Bioreactor Writeup Outline

* CHO metabolic model
  + Reaction set
  + Kinetic rates
  + MFB to get all rates
    - Quadratic programming in MATLAB
  + RK4 to model changing concentrations over time
* Issues with model
  + Poor numerical method
    - R not matching with lower step size
  + Refitting the parameters
    - Our multiple objective functions
    - Our multiple fitting methods (particle swarm, simulated annealing, and pattern search)
    - Final methods: minimize SSR with particle swarm to get approximate global min, then pattern search
  + New parameters, batch output
    - Overall reaction, production, graphs, etc
* Generalizations of the model
  + Show perfusion, batch seed train systems
    - Overall reaction, production, graphs, etc
* O2/CO2 systems
  + Reactor specifications
    - Sparger type, diameters, heights, impellers, etc
  + Model for bubble properties
    - KLa, eps, P/V etc
  + Control system
    - Return with small time step
    - Describe PI controllers, multiple gas feeds
    - Outputs, gas flow rates required