical reaction occur between inhibitor and sulfhydryl group.

There is evidence that many sulfhydryl enzymes occur (*1*) and that all sulfhydryl groups are not equivalent. Sulfhydryl groups might be expected to differ in availability and reactivity depending upon whether they are superficial or deep in a protein, and depending upon the nature of neighboring groups capable of adsorbing or activating an inhibitor. We have shown (*2*) that marked differences exist in reactivity of sulfhydryl groups toward some antibiotics, including penicillin, depending upon the nature of other groups (such as the amino) present in the vicinity of the —SH.

The theory of antibiotic inhibition of enzyme-SH groups has not been postulated for all antibiotics, but only for a large group which has the common feature of reactivity toward one or more types of —SH compounds. Even in this group there may be members in which the —SH reaction is not the primary inhibition mechanism. Although it would be possible to classify antibiotics on the basis of other reactions, such as reactivity toward acids, alkali, or thiosulfate, our group feels that although the others are interesting, the most significant from a mechanism-of-action standpoint are those which have a direct biochemical significance, such as the —SH reaction. This investigator knows of no biological system in which thiosulfate plays a role.

Some of Leonard's conclusions are puzzling. In our work,