



THE NEW FUNDAMENTALS: MEDICAL INFORMATICS

Emerging smart tools are helping prevent disease onset and progression. The medical informatics hub at **NAGOYA UNIVERSITY** is training specialists that will drive life-saving developments.

“Some smart systems working on x-ray imaging for cancer have reached a point where artificial intelligence is more reliable than human judgment,” says Professor Kinji Ohno of Nagoya University Graduate School of Medicine. In this way, medical informatics are rapidly transforming diagnostics, he notes. “Another area where we see some of the most marked transformations is surgical guidance.”

Here, Nagoya’s recent research is making a mark. In collaboration with imaging giant, Olympus, and Professor Kensaku Mori at Nagoya University, a variety of surgical navigation systems are being developed. One is the ‘virtual endoscope’, which constructs accurate 3D virtual renders

from CT and MRI scans to help guide precision biopsies. “With endoscope cameras, you get a view of the stomach’s linings. The virtual endoscope gives you an additional view of what would be behind that duct wall, as though the wall became transparent. It gives guidance on where exactly to do a biopsy for tissue samples,” explains Ohno.

THE VIRTUAL ENDOSCOPE GIVES YOU AN ADDITIONAL VIEW OF WHAT WOULD BE BEHIND THAT DUCT WALL, AS THOUGH THE WALL BECAME TRANSPARENT

In 2019 the team also brought to market an endoscope-scan artificial intelligence (AI) software that helps determine, in real time, the likelihood of a tumour being cancerous. The aim is to improve biopsy targeting, and the early diagnosis of colon cancer, by sorting through the many benign polyps that coexist with cancerous ones.

New course in personalized preventative medicine

Ohno has a unique mix of expertise; both a neurologist and computer programmer, his research interests include developing informatics tools in medicine. “A lot of researchers from across Japan reach out to me when they have a project

at the crossroads of medicine and informatics. They find it difficult to envision how to work together, since they basically speak completely different languages.”

That must change, says Professor Kenji Kadomatsu, Dean of the Graduate School of Medicine. “Society is asking us to innovate in a way that demands sophisticated informatics; even common research methods in medicine, such as cohort studies, would become weak without them,” he observes.

Kadomatsu’s vision is “to cultivate solid literacy in informatics for medicine graduates so that they become good algorithm users. There are so many useful algorithms

SMART SYSTEMS

NAGOYA UNIVERSITY adds medical informatics facilities and programmes to support its already significant cancer research.

NO. 93
globally in the 2019
Nature Index annual tables

NO. 5
in the Nature Index’s
Japan 2019 list

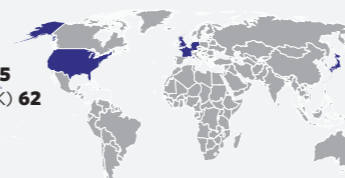
CANCER ARTICLES
per year on Dimensions

2015	448
2016	463
2017	460
2018	521
2019	544

TOP 5 COLLABORATING COUNTRIES

by number of collaborating institutions (2015–2018)

1. Japan **149**
2. United States of America (USA) **95**
3. United Kingdom (UK) **62**
4. France **49**
5. Germany **39**



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out there that researchers in medicine just aren’t familiar with,” he says. “We need more people like Ohno, with both wet and dry lab skills.”

In 2019, Nagoya University obtained a grant from the government as part of an initiative to establish world-class PhD programs that draw on each university’s area of strength. Nagoya University’s new programme, the Convolution of Informatics and Biomedical Sciences on Glocal Alliances (CIBoG), aims to train experts who take personalized treatment to the next level, to achieve personalized preventative medicine. A major research pillar at CIBoG is using big data to look at indicators before the onset of disease.

Personalized prevention

Kadomatsu points out that personalized prevention is key to sustainable healthcare in Japan, as its super-ageing society will see surging numbers of patients with cancer and other age-associated diseases. “Graduates will not only contribute to basic

and clinical sciences, but also holistically to town planning and policy through the likes of personalized health records and smart hospitals,” he predicts. Nagoya partners with local institutions on research to tackle these issues, including the National Center for Geriatrics and Gerontology, Aichi Cancer Center and the Aichi Developmental Disability Center.

The two professors believe that strong research is the core foundation for quality education. In January 2020, the Graduate School of Medicine built a new research hub as part of CIBoG. Named the Center for 5D Cell Dynamics (C5CD), the centre brings researchers in medicine, molecular biology, and mathematical sciences under one roof.

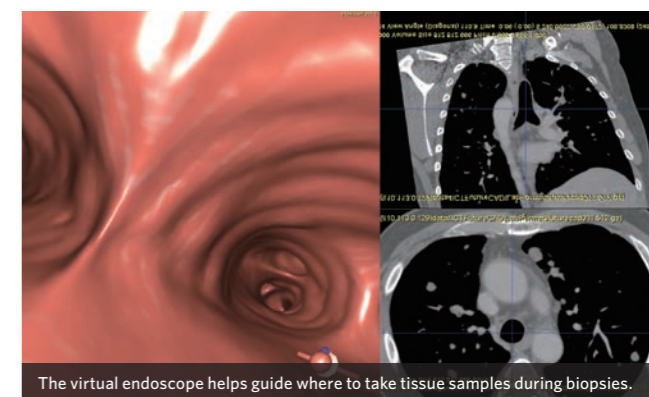
“With recent advances in computational science like sequencing, omics techniques, imaging, text mining, and AI, it’s becoming possible to understand life as a system of cells, and to build a mathematical model of its dynamics,” says Kadomatsu.



Nagoya’s Graduate School of Medicine.



CIBoG students learning at the Center for 5D Cell Dynamics.



The virtual endoscope helps guide where to take tissue samples during biopsies.

“At C5CD, we’re trying to gain a deeper understanding of molecular networks at the single-cell and single-molecule level, over space and time.” Eventually, they hope modelling early disease mechanisms will give researchers the means to predict and prevent progression.

In addition, the university is expanding its horizons through international partnerships in education. “We took the first initiative in Japan in 2015 to offer a joint-degree program,” says Kadomatsu. “Currently we offer joint degrees with universities in Australia, Sweden, and Germany. It’s quite challenging since students must pass the standards of both universities to obtain a PhD — but it’s a very rare opportunity.”

He adds that Graduate School of Medicine is a part of an international alliance named the Global Alliance of Medical Excellence (GAME), where nine medical schools based in Hong Kong, Japan, Korea, Australia, Germany, the Netherlands, Italy, United Kingdom and Canada collaborate on research and

education. Nagoya is currently leading a GAME collaboration looking for early detection symptoms and biomarkers on a common form of dementia called Lewy body disease.

With the 150th anniversary of the Graduate School of Medicine fast approaching in 2021, Kadomatsu points out that, “adding in the personalization aspect to preventative medicine is our way of contributing to the future. Informatics, and its education, are a definite must to take us there.” ■



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