Experimentally measuring the necessary parameters to calculate free energy changes in growing tumor spheroids

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Tumor growth, starting from the earliest, prevascularized state, involves complex biological, chemical, and mechanical processes such as mass transport; cell metabolism, proliferation, and motility; and mechanical interactions between cells, the extra-cellular matrix and surrounding tissues. Each of these processes either consumes or creates free energy. We compute estimates of the free energy changes—a universal measure for comparison of these processes—based on the experimental model of a tumor spheroid growing in a constraining hydrogel. Many of the bio-chemo-mechanical parameters for the free energy calculations may be found in the literature for diverse cell lines and tumor systems. However, for a relevant study of the competing bio-chemo-mechanical processes, we are working towards experimentally obtaining all of these for one cancer cell line and tumor system.