**Biomimetic Microfluidics – The Key to Revolutionising the Performance of Autonomous Chem/Bio-Sensing Platforms**

**Dermot Diamond, Larisa Florea, Aishling Dunne, Alex Tudor, Aymen BenAzouz and Simon Coleman**

**Abstract:**

Imagine a world in which issues related to long-term (months to years) reliability of chem/bio-sensing platforms have been solved, and devices capable of carrying out complex chem/bio-functions in an autonomous manner are ubiquitously available. The potential impact of these technologies socially and economically is enormous, and the demand will be universal, driven by an infinite range of applications. Devices will perform complex analytical measurements while located in remote and environmentally hostile locations, such as the deep oceans, or inside the human body. Their capabilities will go far beyond those of existing devices; chemical sensors, biosensors, lab-on-chip (LOC) systems or autonomous analysers, that cannot deliver the price-performance required for reliable long-term (years) autonomous in-situ operation. Revolutionary device improvements are required to meet this vision, and it is becoming clear that these improvements require a fundamental move towards devices based on bio-inspired approaches. For example, future instrument fluidics will have a much more active role beyond the current tasks of transporting samples, mixing reagents, and cleaning. Much like the circulation systems in living entities, these circulation systems will perform advanced functions, like using mobile micro-scaled biomimetic agents to detect, spontaneously migrate to, and repair damaged channels or fluidic components in order to maintain functional integrity of the device. These strategies, if successful, will be broadly disruptive across many application domains, from chronic disease management to environmental monitoring. In this paper, I will present ideas and strategies through which this exciting vision might be advanced via an exciting combination of stimuli-responsive materials, emerging technologies for precise control of 3D materials morphology (to nanoscale dimensions), and state of the art characterization and visualization techniques.