

Topics in Biophysics
Timothy Newman

Assignment 2, November 16, 2006

This assignment is due by Friday December 8th. Please hand-deliver to my office.

Dynamics of tumor growth, invasion, and metastasis

Cancer is one of the leading causes of death in humans. As we learned in Professor Nagy's lecture, cancer is not a single disease, nor is it a simple disease. The progression of cancer, from one highly mutated cell to systemic malignant neoplasia, depends sensitively on the original region of the body in which the tumor grows (e.g. lung tissue, colon) and has a dynamics composed of multiple stages (e.g. mutations, early tumor growth, vascularization, invasion, metastasis).

This aim of this assignment is to produce a (semi-) quantitative discussion of some aspect of tumor dynamics. I encourage you to think broadly. For instance, your focus can be on the origins of tumor formation from one highly mutated cell (i.e. tumorigenesis), or on the dynamics of tumor cell invasion of healthy tissue, or else on the colonization of remote organs/tissue by metastasizing cancer cells.

Your analysis should be given substance from a literature survey and quantitative arguments (including computer simulations or mathematical analysis).

The final report should be at least 10 pages in length (1 ½ spacing) including all figures and references. One of the major goals of this assignment is to give you experience in working with others on a research project. Aim to be collaborative and inclusive. If your team agrees that each member contributed equally, please list authors in alphabetical order and explicitly state that all members did contribute equally. If this does not apply, the author list should include the percentage effort of members of the team. An individual grade will assigned to each member of the team in this case.

Good luck with your investigations – and start early!

[Some words of advice based on the first assignment: generally all groups did a very good job with the literature survey. Most groups did less well with the quantitative analysis. As this is a biophysics class, I do give credit for the ability to make a rational quantitative analysis of the biological problem to hand. This does not mean that a complicated computer program has to be written (although this is excellent if possible). Equally powerful are “back of the envelope” estimates, or mathematical analyses of simple models. It is important, when constructing your model, to be self-critical. Simplify the biology, but not to the point of implausibility.

And lastly: please make absolutely sure you cite the reference for any quotation or figure taken from either the internet or the literature. Failure to do so could lead to catastrophe.]