**Project Name:**
High Through-Put Sensing of Biological and Chemical Systems

**Professor Daniel I.C. Wang, Chemical Engineering, MIT**

**Project Overview:**
The ability to achieve high through-put sensing of biological systems is extremely important for various applications. These include drug discovery, strain development, media development in bacterial and mammalian cells, product quality and many others. The recent advancements in micro-bioreactors and micro-fluidics have allow the manufacturing through MEMS parallel processing of multiple systems that allow the design of such systems for high through-put operations.
It is the goals of this project are to take the advantages of the already developed micro-bioreactor technology combining these systems with non-invasive sensors to practice quantitative analyses of the biology and chemistry for such biological systems. It is NOT the intent of this project to design new micro-systems but instead to use what has already been done at MIT and explore such systems for achieving the goals of this project.
The goals of this project are to explore and develop *proof-of-concept* using a combination of ideas for high through-put sensing of biological system and these goals include:
• Use of micro-bioreactors as a system for high through-put sensing.
• Apply non-invasive sensing methods to quantitatively measure important parameters of biological systems on-line and in real-time.
• Using prior research findings in our laboratory in fluorescence (fluorophores) sensing to quantify the biological parameters for high through-put sensing.
• Integrating biochemistry and stoichiometry to achieve non-invasive and multiple test systems for monitoring and sensing of biological systems.
Upon achieving the *proof-of-concept*, to develop parallel processes that would ultimately provide a novel system for high through-put sensing of biological systems.

**Faculty Involved:**
Professor Daniel I.C. Wang, Department of Chemical Engineering, MIT. Professor Manuel Carrondo: IBET/ITQB/UNL, Professor Paula Alves: IBET/ITQB/UNL

**Ph. Student(s) Involved:**
The Ph.D. student involved at MIT is Mr. Rage Markely, Department of Chemical Engineering, MIT.
The Ph.D. student involved in Portugal is Mr. Ricardo Perdigao. Mr. Perdigao has been a visiting Ph.D. student at MIT and will be in my laboratory from October 2006 through April 2008. Upon his stay at MIT, Mr. Perdigao will return to IBET/ITQB/UNL and complete his Ph.D. studies there and continue under the

supervision of Professor M. Carrondo and Professor Paula Alves.

**Expected Deliverables:**
There are many deliverables which can be anticipated from this research project. These include:
• Excellent opportunities for collaborations between MIT and Portugal investigators
• High quality research with outcomes as Ph.D. dissertations at MIT and Portugal
• Publications in outstanding journals nationally and internationally
• Major impacts on how to achieve high through-put screening which are fundamentally exciting and industrially relevant
• Filing of patents on the outcomes
• Potential spin-off companies for manufacturing and sales for the system either in the USA or in Portugal

**Timeline (Through August 2008):**
The timeline for this project from February to August 2008 is summarized below.
• Refine the growth model (presently assumes exponential growth) to align the prediction more realistic to the experimental data (linear growth).
• Use a second surrogate indicator (Trytophane) to predict cell growth as well as product formation.
• Initiate studies to measure non-invasively and on-line quality of glycoproteins (Sialic Acid Content).