March 1, 2024

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Announcement of Tohoku University, The University of Tokyo, and Menicon to start joint research on fundamental technology for contact lenses

Menicon Co., Ltd. (Nagoya City, Aichi Prefecture; President and COO: Koji Kawaura; hereinafter referred to as "Menicon") announces that Menicon, Tohoku University (Sendai City, Miyagi Prefecture; President: Hideo Ohno; hereinafter referred to as "Tohoku University") and The University of Tokyo (Bunkyo-ku, Tokyo; President: Teruo Fujii; hereinafter referred to as "University of Tokyo") will commence joint research on the "Establishment of Fundamental Technology for Next-generation Contact Lenses and Contact Lens Manufacturing and Distribution" in April 2024.

By bringing together the research expertise of Tohoku University and University of Tokyo and the contact lens technology of Menicon, we aim to establish a fundamental technology to transform the industry with respect to the design of new contact lens materials and recycling of various plastic materials used for manufacturing and distribution of the contact lens materials.

For details, please refer to the followings.

End

News Release

March 1, 2024

Tohoku University, The University of Tokyo, and Menicon to start joint research on fundamental technology for contact lenses

Bringing innovation to the industry by new material design and material recycling

Tohoku University (Sendai City, Miyagi Prefecture; President: Hideo Ohno), The University of Tokyo (Bunkyo-ku, Tokyo; President: Teruo Fujii), and Menicon Co., Ltd. (Nagoya City, Aichi Prefecture; President and COO: Koji Kawaura; hereinafter referred to as “Menicon”) will commence joint research on the “Establishment of Fundamental Technology for Next-generation Contact Lenses and Contact Lens Manufacturing and Distribution” in April 2024.

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Background of the joint research

Tohoku University established the Research Center for Green X-Tech(Note 1) in January 2023 as part of the Green Goals Initiative, aiming to create an industry–academia co-creation and innovation hub that can solve social issues and business challenges related to the field of green technology through practical research using combinations of advanced technologies, including science, engineering, data science, and IT.

Similarly, University of Tokyo established the Institute for Solid State Physics and the Synchrotron Radiation Collaborative Research Organization in NanoTerasu(Note 2) to promote research for the establishment of a recycling-oriented theory that helps academia lead industry–academia collaborative creation and accelerates academic fusion.

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Menicon has been working on the elucidation of structure–function relationship of contact lens materials by utilizing quantum beam sources at various facilities, including X-ray sources at SPring-8(Note 3) and the Aichi Synchrotron Radiation Center(Note 4) and neutron sources at the Japan Proton Accelerator Research Complex,(Note 5) with the ambition of leveraging the results to achieve new material design.

On April 1, 2024, Menicon and Tohoku University will establish the Menicon × Tohoku University Co-creation Research Center(Note 6) for Miru Mirai on the Aobayama Campus of Tohoku University. Additionally, the Institute for Solid State Physics and the Synchrotron Radiation Collaborative Research Organization of University of Tokyo will commence operations in April 2024.

Future approach

Bringing together the deep knowledge and research expertise of Tohoku University and University of Tokyo and the contact lens experience and technology of Menicon, we aim to establish in this joint research a fundamental technology that transforms the industry in the design of new contact lens materials and recycling of plastic materials used for manufacturing and distribution of the contact lens materials using NanoTerasu and the Co-creation Research Center as research hubs.

Menicon has recognized the need to pursue truth from scientific viewpoints in manufacturing sites through studies that explore the structure–function relationship of contact lens materials by utilizing sources at quantum beam facilities in collaboration with academia. In addition to the facilities used thus far, with NanoTerasu assuming membership in the Coalition(Note 7), we expect to the utilize attractive, outstanding beamlines maintained at the facility to establish a system that drives industry–academia collaboration.

We have found at an early stage that subtle changes on the surface of contact lenses can be captured using spectra in the tender X-ray(Note 8) region and have further deepened our understanding of the performance mechanism of contact lenses. NanoTerasu, which is expected to provide excellent performance in the measurement of “polymer materials”, including contact lens materials, employs a high-intensity (bright) soft X-ray. Using this soft X-ray beam, we will gain a deeper understanding of the correlation between contact lenses and water, which is one of the major issues to be addressed to achieve comfort when wearing lenses.

Moreover, the construction of a digital twin for measurement and computation will be accelerated by not only performing traditional analysis-based research but also by fusing the precise actual measurements via the complementary use of quantum beams with computational science utilizing digital transformation as two wheels to achieve precise material design.

The amount of plastic containers used for the distribution of soft contact lenses is estimated to be approximately 40,000 tons per year. As the plastic materials for contact lenses represented by these containers are primarily used in medical devices, they undergo strict inspection measures to ensure the use of raw materials of high purity.

In addition, BRIDGE(Note 9) research conducted under the jurisdiction of the Ministry of the Environment has confirmed that the recyclable plastic materials are extremely resistant to quality deterioration by heat, light, and pressure during production. Therefore, efficient recycling of these materials will help establish a closed recycling system, which is expected to help meet the recent demand for CO_2 reduction.

In collaboration with the Circular Economy System Construction project team of the Cross-ministerial Strategic Innovation Promotion Program (SIP) through BRIDGE, we will make further efforts to establish a closed recycling technology for plastics used in the process of contact lens manufacturing and distribution. At the same time, we will strive to build a society-wide environment-conscious contact lens distribution system by promoting circular economy activities that recycle contact lens containers on the market.

We will make the best use of the Co-creation Research Center and NanoTerasu to promote research on the recycling of the plastics represented by contact lens containers.

[Overview of joint research]

1. Name: “Establishment of Fundamental Technology for Next-generation Contact Lenses

and Contact Lens Manufacturing and Distribution”

2. Representative researchers:
   Tomonaga Okabe, Professor of Tohoku University
   (Professor of the Department of Aerospace Engineering, Graduate School of Engineering, Tohoku University,
   Director of the Research Center for Green X-Tech, Green Goals Initiative)
   Yoshihisa Harada, Professor of The University of Tokyo
   (Professor of the Institute for Solid State Physics, Director of the Synchrotron Radiation Laboratory, Laser and Synchrotron Research Center,
   Director-General of the Synchrotron Radiation Collaborative Research Organization, The University of Tokyo,
   Visiting Professor of the International Center for Synchrotron Radiation Innovation Smart, Tohoku University)
   Eri Ito, Menicon Co., Ltd.
   (Director of the Menicon Future Device Laboratory,
   Specially Appointed Professor of Tohoku University)
3. Contract period: April 1, 2024 to March 31, 2027

[Notes]

Note 1. Research Center for Green X-Tech

The Research Center for Green X-Tech is an industry–academia co-creation and innovation hub that aims to solve social issues and business challenges related to the field of green technology through practical research using combinations of advanced technologies, including science, engineering, data science, and IT.

Note 2. NanoTerasu (Official name: 3GeV High-brilliance Synchrotron Radiation Facility)

NanoTerasu is a synchrotron radiation facility presently under construction on the Aobayama Campus of Tohoku University. At NanoTerasu, ultra-bright synchrotron radiation produced by an electron accelerator is applied to substances to visualize the ultrafine nanometer-scale world. It is expected to visualize nanostructures such as polymers composed of light elements.

Note 3. SPring-8 (the world’s largest synchrotron radiation facility)

Located in Harima Science Garden City in Hyogo Prefecture and owned by RIKEN, the SPring-8 facility generates the world’s highest-performance synchrotron radiation—a narrow and extremely powerful light that is obtained when the direction of electrons accelerated to close to the speed of light is bent using electromagnets. At SPring-8, research in a wide range of fields, including nanotechnology, biotechnology, and their industrial applications, has been carried out using the synchrotron radiation.

Note 4. Aichi Synchrotron Radiation Center

Managed by the Aichi Science & Technology Foundation, this synchrotron radiation facility commenced shared-use service on March 22, 2013 aiming to contribute to industrial development through its use by industry and academia as an advanced nanoscale measurement and analysis facility.

Note 5. Japan Proton Accelerator Research Complex (J-PARC)

This research complex promotes research to unravel the mysteries of the universe’s origin through studies that explore the origins of matter and life from the structure of atoms and molecules in substances as well as studies that investigate elementary particles and atomic nuclei. In particular, at the Material and Life Science Experimental Facility (MLF), high-intensity pulsed neutrons and muons are used for leading-edge research and development in various fields for purposes ranging from scientific elucidation to industrial application.

Note 6. Co-creation Research Center

Part of the system operated by Tohoku University, this academia–industry collaboration center is located on the university campus, enabling cross-departmental access to university teachers, findings, and facilities so as to drive a variety of collaborative activities, including planning and promotion of joint research, human resource development, and collaboration with university start-ups.
Website of the Head Office of Enterprise Partnerships, Tohoku University (Co-creation Research Center):https://www.rpip.tohoku.ac.jp/jp/information/kyoso_kenkyu/

Note 7. Coalition

A concept of a membership where members pay fees to join NanoTerasu and obtain the right to use the facility and receive services such as experiment and data analysis support from academic members.

Note 8. tender X-ray

Although not yet clearly defined, it is an X-ray with photon energy of 2-5 keV, which is between a soft X-ray and a hard X-ray.

Note 9. BRIDGE

A program in which the Cabinet Office's Council for Science, Technology and Innovation (CSTI) determines the "priority issues" based on science, technology, and innovation policy in order to guide innovative research and development measures of government ministries and agencies and drive initiatives, not only to promote research and development but also to solve social issues. The SIP Phase 3 "Circular Economy System Construction" is a project that aims to successfully create and expand an innovation ecosystem to ASEAN and other countries.

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