Master and Semester Projects Proposals Spring 2013

Sensors, Actuators and Microsystems Laboratory (SAMLAB)

Prof. Nico F. de Rooij

Team μ-fluidics and Bio MEMS

Team leader: Peter Van der Wal
A microfluidic biosensor for detection of water pollutants  
Semester/Master project  
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We are working on a microfluidic chip with integrated biosensors for detection of pollutants in environmental waters. The proposed project will be focused on the fabrication and characterization of the new devices. The goal is to achieve highly sensitive and fast response biosensors with a low-cost fabrication. The first version of this device is shown in the picture. The microreactor is a part of the integrated enzyme-based biosensor. The enzymes are immobilized in the microreactor. The electrodes are used for an amperometric measurement of H$_2$O$_2$.

Microfluidic fabrication techniques  
Semester/Master project  
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We investigate fabrication methods for simple and low-cost microfluidic devices. Metal deposition on different substrates, bonding and immobilization of chemical molecules are the main subjects of this project. The student will develop ideas and skills on different possibilities for designing simpler and cheaper microfluidic and BioMEMS devices.
Miniaturized cell-culture for monitoring the effect of toxins on living cells

Semester/Master project

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Living cells show different types of reactions in contact with toxins. Studying these reactions is an important tool especially for pharmacists in order to develop new drugs. We are working on a miniaturized cell-culture for monitoring a specific reaction of the cells to different types and doses of toxins. The student will develop skills in designing BioMEMS, microfabrication in cleanroom, and performing experiments in a chemistry and biology lab.

Enzyme based biosensors

Semester/Master-project

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At SAMLAB we are working on different types of enzyme-biosensors. Enzymes catalyze a specific reaction as for example glucose oxidase catalyzes the reaction of

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glucose + O_2 \rightarrow H_2O_2 + \text{gluconolactone}
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In case of an amperometric glucose biosensor, the signal is a small current that comes from the oxidation of the peroxide. Often the reaction is limited by the availability of oxygen and the signal saturates because of this. This saturation effect can be delayed by using a diffusion limiting layer; a membrane that is less permeable for glucose, but still very permeable for oxygen. Another approach is the use of mediators as electron-transfer agents as to reduce sensitivity towards oxygen. In this project different mediators will tested. The work will include formulation of different membrane cocktails, deposition on electrodes, testing of the biosensors and evaluation of the results.