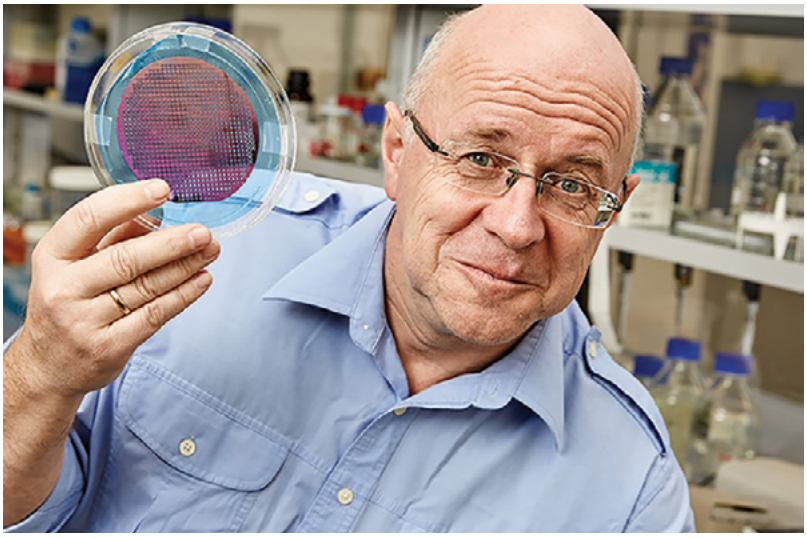
INTERNATIONAL SOLVAY INSTITUTES BRUSSELS

2015 International Solvay Chair in Chemistry

24 August to 30 September



Professor Andreas Manz
(KIST Europe, Saarbrücken, Germany)

Andreas Manz has a diploma and PhD in Chemistry from the ETH Zurich, and has held several teaching and institute director positions at Imperial College, the ISAS institute in Dortmund and Berlin and the University of Saarland. He is generally considered as the founding father of the "lab-on-a-chip" field, currently revolutionizing the analytical and life sciences at a fast pace. He published some of the most seminal papers in this field, bringing him in the top 50 of the most influential chemists (Thomson Reuters Essential Science Indicators). He is the recipient of many prestigious awards, such as the C.R. Fresenius Award and Gold Medal, the European Inventor Award ('lifetime achievement') from the European Patent Office, the H.E. Merck Award for Analytical Chemistry, and many more. His didactic and highly entertaining lecture style makes him a heavily solicited speaker at conferences and in companies. In 2001, he founded the "lab-on-a-chip" journal, a journal of the Royal Society of Chemistry (UK), consistently having an impact factor of over 5.5 over the past years.

Programme

Lecture 1: Thursday 27 August (2 - 4 P.M., Room D0.07 - VUB)

Lab on chip - scaling laws, miniaturization, concept and chip design rules

An elephant walks by slowly moving his legs, whereas a mouse moves its legs much faster. We are all aware of such differences in frequency, possibly less aware of its relationship with scaling laws. I will discuss scaling laws focusing on molecular diffusion and miniaturization, particularly for simple chemical reactions and separations. I will also give examples on how to plan chip design, channel layout and associated manufacturing.

Inaugural Lecture - Monday 31 August (4 - 5 P.M., Solvay Room - ULB)

Lab on Chip - Technology - 10x smaller means 100x faster

For chemistry and the life sciences, measurement of molecular parameters is of growing importance. Particularly, the presence of a certain molecule and its amount can play a key role, for example, in deciding about medical treatment, about the outcome of a forensic investigation, or in the future of experimental research in life sciences. Since the late 1980s, my laboratory explored miniaturizing parts, or even an entire laboratory down to chip size, increasing the throughput of chemical analysis, limiting its need for large sample volumes and potentially reducing the cost for access to the molecular information. I will emphasize scaling laws and chip technology for microfluidics, provide different examples of “lab on chip” devices and discuss possible future directions.

Lecture 2: Tuesday 8 September (2 - 4 P.M., Room D0.07 - VUB)

Lab on chip - flow behaviour, pumping, valving

Trees grow “into the sky”, and your physics teacher probably told you that water in a pipe can only rise to a maximum of 10 meters. In the bible, Moses is dividing the seas and everybody could walk on the dry ocean floor. Weird phenomena? No, not necessarily. On the small scale, you can expect flow to be generated or influenced not only by hydrostatics or external pressure, but also by osmosis, by capillarity and by electrokinetics. New engineering opportunities are opened for pumping and valving at this scale. I will show some examples of pumping and valving on microfluidics chips, mostly from my own lab.

Lecture 3: Tuesday 22 September (2 - 4 P.M., Solvay Room - ULB)

Lab on chip- extractions, mixing, chemical reactions

If you take your coffee with sugar, you need a spoon to stir it. If you need to discover a new pharmaceutical compound, you need millions of compounds tested. And million of spoons? Fortunately, microfluidics can enhance mixing enough to allow rapid chemical reactions or bioassays. Theoretically speaking, a testing of millions of compounds should be possible within seconds. I will show some microfluidics examples to chemical reactions and bioassays aiming to realize this dream, mostly taken from my own lab.

Lecture 4: Thursday 24 September (2 - 4 P.M., Solvay Room - ULB)

Lab on chip - separations, detection

Need a plate of spaghetti? After boiling, you separate them from the water. Need a cup of tea? In this case you will get rid of the leaves, not the flavor and colour. You have separated groups of molecules from each other! Very similarly, separations like chromatography or electrophoresis play a crucial role in state-of-the-art quality control of chemicals and pharmaceuticals, and increasingly for the future of clinical diagnostics, forensics or drug discovery. I will emphasise on microfluidic chip-based molecular separations and detection schemes, including electrophoresis, electrochemiluminescence and plasma emission spectrometry, mostly from my own lab.