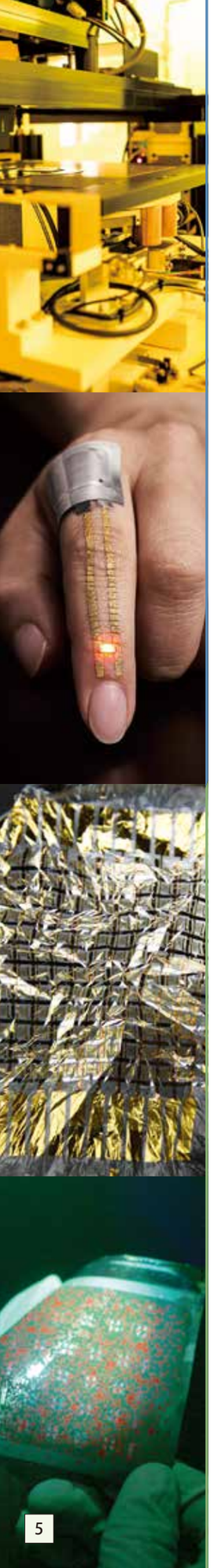


FY2017

Conformal Bioimager

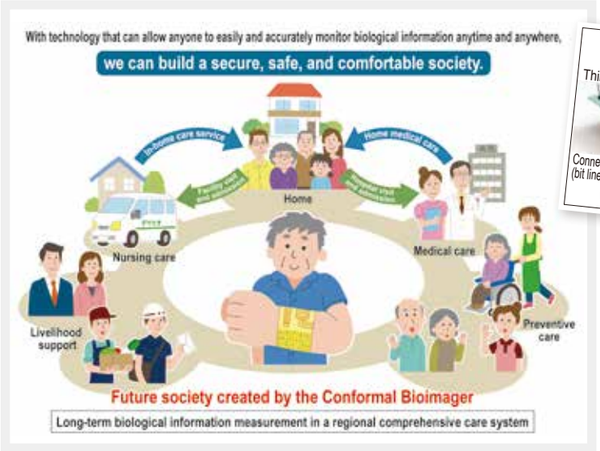
Development of thin, soft, human-compatible organic devices

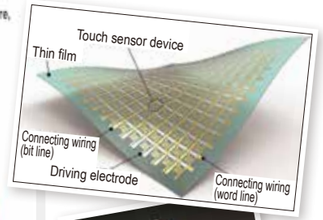
In recent years, the focus of attention in the electronics field has shifted from inorganic materials such as silicon to low-cost, lightweight, soft, and biocompatible organic materials with healthcare applications.

We have done extensive research on materials and devices, with the overall goal of developing human-compatible organic devices. In the CREST Project, we developed a process using organic transistors to manufacture large-area, stretchable, sheet-type sensors. And in the ERATO Project, we established a method for manufacturing integrated circuits based on attaching high-performance organic transistors onto the surface of 1-μm thick ultra-thin polymer substrates. This allowed us to develop sheet-type sensors that do not break even when rolled up and can be attached to flexible surfaces such as human skin. We have also succeeded in developing both a device equipped with organic photodetectors and LEDs that can measure the oxygen saturation levels in blood, as well as a device composed of biocompatible material that does not cause skin inflammation even after continuous attachment for a week.

Towards a society where everyone can easily monitor their biological information in order to protect their health

In the ACCEL Project, we plan to develop a stretchable image sensor (Conformal Bioimager) by integrating and further advancing the processes and technologies we have already developed through previous research. The Conformal Bioimager will allow anyone to easily measure their own biological information anytime and anywhere by simply attaching a sheet to their skin. Development of a wearable sensor that can continuously monitor health conditions for 24 hours a day, 7 days a week without causing any stress or discomfort when applied to the skin of the wearer will be helpful for health management and disease prevention, and can contribute towards bringing about a regional comprehensive care system that can maintain the health of people wherever they live.





Stretchable electronics

'Stretchable electronics' refers to electronics whose biological compatibility is enhanced by being flexible. Thin and soft stretchable electronics will allow wearable devices that can be worn comfortably for extended periods and not interfere with movement, even when applied directly to the skin. Stretchable electronics are expected to be applied not only to the fields of medicine and healthcare, but also to many fields related to human activities.

Research Director

Takao Someya

Professor, School of Engineering, The University of Tokyo

In developing devices using organic materials, we need to ensure both harmony with the global environment and affinity with the humans who live in it. Wearable devices for monitoring with cameras or similar equipment have already been commercialized. However, the skin-attachable devices we have developed feature the ability to accurately measure biological information such as blood flow, respiration, and movement in real time, all which normally cannot be measured without attaching equipment to the skin. Such features have never been seen in wearable devices.

The underlying technology for achieving the Conformal Bioimager is just a step away from completion. To overcome the final hurdle, however, we have to develop something that allows us to utilize both the soft parts that attach to the skin and the hard parts where the battery and other components are mounted as a system, and we also have to establish a manufacturing process. In the ACCEL Project, I would like to solve this problem in order to enable the broad use of this technology for the betterment of society.

As leaders in the field of stretchable electronics, we will put our expertise to work to solve these final problems in order to advance this technology towards commercialization and applications for society.

Program Manager

Yorishige Matsuba

ACCEL Program Manager, Japan Science and Technology Agency

I have known Professor Someya since 2003, and have occasionally helped his research as a materials manufacturer. Since then I have followed his work with much interest. In particular, I feel that the stretchable optical sensor is highly practical and has excellent potential for practical, real world use.

This unprecedented project is unique in the sense that it aims to achieve wholesale integration of the collection and analysis of various body signals. The method is non-invasive and expandable, and the necessary equipment is already available, so a prototype may well be ready sooner than expected. However, being a system for health management and disease prevention, there are various criteria besides the technical aspects that must be satisfied before it can be brought to completion. We are working to make it a business reality within a short timeframe. In doing so, we are drawing on my experience of developing new business projects, and optimally coordinating the university research that forms the project base with applied research carried out by companies.

I believe there is a lot of potential in this technology. This is my chance to show my skill as the PM on how quickly this technology can be developed for different applications.

With the Conformal Bioimager, we will realize a secure, safe, and comfortable society where everybody can accurately measure his/her biological information anytime and anywhere.

PROFILE TAKAO SOMEYA

1997: Ph.D. (Engineering), The University of Tokyo. Joined the Institute of Industrial Science, The University of Tokyo; moved to Columbia University and the Research Center for Advanced Science and Technology at The University of Tokyo; in current post since 2009. Current research is focused on organic electronics and stretchable electronics.

PROFILE YORISHIGE MATSUBA

1979: M.S. (Chemical Engineering), Okayama University. Joined Harima Chemicals Group, Inc.; appointed to Visiting Professor at Osaka University in 2003 and the University of Hyogo in 2004. Engaged in promotion of functional nano-materials as Managing Director/Executive Officer and Head of Tsukuba Research Laboratory of Harima Chemicals Group, Inc. Ph.D. (Engineering)