Week 3: Recording synaptic currents

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Abstract

This week, I measure the synaptic currents associated with action potentials.

1 Recording synaptic currents

I begin by initializing two pyramidal cells and connecting them with a synapse.

```
load_file("nrngui.hoc")
load_file("LAcells_template.hoc")
load_file("interneuron_template.hoc")

number_of_cells=2
objectvar cell_exc[number_of_cells]

for i = 0, number_of_cells-1 {
    cell_exc[i] = new Cell_A()
}

objref syn, nc
cell_exc[0].dend syn = new pyrD2pyrD_STFD(0.9)
cell_exc[1].soma nc = new NetCon(&v(0.5),syn,0,2,1)
```

I then introduce the vectors for recording the synaptic currents.

```
objref tvec, ivec
tvec = new Vector()
tvec.record(&t)
ivec = new Vector()
ivec.record(&syn.iampa) //ivec.record(&syn.inmda)
```

Then I introduce a current clamp and run the simulation.

```
objectvar stim
cell_exc[1].soma stim = new IClamp(0.5)

stim.del = 100
stim.dur = 200
stim.amp = 0.4

tstop = 400
```

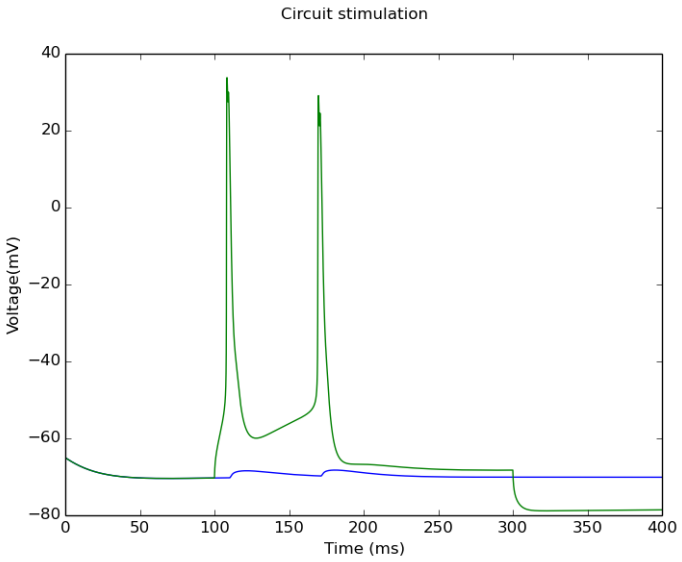

Figure 1: The voltage traces of pre-synaptic(green) and post-synaptic(blue) cells, 400 pA

```
run()
```

Finally, I save the data to file.

```
objref savdata
savdata = new File()
savdata.wopen("current.dat")

savdata.printf("t STHcells[2].soma.v(0.5)\n")
savdata.printf("%d\n",tvec.size())

for i=0, tvec.size()-1 {
    savdata.printf("%g %g\n", tvec.x(i), ivec.x(i))
}

savdata.close()
```

2 Results

For clarity, the voltage traces of the pre-synaptic (green) and post-synaptic (blue) cells are plotted in Figure 1.

In Figure 2, we plot the AMPA current time course and in Figure 3 the NMDA current time course.

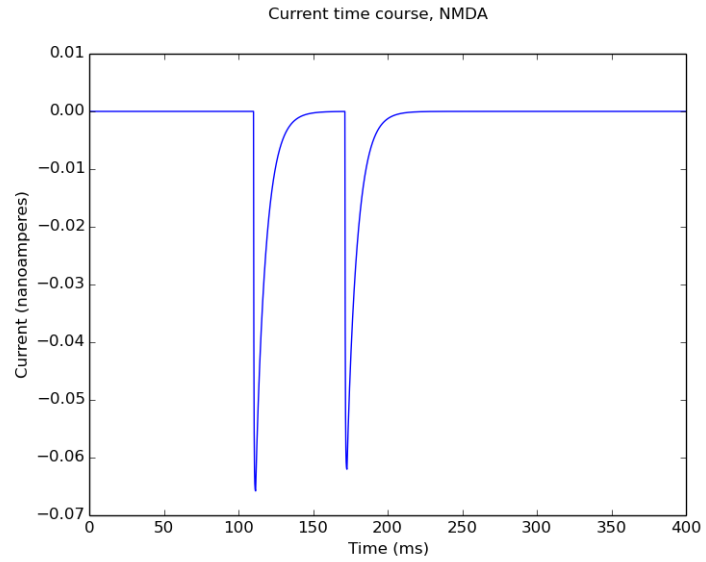

Figure 2: AMPA currents of the post-synaptic cell

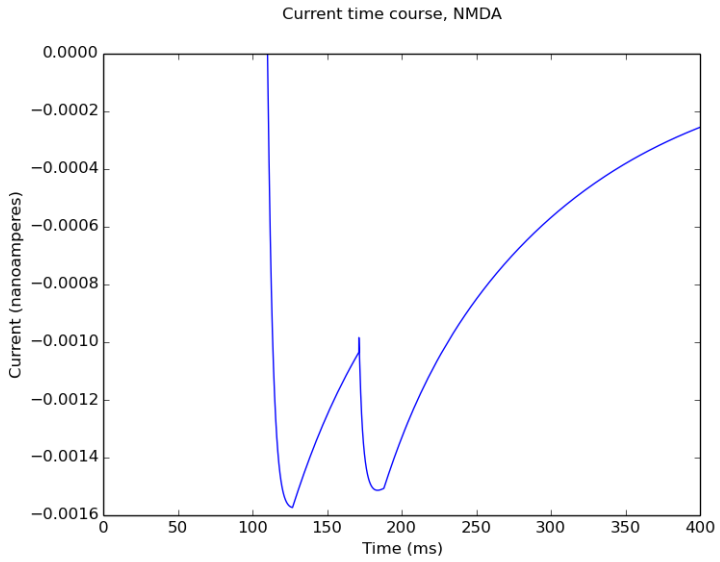

Figure 3: NMDA currents of the post-synaptic cell

3 Conclusion

This week I recorded synaptic currents going through AMPA and NMDA synapses in pyramidal cells.