Contents

Final Physiology Project

By Abby Iacangelo, Kyle King, Ben Tunick, Jackie Weber BIOE340 Section 0102

```
clc, clear all, close all
```

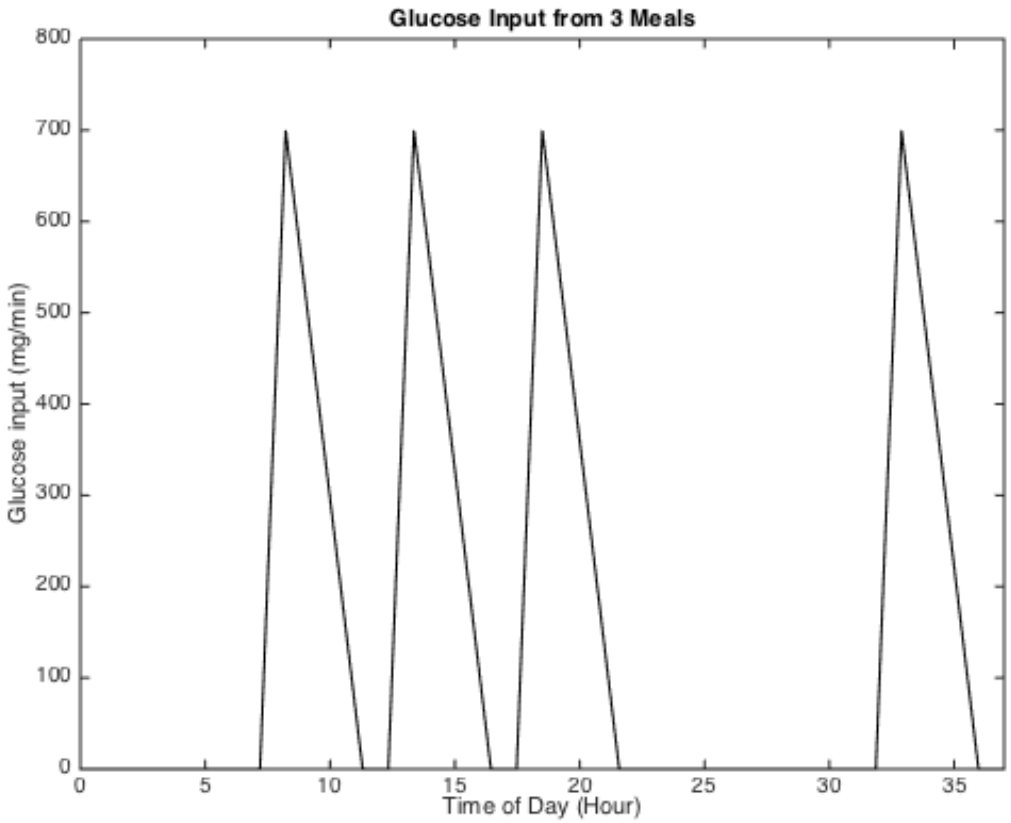
Create Input Array

```
% Set maximum peak value as determined by paper
peak = 700; % mg glucose/meal
% Set time values
num_hrs = 37;
array_time = linspace(0, num_hrs, num_hrs);
hour = length(array_time)/num_hrs;

% Set intake to match the graph seen in the paper
intake = [];
for b = 1:8*hour
    intake = [intake; 0];
end
% Add the three peaks
for a = 1:3
  % Peak up
  for i = 1:hour
    intake = [intake; i*(peak/1)/hour];
  end
  % Peak down
  for k = 1:3*hour
    intake = [intake; peak-k*(peak/3)/(hour)];
  end
  % Flat line
  for j = 1:hour
    intake = [intake; 0];
  end
end
for j = 1:9*hour
  intake = [intake; 0];
end
for i = 1:hour
intake = [intake; i*(peak/1)/hour];
end
% Peak down
for k = 1:3*hour
intake = [intake; peak-k*(peak/3)/(hour)];
end
```

```
% Flat line
for j = 1:hour
intake = [intake; 0];
end

% Plot the intake
figure
plot(array_time, intake, 'k'), xlabel('Time of Day (Hour)'), ylabel('Glucose input (mg/min)
'), title('Glucose Input from 3 Meals')
axis([0 num_hrs 0 800])
```



Run analysis

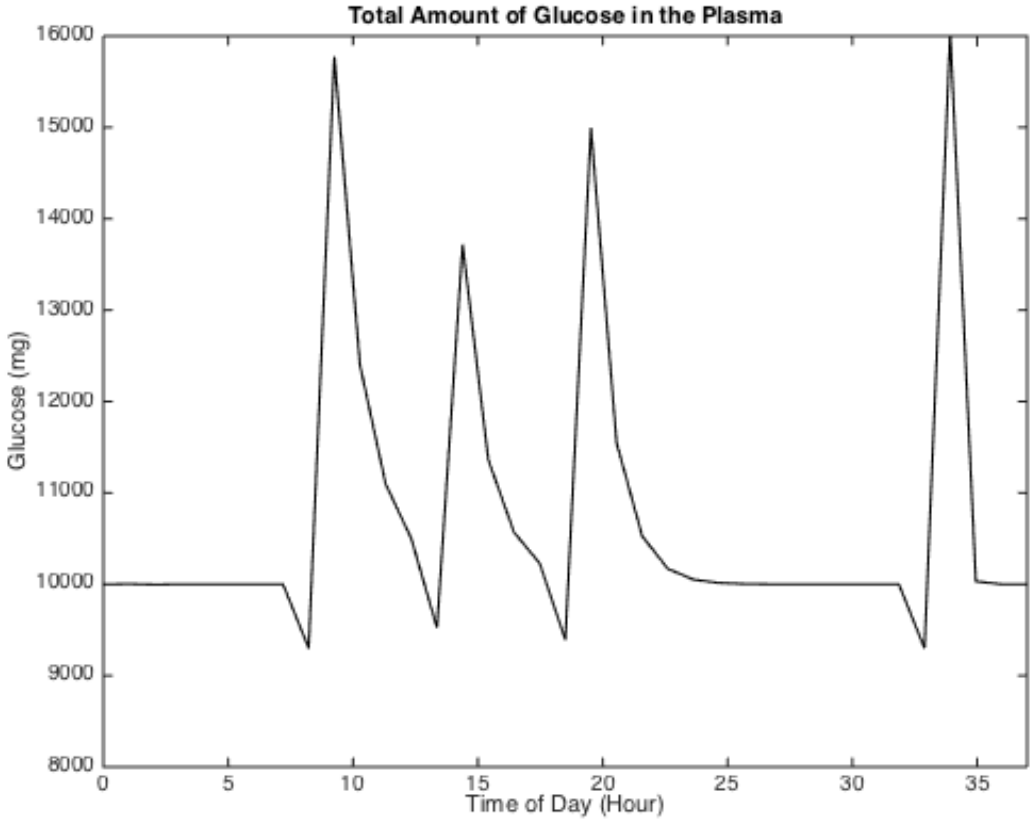
Calculate the output function G and in terms of ATP

```
G = model2(intake);
G_moles = (G./1000)./180.1559;
ATP_mol_gen = G_moles.*32;

% Plot Results
figure
plot(array_time, (-G+10000),'k'), xlabel('Time of Day (Hour)'), ylabel('Glucose (mg)'), axi
s on, title('Total Amount of Glucose in the Plasma')
axis([0 num_hrs 8000 16000]), set(gca, 'YTickLabel', num2str(get(gca,'YTick')','%d'))

% Set physiological rate of caloric consumption (kcal)
laying_down = 1650; % C/day
eating = 200;
```

```
sitting = 150;
net = laying_down + eating + sitting; % kcal
rate_consumed = net/(length(array_time)*686); % moles glucose/hour
r_ATP_deplete = (2000*32)/(length(array_time)*456); % molesATP/hr
```



Manipulate glucose model values

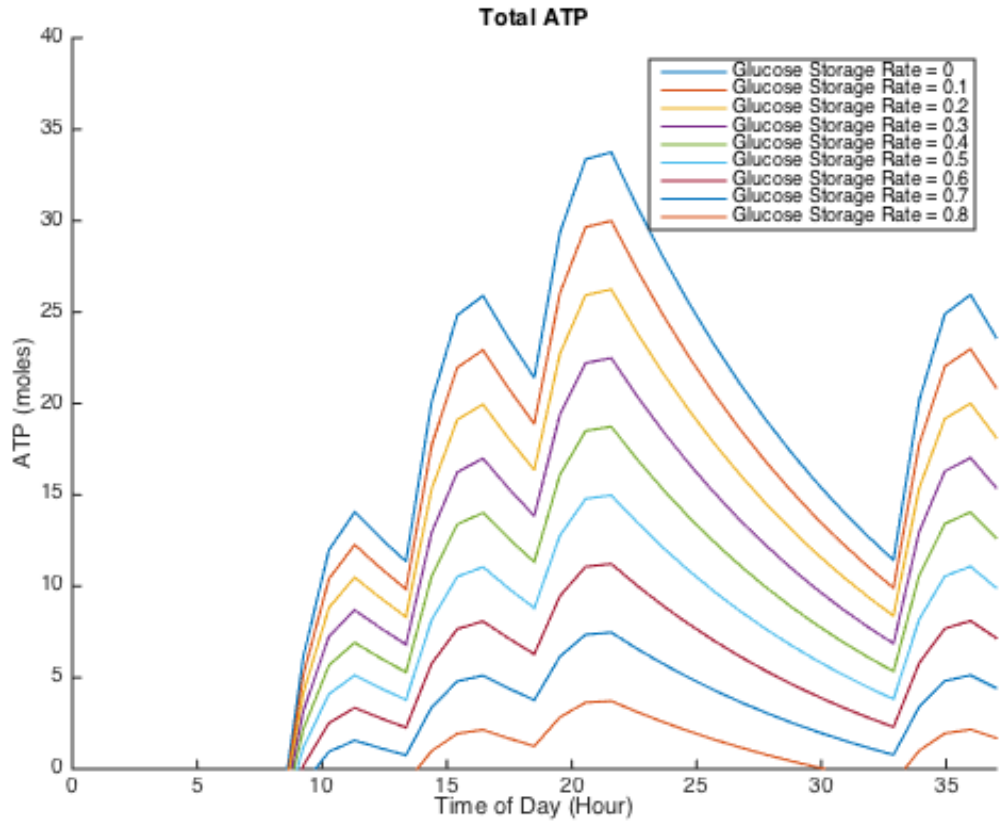
Initialize values for loop

```
labs = [];
glu_moles_metabolisable(1) = G_moles(1);
glu_moles_store(1) = 0;
store_init = zeros(1, length(intake));
intake = intake./(1000/180.1556); % moles glucose/hour, 1000 is a conversion from mg to g
moles_ATP(1) = intake(1)*glu_moles_metabolisable(1) - r_ATP_deplete;

% Create new graph
figure
% Loop through various storage moduli
for glu_storage_rate = [0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8]
  % Loop through time
  for t = 2:length(intake)
    glu_moles_metabolisable(t) = intake(t)*(1-glu_storage_rate) + (store_init(t-1) + glu_mo
les_metabolisable(t-1))*(1 - rate_consumed);
    glu_moles_store(t) = glu_moles_store(t-1) + intake(t)*glu_storage_rate;
    % If there's glucose to metabolize, don't change the storage value
    if (glu_moles_metabolisable(t) >= 0)
      store_init(t) = 0;
```

```
    % if there's no glucose to metabolize and you're not eating
    elseif (glu_moles_metabolisable(t) <= 10000 && intake(t) == 0)
      store_init(t) = glu_moles_store(t-1);
      glu_moles_metabolisable(t) = store_init(t);
      glu_moles_store(t) = glu_moles_store(t-1)-store_init(t);
    % if there's no glucose to metabolize and you're not eating
    elseif (glu_moles_metabolisable(t) > glu_moles_store(t) && glu_moles_metabolisable(t) <
 0)
      store_init(t) = -glu_moles_metabolisable(t);
      glu_moles_store(t) = (glu_moles_store(t-1) + store_init(t));
    end
    % Deplete what is consumed
    moles_ATP(t) = rate_consumed*glu_moles_metabolisable(t-1) - r_ATP_deplete;
  end
  % Plot values from time loop
  hold on, plot(array_time, moles_ATP)
end
xlabel('Time of Day (Hour)'), ylabel('ATP (moles)'), title('Total ATP'), axis([0 num_hrs 0
40])

% Create legend
for z = [0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8]
    label = cellstr(['Glucose Storage Rate = ',num2str(z)]);
    labs = [labs label];
    legend(labs);
end
```



Published with MATLAB® R2014b