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%% Protein Production
clear;
% Solve the ODE numerically
[t1, specs] = ode15s(@Ecoli,[0 1000000],[0.00077042,0,0,0,0.0005]);
x=t1;
y=specs(:,3);
z=specs(:,5);
mdl=scatteredInterpolant(x,y,z);
[xg,yg]=meshgrid(unique(x),unique(y));
zg=mdl(xg,yg);
sup = surf(xg,yg,zg)
xlabel('Time (s)')
ylabel('Protein Concentration (mM)')
zlabel('IPTG Concentration (mM)')
colormap(autumn)
colorbar
%% User Defined Functions
% Ecoli
function dx = Ecoli(t1,vec)
% Initial conditions
L = vec(1); M = vec(2); P = vec(3); C = vec(4); I = vec(5);
K=0.001 ;
n=1 ;
% Rate constants
k1 = 0.038532; k2 = 0.00000030243597; k3 = 0.0011; k4 = 0.3; k5 =
0.00000275058; k6 = 0.00000275058;
% ODEs
dL = -k3*I*L+k4*C; dM = k1*(1+(1+(L/K)^n)) - k5*M; dP = k2*M-k6*P; dC
=k3*I*L-k4*C; dI = 0;
dx = [dL; dM; dP; dC; dI];
end

%code for a 2D plot

plot(t1,specs(:,3),'b')
title('Protein S Concentration vs Time'); xlabel('Time (sec)'); ylabel('Protein
S Concentration (mM)');
grid on;

```