

When analyzing the paper as a class, the first thing that Kevin posed was, What is analogue versus digital signalling? This was a question that, at first, seems simple to answer, even with respect to neurons. Naively, the answer is that action potentials are binary (fired as all or nothing signals) and that tonic release is analogue, but by delving deeper into the understanding, the answer can be based on bit-depth, binary as a function of time. The membrane voltage can be seen as either a series of 1s or 0s at each moment in time, with a full AP being all 1s, and the resting potential be all zeros (with some system for hyperpolarization).

The discussion proceeded to delve into the technicalities of this signalling, and there was the grand mistake of being hung up on details. My personal hang up, was with respect to Ca^{2+} independence being used as a phrase, which was cleared up when the system was explained to me more clearly than the paper first proposed. The paper meant that the channels overall will depend on voltage (which Ca^{2+} plays a role in), but are not directly correlated to calcium with respect to the budding of vesicles, or activation of GPCRs.

The role of electrodiffusion was discussed in depth, as well as its role in the strength, coding, and time effects on the propagation of an action potential down a series of axons. It was also noted with respect to memory, as this paper strongly discussed the hippocampus. We discussed that there could be diffusive actions when encoding memories, as some are thought to be emotional, and thus cannot be just a series of 1s and 0s. However, this sparked my interest and made me question how our body electrochemically changes when different emotions are invoked, and if that is just a side effect of the initial memory. That is to ask, is the series of 1s and 0s that our body (possibly) encodes memory as (just like a computer) eliciting chemical responses? Or are the chemical responses part of the memory itself? Unfortunately, this discussion went well beyond the scope of this paper, and the discussion had to be subdued.

One point that I was very happy to hear, and to learn a bit more about, was how the Cable Model can be used to describe a series of low pass filters, just as measured with the axons in the hippocampal region. This led me to think that a modified cable model or a modified HH model could be sufficient to describe the physics behind how the neurons in this area are working, and it could perhaps be used as a simple starting point, due to the issue of the whole is greater than just the sum of its parts.

The catalyst of the discussion revolved around the most pivotal role of sticking to one reference point, especially with respect to size. When analyzing this paper, I often found myself thinking that analogue signals were digital (at certain levels of zooming), and that certain digital signals could be seen as analogue (when zooming to a certain level). If one is to stay consistent with

the zooming in that they are using, it makes analysis simpler, and by consistency, it is easier to understand each other if discussing in a group. Overall, the experience was excellent, and was enjoyable and stimulating. The research was interesting, and seeing that we can apply what we have learned is extremely rewarding. This also brought to my attention that even if a paper seems very difficult at first, if given some time, it can be analyzed and understood, and enjoyed overall.