

**NUS Graduate School for Integrative Sciences and Engineering
Research Project Write-up**

Title of Project : Integrating electrical, mechanical and metabolic function in the gastrointestinal tract

Name of Supervisor : Dr Martin Buist

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Division of Bioengineering
Faculty of Engineering,
National University of Singapore.
E3A-04-24

Short Description

Digestive diseases affect a significant percentage of the adult population and account for more health spending than both cardiac disease and cancer. We are developing state of the art mathematical and computational descriptions of the biophysics underlying electrical, mechanical and metabolic functions in the gastrointestinal tract with a view to generating new insights into the normal and pathological function of this system. Our approach is multiscale; subcellular anomalies can be tracked to their consequences in the cell, tissue and in the whole organ. A number of promising research opportunities currently exist in this area.

**NUS Graduate School for Integrative Sciences and Engineering
Research Project Write-up**

Title of Project : Modelling cardiac ischemia and reperfusion

Name of Supervisor : Dr Martin Buist

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E3A-04-24

Short Description

Ischemic heart disease is the leading cause of death in the developed world. Short term ischemia is reversible but an extended period of ischemia results in cell death and a loss of function. It has been found that unblocking the artery or bypassing the blockage in a timely fashion greatly increases the chances of tissue recovery. Unfortunately the restoration of normal blood flow has been found to cause significant damage to the ischemic muscle and to generate life threatening alterations in heart rhythm. Our goal is to develop a sophisticated model of this cellular system that can quantitatively reproduce what has been observed experimentally, and can be readily modified to uncover the downstream mechanisms by which therapeutic compounds may act. Ultimately we aim to perform an in-depth analysis of the electrical/energetic system to identify the weakest links in the causal chain, and what compounds would be most effective at exploiting these weaknesses.