

## ARE YOU TRAINING YOUR SYNAPSE?

BY CLARA STEVENS

WHAT is your mental portrait of yourself twenty years hence? Shut your eyes and let desire paint the picture? A pleasing one, so painted. Can it become a reality? Can the roseate colors laid on by desire stand the midday glare of fact? If you are not now realizing your early ambitions, it is possible to give them a substance so that in two decades—or one—that portrait of yourself shall be informed with the breath of life?

The answer may lie in your understanding of a lightning-quick process that takes place many times during the day in your own brain.

Here is the switchboard where the connections are made that result in our characteristic acts. One of the five sense-organs, say, the ear, is the transmitter. The "wire" is the auditory nerve which carries the impression to "central," a certain set of nerve cells in the upper brain. When the number gleams, figuratively speaking, connection is made with a cell of another set known as association, a second "exchange." This in turn connects with a cell of a third group called motor cells. And when thus received, the impulse passes from it into the spinal cord and discharges into the nerves and muscles of the body, resulting in action.

The vital point is, *what* connections are made on that switchboard, for as many are possible in your brain "central" as in that of the New York telephone company—indeed, infinitely more. Therefore, to understand the process is to realize the importance of consciously and intelligently *directing* your connections. On such directing depends the fulfilment of your desires.

But before taking up the details of the process, it will be well to consider the nature of the cell, or neuron, itself. It is our inheritance from our first ancestor, the one-celled amoeba. In contrast to this early progenitor, the human brain alone, to say nothing of the entire body, contains over nine billion neurons. Each is made up of a central nucleus, or body, which supplies nutrition to its

extensions. Of these, the receiving end is called the dendrite, also the "brush end," from its several little filaments. The other is the axon, and acts in response to the impression received by the dendrite and transmitted through the cell body. These billions of nerve cells fall, as has been indicated, into three groups.

When, then, an impression is made on one of the five senses—suppose a soldier hears the command to charge a machine-gun nest—and it has traveled through the, in this case, auditory, nerve and into the first, or receiving, neuron in the brain, the point of interest is, which one of the many association, or second, group will receive it. From each of these many the tiny filaments of its brush-end are extended to catch the impulse. Which one of the second group will be the first to do so will be determined by previous response or by the power of the individual's directing will—or sometimes by even so material a fact as the nutrition supplied or withheld by its cell body. Through the association neuron that has been first stimulated the impulse passes, as in the receiving cell, and again discharges into the microscopic space between it and the numerous motor neurons, each, as in the other cases supplied with its airy branching dendrites to receive the message. And again the vital point is to be determined: which motor neuron will first respond? On that depends whether the soldier will go forward or turn and run.

The latter would be the natural, instinctive response, for to avoid danger, to retreat from probable death or pain, is one of the promptings inherited from our animal ancestors. Had the recruit had no previous training or been reared without any traditions of bravery or duty, he would obey the natural instinct. That is, of the association and the motor neurons only the one in each case which was responsive to fear would receive the impulse.

But when he was being drilled, his will had directed the path of the "current"—if we may so call it—from the receiving cell through the proper association and motor neurons. This directing had then been comparatively easy, for there was no danger present to cause a contrary instinctive impulse directed by fear; and whether he had enlisted or been drafted, his intelligence had accepted the conditions of warfare and was, at first, actively controlling his responses.

Try to visualize the path of that first current; and for the sake of visualization imagine a glowing line as it passes from the nerve in the ear up to the receiving nerve cell in the brain—through its dendrite, cell-body, axon. Then where? For space has been reached.

All about in this space are the dendrites of the various neurons

of the association group. By some mystical means—it seems mystical—the will is able to direct the current into a certain one. Across the space a connection has been established. And this connection, once made, is called the synapse, being, as its name implies, the potential tie between the two neurons. Again the glowing line appears running from dendrite to axon, and once more into a certain cell, now of the motor set, runs the impulse. Another synapse is established. The impulse is transmitted properly, and the soldier advances to make an imaginary charge.

Repeat the visualization of the process when the command is heard the second time. You can fancy the dendrite of the cell in the association set which had before received the current now a little more stimulated than any of the others. Through the synapse, then, flashes the impulse into this one. And from it likewise across the synapse to the cell in the motor group which had carried the first impulse.

When this same "path" has been used several times, the concentration of the soldier's will is no longer necessary. More and more certainly the synapse acts. More and more readily the "educated" dendrites receive. When therefore he is in action on the battlefield his trained nerve-cells carry him forward, even to danger, the inhibition of fear being nullified by the power of the habitual responses.

Indeed, so strong is this power that it operates even when the occasion has passed. This fact is well illustrated by the story, now hoary with age, of an old soldier, long discharged, who was going along the street carrying parcels of provisions, when he heard someone shout "Attention!" Instantly the veteran let fall his burdens and assumed the soldier's proper position, while his potatoes rolled into the street.

When you first tried to drive your automobile you doubtless felt like a feeble infant before a powerful throbbing monster which you would never be able to control. Rather did it seem the master, a diabolical one at that, maliciously awaiting the best moment to tear wildly off and carry you with it to destruction. Again and again you attempted its mastery, and slowly gained, though at each new beginning feeling afresh your helplessness. And then all at once you were in full control. You were conscious of your power. You confidently grasped the wheel, started the motor, released the brake, and rolled purring down the street. Your persistent direction of the impulse in the desired path had trained the proper synapses.

In his *Back to Methuselah*, George Bernard Shaw, developing his thesis of creative evolution, sets forth this formula: "To imagine, to desire, to will, to create." Taking as example the efforts of the cyclist learning to ride, the author asserts that with repeated effort, new tissue for accomplishing the feat is actually created. What seems more probable to the student of psychology is that instead of the formation of new tissue, there has been the forcing of new connections, or synapses, in the association and motor areas by the determination of the cyclist to master the machine. Only a small portion of our higher nerve cells, so psychologists tell us, are as yet made use of; hence new connections are practically unlimited.

The conception is dynamic. One tingles with its exhilaration. What may not each of us achieve? What future may not each secure for himself if he but earnestly wills it? If success is possible in the case of the cyclist or the automobile driver—as we well know it is—then it is also possible in ours in accomplishing whatever subjective result we desire—provided that desire is sufficiently intense. Again quoting Shaw: "If the weight lifter, under the trivial stimulus of an athletic competition, can't 'put up a muscle,' it seems reasonable to believe that an equally earnest and convinced philosopher could 'put up a brain'."

Perhaps you find yourself at the age of forty engaged in a work which is uncongenial and unsatisfying. You are, suppose, a bank teller or head of a department in some industry; receiving a fair salary, living in moderate comfort, able to lay by a little for old age—a position that is safe and sure. And yet it fails to satisfy your inner desires.

You sometimes think of your college days when you were stirred by intriguing speculations of scientific achievements or philosophical conclusions, by the imaginative appeal of real literature, by the wide view of life in the study of history and sociology, by the keen pleasure in mastering a passage of Latin or French. Now you spend your days over figures which have become mere symbols of dullness, over accounts and transactions which are devoid of any imagination or possibilities of subjective interest. This life of yours, you reflect, this something to which in your youth you looked forward as vivid and moving, is passing in a humdrum fashion while some of your best faculties lie dormant. What vocation would make use of that almost sleeping other self—of those long unused synapses?

Gradually your thoughts, thus stirring, may turn to the newspaper or magazine field, where your intellectual nature shall find

more exercise. Then, if you become seriously interested, you must by your will power establish new synapses: a more difficult matter than at twenty, but quite within the bounds of your ability.

The news of a powerful peace pact consummated at Locarno thrills the world. Your eye nerve or ear nerve carries the impression to the same receiving cell as it would have done a year ago. But now your new interest directs consciously the current into a new association, and thence into a new motor cell. Instead of the impression passing into a weak motor neuron, as formerly, expressing itself simply in an exclamation of satisfaction or only a thought reaction of fresh hope for peace, it is now forced through the new synapse into a stronger mental response. The post-war situation in Europe, the years—long enmity between the French and the Germans, their racial characteristics, the fears and ambitions of those closely crowded European nationalists—all these connections and many more must be studied. Your earlier fund of ideas is drawn upon. The new facts must be ascertained in detail and assembled in an orderly, emphatic manner, and finally the physical act of setting forth the whole affair by writing or dictation must be accomplished.

Consider the innumerable hitherto unused—or long unused—synapses which this act has opened. A new mental life has begun. New territory in the brain has been developed. Each stimulation in the region conduces to response by other cells. And if these connections continue to be made frequently and with intensity, they will eventually become habitual, making themselves without your consciousness of special effort.

Our so-called moral acts are the same as those we term mental or intellectual. Physiology takes no account of such distinctions. Along the identical paths, through the same gray matter and silvery fibres run the impressions, to produce the same reactions, whether prompted by ordinary practical motives, our worldly ambitions, or our ideals. To force ourselves to say Yes when No would have saved us from embarrassment or worse, to give ten dollars to a poverty-stricken mother instead of spending it for a new hat, to show tolerance rather than bigotry, to sacrifice interest for principle—all such idealistic acts can be made into habits through the first controlled synaptical connections.

The tremendous significance, then, of directed and repeated control of the brain switchboard connections becomes evident. If the stimulus of the sense organ be slight, that neuron will first be stirred

which has acted before, for it will "remember" the sensation and know what it means. But a stronger stimulus will, by the increased force of the current, open many synapses. Thus, it is vitally important that clearness of judgment and firmness of purpose shall provide a correspondingly strong impulse to direct it through the synapse *most* appropriate; otherwise it will pass into one opened by instinct, or least obstructed, or one used before, any one of which may be highly undesirable reactions. And the connection once made, it will tend to repeat itself when the same receiving cell is again stimulated. Pillsbury says, "The synapse is the point where action leaves its impress upon the nervous system, and it is here that learning has its effect."

Here also, then, lies the basis of habit, for efficiency or for failure; the basis of character and destiny. No need of a recording angel to set down our shortcomings against us. The mystic synapse is recorder; and avenger as well. Its use renders it all-powerful, as ally or as foe. Its neglect bars the future way for either temptation on the one hand or profitable deeds on the other. We can only act and think in the future as we have habituated the synapse in the past.

This physiological fact thus makes possible the realization of our dearest ambitions, so far as our subjective lives are concerned. We perchance have often sighed with Omar:

"Ah Love! Could you and I with Him conspire  
To grasp this sorry Scheme of Things entire,  
Would not we shatter it to bits—and then  
Remould it nearer to the Heart's Desire!"

In the training of our synapses we can mould our own selves to our Heart's Desire, and in so doing make an enormous difference in the Scheme of Things.