

# Viewing challenges as springboards for innovation

An ageing population and reduced government funding are two challenges to which Tokushima University is **FINDING INNOVATIVE SOLUTIONS**.



Indigo dyeing is a traditional craft in Tokushima that many older people practice. Three groups at Tokushima University are tackling the issue of ageing with a view to extending the healthy longevity of people.

**One in three people** in Tokushima prefecture was over 65 years old in 2019, according to Japanese government statistics. This gives the immediate context for the research that Tokushima University scientists are conducting into various aspects of ageing.

Located on Shikoku island in western Japan, Tokushima

University is aggressively pursuing innovation. Under the leadership of President Sumihare Noji, the university is implementing organizational reforms to support its researchers. "We've been enacting various internal reforms to better position ourselves to realize our mission of helping solve some of the world's most pressing problems," Noji says.

## Turning a crisis into an opportunity

The backdrop to Noji's resolve is a growing sense of crisis in Japanese academia. In recent years, Japan's national universities have been struggling to secure enough income because of government funding cuts. To offset the cuts, the government is calling for universities to become more competitive by boosting their external sources of revenue, but this requires radical changes. "Many universities in Japan are trapped in old ways of thinking and are finding it difficult to reform," says Noji. "And Tokushima University is no exception." To solve this problem, the university introduced innovative systems that apply ambidextrous management to a university setting; these systems promote education and research while simultaneously realizing social implementation. "If we don't come up with unique ways to secure new research funding, we won't be able to fulfill our mission," Noji explains.

## Building on strengths

The university is actively building on its scientific strengths, particularly those in the fields of photonics and medicine. Tokushima University is the alma mater of Shuji Nakamura, who was jointly awarded the 2014 Nobel prize in physics for inventing the blue light-emitting diode (LED). Advancing this proud tradition, the university's Institute of Post-LED Photonics is developing new applications of light for communications and medicine.

In addition, researchers at the university's Institute of Advanced Medical Sciences are developing treatments for intractable diseases and chronic diseases based on their collective expertise in the molecular functions of enzymes and other key proteins. Other outstanding work is being

done by researchers at the Bio-Innovation Research Center, who are developing novel biomedical technologies to ensure the sustainable growth of society.

## Innovating in research clusters

As part of its efforts to create an innovative environment, the university has established a system of 60 clusters of researchers in various disciplines. "This cluster system provides a novel framework that enables researchers to focus on their research," explains Takuya Sasaki, vice president for research at Tokushima University. The system encourages researchers to identify curiosity-driven research seeds that might otherwise be overlooked. Many of these seeds go on to attract competitive grants and collaborations with industrial partners.

One example of a successful seed is fusion research involving optical engineering and medical science, which has become one of the university's flagship research projects. By combining advanced optical and diagnostic probe technologies, the team has recently developed a technology that can easily and rapidly detect SARS-CoV-2, the virus that causes COVID-19.

The research cluster system also helps to foster young researchers. As a result, the university was awarded two government-funded projects this year for encouraging doctoral students to attempt ambitious and interdisciplinary projects and to grow as future innovators.

## Tackling the problem of ageing

As Japan is ageing faster than any other country, Tokushima University is focusing on ageing research to extend people's healthy longevity. Three clusters are tackling different aspects of ageing.

Yoshihiro Uto, a medicinal chemist at the Graduate School

of Technology, Industrial and Social Sciences, has developed nanotechnologies that aim to aid the regeneration and activation of ageing skin cells. He is collaborating with venture company Saint Clair, which has its headquarters in Tokyo and is headed by CEO Kaori Kunikata, to research and develop highly functional cosmetics based on scientific evidence.

Ken-ichi Aihara of the Graduate School of Biomedical Sciences, who specializes in diabetes, endocrinology and metabolism, is heading a research cluster that is seeking to elucidate how chronic inflammation induces ageing and lifestyle-

at the Graduate School of Biomedical Sciences, is looking into multi-organ linkages that regulate phosphorus and mineral metabolism. Using a knockout mouse lacking a gene to express Klotho, a protein associated with the suppression of ageing, the team found a possible link between premature lesions such as cardiac hypertrophy, vascular calcification and bone loss and the disruption of the phosphorus and mineral metabolism of the tissue-organ system. Treating Klotho-deficient mice with a low-phosphorus diet extended their lifespans, indicating the possibility of controlling ageing by regulating phosphorus metabolism.

collaboration at Tokushima University.

To meet such growing demands, Tokushima University became Japan's first national university in 2016 to run a crowdfunding scheme to support both university projects and local and municipal projects that contribute to society. No other university has independently launched similar initiatives.

As of September 2021, the crowdfunding scheme has raised 125 million yen for 93 projects, including 70 million yen for the university's 39 projects. For example, one project, which received more than 9 million yen, will help disseminate an innovative surgical method to treat scoliosis under local anesthesia by using a very thin, next-generation endoscope.

In 2018, Tokushima University established the Industry-University R&D Startup Leading Institute (INDUSTAL) to swiftly commercialize research outcomes. INDUSTAL provides strong support to researchers so that they can focus on their research. This support includes negotiating with companies wanting to collaborate with them, helping them register their intellectual property, and providing funding to establish startups.

"INDUSTAL has transformed the way the university collaborates with industry," says Yoshida. "In the past, collaborations used to be one-time, small-scale projects such as joint research between individual researchers and companies, but many projects have now evolved into ongoing inter-organizational collaborations with a view to realizing social implementation."

INDUSTAL actively promotes entrepreneurship, and students have launched three start-ups. The university has established about 30 start-ups, which include ones that are developing

gene-editing technologies, producing edible crickets as a next-generation protein source, and conducting measurement-based research using advanced laser and plasma technologies. In 2020, Tokushima University received 140 million yen (roughly US\$1.23 million) in patent revenues – a record for the university.

**"WE WILL KEEP STRIVING TO FOSTER GLOBAL LEADERS THROUGH COLLABORATIONS"**

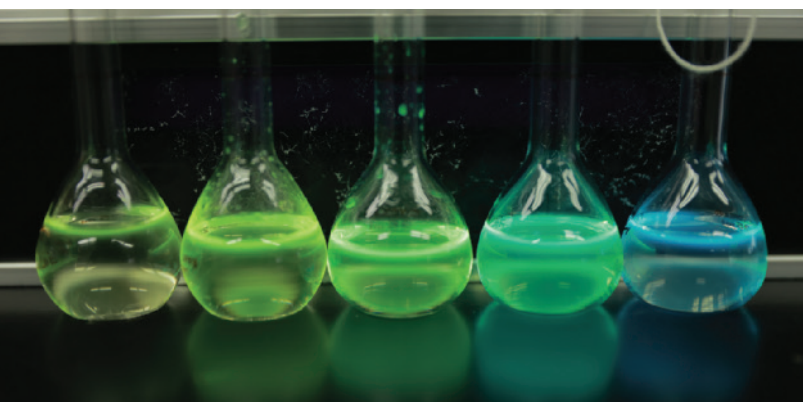
#### A global vision

Tokushima University's endeavours to support research extend overseas, and it has forged international collaborative agreements with 99 research institutes and universities in 30 countries. The most recent one is the establishment of the Tokushima International Science Institute in collaboration with Technion-Israel Institute of Technology and Nichia Corporation, a world-leading developer of LED technologies. Tokushima University aims to foster world-class researchers and engineers in various fields. The university will also offer scholarships to attract excellent international students and researchers.

While much progress has been made, Tokushima University is committed to pursuing further reforms, Noji says. "We will keep striving to foster global leaders through collaborations and researcher exchanges and address key solutions to ensure global sustainable development." ■



**Tokushima University**



Photoluminescence from organic molecules in solution. A group at the Institute of Post-LED Photonics is developing photofunctional organic materials based on  $\pi$ -conjugate systems that show photoluminescence. (Photograph courtesy of Associate Professor Fumitoshi Yagishita.)

related diseases. Using animal models and clinical samples, the team is identifying molecules that are common to chronic inflammation and ageing. They will investigate risk factors for the development of nonalcoholic fatty liver disease, diabetes-related complications and frailty in diabetic patients. The researchers are also analyzing the effects of bariatric surgery at clinical and molecular levels while pursuing the clinical application of adipose-derived stem cells.

With the ultimate goal of controlling ageing and extending healthy life, a cluster led by Hiroko Segawa, a nutritionist

#### Going after alternative funding sources

With diminishing funding from the government, universities are under increased pressure to improve their management efficiency, acquire more external funds and collaborate with industry. "In recent years, not only the national government but companies and regional municipalities are calling for universities to develop more start-ups and new industries and strengthen their roles as intellectual centres to solve social and regional problems," says Kazufumi Yoshida, vice president for industry-academia