Warnat Lab: Development of a microfluidic flow switching-unit

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In the United States alone, significant socio-economic impacts result from changing water conditions, such as eutrophication of freshwater. For example, a persistent algal bloom in an Ohio lake caused $37 million to $47 million in lost local tourism revenue over two years or a harmful algal bloom (HAB) outbreak on the Maine coast prompted shellfish bed closures, leading to losses of $2.5 million in soft shell clam harvests in one season. Reliable, high-resolution data on water quality is needed to counteract or predict changes in water quality before damages occur. Remote sensors are an important development to monitor water changes in real-time. However, sensors are exposed to a harsh aqueous media, indicate degradation, and cause an increase in system maintenance.

The CapStone project will develop a prototype of a mechanical housing for a redundant sensor integration for real-time water monitoring applications. Several sensors of one kind are integrated in this housing and a mechanical ‘flow switch’ opens one sensor at the time. Other sensors do not see the harsh aqueous media and do not degrade. An electronic component monitors the open sensor response and changes the flow path if the signal drifts or after a defined time-interval. A ‘fresh’ and calibrated sensor is exposed to the media after the flow path is changed. No maintenance is required. The goal of the project is to design, fabricate and test the described flow switching-unit for sensors that require a very low media flow (microfluidics).