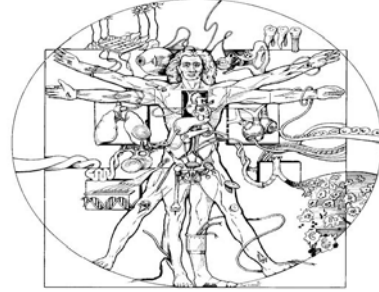


Biomedical Engineering Seminar

**Monday, September 14, 2009
2:00 pm
Keating 103**



Michael Caplan, Ph.D.

Associate Professor
School of Biological and Health Systems Engineering
Arizona State University

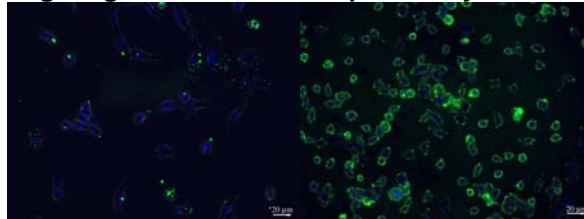


“Multivalent binding to improve molecular imaging and DNA diagnostics”

Abstract

Molecular engineering holds tremendous potential to improve medical imaging and diagnostics, but its ability to do so is limited by the molecular interactions that mediate specific interactions between the molecules and their biological targets. Unimolecular interactions are inherently limited by a tradeoff between sensitivity and selectivity. In this tradeoff, sensitivity can be increased by increasing affinity; however, this almost always leads to more false positives as well (decreases selectivity). Biological assemblies, such as antibodies and viruses, avoid this tradeoff by using multi-molecular or multivalent interactions. This effect is based on the principle of cooperativity to achieve selectivity by having all individual interactions be weak but also achieve sensitivity by having the combined interactions have strong avidity. We have created and study multivalent biomacromolecules which target cancer cells. We have demonstrated that the principles of cooperativity predict enhanced specificity at concentrations less than the receptor-ligand affinity, and we have recently verified this prediction experimentally. This result has important implications for the choice of imaging modalities, strategy for delivering the targeting agent, and other considerations in molecular imaging. We have also applied these principles to DNA detection by making a bivalent DNA probe including a molecular beacon. These probes exhibit similar sensitivity to gold-standard probes; however, we have demonstrated that these probes are far more selective and, in the case of detection of Anthrax and Bubonic Plague DNA, generate no false positives compared to significant rates of false positives in the gold-standard probes.

Multivalent-targeting constructs bind specifically to brain cancer cells



**Normal Human
Astrocytes**

Brain Cancer Cells

Host: Marty Pagel, Ph.D. (404-7049)

Persons with a disability may request a reasonable accommodation by contacting the Disability Resource Center at 621-3268 (V/TTY). Requests should be made as early as possible to allow time to arrange the accommodation.