

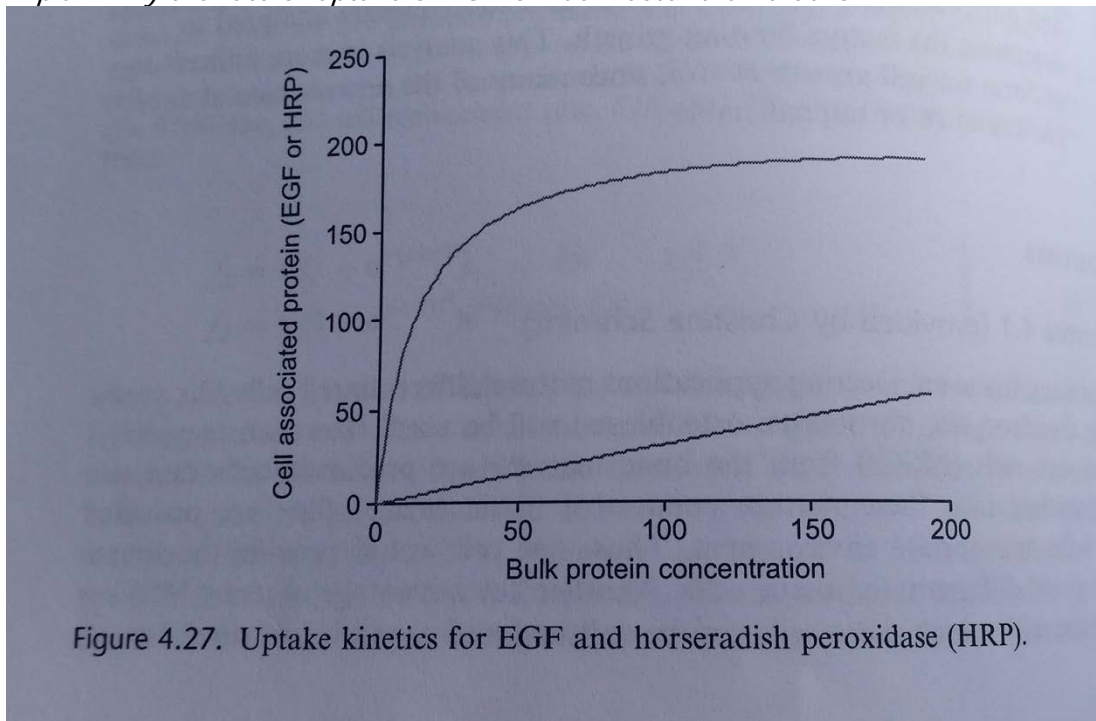
Assignment 3: Cellular Dynamics and High Throughput Biological Data

Cell and Tissue Engineering

1. From *Tissue Engineering*, Saltzman
Exercise 4.2 (provided by Peter Zandstra)
In part a and b replace “the uptake” with “the amount of cell-associated”

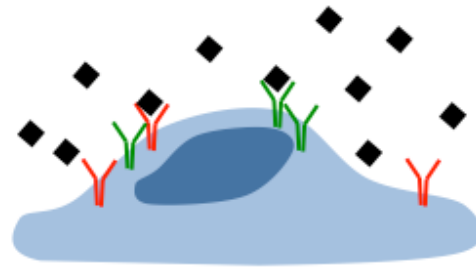
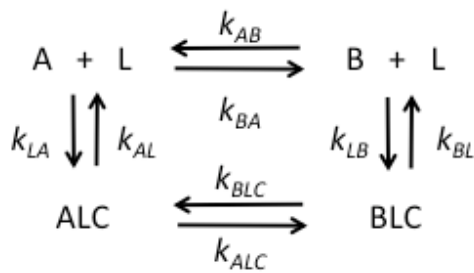
Cells take up EGF from the extracellular medium by receptor-mediated endocytosis and horseradish peroxidase (HRP) by fluid-phase endocytosis. An example of the cell uptake of EGF and HRP as a function of the concentration in the medium is shown in Figure 4.27.




- a) Explain why uptake of HRP is linear whereas the EGF uptake is hyperbolic.
- b) Explain why the rate of uptake of EGF is much faster than that for HRP



2. In order to model the protein dynamics of a ligand binding to a receptor you need to both write appropriate equations and know appropriate parameter values. In this problem you will investigate a 2-state receptor-ligand network. In this network the receptor is either active (called A) or inactive (called B). As we discussed earlier this semester – regulation occurs on many levels in the body and changing the activity state of a receptor is one level of regulation that allows for quick changes to the cell behavior. Instead of turning on a gene, transcribing, translating, folding and translocating – the cell can keep all of the receptors made in an inactive state and simply activate them when needed.

- a. Please write ODEs to describe this system (following the Laws of Mass action). There should be 5 equations, one for each species present in this system (for example $d[A]/dt$)



 Inactivated receptor
 Activated receptor
 Receptor

- b. Please describe methods you could use to experimentally measure the necessary parameters including rate constants and species concentration.

Assignment Rubric

Question	Component	Total Point Value
1	A	7
	B	7
2	A	6
	B	10

Total Point Value = 30