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[Column 1]

HOW EDUCATION MAKES THE BRAIN

RESULTS OF RECENT REMARKABLE EXPERIMENTS WITH YOUNG DOGS.

TRAINED, THEN CHLOROFORMED

Professor Elmer Gates Demonstrates the Manner in Which Training Affects the Gray Matter, Which Grows Heavier and Fuller of Cells and Blood Vessel as It Is Exercised— The Physical Explanation of Memory.

The results of some remarkable experiments concerning the relations of the structures and functions of the mind have recently been announced by Professor Elmer Gates, a physiologist, who has for several years been making elaborate studies both in Washington and Philadelphia.

By training pet animals, especially dogs, to perform various difficult tricks, Professor Gates developed many strange abnormalities in the gray structures of their brains. In this manner he has not only located the exact parts of the brain in which even the most intimate emotions originate, but has convinced himself of a method by which the brain of man may be built entirely anew. His laboratory is one of the most interesting institutions of the kind in the world. Various instruments have been erected in it for aiding the professor in his peculiar training. Some of these work by electric aid, a slight shock from a battery giving such a gentle reminder as is generally administered by a whip.

In one experiment he trained dogs so skillfully that they were able to distinguish colors one from another, and associate them with action. Seven little shepherd puppies were kept in a totally darkened room from the minute they were born until they became nine months old. So careful was the professor lest even a spark should enter this room that he placed three different doors in the approach to it. A second group of little shepherd dogs of the same age were allowed to lead a normal life. A third group of the same age and stock were put through an interesting course of sight training. To accomplish this the floor of the hall leading to one room of the laboratory was covered with square metal plates separated from each other by insulation. These with the exception

of a few were connected with the current of a strong electric induction coil. Those not connected were irregularly scattered and painted a like color. The others were painted in various other shades giving the whole floor a checkered appearance. At first when the dogs followed the professor to his laboratory they had their feet uncomfortably tickled, not knowing the proper combination. In a few months, however, after being trained a number of hours each day they gradually learned the proper plates, no matter how their positions were changed. Within five months the professor had perfected this unique education to his satisfaction.

Another interesting method of developing the color bumps [Editorial Note: "bumps" is used as a phrenological metaphor] was by feeding the same dogs meat placed under different colored pans which had to be turned over with their noses before the food could be discovered. Each pan was rubbed with meat on the outside that they might not be led to the proper pan by smell. Each was shown that the yellow pans only contained the meat. For several weeks, however, they continued to turn over each pan indiscriminately until finding the dinner. After six weeks the proper places were found the first time, no matter in what manner their positions were altered. By placing the food under pans of other colors, they soon became able to discriminate between seven different shades of red, several of green, and of still others.

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The three groups of puppies when nine months old were chloroformed and their brains and spinal cords studied under powerful microscopes and by applying various chemical tests. Those kept in the dark room all their lives showed a total absence of development in the portion of the gray exterior covering, or cortex, which Professor Gates previously knew to be occupied by the "seeing area." This was totally lacking in cells. The group which had led a normal dog's life had much greater development in this "bump of sight," as the phrenologists would call it. The cortex was thicker, more thickly supplied with arteries and veins. It was more gray in color and contained cells. But the seeing area of the dogs highly trained showed a wonderful development. The cortex was abnormally thick and exceeded those of the normal dogs in the number of cells and blood vessels. The cells were much more complex in form. In short, in that portion of the brain where originates the sense of sight the trained dogs were found to be twenty-five times as complex as the group which had led a usual life. It therefore seems very apparent that similar training applied to human beings deficient in brains might accomplish untold wonders in a few years, if only nine months would improve

a separate portion of a dog's mind twenty-five fold.

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Professor Gates has obtained equally wonderful results not only with dogs but with other animals. He grouped some of these so that they were deprived of hearing, while the others underwent a series ear trainings quite as interesting as the sight exercises. Practically the same results were obtained upon examining the parts of the brain employed for observing sounds. Other tests with the senses of smell and taste showed the same results. And going still deeper into this mysterious science, he found that rabbits made to see only one color all their lives had brain matter in the color seeing regions chemically different from that of other rabbits subjected solely to another shade.

One dog was made to go through certain exercises daily with his right leg, another one with his left leg. On examining their brains he found the former to have a marvelous development in what is known as the "right-leg area," while the other had the same abnormal condition of the "left-leg area." One dog was prevented from walking all during life. Another was made to follow a huckster's wagon through the streets every day. The difference in their "leg-areas" was as great as that in the "color areas" of the dogs confined in the dark and those trained with pans, etc.

But still more marvelous! Certain dogs were made to go through leg exercises in response to certain sounds, while other did the same on being shown certain colors. In the first lot there was an unusually thick development of the fibre connecting the leg area with the hearing area, and in the latter there was the same between the leg area and the seeing area.

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The fact that fibres became enlarged between areas of the brain exercised sympathetically convinces him that our memory passes from one past event to another through a continuation of these fibres. Thus it would seem that these various compartments each contain an electric battery for impacting a separate action or thought, and that when several of these are used at once they develop wires connecting one with another. When our recollections, therefore, are carrying us back from one line of thought to another, these memory strings doubtless are struck in familiarly harmonious chords.

Professor Gates further believes that there is a chemical basis for both right and wrong. Good and evil thought produce characteristic brain structures. If his studies are applied to the fast

developing medico-legal sciences it would appear that before many years there will be little guess-work in determining the life histories of executed criminals.

But Professor Gates would apply his new discoveries to education. He would develop brain architects rather than brain stuffers. Every time we indulge in certain thought or action, its corresponding section of the brain, from which it is derived, becomes more developed. Hence it is easier the next time to exert the thought or prompt the action, just as it becomes easier and easier each day to carry a heavy load. In the first instance the muscles—so to speak—of the mind are enlarged; in the second the development is in the muscles of the body. A bad habit therefore is mental strength developed over the wrong area. The bad "bump" works more readily than the good one, just as a muscular arm is more active and willing to strike than a weak one.