

Nerve Cells, Axons, Dendrites, and Synapses: The Foundation of Rehabilitation

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The nerve cells and their axons, dendrites, and synapses form the most important components of the nervous system and as such are the foundation for rehabilitation. A nerve cell (neuron) is the structural unit of the nervous system. Axons and dendrites are the parts of the neuron that make contact with other neurons. A synapse is a contact point of one neuron to the next neuron. The electrical impulse from one neuron travels down its axon and when it reaches the end, it activates a chemical transmitter that carries the impulse across a small gap to the next nerve cell. The component containing the gap is the synapse. This point of contact is modified when we learn or unlearn something, be it facts, emotions, or movements.

The Synapse

When we learn something, the nervous system responds and makes the synaptic contact stronger. This response also causes the neuron to expand its receptive connections, the dendrites, and it creates more axon contacts for association. These are real physical changes and they can be demonstrated in experimental animals such as snails. While we are much more complex than a snail, these same structures are the foundations of our nervous system, and they are the structures that therapists try to influence during rehabilitation.

Rehabilitation is a process of relearning old functions or developing new ones. Since it is a learning process by the neurons in the nervous system, it takes many repetitions to have an effect. Learning is a repetitive activity and so is rehabilitation.

The modification of the synaptic contact is such that repetition strengthens the synapse, just as not using the synapse causes it to stop functioning. This works on a

larger scale than just a single synapse. In many learning situations the constant neuronal activity causes many neurons to respond and the number of synapses to increase. It is the constant repetition of the therapeutic activity that forms the strong synaptic contacts, and generates multiple synapses.

Axons and Dendrites

In addition to the increased strength and number of the synaptic contacts, the individual neurons increase their number of axons and dendrites in response to the increased activity of therapy. These developments create a richer environment for neural activity. They provide for associations to be formed between the neurons, and thereby establish the possibility of coordinated, sequenced, and associated activities.

It is the coordinated, sequenced, and associated activities that are sought by therapists. The activity may be as simple as being balanced while standing or it may be the ability to differentiate between two- or three-dimensional objects drawn on paper. The activity can also be as complex and abstract as the concept of using an object for more than one task, i.e. a chair to sit on or to use as a ladder to reach something high up. In any of the above examples, the basis for being able to accomplish the activity is the strengthening of the synapses and dendrites involved in the activity.

Repetition

Rehabilitation is the process of intervention by a therapist to establish, or reestablish, functional usefulness to the individual who has a deficit due to injury. Every therapy works on the principle of repeating an activity to instill the correct movement or response. It is constant repetition that creates a pattern of correct activity. As small infants and children we learned to perform certain activities by constantly repeating words or movements until we became proficient at them. In rehabilitation it is no different. Repetition, repetition, repetition is the foundation of the learning process.

