

Reference [Part F] Hodgkin and Huxley Model

```
function dy = lab5partf(t,y)
Vm = y(1); %set matrix column to Vm
n = y(2); %set matrix column to n
m = y(3); %set matrix column to m
h = y(4); %set matrix column to h

% Setting up Parameters in SI units
G1 = 30*10^-9; %Leak Conductance 30nS
GNa = 12*10^-6; %Max Sodium Conductance 12uS
GK = 3.6*10^-6; %Max Delayed Rectifier 3.6uS
ENa = 45*10^-3; %Sodium Reversal Potential 45mV
EK = -82*10^-3; %Potassium Reversal Potential -82mV
EL = -60*10^-3; %Leak Reversal Potential -60mV
Cm = 100*10^-12; %Membrane Capacitance 100pF

%set iapp to 1nA over the time interval from 100ms for 5ms
if t >= 0.1 && t <= 0.105
    iapp = 1*10^-9;
else
    iapp = 0.65*10^-9;
end

%Gating Variable m
alpha_m = (10^5*(-Vm-0.045))/(exp(100*(-Vm-0.045))-1);
beta_m = 4*10^3*exp((-Vm-0.070)/0.018);
%Gating Variable n
if Vm == -0.06
    alpha_n = 100;
else
    alpha_n = (10^4*(-Vm-0.060))/(exp(100*(-Vm-0.060))-1);
end
beta_n = 125*exp((-Vm-0.070)/0.08);
%Gating Variable h
alpha_h = 70*exp(50*(-Vm-0.07));
beta_h = 10^3/(1+exp(100*(-Vm-0.040)));

%joint ODEs
Leaky = G1*(EL-Vm);
INa = GNa*m^3*h*(ENa-Vm);
IK = GK*n^4*(EK-Vm);
dVm_over_dt = (1/Cm)*(Leaky+INa+IK+iapp);
dn_over_dt = alpha_n*(1-n) - beta_n*n;
dm_over_dt = alpha_m*(1-m) - beta_m*m;
dh_over_dt = alpha_h*(1-h) - beta_h*h;
dy = [dVm_over_dt;dn_over_dt;dm_over_dt;dh_over_dt];
end

%ignore the comments as the function is perfectly integrated into the main
%code without any error message. The function cannot work by its own.
```

Not enough input arguments.

Error in lab5partf (line 3)

Vm = y(1); %set matrix column to Vm

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