FUKUBA LAB.

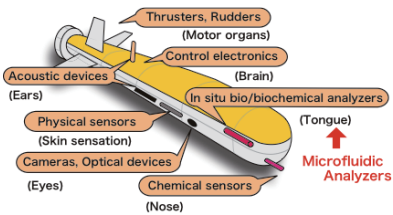
Enabling next-generation bio-chemical ocean sensing with microfluidics

Department of Mechanical and Biofunctional Systems

Ocean Sensing
https://sites.google.com/view/fukuba-lab/home?authuser=0

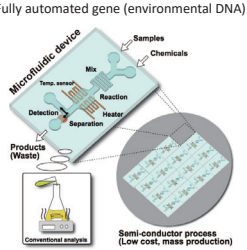
● Towards Multi-modal Ocean Sensing

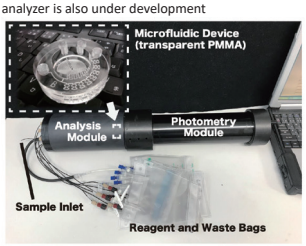
To provide a high-class intelligence such as taking an optimal decision making according to the surrounding environmental conditions to underwater observation platforms such as AUVs, miniaturization of sensors and analyzers are essential.
On the other hand, as compared with the remarkable progress of chemical and physical sensors, the biological and biochemical sensors are behind in practical use because of the difficulty of miniaturization and lack of energy efficient pumping technologies.
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

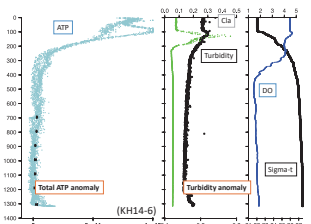
- Distribution and Abundance of marine microbes: Miniaturized *in situ* analyzer is needed for detailed visualization
- *In situ* quantification of microbial ATP (Adenosine triphosphate) as a biomass proxy
- Can be applied to underwater resources survey and environmental impact assessment missions
-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





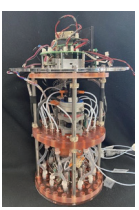
ATP analyzer developed with microfluidic technology
Fukuba *et al.*, Micromachines 2018

ATP analyzer mounted on Autonomous Underwater Vehicle

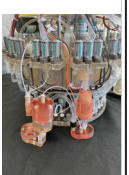


Result of vertical in situ ATP measurement at the Seamont-X (the Mariana Trough) Hydrothermal site using ATP analyzer mounted on a CTD

Microfluidic device for DNA purification



Automated eDNA sampler
(JAMSTEC/AORI)



Microfluidic device for
DNA detection (JAMSTEC)

***In situ* Gene Analysis System**