"Cellsense" – Design of a whole cell biosensor for biomedical applications

Joaquim S. Barbosa[1]

[1]MIT Portugal Program, Department of Biological Engineering, University of Minho - Campus de Gualtar 4710-057 Braga – Portugal, Joaquim_sb@ceb.uminho.pt

Supervisors: Project Coordinator/Supervisor in Portugal: Lígia Rodrigues, Universidade do Minho

Co-Supervisor: Leon Kluskens, Universidade do Minho

Cancer represents a public health problem worldwide with growing incidence as result of population aging, but also the adoption of a cancer associated lifestyle.[R1]

The major problem of cancer is that most types are diagnosed on a later stage, reducing treatment effectiveness, so an early diagnosis would considerably improve clinical outcome.[R2] Cancer diagnosis, if based on molecular features, can be highly specific and sensitive but very few biomarkers are available. Since most methodologies rely on known biomarkers to develop molecular probes, discovery of unknown molecular features of diseased cells is very difficult.[R3]

SELEX (Systematic Evolution of Ligands by Exponential Enrichment) is a procedure applied to perform an in vitro selection from a random pool of nucleic acid sequences, called aptamers. These present specific binding to complex target mixtures, due to their complex 3D structure, and high affinity to the ligand, comparable to monoclonal antibodies.

Cell-SELEX allows using whole living cells as targets to select aptamers that specifically recognize them. Diseased cells usually present specific biomarkers, such as wild-type proteins specifically or differentially expressed, with aberrant post translational modifications, potentially resulting from genetic lesions. Aptamer probes selected against cancer cells are able to identify these molecular differences, discriminating between normal and tumor cells, but also cells at different disease stages or from different patients. Cell-SELEX has the advantage that aptamer selection can be done without prior knowledge of target molecules.[R3]

In this work, cancer cells and fibroblasts are being used to obtain a reduced pool of sequences that specifically recognize cancer cells. After studying this pool, their binding affinity and detection will be tested and optimized. Generated aptamers can be further combined with nanotechnology to obtain a multivalent nanovector for cancer diagnosis.

[R1]. *Jemal, A., et al., Global Cancer Statistics. Ca-a Cancer Journal for Clinicians, 2011. 61(2): p. 69-90.*

[R2]. *Shangguan, D., et al., Identification of liver cancer-specific aptamers using whole live cells. Analytical Chemistry, 2008. 80(3): p. 721-728.*

[R3]. *Shangguan, D., et al., Aptamers evolved from live cells as effective molecular probes for cancer study. Proceedings of the National Academy of Sciences of the United States of America, 2006. 103(32): p. 11838-11843.*

MIT Portugal

Excellence in engineering for innovation in global markets

3rd Abstracts Book of the MIT Portugal Conference

28-9 May 2012

Massachusetts Institute of Technology

FCT Fundação para a Ciência e a Tecnologia
MINISTÉRIO DA EDUCAÇÃO E CIÊNCIA