

# Department of Biomedical Devices and Instrumentation

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## Advanced sensor technologies for biomedical and health sciences

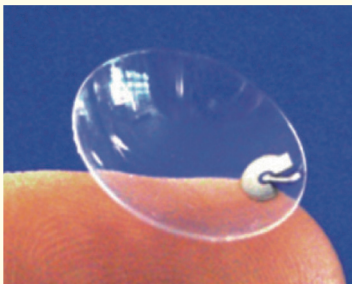
- 1. Cavitas sensors: Detachable bioinformation monitoring systems for body cavities**
- 2. Bio-sniffers & Sniff-cams: Biochemical "odor" sensors and imaging systems**
- 3. Regeneratable immunosensors for medical treatment and environmental medicine**
- 4. Organic Engine: A chemo-mechanical energy conversion system for artificial pancreas**

1. Itani K, Sato T, Naisierding M, Hayakawa Y, Toma K, Arakawa T, Mitsubayashi K: Fluorometric sniff-cam (gas-imaging system) utilizing alcohol dehydrogenase for imaging concentration distribution of acetaldehyde in breath and transdermal vapor after drinking, *Anal Chem* 90, 2678–2685, 2018.
2. Chien PJ, Suzuki T, Tsujii M, Ming Y, Minami I, Toda K, Otsuka H, Toma K: Biochemical gas sensors (biosniffers) using forward and reverse reactions of secondary alcohol dehydrogenase for breath isopropanol and acetone as potential volatile biomarkers of diabetes mellitus, *Anal Chem* 89, 12261–12268, 2017.
3. Toma K, Miki D, Yoshimura N, Arakawa T, Yatsuda H, Mitsubayashi K: A gold nanoparticle-assisted sensitive SAW (surface acoustic wave) immunosensor with a regeneratable surface for monitoring of dust mite allergens, *Sensors Actuators B Chem* 249, 685–690, 2017.

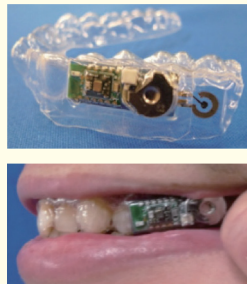
Our group pursues interdisciplinary research on biosensors and bio-Micro Electro Mechanical Systems (MEMS) by combining knowledge from a broad range of fields, such as electrochemistry, mechanical and electrical engineering, material science and information technology, to develop new and advanced medical and healthcare sensing devices.

### Cavitas sensors for bioinformation monitoring

Cavitas sensors such as contact-lenses and mouthguard biosensors for biomonitoring are being developed using advanced polymer MEMS techniques.



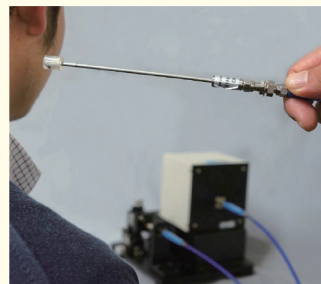
Contact lens-type biosensor



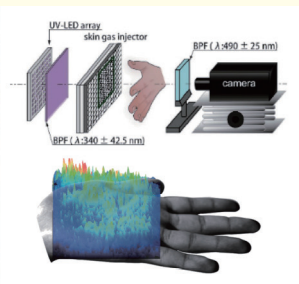
Mouthguard-type biosensor

### Biochemical sensors and imaging systems for non-invasive health evaluation

A sensitive and selective "Bio-sniffer" and "Sniff-cam" are being developed utilizing drug-metabolizing enzymes from liver for non-invasive and simple medical screening and healthcare sciences.



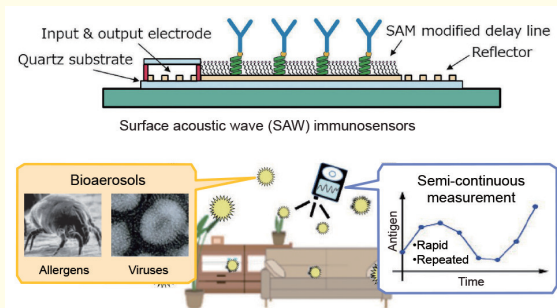
Bio-sniffer



Sniff-cam and a gas image on a palm

### Immunosensors for medical treatment and environmental medicine

Immunosensors relying on light or surface acoustic waves are being developed for rapid and repeated — semi-continuous — measurement of antigens, such as mite allergens.



### An artificial pancreas using a chemo-mechanical energy conversion system (Organic Engine)

An Organic Engine that directly converts the chemical energy of biological components into mechanical energy is being developed for the artificial pancreas, resulting in an autonomous drug-release system.

