

FOCAL POINT ON BIOTECHNOLOGY IN OSAKA

A MELTING POT FOR FUTURE BIOTECHNOLOGIES

Boasting a high concentration of medical research facilities and pharma companies, Osaka is ideally situated to **INCUBATE AND DEVELOP EMERGING BIOMEDICAL TECHNOLOGIES.**

It's no secret that Japan is investing heavily in the field of regenerative medicine, with the government pouring hundreds of millions of dollars into research on how stem cells could be used to treat diseased organs. What is less well known is that much of that research is concentrated in the city of Osaka and the surrounding region.

For example, a group led by Kohji Nishida at Osaka University is considering the use of induced pluripotent stem (iPS) cells — mature cells genetically reprogrammed into an embryonic-like state that can then develop into any cell type — to repair damaged corneas. Led by cardiac surgeon Yoshiaki Sawa, another Osaka University group is hoping to use iPS cells to produce heart-muscle cells for treating cardiac failure.

The enthusiasm in Japan for regenerative medicine is hardly surprising given that Shinya Yamanaka of Kyoto University was awarded a Nobel Prize in 2012 for discovering how to make iPS cells. But its concentration in Osaka also owes a lot to local government policy designed to create a conducive environment for innovation in biotechnology and health sciences.

"Our vision is to form a global centre for future medicine at Osaka with regenerative medicine at its core," says Hirofumi Yoshimura, the governor of Osaka Prefecture. This vision is shared by Shizuo Akira, the president of Senri Life Science Foundation: "We hope that regenerative medicine using iPS cells will lead to new treatment strategies

**CULTIVATING NEW BIOTECHNOLOGIES**

A high concentration of research centres, universities and pharmaceutical companies make Osaka an attractive place for innovation in emerging medical technologies such as regenerative medicine.

1

The Kansai region, which consists of Osaka and five neighbouring prefectures, accounts for **ABOUT 30% OF JAPAN'S PHARMACEUTICAL INDUSTRIES.**



2

More than 300 pharmaceutical companies are **BASED IN OSAKA CITY.**



for various diseases that currently lack effective treatments."

ADVANCING IMMUNOLOGY

While regenerative medicine will feature prominently in this global hub for biotechnology, it's not the only emerging area in the spotlight. "We hope that further development of the fields of infectious diseases and immunology, in which the region around Osaka has made outstanding achievements to date, will lead to the development of treatments for various inflammatory diseases and autoimmune diseases, as well as cancer immunotherapy," adds Akira, who is both a highly cited researcher in immunology and is the president of Osaka Bio Headquarters.

This field also has a strong connection with the Osaka region. Tasuku Honjo of Kyoto University was awarded the 2018 Nobel Prize in Physiology or Medicine for his discovery of programmed cell death 1 (PD-1), an inhibitory immune checkpoint receptor that is a key component of programmed death signaling. Honjo showed that inhibiting PD-1 can assist cancer treatment, and cancer immunotherapy using anti-PD-1 has now been approved in the US, European Union and Japan. This discovery has catalysed research into immunotherapy, and its significance has been compared to the impact of penicillin's discovery.

THREE PILLARS

What makes Osaka so conducive to biotechnology research is the concentration of biomedical facilities in a small area, according to Yoshimura. "In addition, to Osaka University, Osaka is home to such outstanding research institutions as the National Institute of Biomedical Innovation and the National Cerebral and Cardiovascular Center (NCVC)," he says.

Three recent initiatives promise to make Osaka an even more attractive place for biomedical research and development. In north Osaka, there is Saito, a centre for drug discovery, and Kita Osaka Health and Medical

City (Kento), a center for innovation and practice in health and medicine. Finally, the International Center for Future Medical Care, centered on regenerative medicine, is scheduled to open in the spring of 2024 in Nakanoshima, in central Osaka.

"We believe that this concentration of diverse players in Osaka, centered on these three centres, will spawn innovations that require speed and precision," says Yoshimura. "By forming these three distinctive biotechnology clusters, the Osaka prefectural government is promoting collaboration between industry, government and academia," adds Kinya Otsu, the President of NCVC, Kento's core institution.

Osaka's dominance in Western medicine has a long history, predating Japan's official opening up to the West in the 1850s. Osaka University, for example, can be traced back to a private medical school established in 1838 to teach medicine that Dutch emissaries brought to Japan. "Osaka's historically strong background in pharmaceuticals continues today," says Otsu. "The Doshomachi area in Osaka has been home to a concentration of medical enterprises since the mid-Edo period, some 300 years ago."

COLLABORATIVE SPIRIT

This historically high concentration of medical facilities has been attracting commercial operators for a long time. "Many Japanese pharmaceutical companies originated in Osaka, including Takeda, Astellas Pharma, Shionogi, Sumitomo Pharma, Mitsubishi Tanabe Pharma, and Ono Pharmaceutical, and they still have bases here today," says Otsu. "As a result, major global pharmaceutical companies and medical equipment manufacturers have established operations in Osaka and its surrounds, and many start-ups in the life science field have been born in the region."

It's not just pharmaceutical companies that are found in Osaka. "There's a full range of supporting industries, including chemical, machinery, metal, and other

3

Regarded as the founder of modern medicine in Japan, Ogata Koan introduced a smallpox vaccine to the country and **ESTABLISHED A PRIVATE SCHOOL** that developed into Osaka University School of Medicine.





Ryuichi Morishita is an endowed chair professor at **OSAKA UNIVERSITY**.

“Osaka has a long history of collaboration between industry and academia.”

manufacturing industries that support pharmaceutical-related industries, medical device industries, and other life-science-related industries,” says Yoshimura. “These are concentrated within a radius of approximately 20 kilometres from the city centre.”

A key factor to Osaka’s success in biotechnology is the collaboration between academia and industry, according to Akira. “The headquarters of many pharmaceutical companies are located in the city, making it an ideal environment for collaboration,” he says. He notes that Osaka University entered into a comprehensive collaboration agreement with Chugai Pharmaceutical Company in 2016 — the first of its kind in Japan.

“Under this new collaboration system, university researchers regularly disclose the results of their research to the company before making them public, accelerating the discovery of new drugs,” explains Akira. “This is the first time that a university in Japan has entered into an agreement with a pharmaceutical company. Subsequently, other universities have followed suit by establishing similar agreements.”

This close relationship between academia and industry goes back a long way and is special to Osaka, according to Ryuichi Morishita, an endowed chair professor at Osaka University. “Osaka has a long history of collaboration between industry and academia,” he says. “I think this

kind of atmosphere is unique in Asia, and makes Osaka very attractive for biotech researchers.”

A TASTE OF THE FUTURE

In 2025, Osaka will host the World Expo. It will provide the city with the perfect platform to showcase its vision for the future of biotechnology. In particular, the prefectural government will have a pavilion devoted to healthcare. “The Osaka Healthcare Pavilion will give the public a taste of what medical care in Osaka in 2050 might be like,” says Morishita, who is also general producer for the Expo Osaka Healthcare Pavilion.

“Visitors to the pavilion can be scanned by various sensing devices, which will measure various, ‘ageing clocks’, including blood vessels, skin, heart and hormones,” Morishita explains. “Then they will receive AI-generated recommendations regarding their diet and lifestyle. We believe such hassle-free health measurements and recommendations will help prolong lives and promote wellbeing.”

The pavilion will help to promote a vision for the future of medical research and development that Osaka will play a prominent role in. “Osaka as a whole offers a favourable environment for life science and biotechnology research and development,” says Otsu. “And we expect the wider region to grow into a world-class life science cluster in the future.” ■

4

Shinya Yamanaka, who was awarded a Nobel Prize in 2012 for his work on stem cells, **WAS BORN, LIVED AND WORKED IN OSAKA.**



5

About 28 million visitors are projected to visit Expo 2025 Osaka — roughly **10 TIMES THE POPULATION OF OSAKA CITY.**

