Issue XXV

STEMBoost Newsletter

Brought to you by the STEMBoost Editorial Team

Fun Fact:

What is the smallest organ in the body?

Autumn Updates!

Engela Zhang, Staff Editor

As the summer draws to a close, so do our summer workshops. We'd like to thank all of our instructors for their hard work on the STEMBoost summer workshops, and all attendees for supporting us. We hope all attendees learned a lot from our workshops and are excited to attend again next year. If you missed them this year, make sure to check back at the start of the next summer to see what workshops we'll be offering next year!

Although workshops may be ending, the start of the school year also means the start of the Science Olympiad season. We encourage all interested parties to consider joining their schools' Science Olympiad teams to join the nationwide network of school teams competing in various STEM events. STEMBoost will be holding its annual STEMBoost invitational in early 2023 as per usual, and various STEMBoost members will also be proctoring at many other invitationals, especially at the annual Kennedy Invitational. To support Kennedy Middle School's Science Olympiad team, STEMBoost will be organizing presentations on the different events offered by Science Olympiad this year to help students gauge which events they'd like to participate in.

Two Brains Better Than One?

Joseph Lee, Chief Editor

In a recently published study, neuroscientist Dr. Sergiu Pasca and his colleagues successfully transplanted human neurons into the brains of living mice.

First, the group transformed human skin cells into neurons. Different genes in a cell's DNA can be turned "on" or "off" to give it specific characteristics, causing it to become a specialized type of cell, be it a skin cell, muscle cell, neuron, etc. By bathing the cells in a series of chemical solutions, scientists manipulated which genes were activated or deactivated. They first changed the skin cells to make them more similar to embryonic stem cells, which can develop into any tissue in the body. Afterwards, these cells were made to grow into neurons.

Using this method, scientists could grow human neurons in a Petri dish and join them together to form rudimentary organs called "organoids." However, observing these cells outside of the body limited what researchers could learn from them. Because they were unorganized masses of tissue, they did not have the ability to receive sensory input and feedback, a core aspect of neurological function. Furthermore, a lack of blood vessels and support cells stunted their growth while making them a less reliable model for the brain, having been placed outside of their natural environment.

In order to move past these constraints, scientists moved to transplanting organoids into animal's brains to create a model of the human brain more accurately and study how what goes wrong with the brain for individuals with certain diseases.

Dr. Pasca's team transplanted a clump of cells into the somatosensory cortex of the brain, which is responsible for detecting a variety of physical sensations, and is wired to process stimuli detected by the whiskers in mice. As the mouse brain supplied the human neurons with blood vessels, they multiplied and fully matured. They were remarkably adaptable; over time, the neurons integrated themselves with the surrounding circuitry, eventually learning to send messages to the rest of the mouse's brain. When air was blown over the mouse's whiskers, the human neurons demonstrated corresponding electrochemical activity. After a period of time, subjects showed no evidence of pain, seizures, memory loss, or physical impairment.

This new achievement has several implications; it gives us the ability to monitor human brain tissue in context, and gives us a more accurate model of the human brain to test various treatments for disease. Another promising possibility is using these transplants as a treatment to replace dead or damaged brain tissue to restore function in people whose brains have been affected by severe injury or disease.

Research involving Chimaeras, or human-animal hybrids, has been around for a few decades now, and continues to be a field under heavy bioethical scrutiny. Particularly, this ongoing research is new territory which we have never stepped foot on before, and it raises a host of new bioethical questions.

For one, science tells us our brains are essentially what makes us human; they are the root of our consciousness and our sense of self. However, such procedures blur the line between humans and other animals, and scientists are especially concerned about the possibility of endowing animal test subjects with human characteristics, and what it might mean if those test subjects feel emotional distress or pain.

New breakthroughs continue to illustrate that as the field of biology continues to evolve, rules and regulations in consideration of ethical and moral values must evolve alongside it. Consequently, we must continue having discussions about how far such science can and should go.

Works Cited:

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Answer:

The pineal gland, which secretes melatonin, a hormone that helps regulate your sleep cycles!