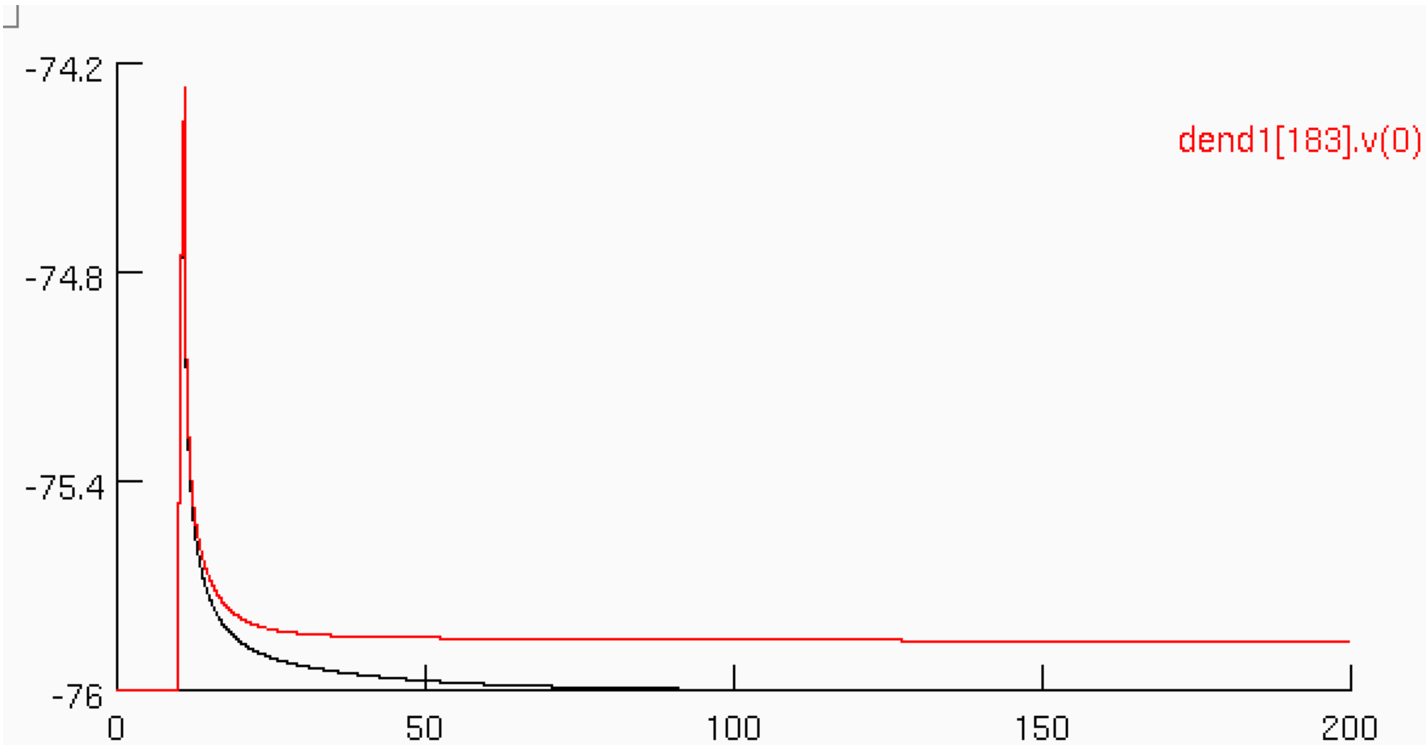
Assignment 1 feedback

1. Simple cable

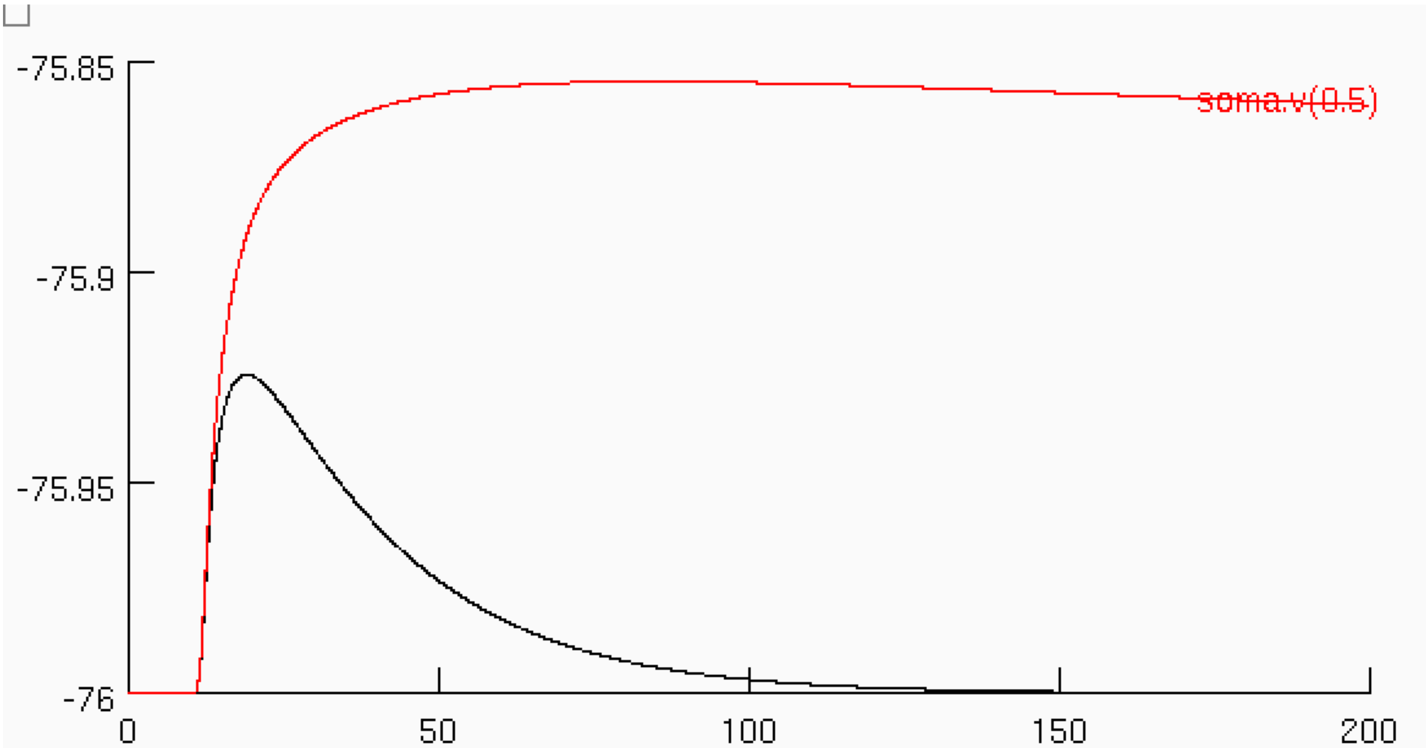
1. Just by using the formulars in the Koch,
    - Time constant: $\tau = C_m R_m = C_m / G_m$ = 20 ms.
    - Space constant: $\lambda = (r_m / r_a)^{1/2} = \left(\frac{R_m}{\pi d} \cdot \left(\frac{4R_a}{\pi d^2} \right)^{-1} \right)^{1/2} = \left(\frac{d}{4R_i G_m} \right)^{1/2}$ ≈ 577 µm.
2. The measured τ should be close to 20 ms.
3. The measured λ should be close to 577 µm but can be larger since this is a finite cable whose length is close to the theoretical λ and the cable has sealed ends.
4. The cable end is more depolarized as the cable gets shorter since the current escape through the membrane becomes smaller. In the open end case, the opposite is true since the current sink becomes closer to the current source as the cable gets shorter. Therefore, the axon has sealed ends. Another way is to find the boundary condition is that dV/dX ≈ 0 in the simulated data.

2. Passive pyramidal neuron

1. The transfer resistance can be measure by a voltage response to a sustained current input, as in Equation 3.19 in the Koch.
2. Easy!
3. It is fairly straightforward to reproduce Fig. 3.15A and B. Here the point is that you have to show responses both at the soma and dendrite for a dendritic input.



Membrane voltage *at the input site*. Red: g_m rescaled



Membrane voltage at the soma. Red: g_m rescaled.