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Microfluidic technologies for the bottom-up construction of artificial cells

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This talk will outline microfluidic strategies for bottom-up synthetic biology that are being used to construct multi compartment artificial cells where the contents and connectivity of each compartment can be controlled. These compartments are separated by biological functional membranes that can facilitate transport between the compartments themselves and between the compartments and external environment. These technologies have enabled us to engineer multi-step enzymatic signaling cascades into the cells leading to *in situ* chemical synthesis and systems that are capable of sensing and responding to their environment. Finally, we have developed printing strategies for translating these enzymatic pathways into microfluidic flow reactors that have the potential to be scaled-up for industrial usage.

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Biomarker development for allergic risk assessment

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There is an increase in the incidence of allergy/immunotoxicity-related post-market adverse events associated with medical devices. Biomarkers are commonly used in toxicology for risk assessment and clinically as diagnostic and monitoring tests. We developed a new *in vitro* model where human peripheral blood mononuclear cells (PBMC) serve as immunomodulators for biomarker development specifically for metal related allergenicity. The cell surface proteins were determined quantitatively. One of the purposes is to know whether the biomodulator system is transferable from the dendritic cell (DC) to the PBMC. Out of 12 surface proteins selected from the first tier selection that were screened, we found consistency of BM1 performance between DC and PBMC and other 3 proteins (BM2, BM3 and BM4) showed promise. The expression of BM1 was down-regulated significantly following exposure to three well-known metallic allergens (Cobalt (II) chloride, nickel (II) sulfate, potassium dichromate (VI)), while the expression remained unchanged when exposed to two metallic non-allergens (lead (IV) acetate, magnesium (II) chloride) compared to untreated cells. Data from four healthy donors showed the same pattern. These results indicate that BM1 shows promise for use as a pre-clinical biomarker in screening potential allergenic risks to metal-containing devices. Further validation is planned.

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