

FUKUBA LAB.

Advancing ocean observation through nanoscale sensing and eDNA technology



Department of Mechanical and Biofunctional Systems

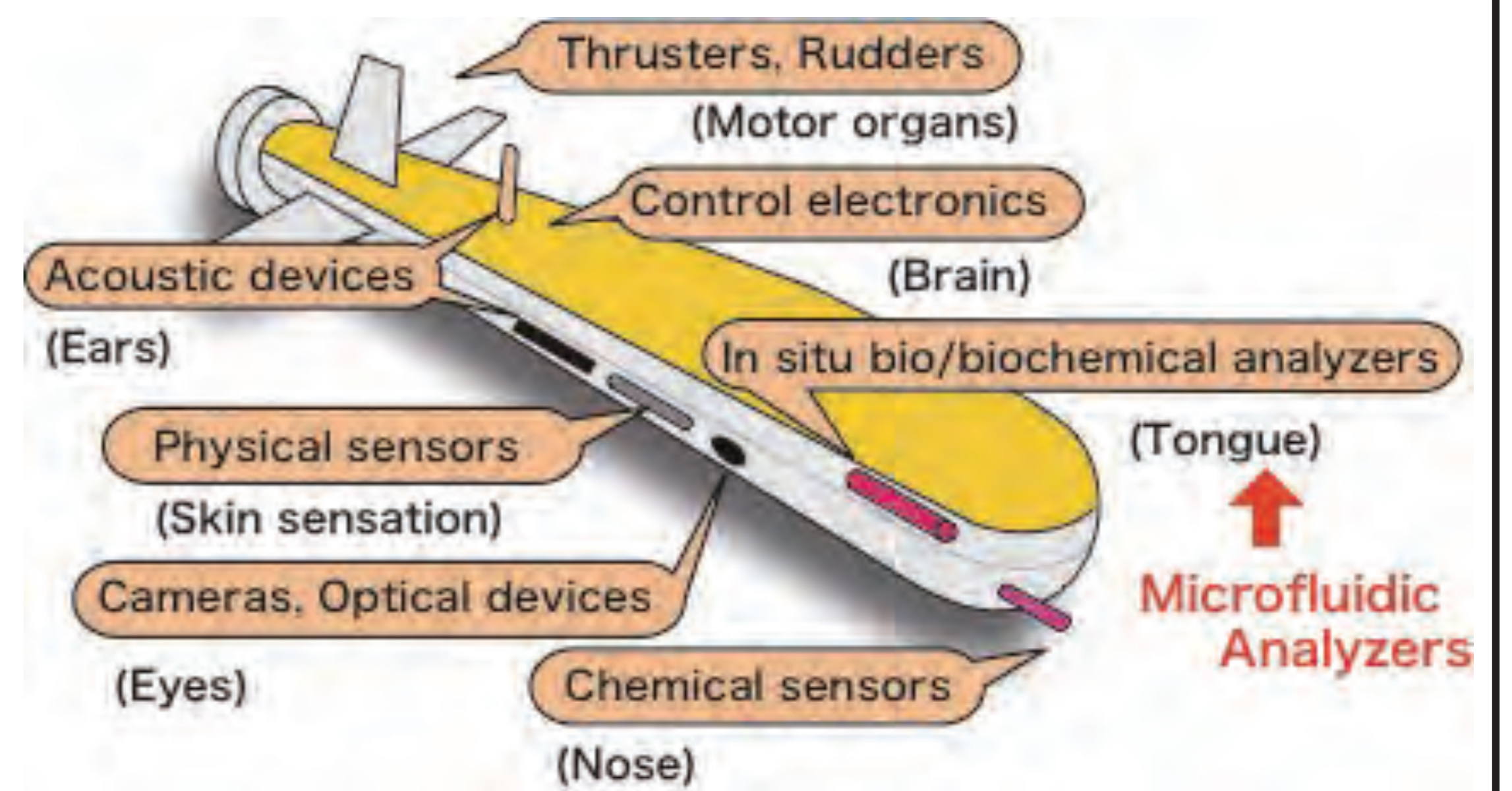
Ocean Observation Technology

<https://sites.google.com/view/fukuba-lab/>

● Towards Multi-modal Ocean Sensing

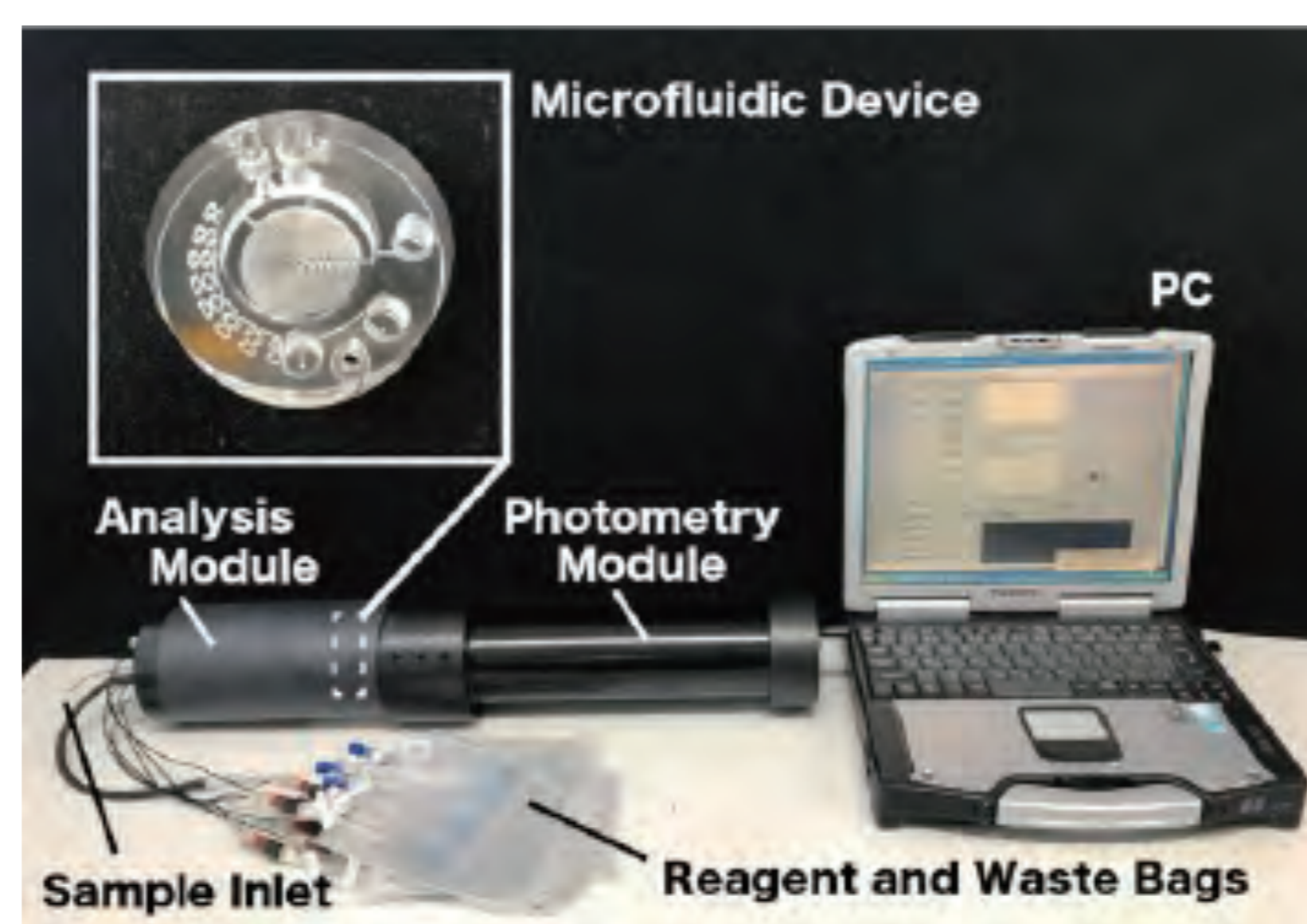
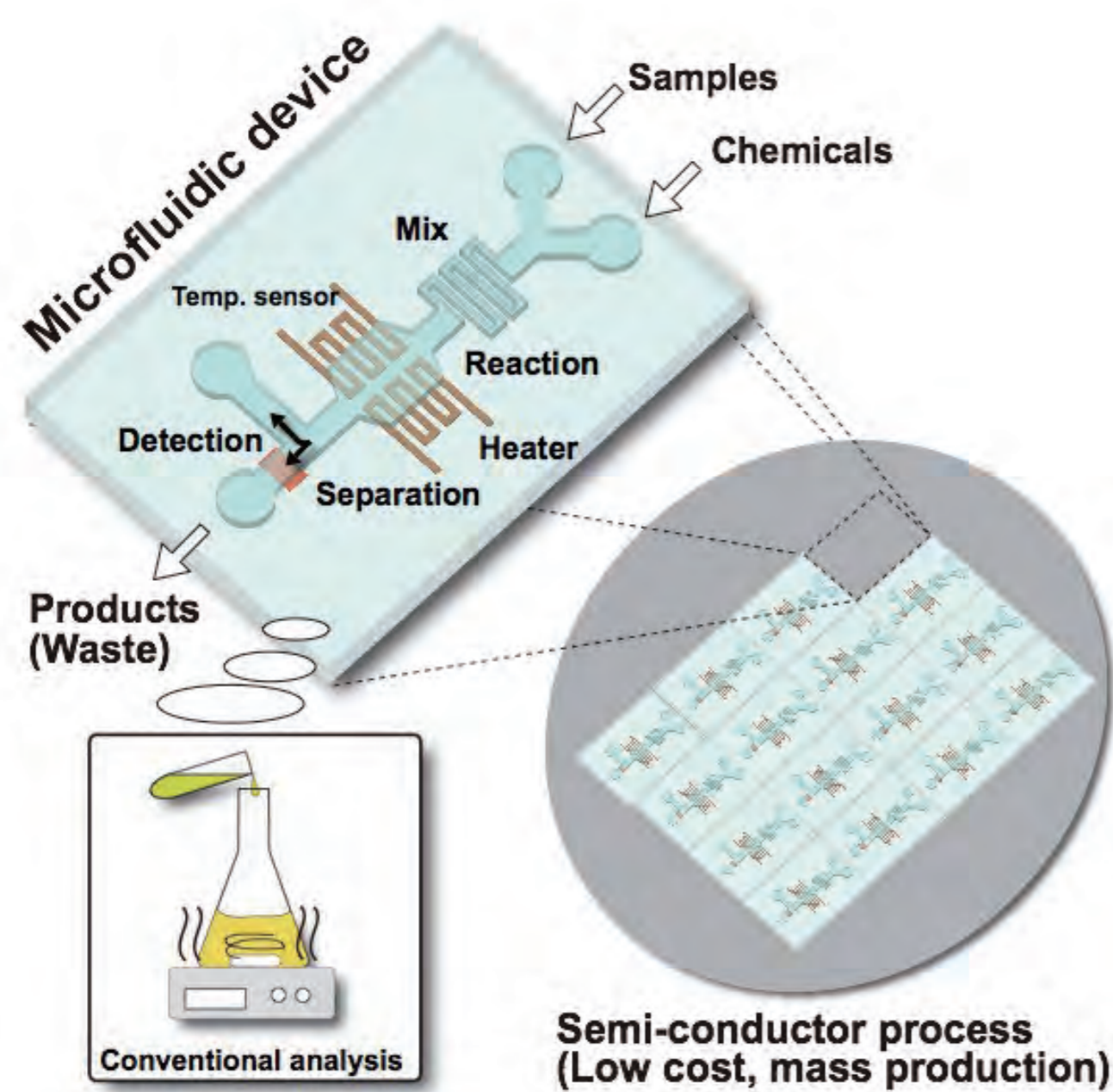
To enable intelligent, environment-adaptive observations with autonomous platforms such as underwater vehicles, the utilization of sensors as “sensory organs” is essential. However, the realization of miniaturized chemical, biological, and biochemical sensors with multi-parameter sensing capability remains challenging.

In collaboration with JAMSTEC, we aim to develop miniaturized *in situ* sensing systems utilizing Lab-on-a-Chip (LOC) and nanoscale sensing technologies. Furthermore, we aim to achieve advanced multimodal chemical–biological ocean observation by integrating environmental DNA (eDNA) sampling and *in situ* analysis technologies developed so far.

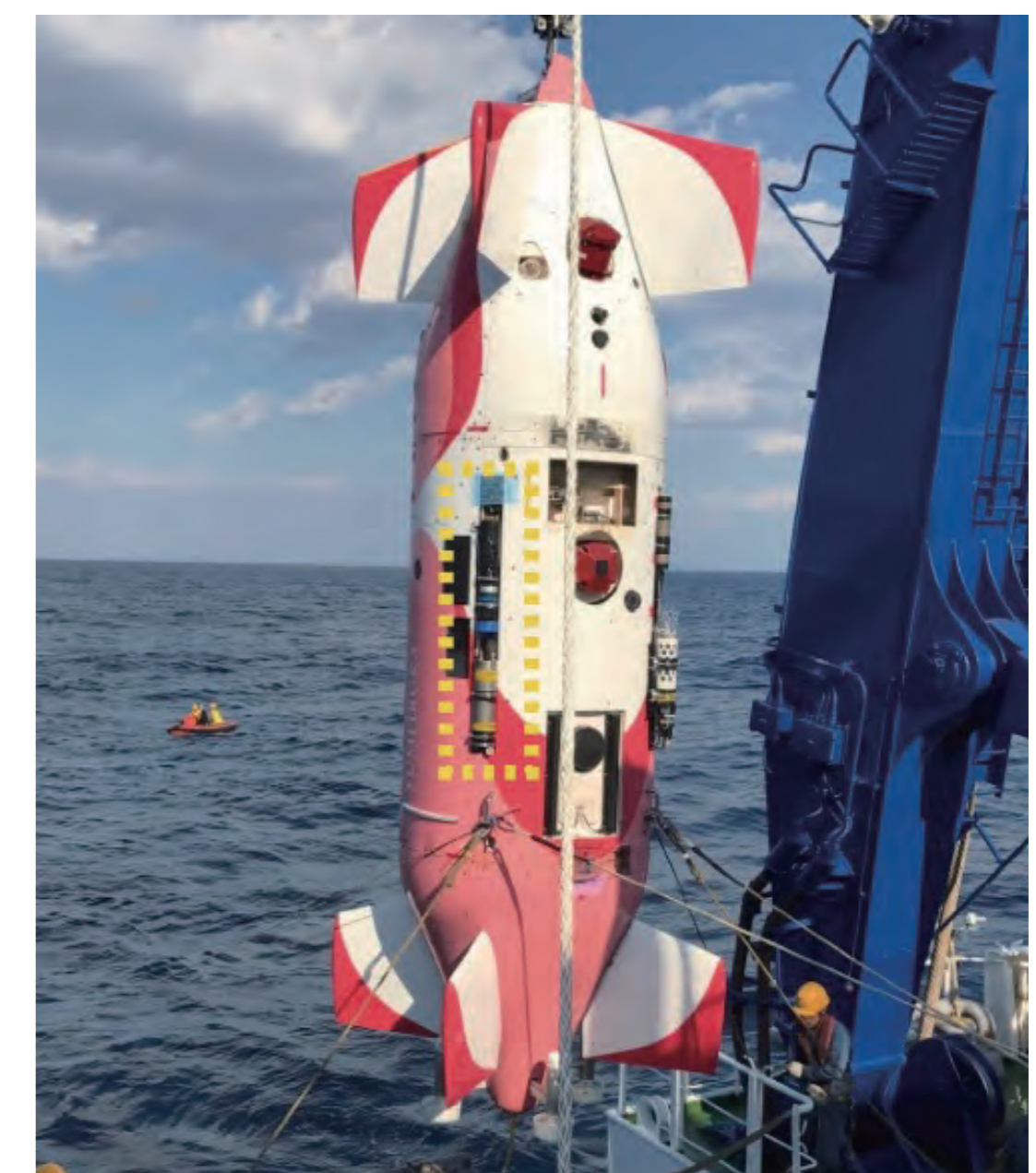


● Application of Microfluidic Technology for *in situ* Microbial Analysis

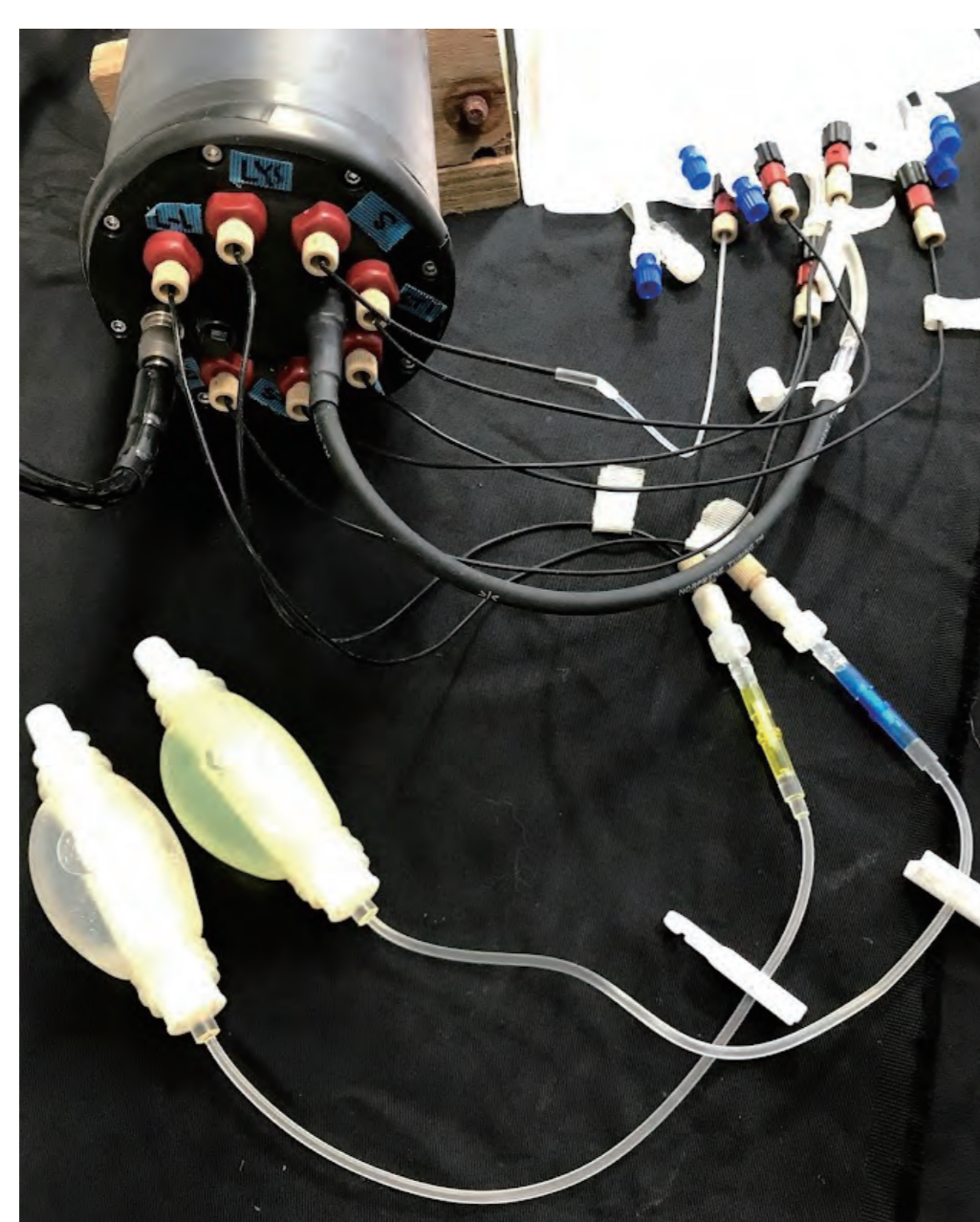
- Miniaturization of ocean observation platforms → development of compact *in situ* analytical devices and multifunctional sensors is required.
- In particular, we aim to achieve device miniaturization through with power saving technologies to enable long-term measurements
- Accelerating the miniaturization and power-saving LOC devices through the application of low-saving and power-free pumping technologies.
- Realizing next-generation sensors through the integration of nanoscale sensing technologies and eDNA sampling/ analysis technologies



ATP analyzer developed with microfluidic technology
Fukuba *et al.*, *Micromachines* 2018



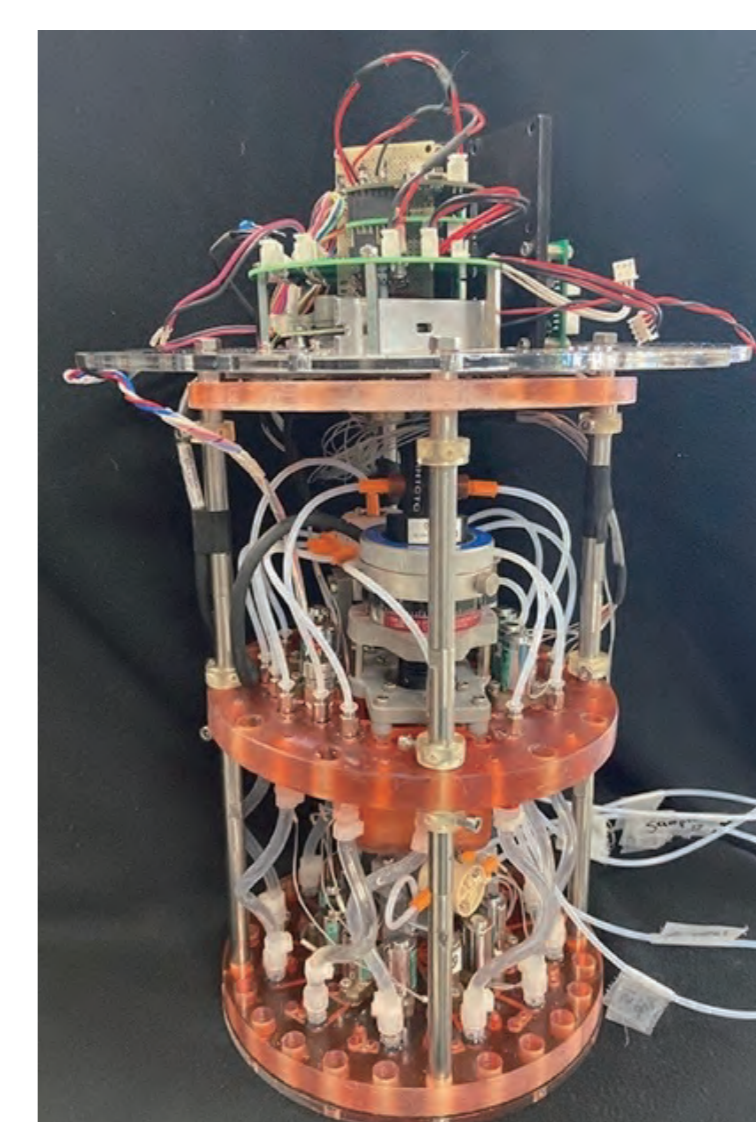
ATP analyzer mounted on Autonomous Underwater Vehicle



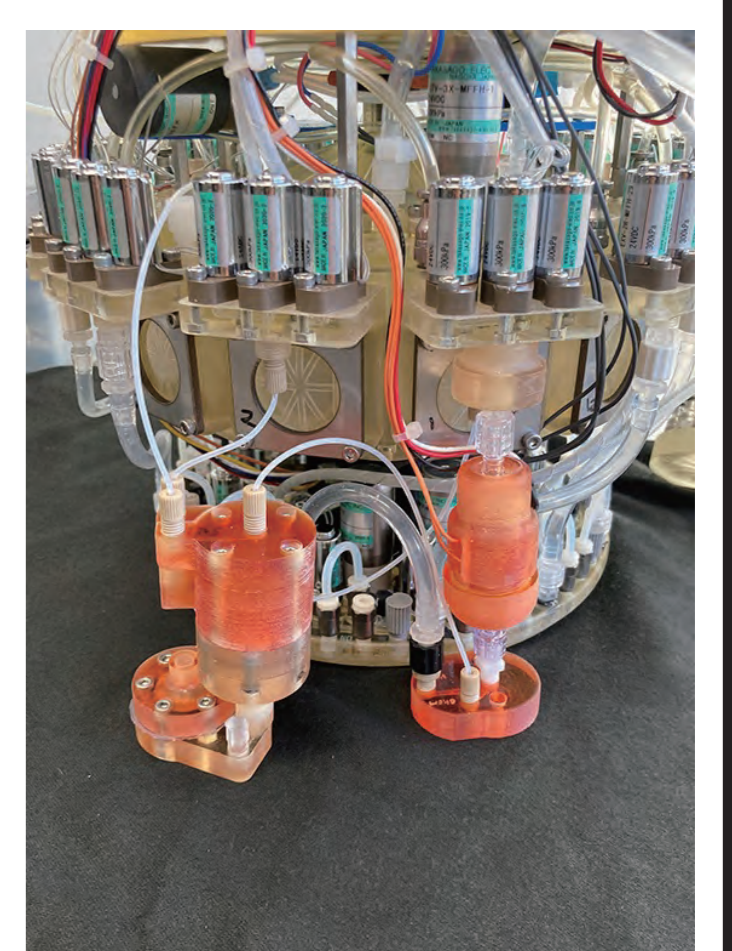
In situ ATP analyzer with a power-free balloon pump



Microfluidic device for DNA purification



Automated eDNA sampler (JAMSTEC/AORI)



Microfluidic device for DNA detection (JAMSTEC)