

Neuron 208®

Clarence Williams, February 2, 2007

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Malaise greeted me as I tumbled out of bed, and continued dogging me as I plodded to the kitchen to swallow some caffeine, dark, manly coffee that jolts rather than cajoles. My mood sharpened after I gathered enough wits to run through a physical inventory and found no impending illness, but a sense of injustice instead. Over what? The question brought a feeling of injustice, and with it a healthy dose of anger. I marched to the living room, lazing back in the couch and carelessly leafing through the latest issue of *Science*. After a few minutes, an article caught my attention, and I stiffened, carefully reading the abstract before bolting upright and breaking into a wide-eyed sneer, crying, "Yes!" through gritted teeth. I followed that with a few pumps of a clenched fist, signifying victory over this morning's damnable discomfort, and a major discovery to boot. I eyed the article again, repeating, "Yes!" They've discovered the neuron that made me do it, and soon they'll have the god-awful gene that built the damn neuron that... I should explain my excitement.

Last night at the Oasis, I had finally achieved a confident state when a comely lass sashayed in to take up position at the end of the bar. I ordered another Scotch then offered her a smile, delighting at receiving one in return. It was a small one, to be sure, but other instincts assured me it was an invitation—she was dressed to kill—, so I motioned to George the barkeep, and we joined at the lady, where I bought her a drink and began polite conversation. After a couple of minutes of feeding her some meaningful dialogue, I faced decision time: continue the idle chatter or get to the point. Something went wrong, and a slap had followed my offer, a generous one, both the offer and the slap.

I shrugged my shoulders at recalling the details of my earlier angst, and then dismissed it for good, saying to myself, what's the big deal? I refocused on the article, "Optical Imaging of Neuronal Populations During Decision-Making." You can find it in volume 307, February 11, 2005, if you need reassurance science knows why you act the way you do. You might even ask PubMed to notify you of future citations, but after reading it I'm comfortable with the findings. This group of scientists studied the mechanisms of behavioral choice, using the medicinal leech because of its simple central nervous system and immunity to the complications of consciousness. I guess that means it's a stupid creature. I'm a few steps up the evolutionary ladder—or so I'm told most of the time—but the central nervous system is similar enough in all animals to give hope men can learn from this lowly thing.

These scientists were ingenious in their approach, providing the creature with identical sensory inputs, which sometimes elicited crawling and other times swimming. Why one behavior and not the other? Lo and behold, they found a neuron, cell 208, which selectively biased the decision to swim or to crawl. When it was hyperpolarized by a nerve shock, neuron 208 reliably

evoked swimming; with it depolarized, the nerve shock evoked crawling, or at least delayed swimming.

So, the leech faced a conflict similar to mine, swim (dive in with my urgent proposal) or crawl (more banter), and either behavior was elicited by identical stimuli, much as mine was induced by a pretty girl. My neuron—calling it *h208* seems appropriate—had been hyperpolarized!

Behavior has long puzzled me—I was not your typical kid, nor were others in my family average—so I made it a lifelong project to learn as much as I could about human behavior. Regarding choices, either the stronger synaptic charge wins out over a weaker, conflicting response, or your brain weighs costs and benefits. And that doesn't always mean it's a rational choice; humans make a lot of irrational decisions. It's in our nature, this cognitive bias, which is an especially comforting thought.

But here, a poor creature had faced identical stimuli—an electric shock for the leech, a pretty girl for me—and could make one of two mutually exclusive choices, which neuron 208 had decided. There's a master neuron! I smiled triumphantly, laid the magazine aside, and slid back into the couch, wondering, does this mean there's a homunculus? I'd always rejected that belief, too supernatural for my taste, but here was a master switch.

I shuddered, sat up again, and recovered the magazine, carefully rereading the article. "Hm," I breathed, noticing something I'd missed. It seems neuron 208 had not determined the choice on all trials, but was statistically reliable. This less-than-perfect control was credited to the fact that the researchers never tested the 20 others like cell 208, sister neurons. I puzzled over this a bit, then tossed aside the magazine before it pestered me. Scientists always create wiggle room.

As I eased back in the sofa, I wondered about my leech, and by evolution, about myself. Was he immersed in his normal medium, or outside his element? Strange surroundings often cause odd behavior. Was he comfortable between shocks? Persistent stress can have severe effects, as my young brother knows too well. And how does alcohol effect... Now that's a silly thought. Leeches don't drink. But surely they have a dopamine reward system, like mine. Could they have genes for addictive behavior too? And how could the stimulus be identical? Surely electric shocks can't be perfectly matched. Does my leech have a socialization process of any kind? Where does it learn to be a... Well, that's another stupid idea. They don't learn; all their behavior is instinctive. But was its parent—do leeches reproduce sexually?—involved in some environmental insult, maybe effecting this neuron epigenetically? Maybe the mother had been shocked too, and just at the wrong time for the developing cell 208. And what about the un-stimulated neurons, those pesky, untested sister cells?

"Damn," I yelled in frustration, leaping to my feet and eyeing my watch. It's time to pass the day at the office and get back to the Oasis... me and good old neuron *h208*.

