

# FUKUBA LAB.

## Application of Microfluidics for Advanced Underwater Measurements



Department of Mechanical and Biofunctional Systems  
Japan Agency for Marine-Earth Science and Technology

Multi-modal ocean sensing systems

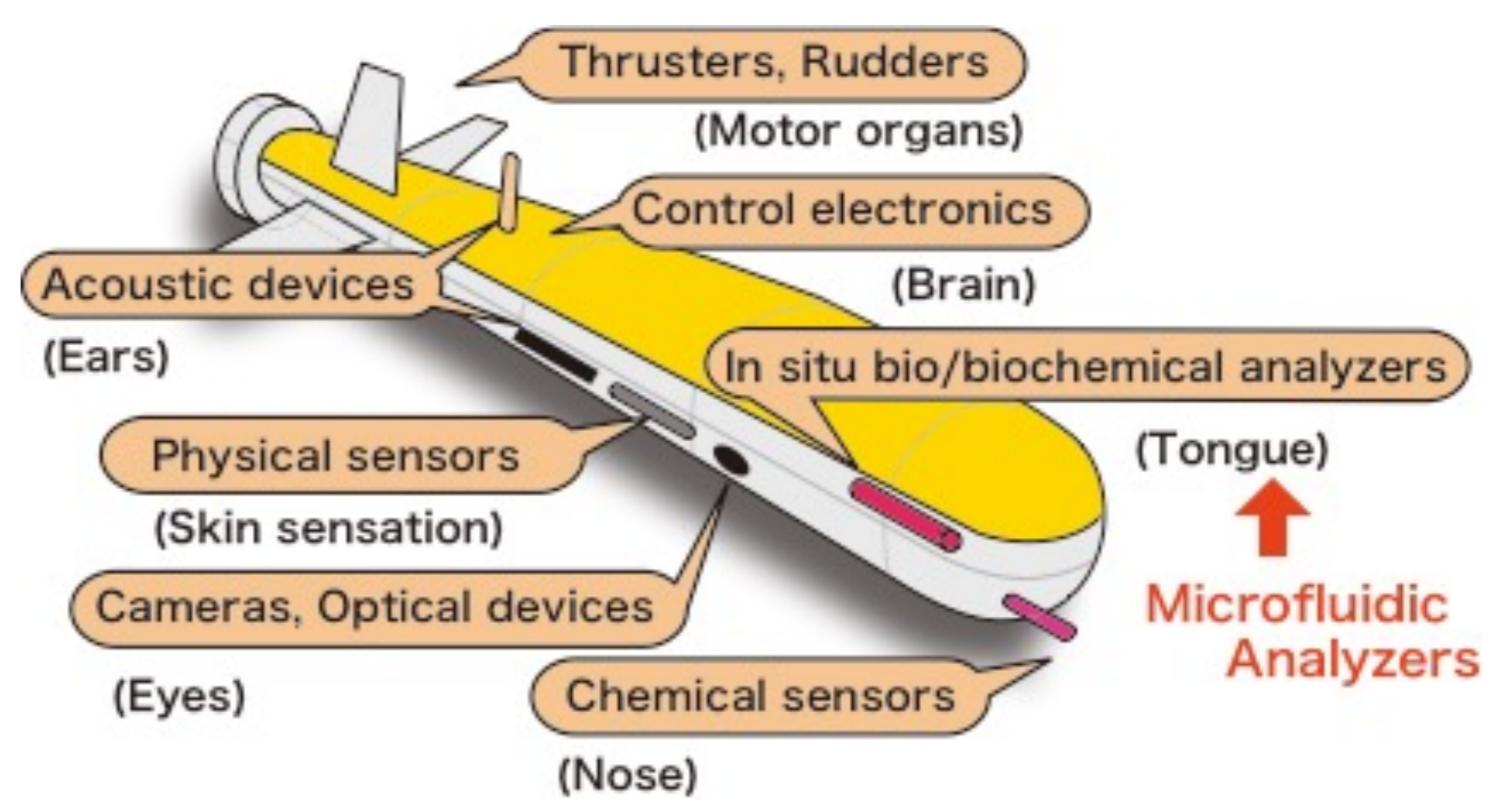
<https://sites.google.com/view/fukuba-lab/home>

### ● Towards Multi-modal Ocean Sensing

To provide a high-class intelligence such as taking an optimal decision making according to the surrounding environmental conditions to underwater observation platforms such as AUVs, miniaturization of sensors and analyzers are essential.

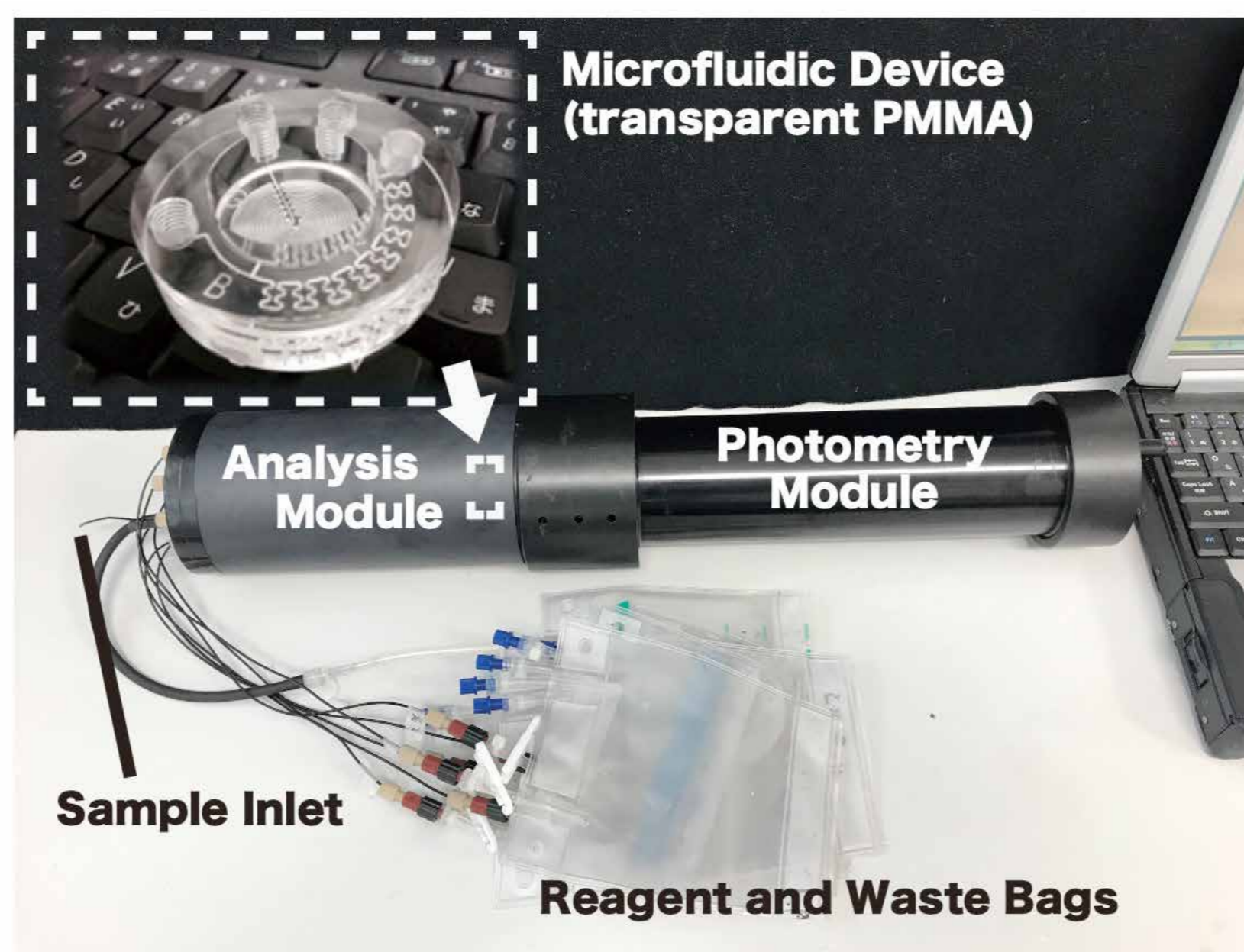
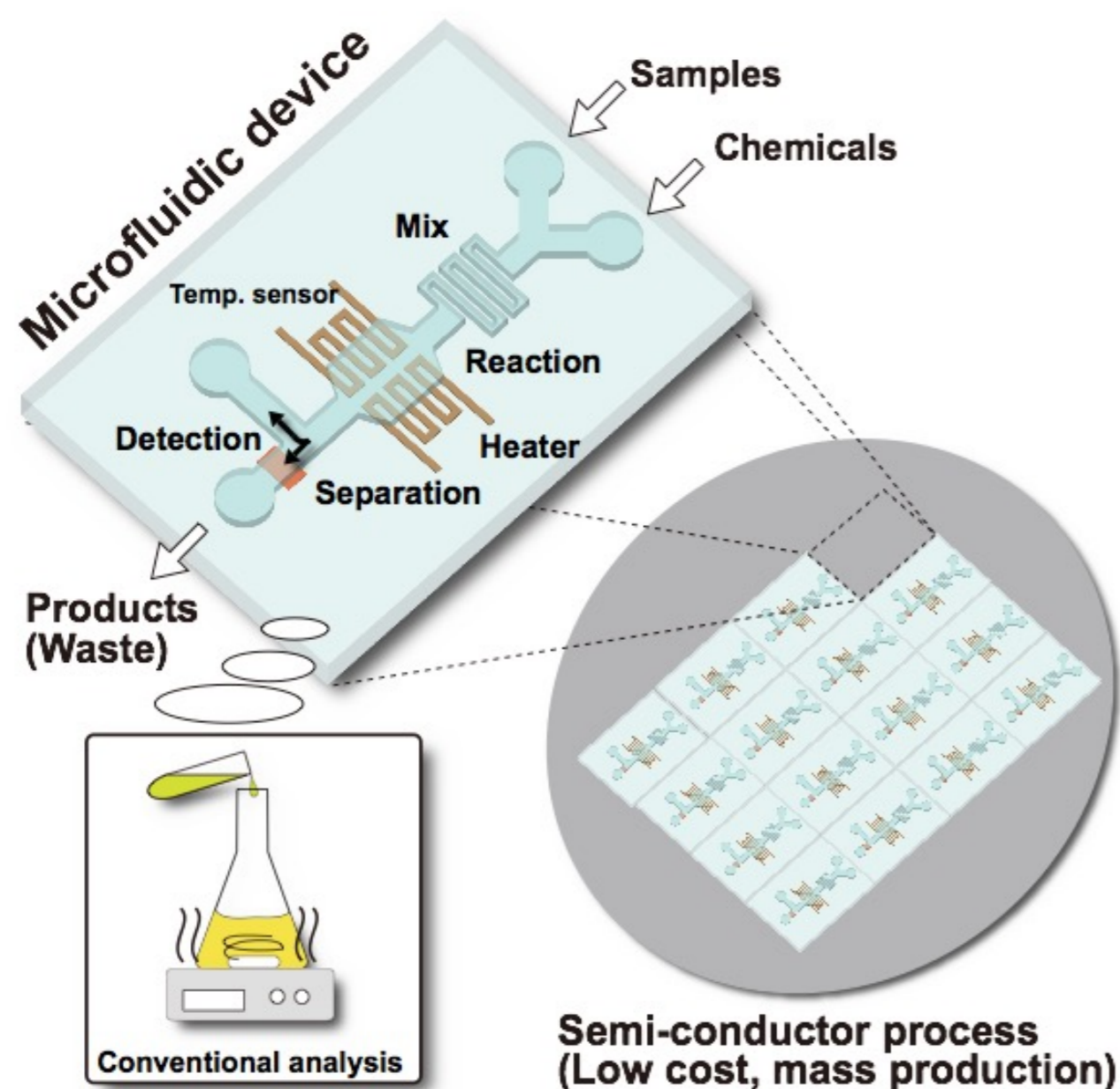
On the other hand, as compared with the remarkable progress of chemical and physical sensors, the biological and biochemical sensors are behind in practical use because of the difficulty of miniaturization.

We aim to realize portable *in situ* biological and biochemical sensors by applying microfluidic and semiconductor sensor technologies, and to realize advanced multi-modal underwater observation using them.

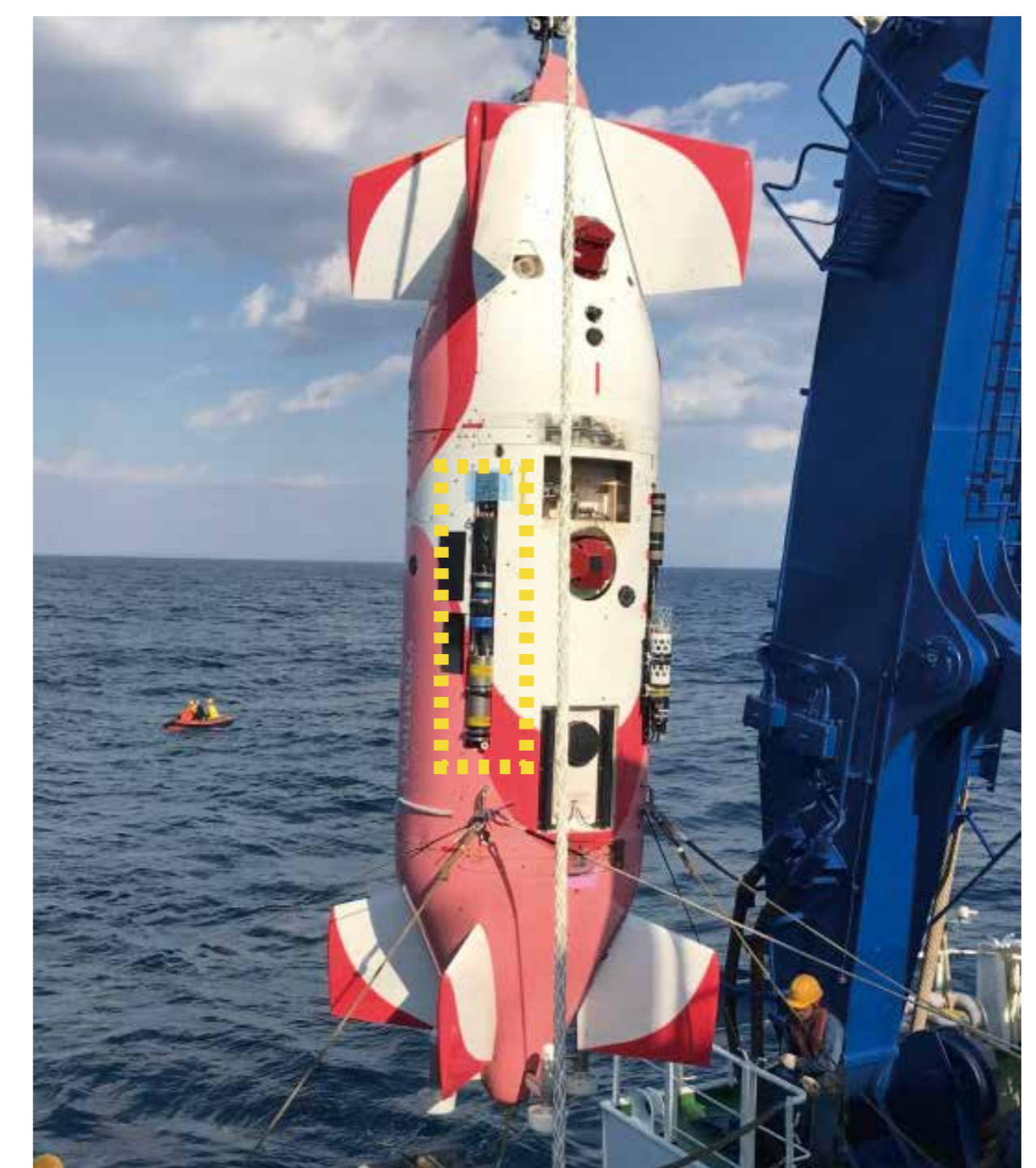


### ● Application of Microfluidic Technology for *in situ* Microbial Analysis

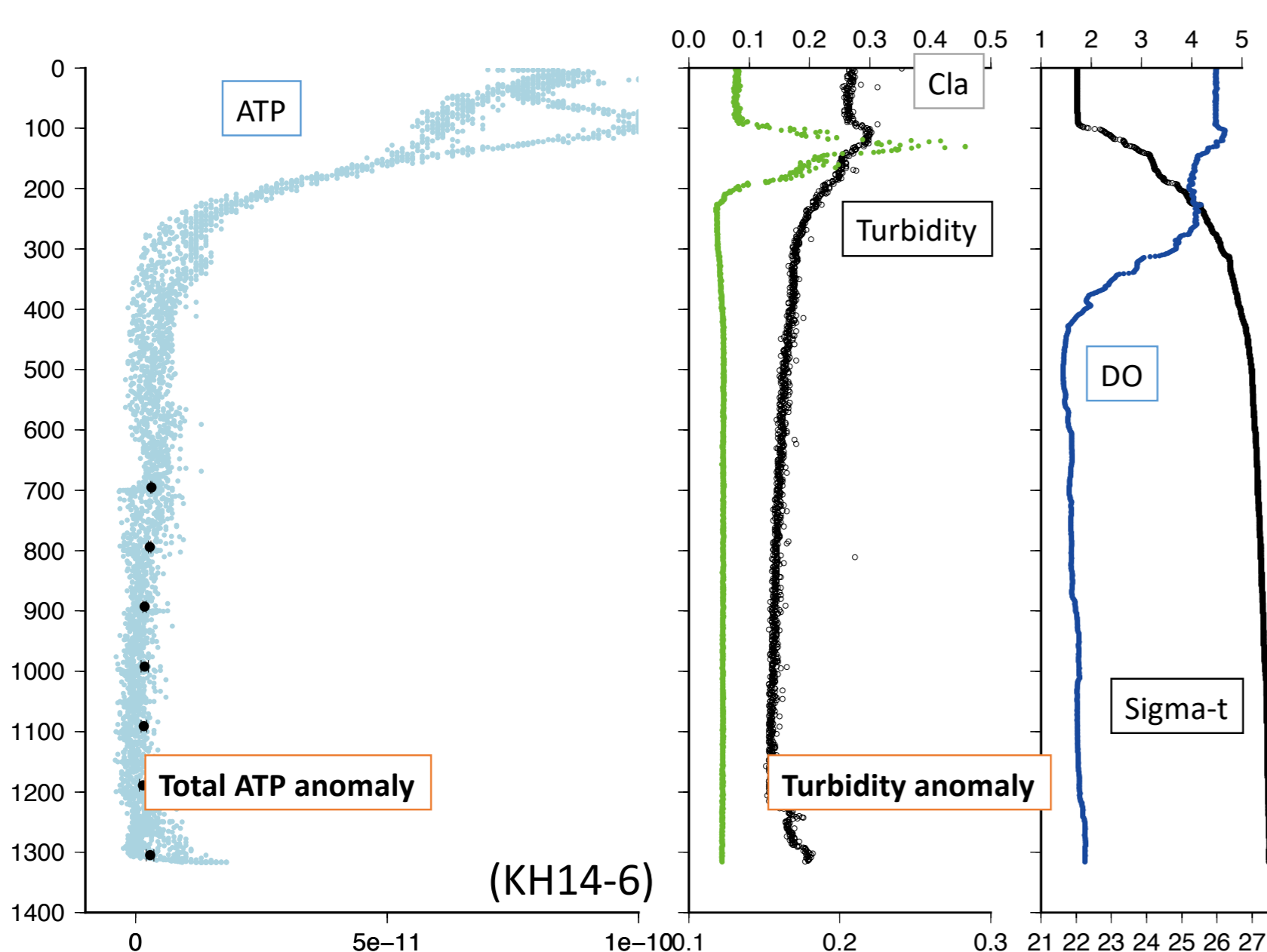
- Distribution and Abundance of marine microbes: Miniaturized *in situ* analyzer is needed for detailed visualization
- *In situ* quantification of microbial ATP (Adenosine triphosphate) as a biomass proxy
- Can be applied to underwater resources survey and environmental impact assessment missions
- Fully automated gene analyzer is also under development



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



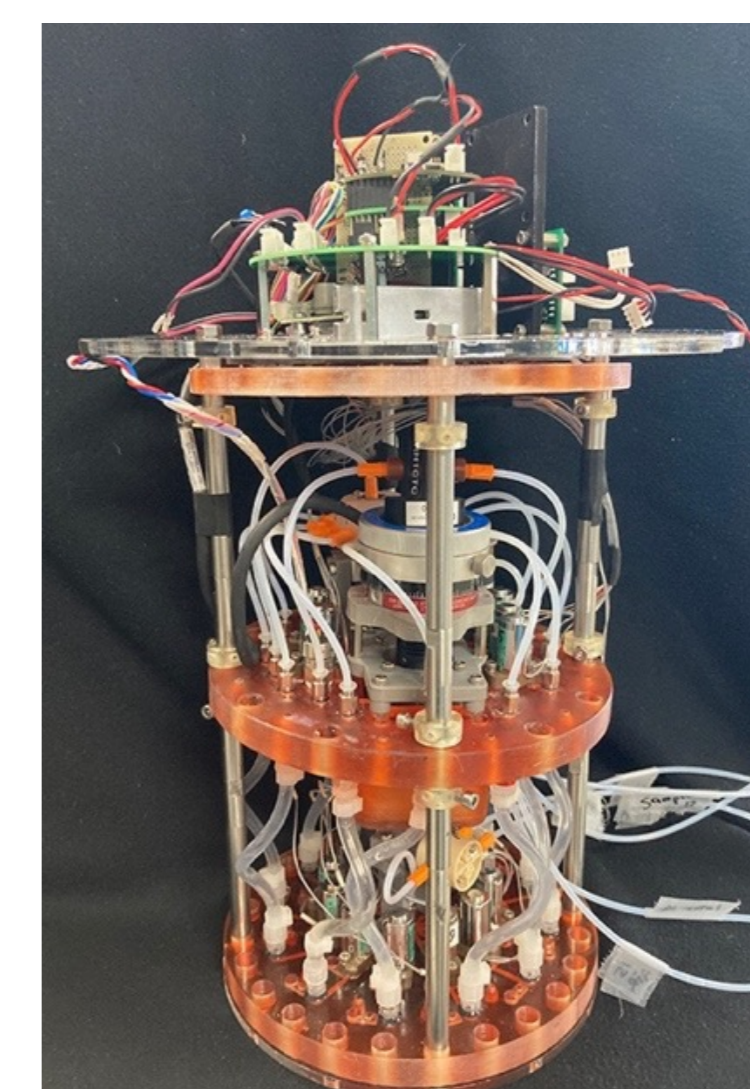
ATP analyzer mounted on Autonomous Underwater Vehicle



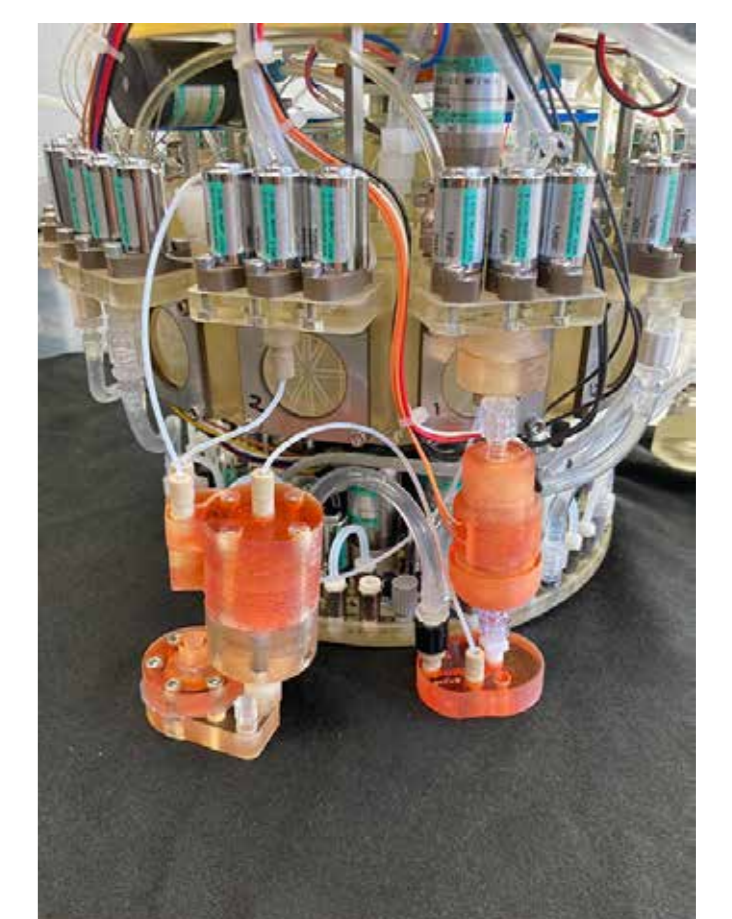
Result of vertical *in situ* ATP measurement at the Seamount-X (the Mariana Trough) Hydrothermal site using ATP analyzer mounted on a CTD



Microfluidic device for DNA purification



Automated sampler (JAMSTEC/AORI)



Microfluidic device for DNA detection (JAMSTEC)

***In situ* Gene Analysis System**