I1 Microfluidics for Lab-on-a-Chip. Simon Song. *Nano/Biofluidics & Control Laboratories, School of Mechanical Engineering, Hanyang University.*

Microfluidic chips have attracted much attention recently in the areas of genomics, proteomics, pharmaceutics, clinical diagnostics, and analytical biochemistry, as they provide miniaturized platforms of conventional analysis techniques. The microfluidic chip allows faster and cheaper analysis consuming much smaller amounts of samples and reagents than conventional methods. This presentation discusses the necessities, concept, and functionalities of a microfluidic chip. Also, representative examples of microfluidic chips, like micromixer, microvalve, micropump and so on, are introduced from the microfluidic point of view.

I2 Development of Photodiode Array (PDA) Biochip using Bipolar Semiconductor and its Application to Detection of Human Papilloma Virus (HPV). Gi Hun Seong. *Hanyang University, Korea.*

We report DNA microarray system using a bipolar integrated circuit photodiode array (PDA) chip as a new platform for DNA analysis. The developed chip is tested for the selectivity and selectivity of the PDA chip system for HPV diagnosis. The PDA chip consists of 8 × 6 array of photodiodes with a diameter of 600 m and 600 m of photodiode-to-photodiode distance. In photodiode element, n-type impurity (n+) was doped into the p-n junction to induce a higher leakage current. The photocurrent produced from irradiated light flows into the current amplifier and then is converted to a digitized voltage by converter. DNA detection for high-risk HPV was carried out on PDA chip system and the PDA chip showed dramatically high signal for complementary HPV target DNA, indicating the high selectivity of the PDA chip for HPV diagnosis. In addition, in quantitative analysis of the HPV target DNA, the linear range was observed for concentrations ranging from 5 to 27.5 nM and the detection limit was determined to be as low as 0.1 nM. This PDA chip has a great potential as a new platform for biochip and a portable miniaturized device by avoiding the need of the complicated optical components in conventional microarray system. We expect this portable biochip system to contribute significantly to on-chip bioassays for medical diagnosis and environmental sensing.

I3 *In Vivo*-like Microsystem for High throughput Drug/ Toxin Screening. Joo Young Park, Won Kang Moon, Miroo Kim, Hyungjoon Park, Hyungil Jung*. *Department of Biotechnology, Yonsei University.*

In inflammation site, T cells bind to endothelium via adhesion molecules such as E-selectin and intercellular adhesion molecule-1 (ICAM-1) according to a pro-inflammatory cytokine, Tumor Necrosis Factor-alpha (TNF-α). Here, we demonstrate the binding process between T cells and Human Umbilical Vein Endothelial Cells (HUVEC) by using microfluidic device that imitates an *in vivo*-like inflammatory system. HUVECs were cultured within the microfluidic device and stimulated with Tumor Necrosis Factor-alpha (TNF-α) to induce E-selectin and ICAM-1 expression. The expression of those surface molecules were confirmed by immunocytochemistry in the microfluidic device. T cells were activated with phorbol myristate acetate (PMA) and Ionomycin) or inhibited with the immunosuppressive agents, cyclosporin A (CsA) and tacrolimus. These cells were perfused at 3 dyn/cm^2 of shear stress into the device which containing E-selectin or ICAM-1 expressing HUVECs. The binding between leucocytes and HUVECs were monitored by confocal microscopy. We observed the less binding between anti-inflammatory drugs treated T cells to HUVEC. This showed that our device can be applied to detect the binding affinity change in response to not only drug, such as immune suppressor but also chemicals or toxins which affect cell-cell interactions. Furthermore, this device is useful as a biosensor for clinical diagnostics as well as high throughput drug / toxin screening system using living cells.

I4 Systems Toxicology for the Development of *In Silico* Toxicity Evaluation System. Kwang-Hyun Cho. *Department of Bio and Brain Engineering and KI for the BioCentury, Korea Advanced Institute of Science and Technology, 335 Gwahangno, Yuseong-gu, Daejeon 305-701, Republic of Korea.*

Conventional toxicology has been studied with experimental animals in general and it focuses on the relationships between intake dose of toxic materials and the corresponding lethal rates. In spite of the practical usefulness of this conventional approach, there are fundamental limitations on the experiments, logistics, and ethics related to the animal rights. Hence, there is a pressing need to introduce systems biological approach and to develop a virtual model system that can be used for toxicity evaluation. Motivated from this, we have been developing an *in silico* TCDD toxicity evaluation system (TES) based on an ordinary differential equation model and a systematic perturbation experiment of all the related signal transduction pathways. In this presentation, I will briefly introduce this on-going project as a step towards systems toxicology.

I5 A Systems Medicine Approach: Application to Prion Disease. Daehee Hwang[1], Inyoul Lee[2], Hyuntae Yoo[2], Leroy Hood[2]. *[1]School of Interdisciplinary Bioscience and Bioengineering & Department of Chemical Engineering, POSTECH, [2] The Institute for Systems Biology, Seattle, USA.*

Living organisms execute their diverse functions by virtue of the operation of biological networks and their nodal components within or among cells. Disease arises by genetic or environmental perturbations of one or more of these networks. A systems view of disease attempts to understand the initiation and progression of disease in terms of their initial disease-perturbations and their dynamic transitions as disease progresses. Systems approaches to disease have two cardinal features: 1) global analyses to generate comprehensive data sets (e.g. how do all genes, mRNAs or proteins change upon perturbation or during transition) and 2) the integration of different levels of biological information (e.g. DNA, mRNA, protein, interactions, networks, tissues or organs, individuals, etc) to generate coherent hypotheses about health and disease. In this talk, I will present one of the first systems approaches to understanding a disease— prion infection in inbred strains of mice. This approach transforms how one thinks about disease—explaining dynamic aspects of its pathophysiology and offering a new approach to early diagnostics.