

2022 Best in Literary, University of Michigan Science as Art Competition

Notes on Electrophysiology

After rapidly removing the brain, tissue was sliced on a vibratome in an ice-cold sucrose saline solution.

we buzz
we crackle
we pass notes on salt packets
saline jolts of happiness
opening and closing gates welcoming a storm
a lightning bolt fractured and passed, potluck style,
among our greedy mouths
we electric jello, all shivers and smiles,
all bodies jolted together by ecstatic ionic music
writhing in this soda-pop dish
kaleidoscopic snowflakes picking up speed
we hurtle through plasma waves
as you try to catch us on your tongue
just to watch us melt

The coronal slices were bathed in oxygenated artificial cerebral spinal fluid.

we dance
we whirl
we stretch our tree tops out into wild space
a neverending spiderwebbing of
too many octopuses crawling through an over salted ocean
arms and arms and arms branching
into fingers into fractal twigs
that touch and kiss in tripartite waltz
a lavalamp library of alexandria
where memories are handshakes
and words a sloppy wet tentacle hug
every story growing stronger with each telling

GFP expressing neurons were identified using fluorescence microscopy.

we spark
we shine
we light up like jellyfish
brilliant lurid greens barrel rolling through the velvety darkness
it is a startling aurora

one that you remember from dipping your hand in the ocean and stirring
watching the bioluminescence popcorn
a cupful of stars too ephemeral to grab
flashing in patterns you didn't know how to read
desperate to decipher you
press a glass to the wall so hard it shatters
we are the rainbows bouncing off the pieces

A low resistance seal was formed between a glass recording pipette and neuron and activity was recorded.

we roar
we erupt
we joyous jubilant things
burst like shaken cans of sprite into the hard silence of your room
staccato static pop popping from that speaker
sparks becoming music becoming squiggles on your graphs
you embroider a rosetta stone with your glass needle
every bolt a calculation you try to wrap your mind around
merry-go-round mathematics and jungle gym physics
flipping and landing hard on x y monkey bars
it's a current made conspicuous
a chorus singing a neon song all brass band and sharp sounds
discordant resolved to harmony resolved to a single resonant wave
the type that some use to enter a trance
where all bounds of self dissolve like ions in a bath

Mean firing rate (number of action potentials/duration) was calculated.

you watch
you eavesdrop
you remember that night in the middle of the sea
when you were swallowed by it all
by too many stars above and below and
too much darkness above and below
by a universe where you were so small and they were so big
and you know that the universe inside your head is too vast for any spaceship to traverse
and you keep launching anyways
because under every answer is another question
and they ache in your chest and beat in your fingers
and we sing your questions back to you
you emergent property of us

Abstract

Every time I hold a brain, I am struck by the thought that this tissue contains the entire memories, sensations, behaviors, and motivations of a creature. This poem was my attempt to capture that feeling of wonder at the brain during an electrophysiology experiment. In between stanzas are the methods for an experiment involving extracellular recording of action currents, which records the electrical activity of a neuron. With the chaotic imagery I hoped to describe the indescribable and inspire a sense of awe at these truly incredible brain cells.

Explanation of Work

This poem was written from the collective perspective of neurons to convey my own scientific wonder the brain. I contrasted scientific prose with poetry to highlight the magical moments of experiments you don't see in a scientific paper. I repeated images of the ocean and space, two other expanses that inspire awe, are complex, and are mysteries to science. I used chaotic and vivid imagery, hoping to create a sense of being overwhelmed and capture the failures of language to describe what it is to be a neuron.

The poem describes an electrophysiological experiment. The italicized lines are the methods I used for extracellular recordings of action currents. Neurons convey information through electrical currents. In an extracellular recording, a small glass pipette is positioned on the cell membrane. This pipette then records the changes in the electrical current of the cell, which is a proxy for activity.

The first stanza describes the electrical nature of neurons. I reference the fact that the electrical charge is carried in part on sodium (salt) ions and channels open like gates to let ions into the cell. The texture of brain is similar to jello, which is why I described neurons as electric jello. In electrophysiology, the brain slices are kept in solutions where oxygen is bubbled through the liquid, hence soda-pop dish.

The second stanza describes the physical structure of neurons. The end of the neuron that receives signals is a dendrite, which comes from the Greek word for tree. These structures are branched like treetops. Neurons communicate at points called synapses. Many of them are three-part tripartite synapses consisting of two connecting neurons and an astrocyte, a star-shaped cell that inspired some of the imagery. This stanza also refers to the process of creating memories. While the exact details are unknown, we know that memories are physical changes to how these cells act. I reference one mechanism, long term potentiation, where a synapse or response of a neuron grows stronger with more frequent or stronger stimulation.

The third stanza describes the use of genetically encoded fluorescent markers. For my experiments, I used neurons that expressed green fluorescent protein (GFP). This protein glows bright green and is derived from jellyfish.

The fourth stanza describes neurons firing action potentials and how they are recorded. Old electrophysiology rigs had a speaker attached to them that would translate electrical current into sounds like crackling white noise, so the scientist could hear when their neurons fire. The action currents are also recorded on graphs, which to me are like translating the language of the neurons into something we can understand.

In the final stanza, the collective voice of the neurons addresses the experimenter. This stanza references a meaningful memory of being overwhelmed by the universe, mirroring how overwhelming the brain can be. Finally, an emergent property is a feature of an entire system that the individual components of the system do not have. Consciousness and a sense of self are emergent properties of these incredible neurons.