Final Project: Sodium Conductance in HH neuron

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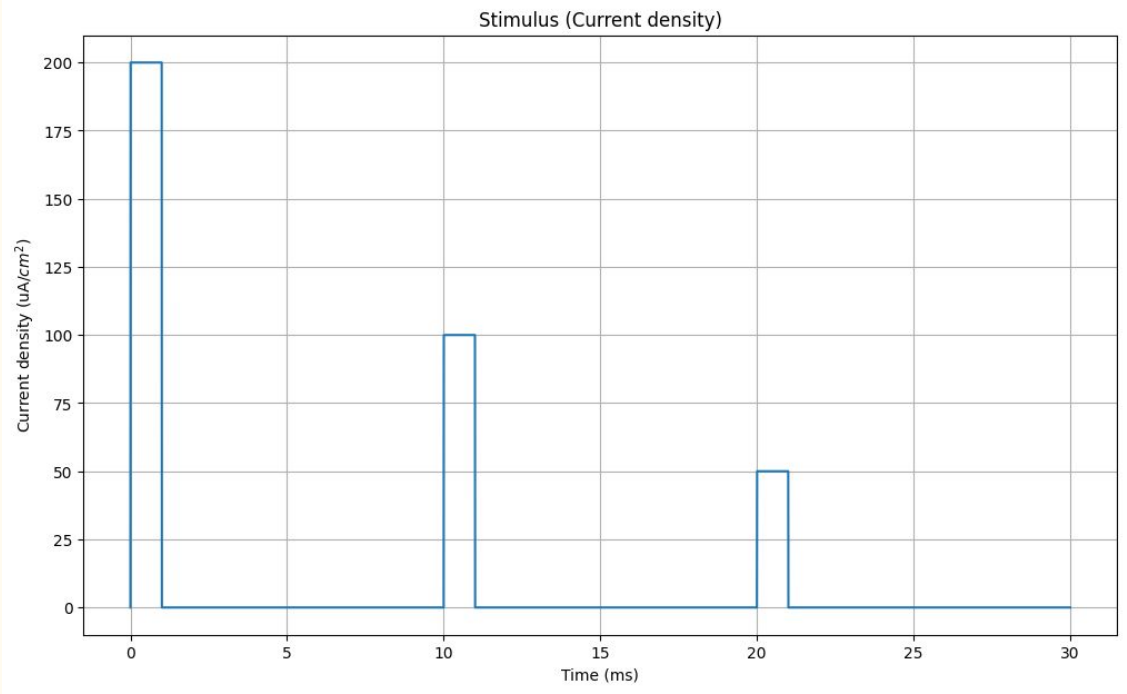
Teja

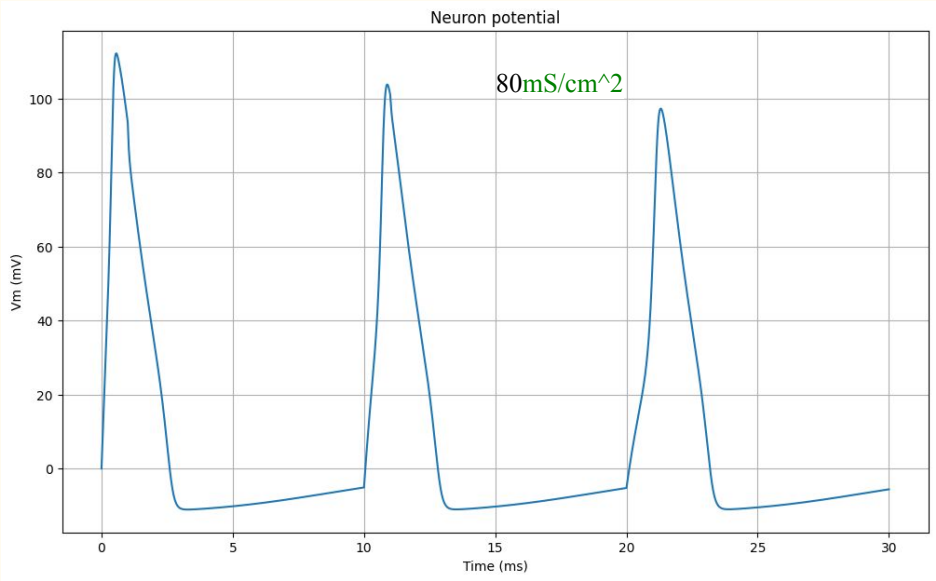
Introduction

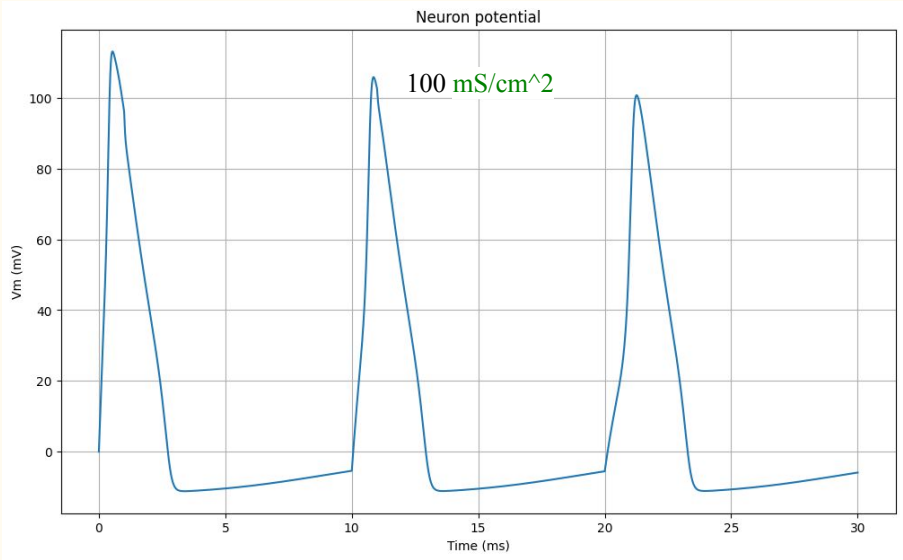
- Epilepsy
- AEDs
- Phenytoin
- Issues with Initial Project Plan:
  - Standard HH model
  - Drug and Voltage Gating

Results

Stimulus Currents

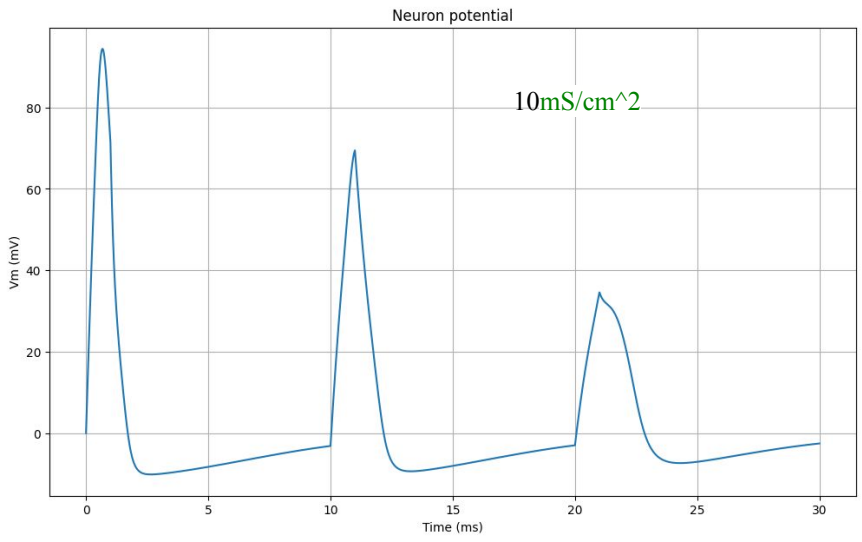




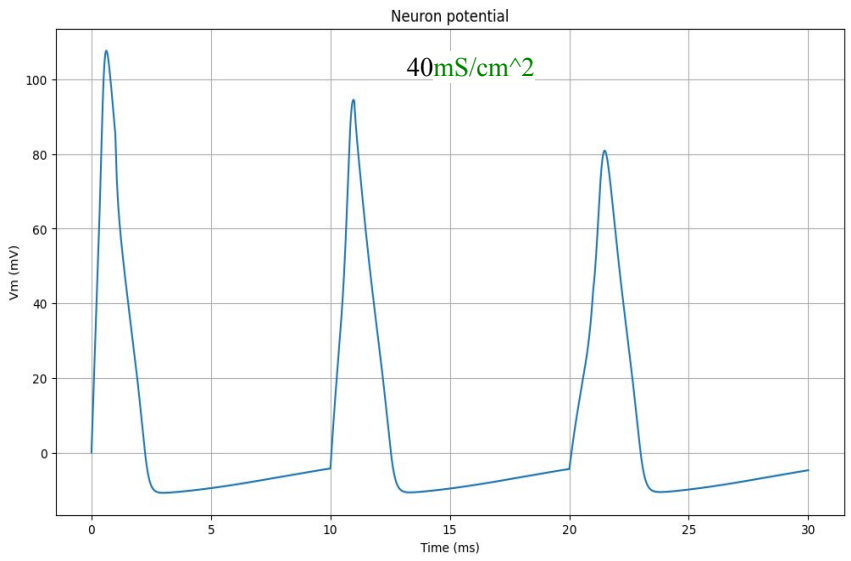


118,102,98

118,104,101

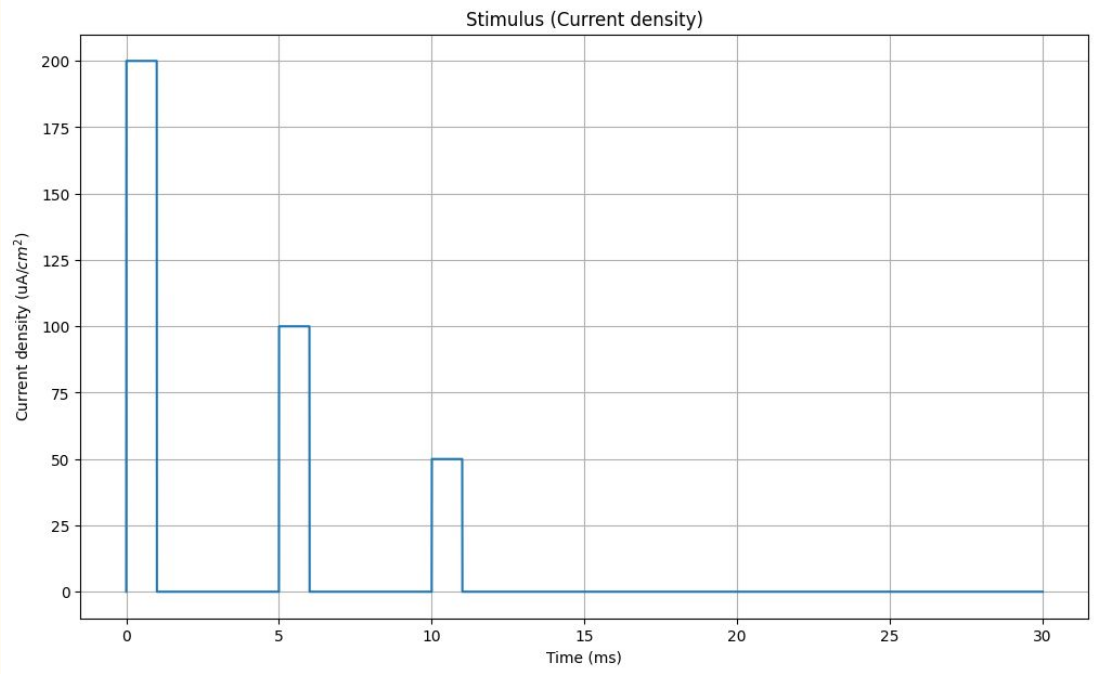


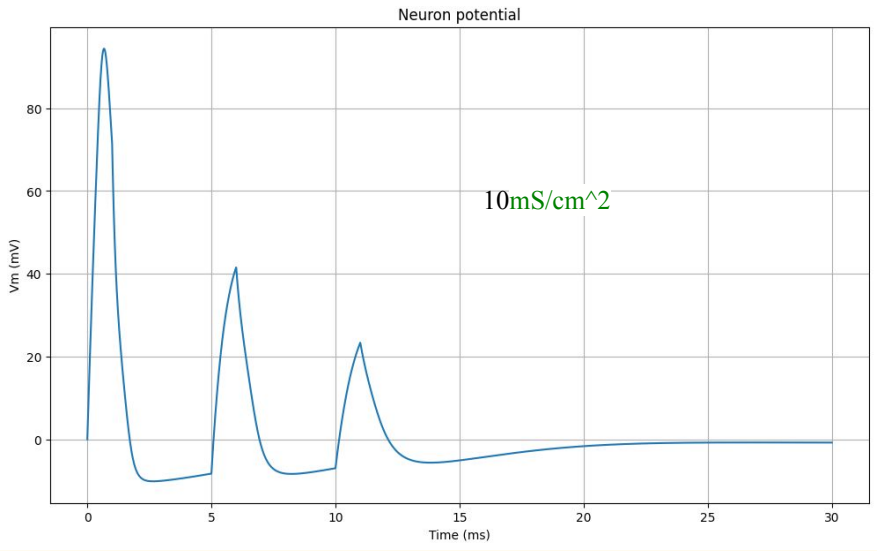
96,72,37

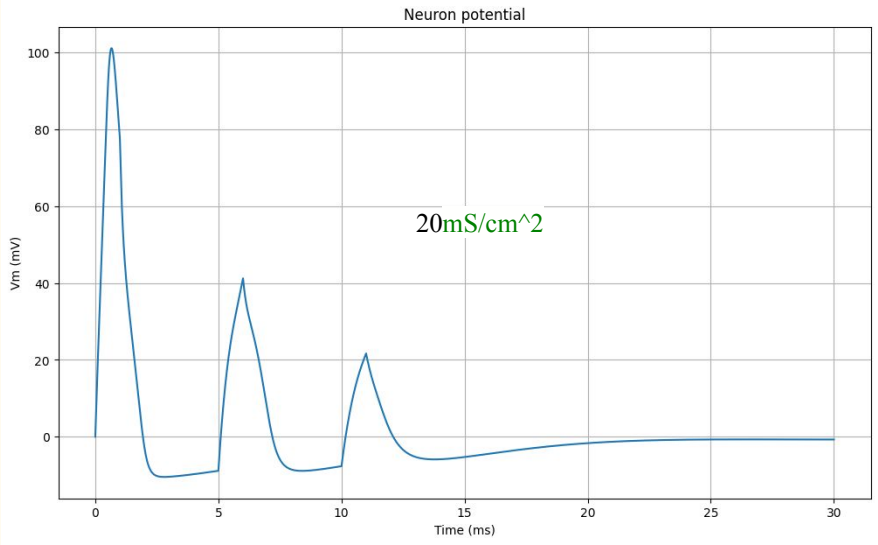


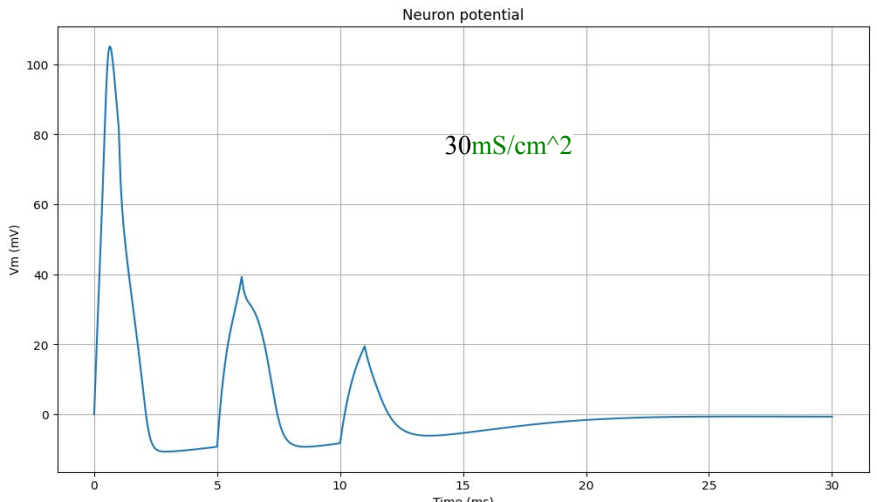
115,95,81

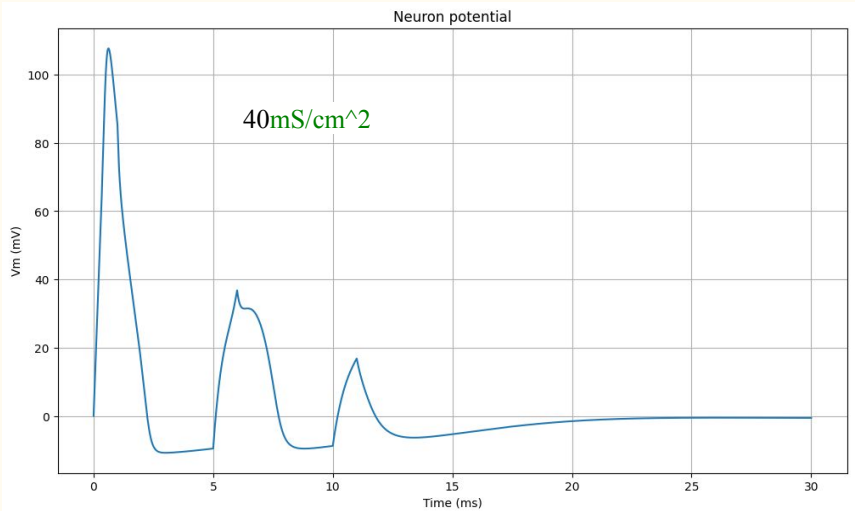
Stimulus Currents

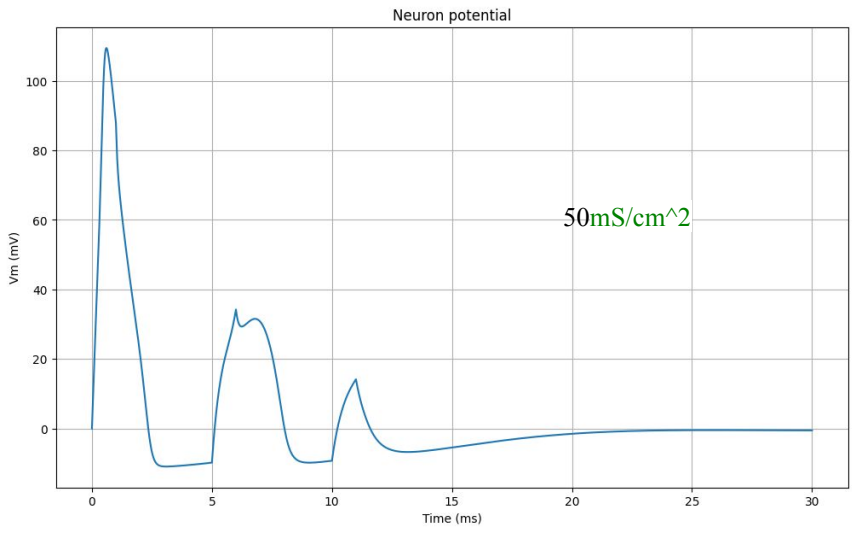


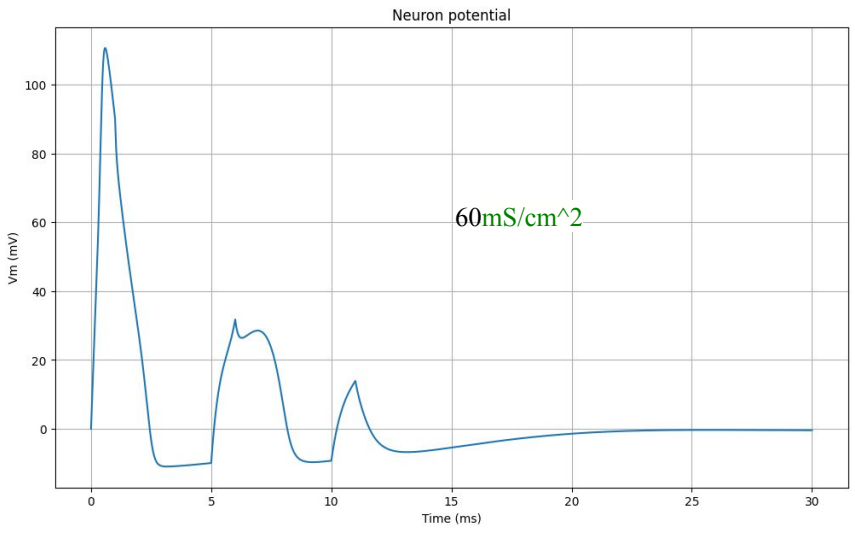

Neuron potential
10mS/cm^2
Vm (mV)
Time (ms)

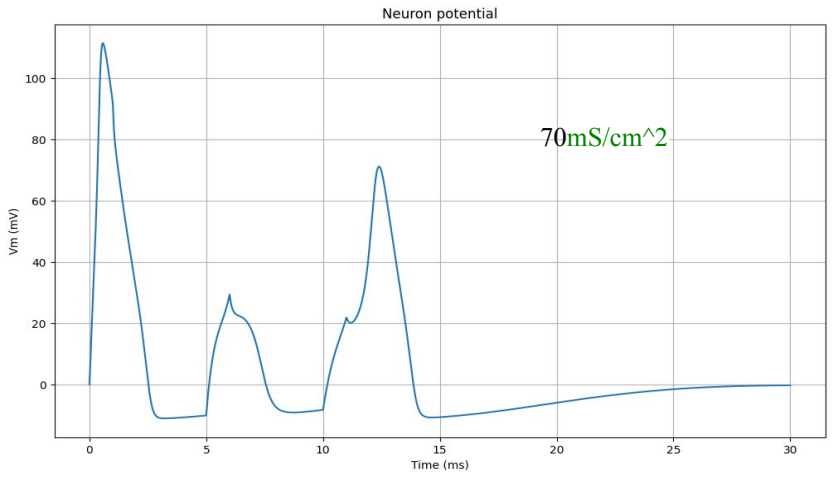

Neuron potential
20mS/cm^2
Vm (mV)
Time (ms)

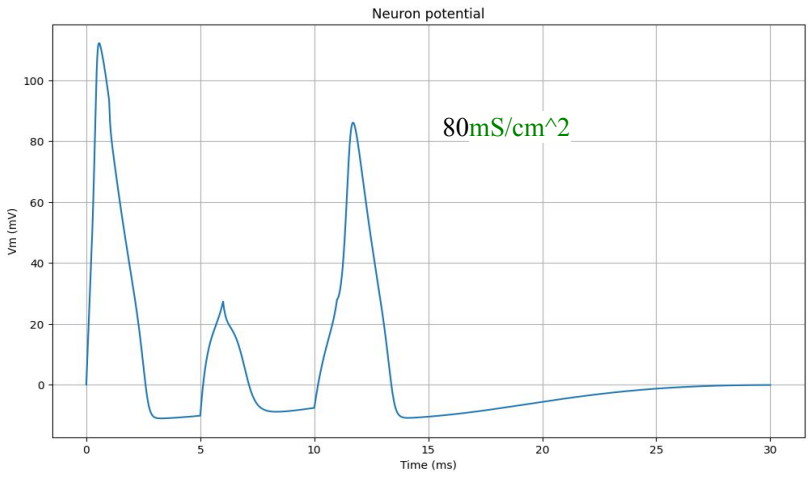

Neuron potential
30mS/cm^2
Vm (mV)
Time (ms)

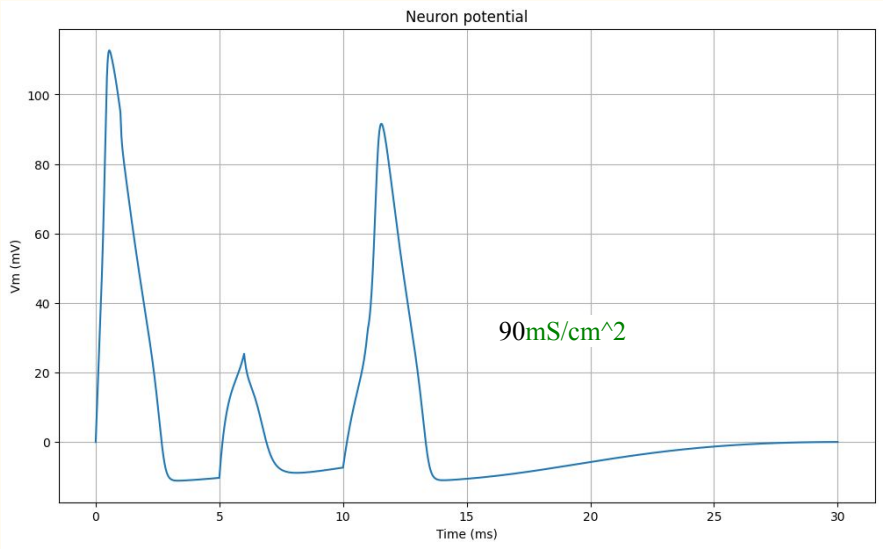

Neuron potential
40mS/cm^2
Vm (mV)
Time (ms)

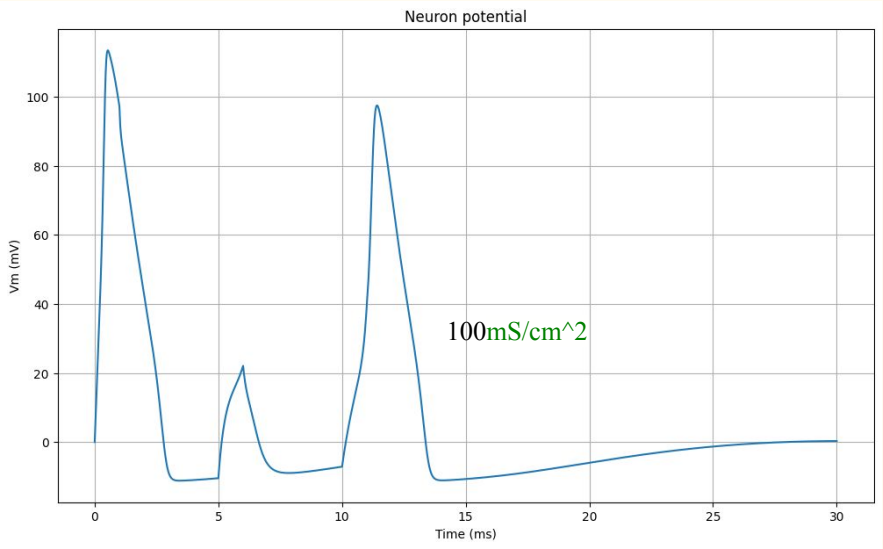

Neuron potential
50mS/cm^2
Vm (mV)
Time (ms)


Neuron potential
60mS/cm^2
Vm (mV)
Time (ms)


Neuron potential
70mS/cm^2
Vm (mV)
Time (ms)


Neuron potential
80mS/cm^2
Vm (mV)
Time (ms)


Neuron potential
Vm (mV)
Time (ms)
90mS/cm^2


Neuron potential
Vm (mV)
Time (ms)
100mS/cm^2

Discussion/Conclusion

- Relationship between conductance and spikes
- Future Directions:
  - Explore Petrou Model
- Things I would have done differently:
  - Action potential waveform: peak-to-peak duration, half-width duration, amplitude, and slope of the waveform to quantify changes in the shape or duration of the action potential

References

Thomas EA, Petrou S. Network-specific mechanisms may explain the paradoxical effects of carbamazepine and phenytoin. Epilepsia. 2013 Jul;54(7):1195-202. doi: 10.1111/epi.12172. Epub 2013 Apr 8. PMID: 23566163.

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Yaari, Y., Selzer, M.E. and Pincus, J.H. (1986), Phenytoin: Mechanisms of its anticonvulsant action. Ann Neurol., 20: 171-184. https://doi.org/10.1002/ana.410200202

Mochizuki Y, Suyehiro Y, Tanizawa A, Ohkubo H, Motomura T. Peripheral neuropathy in children on long-term phenytoin therapy. Brain Dev. 1981;3(4):375-83. doi: 10.1016/s0387-7604(81)80066-6. PMID: 6274215.

Synaptic input on temporal variance

Might produce synaptic filtering