



## EMBRACING THE ROOT

For years the question of whether plants possess a nervous system has been debated. However, scientists now know that trees are capable of facilitating their communication, retaining memory and even learning through their own special nervous system. It is becoming more evident that trees process and transmit electrical signals, carrying a neurobiology that would prompt them to have a nervous system.

To highlight some connections that Embracing The Root recognizes with that of the neurobiology of trees , let's expand on three main points. All of these are focused on trees and their roots, stress and communication, and fungal relationships.

**The first point** will state that connection prompts growth. Connection is a collective effort, coming from interconnections with all subsystems of a working entity. However, connections may also refer to those

outside an entity. For instance, trees take part in an outreach process defined by mycorrhizal networks. Most recently, trees have been found to not only possess the ability of self regulation but also proven to take part in the regulation of other trees. Trees that live together help each other. This is because of the intrinsic communication system they have developed. Through the process of isotope tracing, scientists have determined that trees that live together are capable of sending the necessary resources, including nutrients, to other trees in need- via their roots. This intercommunication not only aids the trees in need, but have also shown to increase resiliency in all trees. Mycorrhizal networks, which are built amongst trees, are the ones facilitating tree resiliency. To add into this relationship between trees, a technique called allelopathy explains how trees communicate amongst themselves to warn each other about invasive predators.

**For our second point**, we will establish that neuron connections and root connections are similar in structure and function. The vehicle of all neuron connections are recognized as dendrites. Dendrites are projections from a nerve cell, derived from the Greek word Dendron for “tree”. From such derivation, we can deduce that roots from a tree and nerves from the nervous system (neurons) are similar in structure and function. Similarly, they both take stimulation, are adaptive in their pathways, possess a memory and have the ability to learn. Because roots and neurons are affected by an environment of stimulation we will discuss stress in our third point.

**We have stated** that tree development is not static, since roots of a tree develop new pathways to form stronger connections, such as our own human brain. In the case of stimulation, we will pose the example of watering. If a tree is under watered, the tree will not flourish. Conversely, if a tree is overwatered, it will wilt. We can see a related

Science notes by Neuroscientist, Biochemist & ETR partner Sofia Hidalgo.

effect on the human condition. Place a human under an overstimulation of stress, and he/she will suffer and become unhealthy.

To conclude, it is important to note that in order for a tree and human to be healthy, there must be a symbiotic relationship with microbes such as fungi and bacteria. In trees, the mycelium or fungal threads in fungi help trees acquire vital minerals. The human microbiota also maintains homeostasis in the body. It is always necessary to refer back to the basis of human survival strategies. Human survival strategies go back to single organisms such as fungi, which have the ability to close their outer wall in the presence of harmful substances or non nutritional value. Trees, their roots, and the communication system they carry are all connected to stimulation and fungal relationships.

The human brain has developed to be a communication system that is connected to our own biological nature, but also a nature beyond the whole human entity.

### **About Sofia and her involvement in Embracing the Root project:**

Embracing the Root involves a scientific understanding about the human brain and the biological systems of trees and fungi. To facilitate a scientific understanding for the audience, Sofia will engage the audience with questions and discussions about the interconnections of the project and science. Topics of discussion related to neuroscience will include but are not limited to: brain motor systems and coping mechanisms, stress responses of the human body, the amygdala and emotional wellbeing. For the biology of trees and fungi, topics of discussion will include tree communication, symbiotic organisms and processes, and nature's stress responses. Lastly, both fields will be brought together in discussion to relate them in their similarities as well as their symbiotic and beneficial relationship.

Education: Having received her **Bachelor's degree in Biochemistry** with a concentration in **STEM Education and Neuroscience in Research** from **The University of Texas at Dallas**, Sofia Hidalgo continues to aspire to further her education in the emerging field of Educational Neuroscience. Her main interest lies in the educational field and in incorporating research-based practices in the areas of learning, memory, and cognition. She has dedicated her work to **Adolescent Reasoning and Cognition** investigation with **The Center for Brain Health- Dallas**. She has also conducted **Neurolinguistic Research** for the **Callier Center for Communication Disorders**. Sofia's goal focuses around promoting brain health by gaining a better understanding of the human connectome network and developing research driven metacognitive practices.