## Vision

Building Micro/Nano ***Interfaces*** to Cells and Organisms and Exploring Bio-derived Fabrication Methods based on ***Biomaterials Technology*** for developing microfabricated interfaces for
**Synthetic Biology**
**.**

## Mission

We aim to create an environment where chemists and biologists can communicate with one another on theory, methodology, design of experiments and the end results so that fruitful collaborations and training in chemical biology can be established.

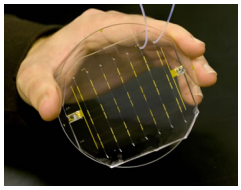
Key Scientific Areas: Matrix's research activity is very interdisciplinary in nature and bring together the filed of Biomaterials, Biology, Micro/Nanofabrication, and Basic/Clinical Medicine. Our research interests are closely related to the needs of the society. To address pressing needs in Healthcare, Environment, and Security, we carry out cutting edge research in the in following areas:

***Design of Next Generation of Diagnostic Tools***

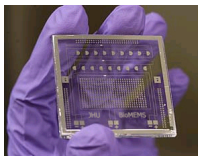
Research and development on drug discovery, regenerative medicine, biotech and pharmaceutical industries are very costly and takes several years to bring a single drug/product to the market. The goal of our research is to merge biomaterials science, nanotechnology, and biological principles to generate 3D *in vitro* living system or "Organ on Chip" to mimic organ/tissues in order to partially reduce the amount of *in vitro* and *in vivo* animal testing, clinical trials, and to solve the above problems. We apply bottom of approach of nanotechnology through self-assembling molecules to engineer novel smart biomaterials that are similar to native tissue/organ mimicking extracellular matrix (ECM) to influence cell/tissue development. Top down approach of semiconductor industry developed in Taiwan is applied to fabricate specific diagnostic tools. These products will have to mimic the physical, chemical, and biological properties of natural tissues and organs at different scales, from molecules to cells to be sued as novel *in vitro* systems.

**Current on going Projects:**

***Early Stage Cancer Detection***



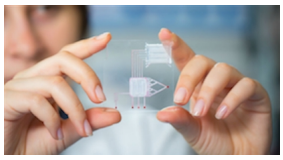
We propose to fabricate novel biomaterials that are useful for *in vitro* diagnostics and drug screening applications at early stage cancer formation.
Furthermore, our technology significantly contribute in developing microscale biosensors that will be more portable and scalable for point-of-care sample analysis and real time diagnosis. Modern biosensors based on micro- and nanoscale techniques have the potential to greatly enhance methods of detecting foreign and potentially dangerous toxins and may result in cheaper, faster, and easier-to-use analytical tools.
We are working at cutting edge technology through the use of micro- and nano-engineering approaches, precise
*in vitro*
systems with applications in cell-based detectors in detection of specific cancer antigens as well as in drug screening.



***Novel Biosensors***

We are working on designing of cell-based biochip for Integration of High-throughput Technologies applications. We are actively working on designing of biosensors that provide unique ways to investigate and monitor the health of a living body. From determining the presence, or concentration, of chemicals or compounds or living microbes and molecules, to signaling when a cellular event takes place, biosensors can provide researchers and medical personnel with critical information. Research in Matrix is pushing toward new boundaries of detection and response. Bio molecules analysis is a topic of high importance for many applications in various fields such as medicine, security, forensic science or environmental protection.

***Personalised Medicine***



There is enormous need in the market for new tools for the detection of DNA, proteins, bacteria, and viruses which can provide a fast and reliable response, allowing at the same time in-situ analysis. A biosensor is the ideal tool which can fulfill all the above mentioned requirements. In the development of the latter a key issue is represented by the choice of both the sensing platform and the detection technique. We aim to engineer novel *in vitro* biomaterials technology to develop set of tools that are simple, inexpensive, portable and robust that could be commercialized and used in various fields of biomedical sciences such as drug discovery, diagnostic tools, agriculture, and therapeutic approaches in medicine.

***Artificial Intelligence (AI)***

Artificial intelligence refers to the simulation of human

intelligence in machine that are programmed to think like humans and mimic their actions. AI in healthcare is an overarching term used to describe the utilisation of Machine Learning (ML) algorithms and software, or AI, to emulate human cognition in the analysis, interpretation, and comprehension of complicated medical and healthcare data. AI applications can save cost and time for diagnosis issues and management of disease states to identify trends

or genetic information, thus making healthcare more

effective and efficient. Research in Matrix, Inc. is pushing

toward to engineer Deep Learning (DL) as subfield of ML by

focusing on developing Neural Networks (NN) able to

automatically learn hierarchical representations.