BRAIN'S BASIC FUNCTIONAL CIRCUIT. THE FUNCTIONAL UNIT OF THE BRAIN.

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Abstract.- Neuroscience considers that the neuronal cell is at the same time the anatomical unit and the functional unit of the brain, working with innovative and appropriate methodology it is found that the true Functional Unit of the Brain is a microcircuit of three neurons appropriately located with respect to each other, in such a way that a main excitatory neuron and an auxiliary inhibitory neuron innervate a third, to generate in it a binary code, a bit, which is a two-time electromagnetic event of opposite sign, positive and negative, which takes place in each synaptic station in the Nervous System (NS), which turns the brain into a mixed, biological and electronic machine that is also governed by quantum physics. This is the true anatomy of the synapse in the NS.

Keywords: Microcircuit 1; Synapse anatomy 2; Binary Code 3; Functional Unit 4

Introduction. - When Ramón y Cajal published his great work in 1.899, he had in mind to show that the brain was made up of independent anatomical units that he called neurons. We have thought about the way in which these neurons have to come together and associate to form circuits that modulate electromagnetic fields generated by neurons, in short it is about the anatomy of the synapse, which is what we have called the Brain's Basic Functional Circuit (BBFC), the Functional Unit of the brain. To date, it has been considered that neurons connect one by one to transmit information. Lately, a glial cell has been added to the synapse, which provides enzymatic support to the neuron for the treatment of the neurotransmitter molecule GABA (McGeer and McGeer 1.985), another glial molecule has recently been associated that provides enzymatic help for the management of the glutamic acid molecule. In our work we have found that the BBFC is a trio of neurons to make it possible the generation of a binary code.

Hypothesis. - The functional unit of the nervous system (NS) is not the neuron considered in isolation but a microcircuit formed by three neurons, a main excitatory neuron and an inhibitory neuron that innervate a third, to generate with it a binary code, a bit, electromagnetic event of two times of opposite sign, positive and negative, which takes place in every synaptic station in the NS. Also, the BBFC is required to generate the pathology due to quantitative changes.

Main objective. - Achieve the most complete knowledge possible of the Human Person.

Partial objective. - Achieve knowledge of the structure of the human brain, its application in normal function and pathology and in the design and manufacture of an artificial device.

MATERIALS AND METHODS. — Our methodology, termed New Scientific Clinical Applied Research (NSCAR), is the classic approach, supplemented and enhanced with relevant information to achieve a better understanding of the human person, thereby enabling the proposal of valid hypotheses regarding the constitution and functioning of said human person. This additional information is drawn primarily from psychology, anatomy, physiology, pathology, electronics, and mathematics. NSCAR is supported by the inductive-deductive method of René Descartes (1669) and by the observational approach as practiced by Sigmund Freud (1856–1939). H. Dale who stated neural cells can produce one kind of neurotransmitter only (1932).

DEVELOPMENT. - With the NSCAR we were able to observe that human pathology occurs according to four different mechanisms, namely, through quantitative changes, qualitative changes, inflammation and trauma. The first group, also called organ pathology, consists of organs such as glands, muscles or sense organs that only become ill due to quantitative changes, either because their function increases excessively or because it decreases, such as Cushing's disease and Addison's disease, in the same way a seizure or paralysis occurs. As is known, every peripheral organ or tissue is strictly and meticulously governed by the brain, therefore for these changes to occur in said organs and tissues it is mandatory that the neurons are organized in trios that constitute the BBFC, the Functional Unit of the brain. (See figure 1). Thus, for the function of a gland to change excessively, it is required that the peripheral neuron that innervates the gland be subjected to an excess of excitatory impulses by the glutamatergic excitatory pre-synaptic neuron and for its function to decrease and even cease, it is required that the peripheral neuron be subjected to an excess of inhibitory impulses by the GABAergic inhibitory presynaptic neuron. (See figure 2).

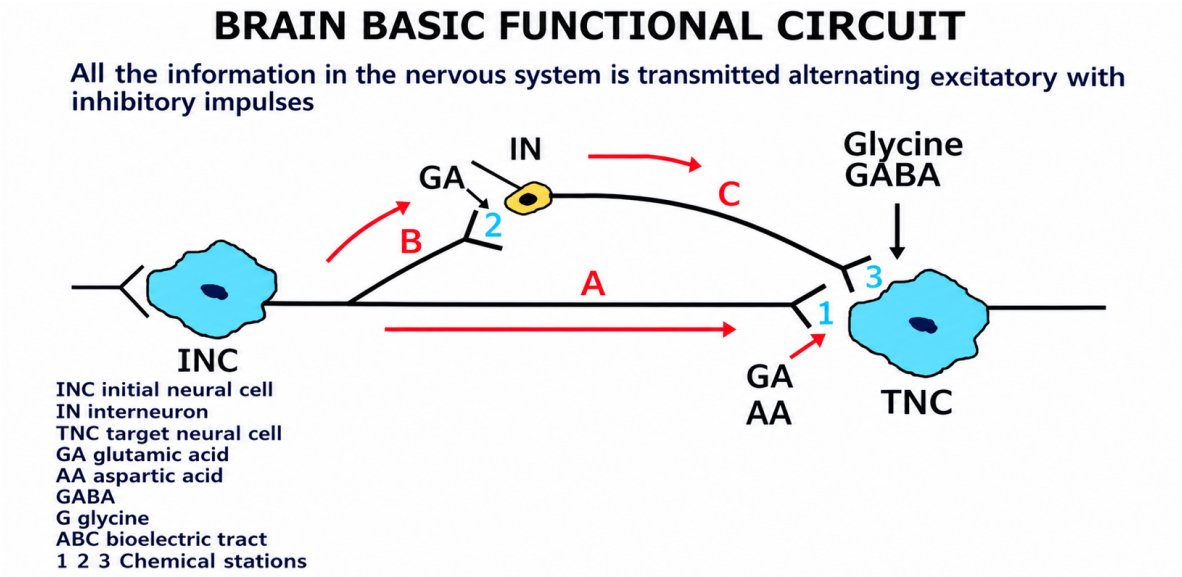


Figure 1.- Graph that schematizes the constitution of the Brain's Basic Functional Circuit, two neurons that innervate a third, one excitatory and the other inhibitory, the three neurons do not need to be close

to each other, nor do they have to be part of the same nervous nucleus. The BBFC is the functional unit of the CNS, not the single neuron.

The dependence of every organic structure on the innervation provided by the brain is demonstrated by experimental surgery and also by trauma, if the innervation of any peripheral organ is suppressed intentionally or if it happens through trauma, its function ceases and tends to disappear due to atrophy, something that is widely known. We also have therapeutic proof that therapeutic interventions through the administration of the three natural co ferments of neurons restore the function of the organs, whether it is increased or decreased. We do not yet have a therapeutic trial on these co ferments that is pending, but in isolated cases we have been able to observe the behavior of the pathology intervened with the combination of Pyridoxine, folic acid and magnesium ions, in salt form, which are the natural co ferments used by neurons in the synthesis of the two main pairs of neurotransmitters.

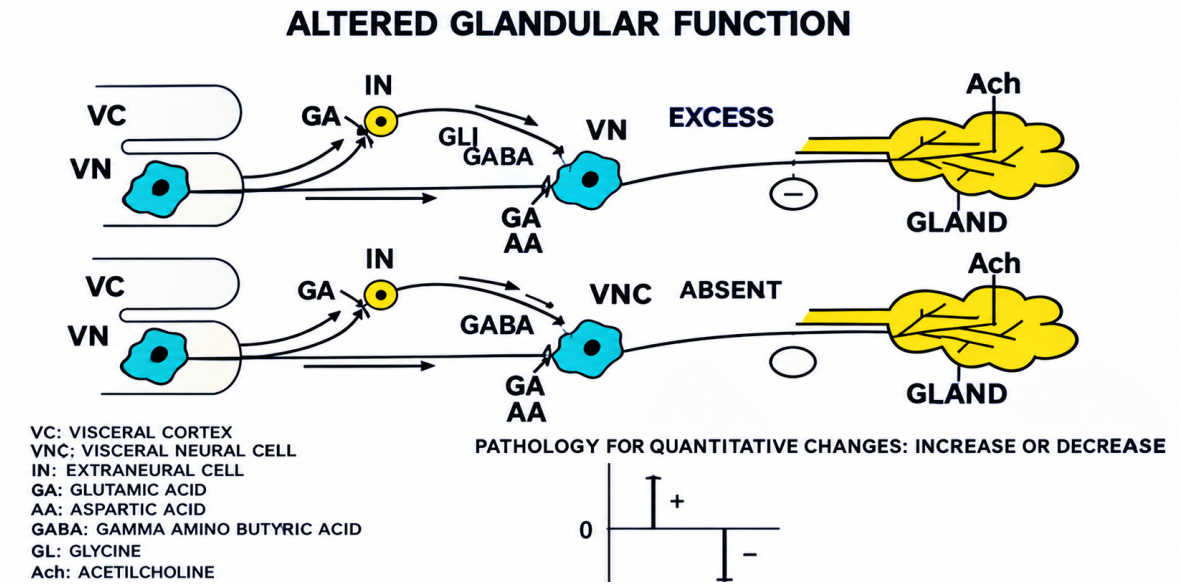


Figure 2.- Graph that outlines the way in which the innervation can vary the glandular function, by excess or by default through the BBFC. In the same way, muscular and painful pathology would occur.

When a neuron receives an excitatory impulse, a change occurs in the electromagnetic field within the neuron's cytosol—a process known as depolarization. This depolarization happens because an excitatory neurotransmitter—by virtue of the electrical charge carried by its molecule—is able to alter the isomerism of a neuroreceptor molecule. This change opens a channel lined with negative charges, which allows only sodium ions (carrying positive electrical charges) to enter. These positive charges reduce the negativity of the neuron's internal environment, making it less negative. This change propagates along the entire neuronal membrane, generating the excitation that is the intended result of the excitatory neurotransmitter's release; the neuron then transmits this excitation to other neurons with which its axon makes contact.

Immediately afterward, however, the neuron is affected by an inhibitory neurotransmitter released by the corresponding interneuron of the BBFC. Due to the electrical charge carried by its molecule, this neurotransmitter alters the isomerism of the neuroreceptor molecule, opening a channel lined with positive charges. This allows only chlorine atoms—which carry negative electrical charges—to enter. These charges increase the negativity within the neuron's interior; this process is known as repolarization. It renders the neuron refractory—or blocked—preventing it from receiving or generating impulses for a duration of one millisecond. This state is essential for completing the binary-code phenomenon, which is the fundamental purpose of every synaptic station.

This is the true scenario in the functioning of the brain, to capture stimuli, to perceive information, to store it, that is, memorize it, to remember it, to process it, that is, think. In each synaptic station of the different fascicles that run through the brain, the alternation of impulses is carried out to create the binary code, there are no nervous pathways whose impulses are only excitatory or inhibitory, this would be inconceivable, since it would not contain information of any class, nature would not produce such a structure. It is the electromagnetic event of ON and OFF positions of the cytosol field that contains the information.

It has been possible to study by means of Boolean algebra and trigonometry, the mathematical behavior of the variation of the electric field of the innervated neuron during the synaptic transmission of the signal, demonstrating that it is an asymmetric sine wave, recognizing the different duration of the three voltages, that of rest, depolarization and repolarization, which, when examined using truth tables, agree with the anatomical and physiological description that we are proposing. (See figure 3).

Electrical recordings carried out in the brain indicate that the electromagnetic field of the cytosol of the neuron at rest has a charge of -65 millivolts, when it is depolarized by the excitatory neurotransmitter, it becomes less negative up to a charge of -55 millivolts, at this moment the inhibitory neurotransmitter arrives that repolarizes the neuron and takes it to a charge of -75 millivolts, it is the refractory state of the neuron that remains for one millisecond, after which the resting field is restored with a charge of -65 millivolts. These were values recorded by Hodgkin and Huxley 1952. (See figure 3).

Furthermore, the digital and non-analog functioning of the nervous system requires an appropriate anatomical arrangement, which is the BBFC, with which it creates the binary code, on and off of the neuron, the values -55 millivolts and -75 Mv represent the ONE (1) and ZERO (0) of digital phenomena, an essential element for processing and transporting digital and non-analog information, which is also the highest ranking in the universe. Also, and above all, the CNS has to exercise regulation, government or control over all peripheral structures and this cannot be done if it cannot alternate excitatory impulses with inhibitory ones at each synaptic station, for which the neurons are required to be arranged in BBFC.

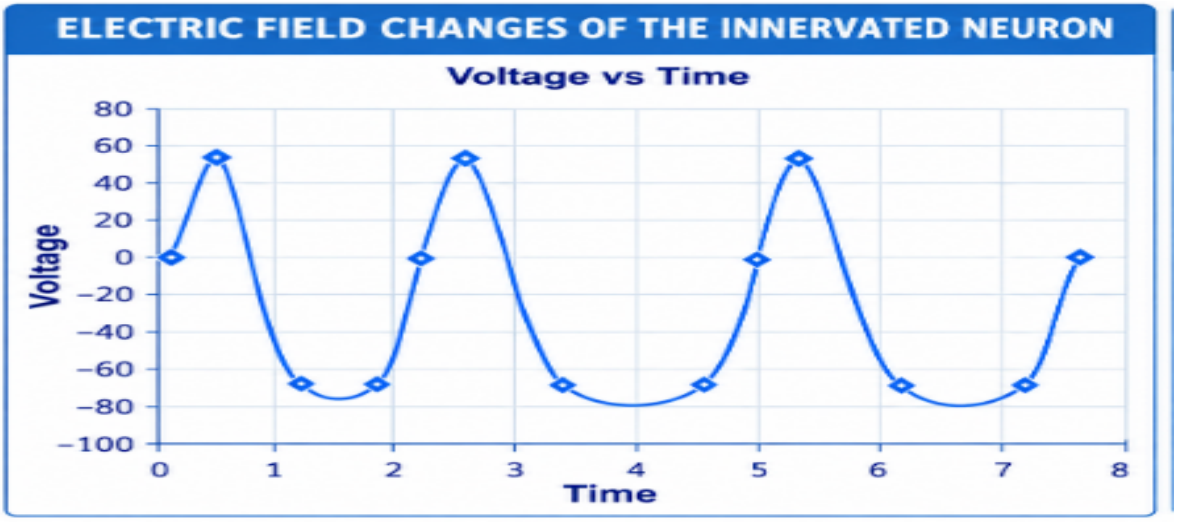


Figure 3.- Graphic that shows how the electric field of the innervate neuron changes after the liberation of the excitatory and inhibitory neurotransmitter, generating and asymmetric wave. (Contribution of the engineer Natalia Guzman).

To fulfill the aforementioned functions, the anatomical unit of the SN, the neuron, is insufficient; a functional unit is required that allows the brain to perform all its innumerable functions and tasks. This functional unit is what I have called the brain's basic functional circuit, which consists of a group of three neurons, arranged in such a way that the nervous impulse starts from an initial neuron, which sends it through its axon which reaches the neuron that is the recipient of the impulse and stimulates it with an excitatory neurotransmitter (glutamic acid in the cortex and aspartic acid in the spinal cord), but in addition the axon of the initial neuron always bifurcates, to contact an interneuron through a second branch, which sends its axon to the same target neuron, to produce the refractory state in it through the release of an inhibitory neurotransmitter (GABA in the cortex and glycine in the spinal cord).

With the above, a neuroanatomical device is designed, which ensures that each neuron receives the axon of the initial or main neuron and also the axon of the interneuron. With which it happens that the direct impulse arrives first, with the excitatory neurotransmitter and a moment later the impulse from the interneuron arrives with the inhibitory neurotransmitter which is required by the recipient neuron to fulfill its refractory time and to generate the binary code. The intense deformation that the cerebral cortex undergoes to accommodate itself in the cranial cavity has prevented the BBFC from being visualized by the microscopic studies carried out until now.

The arrangement in a basic functional circuit is essential so that the CNS can generate an increase or decrease in glandular secretion, whatever it may be (see figure 2); to generate muscle hypertonia, a seizure or paralysis; a paleness or redness of the skin; Without an appropriate device the brain could not carry out these regulatory functions. It could not otherwise regulate the input of sensory and sensitive afferents, since the sense organs are its external agents. It could not regulate the constant cell division in the endo- and

ectodermal tissues that are permanently replaced, although the brain involves other hardware for this. The so-called pathology due to quantitative changes could not occur if the NS were not organized into BBFC.

The previous description corresponds to the individual connections of neurons, but we know that some brain structures communicate with each other and with peripheral structures, through sets of nerve fibers called fascicles, in these cases each axon of the fascicle bifurcates, at least once, to contact an interneuron that allows it to alternate excitatory and inhibitory impulses at the next synaptic station. That is, the connections between two synaptic stations are always constituted by BBFC and not by single neurons.

An example of this way of connecting the different fascicles is the connection between the two cerebral hemispheres, in which case the interneuron is located in the caudate nucleus, which is demonstrated by the shape and route of the caudate nucleus, which reproduces as in a mirror the shape and route of the cerebral hemisphere. It would be as follows: from a pyramidal neuron in one hemisphere an axon emerges that is directed to another pyramidal neuron in the opposite hemisphere and after passing through the corpus callosum, the axon bifurcates to contact with this second branch the interneuron that is located in the caudate nucleus on the opposite side, from this in turn an axon emerges that is directed and contacts the same neuron of the same hemisphere to which the axon of the first one is directed.

The first neuron releases an excitatory neurotransmitter that stimulates the neuron that is the target of the impulse, and the interneuron releases an inhibitory neurotransmitter that induces the refractory phase in the neuron that is the target of the impulse, thus creating the binary code that is the computing unit of the brain. (See figure 1). For the corticopontine and corticospinal motor pathways, the interneuron is located in the lentiform nucleus.

From the above it can be deduced that the neurons originating from each fascicle can exert on the recipient neurons an excitatory effect alternating with another inhibitory one and that, for normal function, the two types of impulses must maintain a temporary balance, but when this balance is broken, the target neurons can begin to function excessively, if excitatory impulses predominate or decrease their functioning, if inhibitory impulses predominate. To generate one situation or the other, it is required that the interneuron be permanently inhibited by a second synapse or, on the contrary, that the original neuron be inhibited, by a second synapse.

If we imagine that, due to persistent inhibition of the original neurons, only inhibitory impulses reach the destination neurons, they would be permanently inhibited. If the target neurons are those of the primary motor cortex, area 4 of Brodmann (1909) and Sarkisov (1955), paralysis of the opposite side of the body would occur, that is, what is known as hemiplegia. Here is the mechanism of this pathological entity, according to the functioning of the NS according to the new paradigms proposed here.

It would be very reasonable to think that the inhibition would not be established suddenly and definitively, if not, that the excitatory impulses continue to alternate for a period of time with the inhibitory ones, so that during the time of the excitatory impulses the patient could suffer seizures and during the time of the inhibitors he would suffer paralysis, which is the scenario to which the so-called stroke clinic has accustomed us. Also, that paralysis does not set in instantly but progressively, over the course of hours.

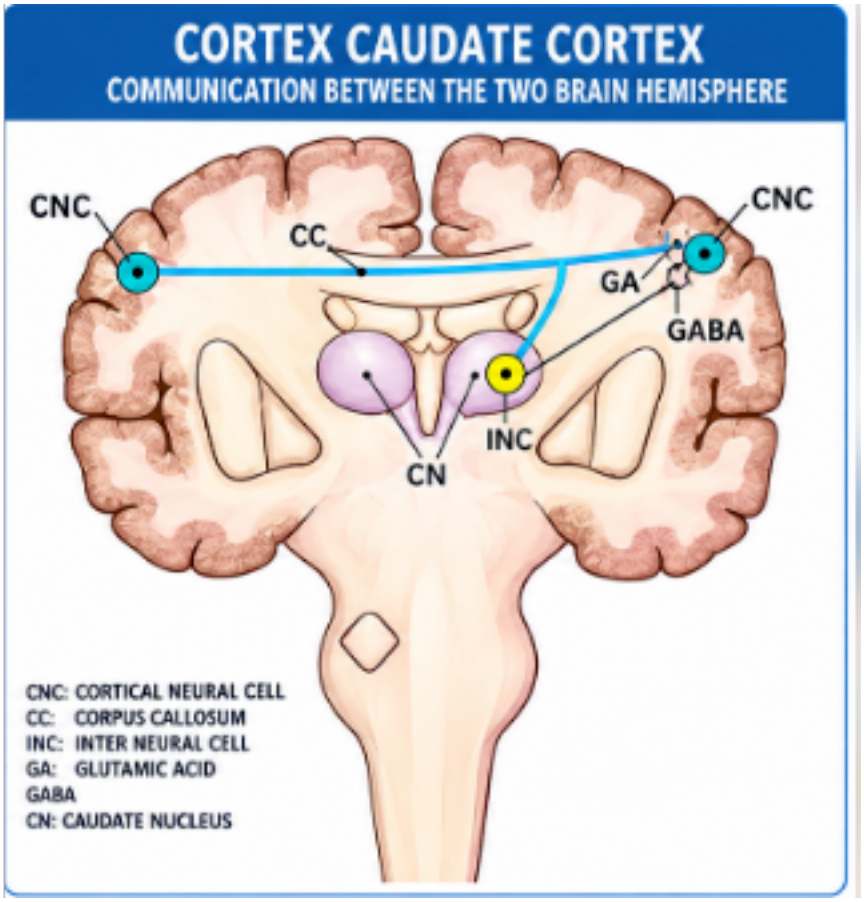


Figure 4.- Semi-anatomical graph showing interhemispheric communication, with the excitatory neuron sending its axon to the neuron of the opposite hemisphere, passing through the corpus callosum and once it passes through it, it bifurcates and incorporates an inhibitory interneuron located in the nucleus caudate of the opposite hemisphere.

Events such as forgetting known things, which are considered different in nature from paralysis, could not happen if the brain did not function based on functional units such as the BBFC. Forgetting occurs because the forgotten information that is stored in a storage circuit cannot make its way to the corresponding primary cortex (site where we remember), because through a BBFC the brain closes, blocks, the output to the impulses that they should convey this information. That is, all brain functions, organic and psychological, can only be carried out if the functional unit of the brain is the BBFC.

The last example constitutes a fact that shows what the union is like between the psychological and the organic, between the mind and the brain, there it appears how the psychological takes place in a physical, anatomical substrate and with equally physical, measurable events. Because forgetting known things is a daily experience for all humans.
The example mentioned is new knowledge generated by working with NSCAR as a scientific research instrument.

What the brain does is to replicate this functional unit (BBFC) as many times as necessary, to build the different hardware it requires to carry out its various functions. In addition, such hardware must have a predetermined shape and size. In such a way that if we now want to build an artificial brain, we only have to build functional units like the BBFC and assemble them as needed to build a brain as complex as necessary, that is, here is the basis for producing new generation artificial intelligence and of unlimited scope. (Vergara Campillo 2018).

R**esults.** - 1. With this result we have gotten remarkably closer to the true structure of the brain and we have opened a door to continue exploring. 2. From now on researchers will have guidance and we will save a lot of time and resources. 3. We have brought closer the understanding and solution of many diseases and aging. 4. We have learned a lot by avoiding the fragmentation of information and adding different sources. Among others.

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