

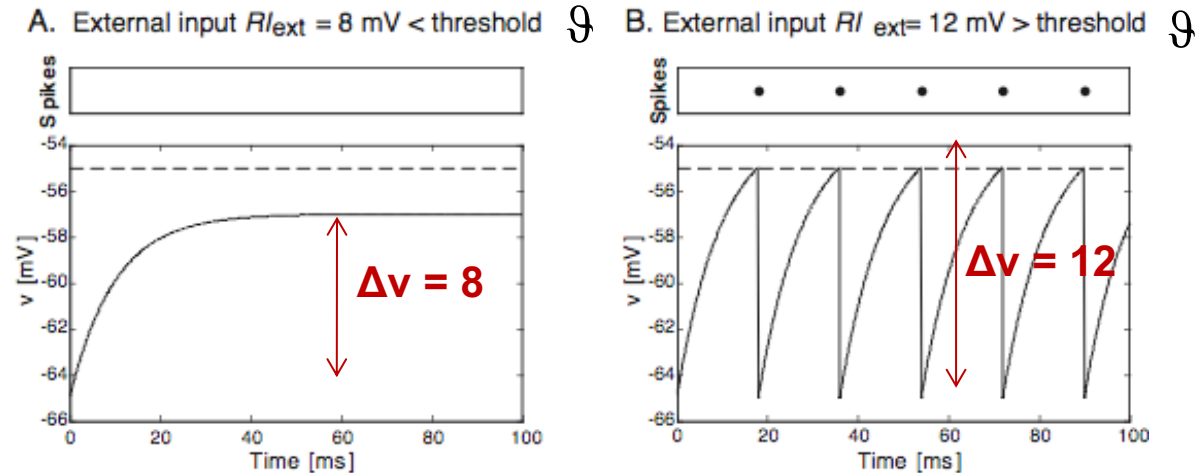
## Practical 3: Modelling Integrate and fire neurons

Get the Matlab files

[https://web.cs.dal.ca/~tt/fcns/fcns\\_programs/spikes/if\\_sim.m](https://web.cs.dal.ca/~tt/fcns/fcns_programs/spikes/if_sim.m)

### *if\_sim.m*

1) Run the *if\_sim* programme.



2) Vary the external input from 5 to 15 (step 1) [mA/Ohm]. What do you observe? What could a ‘constant external input’ correspond to for a real biological neuron?

3) What is missing compared to a detailed Hodgkin-Huxley model of neuronal spiking?

### ***Izhikevich neurons (p. 61-63 in the textbook)***

Get the related pages

<http://www.dynamic-connectome.org/t/cneurosci/Izhikevich1.pdf>

<http://www.dynamic-connectome.org/t/cneurosci/Izhikevich2.pdf>

1) Change the *if\_sim.m* routine to the Izhikevich model of spiking neurons (see textbook for values of parameters a-d).

$$\frac{dv(t)}{dt} = 0.04v^2 + 5v + 140 - u$$

$$\frac{du(t)}{dt} = a(bv - u)$$

$$v(v > 30) = c \text{ and } u(v > 30) = u + d$$

2) What do the parameters a, b, c, d represent?

3) Adjust the parameters to show the different types of neurons (see Fig. 3.4)

