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Title: Micron Scale Mobile Sensor Modules for In-Line Repair of Dialysis Filters

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Abstract:

Dialysis filters provide a system whereby a wide variety of molecules can be selectively and efficiently removed from biological fluids. A prime disadvantage of these filters is their tendency to rupture in use requiring replacement; this brings risk for a patient from medical perspective and requires their treatment to be given in a hospital. The applications objective for this project is to provide platforms for on-line maintenance and repair of dialysis filters for organ replacement therapy systems. This project is investigating methods to fabricate micro-scale mobile electronic modules that can learn and evolve in a bio-system. Using the micron scale sensors these units will navigate in a bio-medium and at the same time continuously sense their microenvironments for chemical change using electrode sensors built directly onto the micro-modules. Groups of these electronic modules will work together to solve global problems in the filter by collaborating through a mechanism analogous to stigmergic behaviour. Successful collective behaviour in missions of this type critically depends upon accurate environmental perception, real-time decision-making and effective system learning. This paper focuses upon the challenge of accurate environmental perception through the sensor network that will be built onto the autonomous module. Several types of chemical change or the presence of certain chemical compounds can be detected using the electrodes and future research will investigate the sensitivity that can be achieved on the micro-nano scale.