ISSUE 05

SWEET

NEUROSCIENCE

DIY ACTIVITY

BRENDA MILNER

GRANDMOTHER CELL

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CONTACT US!

@sweetsciencezine

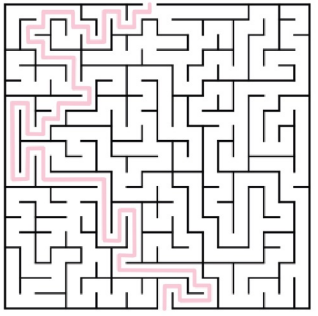
sweetsciencezine@gmail.com

sites.google.com/view/sweetsciencezine

ABOUT

SWEET (Science with Exciting Experiments & Tips) is a zine that aims to spark curiosity and empower the next generation of girls in STEM through hands-on experiments, fun lessons, and games.

SOLUTION



OUR TEAM

Chloe Drieu
Clémentine Préfot
Aleena Wong
Melody Alduy-Berman

THANK YOU!

Dear Readers,

Welcome to the fifth issue of SWEET!

This time, we're taking a closer look at something that's always working, even when you're asleep.

This issue is all about neuroscience: the science behind how your brain and body stay connected. We'll be learning how messages travel through your body, why quick reflexes matter, and how scientists are uncovering the secrets of what makes us us. It's one of the most mind-blowing topics we've ever covered, and I can't wait for you to dive in.

Happy exploring,

Chloe

STEM Exploration

NAVIGATING NEUROSCIENCE

Have you ever stopped to think about thinking? Or wondered how your body knows when to jump, laugh, cry, or even read these words? That's all thanks to one amazing thing: your brain.

THE SCIENCE OF YOU

The brain is the command center of your entire body, and the science that studies it is called **neuroscience**. Neuroscience helps us understand how we **move**, **feel**, **learn**, **remember**, and **react** to the world around us.

So... what's a neuron?

A **neuron** is a special kind of brain cell that sends and receives **messages**. Neurons help you think, feel, and remember. You have billions of them working together all the time!

IS IT REAL?

Yes and no. Scientists really *did* find neurons that respond to very specific people or objects. However, that doesn't mean there's literally one single cell for every person or thing you know. Instead, the Grandmother Cell helps us imagine how the brain might store **complex memories**, like recognizing your grandmother, or remembering the smell of her cookies. Your brain most likely uses a whole team of neurons working together, with some doing the heavy lifting for certain memories or images.

This means your brain is super smart about saving space and organizing memories. Instead of storing every single picture of your grandmother, it might use one cell to put together everything you know about her.

The Grandmother Cell might not tell the whole story, but it opens the door to how amazing your brain really is. Your brain has a powerful way of making meaning from the world around you, whether with one neuron or a thousand!

Lesson

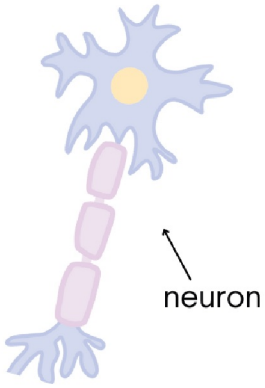
The Grandmother Cell

Imagine a single brain cell that only lights up when you see butterflies. Sounds like something out of a movie, right?

Well... it might not be so far off.

Scientists call it the **Grandmother Cell**, a nickname for a hypothetical (as in imagined or possible, but not proven) **neuron** in your brain that's so specific, it only responds to one person, place, or thing. Like your grandmother. Or a puppy. Or, in one famous case... the actress Jennifer Aniston.

WHAT IS IT?



When researchers were studying the brains of patients with epilepsy, they noticed something strange: one **neuron** only fired when the patient saw a photo of Jennifer Aniston, the actress best known for the TV show *Friends*. That single brain cell recognized her face and her name. That's how the idea of a "Jennifer Aniston neuron" became neuroscience-famous.

MEET YOUR BRAIN

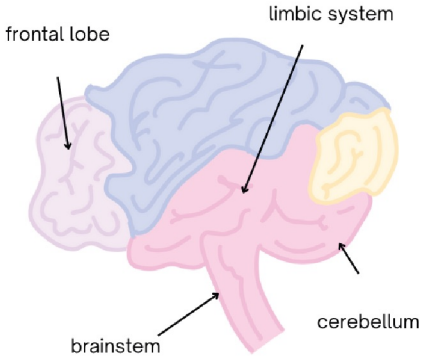
THE FRONTAL LOBE

The **frontal lobe** is part of the cerebrum, the biggest part of your brain. The left side of the frontal lobe usually handles **language** and **logic**, while the right side is better at **creativity** and **visual thinking**.

THE CEREBELLUM

This smaller part of your brain is tucked under the back of your cerebrum. It helps with basically anything that involves **movement**, like balance, posture, and coordination.

Schema of a human brain



THE BRAINSTEM

The **brainstem** connects your brain to your **spinal cord** and controls the things you do without thinking, like breathing, heartbeats, and digestion.

THE LIMBIC SYSTEM

This group of parts sits is in charge of emotions and memories. When you feel excited, nervous, or super happy, that's your **amygdala** in action. When you remember your first day of school or your favorite song, your **hippocampus** is at work.

Your brain is always learning, changing, and growing, just like you. The more you understand how it works, the more powerful your thinking can become. Next time you solve a puzzle or feel a rush of excitement, thank your brain and the incredible study of neuroscience.

Activity

Build a Brain Cell!

By Melody Alduy-Berman

MATERIALS

- Pipe cleaners (12in)
- Beads
- Yarn
- String

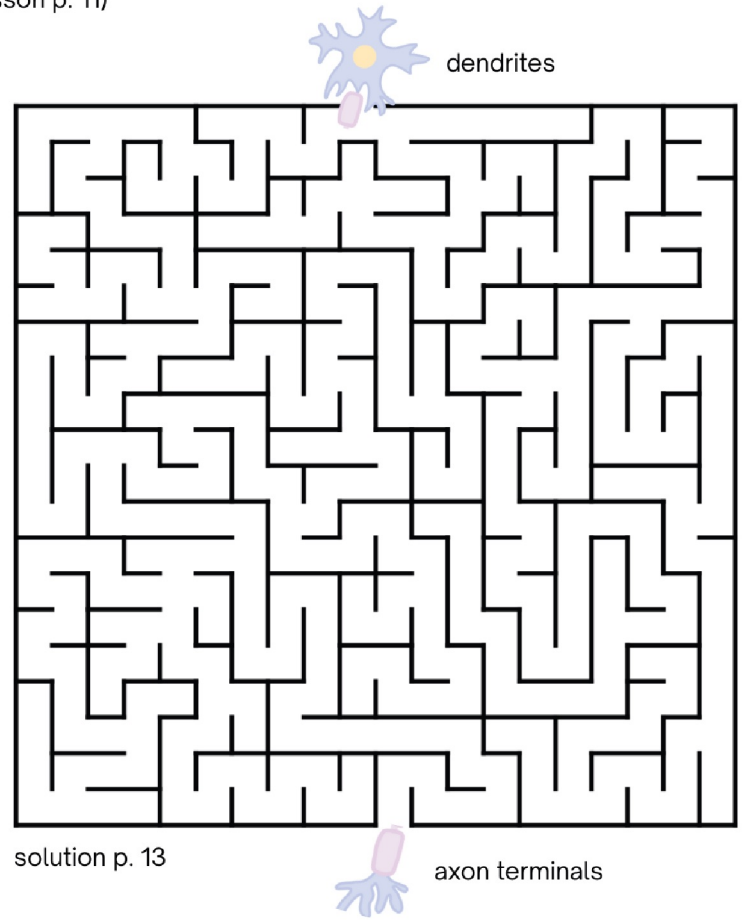
Are you ready to take a little trip to the depths of your mind? In this activity, you'll learn how different parts of a brain cell (or, a **neuron**) are connected and gain a better understanding of how it transmits information.

VOCABULARY

- **Dendrites**: Small, branch-like parts of the neuron. They're where neurons receive most of their information. They have special receptors that pick up signals from other neurons, called neurotransmitters.
- **Soma** (Cell Body): The part of the neuron that holds its genetic material (**DNA**). It gathers signals from the dendrites and, if the signal is strong enough, passes it along to the axon.
- **Axon**: A long "wire" part of the neuron that carries electrical signals away from the soma to other neurons, muscles, or glands.
- **Axon Terminals**: The tiny ends of the axon. They change the electrical signal into a chemical signal by releasing **neurotransmitters**.

NEURON NAVIGATOR

Your brain cells send messages all day long to help you move, think, and feel. In this maze, help a message travel through the neuron just like a real brain message!
(lesson p. 11)



solution p. 13

Her father, who was a music critic and teacher, supported her love of math and problem-solving, encouraging her to think logically and ask questions. After he passed away when Brenda was eight, she began attending regular school and eventually studied experimental psychology at Newnham College, Cambridge.

The brain is a world consisting of a number of unexplored continents and great stretches of unknown territory

In 1944, after marrying her husband, she moved to Canada for his work and began a PhD at McGill University after completing her Master's at Cambridge. There, she attended a lecture by Donald Hebb that inspired her to keep studying how the brain works. Hebb supported her interest in clinical research and helped her get connected with the Montreal Neurological Institute, where she worked with Dr. Wilder Penfield.

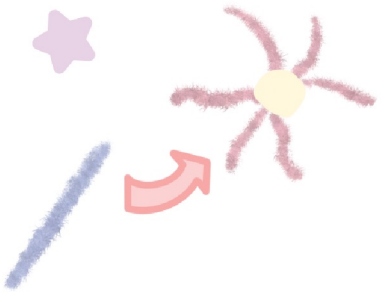
At the MNI, Brenda met Henry Molaison, a patient who had surgery to treat epilepsy but lost the ability to form new memories. Back then, scientists didn't know which parts of the brain made memories possible. In 1957, Milner published research proving that losing the hippocampus caused Henry's memory problems.

LEGACY

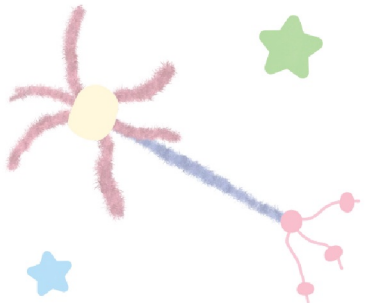
Brenda Milner's work changed the way we study the brain. She helped start a brand-new area of science and proved that memory is more complex than we ever thought. Milner continues to inspire generations of neuroscientists and students, especially young girls, to boldly challenge the norm, ask big questions, and explore the unknown.

1 Craft a Neuron

- Use your scissors to cut 3–4 pipe cleaners to about 6 inches long. These will be the dendrites, or branches of your neuron.
- Take a large bead and slide all your dendrite pipe cleaners through the hole, twisting them together so the bead stays in the center. This bead represents the soma, or cell body.



- Take one long pipe cleaner (about 12 inches) or a piece of string the same length, and twist it onto the soma bead so it extends outward in one direction. This will be your axon.
- Next, cut 3–4 pieces of yarn or string, each about 3 inches long. Twist or tie them onto the end of the axon. These will be the axon terminals, also called synaptic terminals.
- Finally, for extra detail, you can glue or thread smaller beads at the tips of the terminals to represent neurotransmitters and make your brain cell more colorful!



2 Reaction Time Test

Brain cells sense information from the outside world to help you respond to it and learn.

Neurons send messages to each other day and night at lightning speed. They sense information and instruct other cells on how to respond. Then, they remember and respond to what you have learned.

Picture this: It's winter, and you step outside. The air is cold, so you decide to put on a sweater to keep warm. Or, when you go to the zoo and hear a lion roar for the first time, next time you see a lion, you know what sound to expect when its mouth opens. These experiences are possible because of the cells inside your brains!

CHALLENGE TIME!

Are you ready for a challenge? First, grab a ruler. Have one person hold the ruler at the 0 cm mark. Another person should place their open fingers at the bottom of the ruler. The person holding the ruler drops it at random and the other person tries to catch it before it hits the ground.

Note the centimeter mark where the ruler is caught, and repeat a few times to get an average result. This reflects how quickly your neurons send information to your muscles and organs to catch the ruler in time.

Women in STEM

Dr. Brenda Milner

1918--Present

By Aleena Wong

Brenda Milner is a 106-year-old neuroscientist who helped create a whole new field of science: cognitive neuroscience. That's the study of how our brain works when we think, remember, and learn. Her work has helped us understand so much about how memories are made. Her amazing discoveries all started with an unusual patient who changed the course of her research and our knowledge of memory forever.

Brenda has been studying the brain for over 70 years and is still teaching today at McGill University in Canada! Some of her recent research looks at how bilingual and monolingual people process language, especially if they've had brain injuries.

HER STORY

Brenda Milner was born and raised in Manchester, United Kingdom. As a child, she was homeschooled and learned many languages. By the age of 6, she was fluent in English and German and also studied French with her mom.