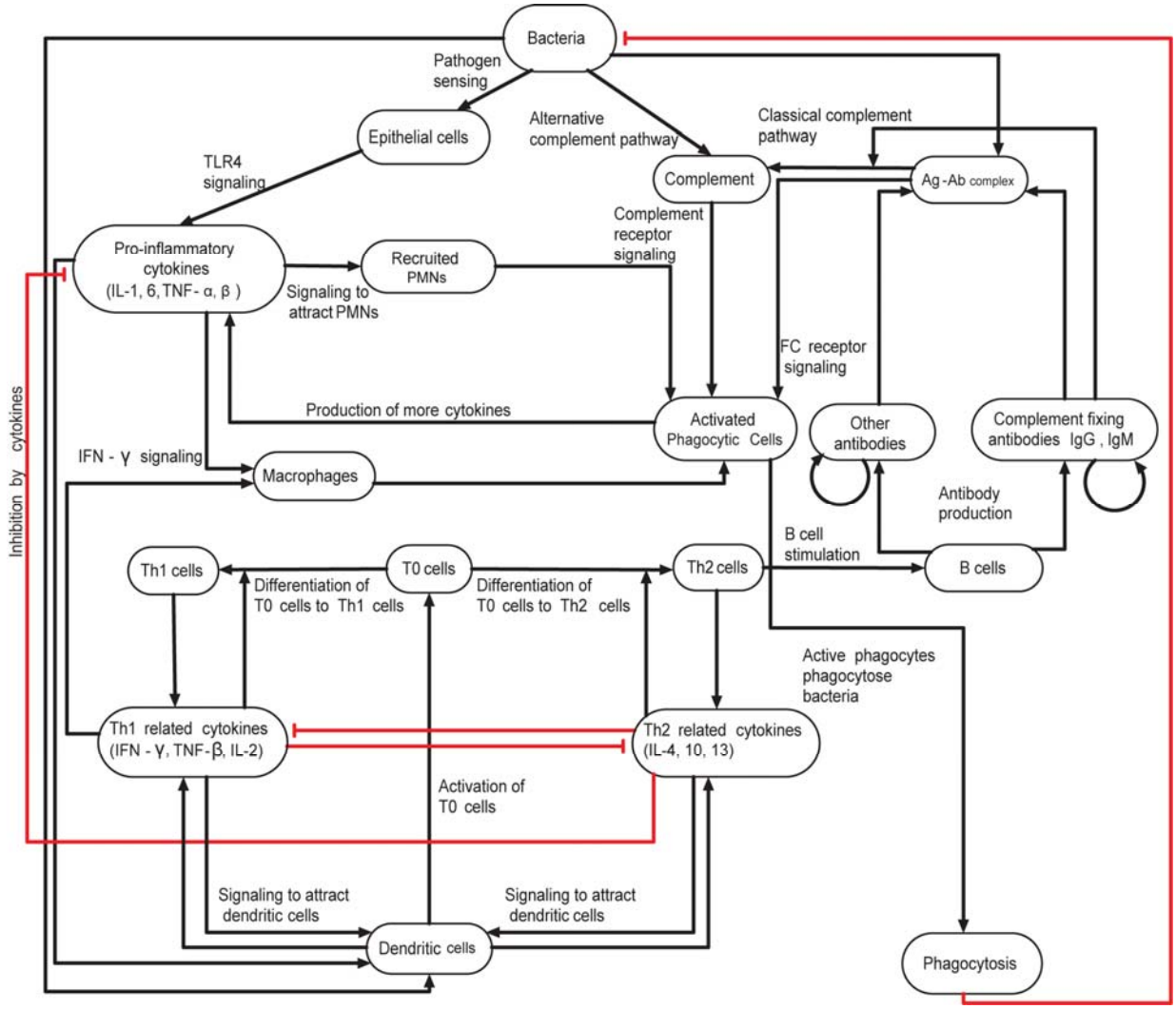
PHYS 597A, CMPS 497E, Graphs and Networks in Systems Biology

Homework 9, due Tuesday March 31

1. Perform a topological analysis of the network below. Consider that edges terminating in edges are directed toward the endpoint of the edge (e.g. the edge from Th2 related cytokines is directed toward Th2 cells). For the distance and connectivity measures you can disregard the sign of the edges and the two autoregulatory loops.



(a) What is the degree distribution of the network?

(b) Is the network strongly connected? If not, find the largest strongly connected component, and the in/outcomponents of the strongly connected component.

(c) What is the average path length of the largest strongly connected component?

(d) Give examples of network motifs and interesting subgraphs. Now you can take into account the edge signs.

(e) Which nodes or edges play the most important role in the connectivity of the network?

2. Now turn the topological analysis into a pseudo-dynamic one. Assume that initially only the node Bacteria is active. How will the activity propagate through the network? At what steps do you need more information to decide what will happen next?

Try to extract as much information from the graph as you can. By doing this you are predicting the extent to which the network topology determines the system's dynamics.