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Supplementary Materials for

Differential expression of voltage-gated sodium channels in afferent neurons renders selective neural block by ionic direct current

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The PDF file includes:

- fig. S1. Example of a real-time output of the MATLAB script provided in the Supplementary Materials.

Other Supplementary Material for this manuscript includes the following:
(available at advances.sciencemag.org/cgi/content/full/4/4/eaaq1438/DC1)

- data file S1. iDCBlock.m MATLAB script that implements the model described in the publication. See the supplementary instructions for using this script.

Supplementary Materials

The MATLAB model file iDCBlock.m is provided in the supplementary material. This is the only file needed to run the simulations described in the manuscript. The model produces a figure that periodically changes as the model runs through time. There are three plots in the figure. The first is the membrane potential along the axon. The second is the membrane potential at 80% of the length of the axon as a function of time. The third is the fraction of VGSCs in the open, inactivated, or closed states at each position along the axon.

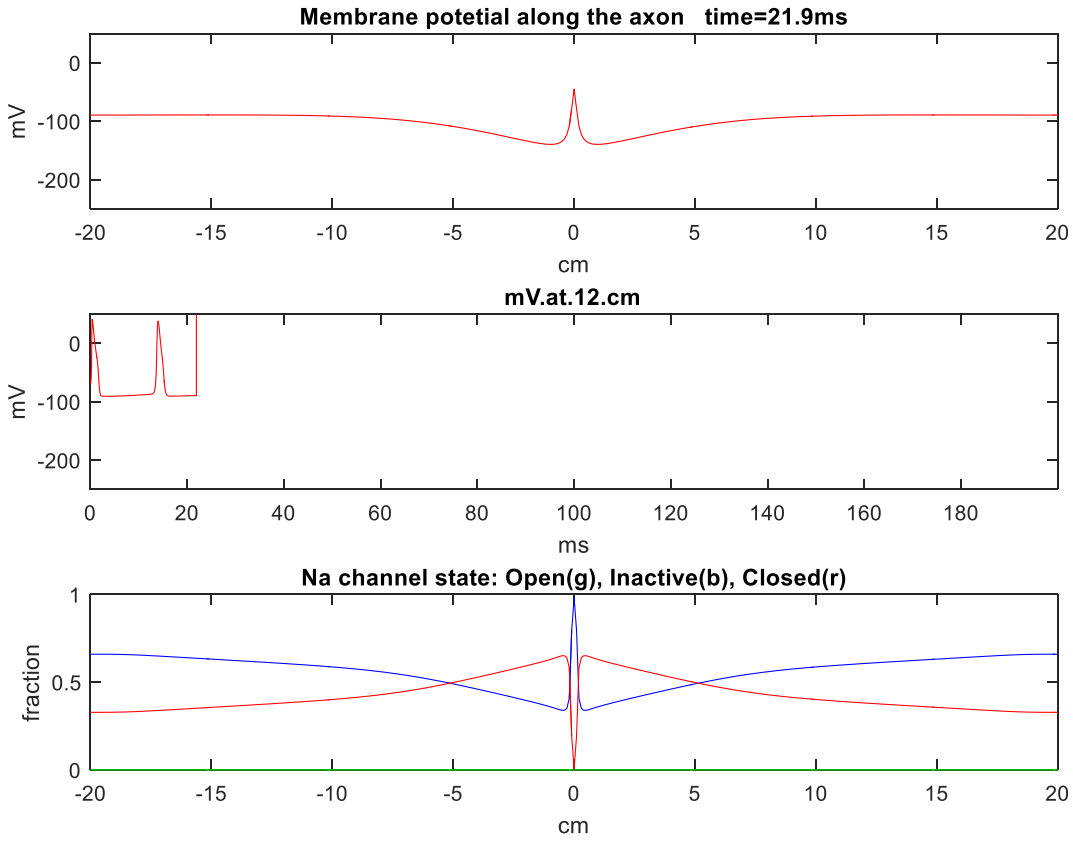

fig. S1. Example of a real-time output of the MATLAB script provided in the Supplementary Materials.

At the end of the simulation a 3D plot showing the membrane voltage as a function of both length along the axon and time.

To run the model:

1. Copy this file into a directory on your computer.
2. Run Matlab and change your path to the directory with the file >>cd ‘pathname’
3. Copy and paste any of the following 200ms execution time examples at the prompt:

e.g. 1) 10um fiber with Nav 1.6 BLOCKED at -800uA, depolarizing pulse is evoked at 100ms
El=[-500,-15,0.1, 100, 101;-800,0,0.1, 10, 250]; iDCBlock(El, 200, 10);

e.g. 2) 10um fiber with Nav 1.6 NOT BLOCKED at -500uA, depolarizing pulse is evoked at 100ms
El=[-500,-15,0.1, 100, 101;-500,0,0.1, 10, 250]; iDCBlock(El, 200, 10);

e.g. 3) 1um fiber with Nav 1.7 BLOCKED at -400uA, depolarizing pulse is evoked at 100ms
El=[-5000,-1.5,0.1, 100, 101;-400,0,0.1, 10, 250]; iDCBlock(El, 200, 1);

e.g. 4) 1um fiber with Nav 1.7 NOT BLOCKED at -100uA, depolarizing pulse is evoked at 100ms
El=[-5000,-1.5,0.1, 100, 101;-100,0,0.1, 10, 250]; iDCBlock(El, 200, 1);

To stop simulation before the 200ms are finished hit CTRL-C at the command screen.

The arguments are described in the file header. To see this header, you can edit the file or type “help iDCBlock” at the prompt. This is what you will see.

```
function []=iDCBlock(El, dur_stim_ms, AxonDiameter_um)

 Output: plots that change in time as the model runs
 Inputs:

   El is stimulation electrode information -- where is it when does it
   start and when does it stop.
   El is in the form of :
    [ Iel1_uAmp,x1_cm, z1_cm, time_onset_ms time_offset_ms
      Iel2_uAmp,x2_cm, z2_cm, time_onset_ms time_offset_ms
                  ...]

   dur_stim_ms is duration of model simulation time in ms
   AxonDiameter_um is the diameter of the simulated axon in um


 HERE ARE 200ms SIMULATION TIME EXAMPLES TO COPY
```

AND PASTE INTO COMMAND LINE

e.g. 1) 10um fiber with Nav 1.6 BLOCKED at -800uA,
depolarizing pulse is evoked at 100ms
El=[-500,-15,0.1, 100, 101;-800,0,0.1, 10, 250]; iDCBlock(El, 200, 10);

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El=[-5000,-1.5,0.1, 100, 101;-100,0,0.1, 10, 250]; iDCBlock(El, 200, 1);

REPAINT_MS controls how often the figures are reploted as the simulation runs (in ms of simulated time) -- this value must be changed in the file reduce for visual smoothness or increase for faster simulation execution

The default dt step is 0.001s. This value can be changed in the file.
The fiber is considered myelinated if it is greater than 1.5um.
The fiber is considered unmyelinated if it smaller than that.
Myelinated fiber uses the model of Nav 1.6
Unmyelinated fiber uses the model of Nav 1.7.