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Dr Fu-Tong Liu, vice president of Academia Sinica, introduces the institution and its research mission of promoting basic research and enhancing translation. Dr Liu goes on to describe Academia Sinicaâ??s biomedical research environment and also highlights the new National Biotechnology Research Park which will have a vital role in developing Taiwanâ??s biomedical

industry and innovation ecosystem.

Please begin by introducing Academia Sinica and its research mission.

Academia Sinica was founded in China in 1928 to promote and undertake scholarly research in the sciences and humanities. After the Republic of Chinaâ??s government moved to Taiwan in 1949, Academia Sinica was reestablished in Taipei. The institute promotes the internal integration of research activities in its three divisions: mathematics and physical sciences, life sciences, and humanities and social sciences. Altogether, we have 31 institutes or centres within Academia Sinica. The organization has over 9000 employees in total and about 900 principal investigators.

Our primary mission is to conduct fundamental research, but we encourage our PIâ??s to address societal needs through their research and also consider translating their research into industrial or clinical applications.

We also have a mission to attract and cultivate young talents. To clarify, we do not offer degrees but through our joint-degree programs and university partnerships, students can receive training here at Academia Sinica. We also have postdoctoral fellows participating in our research. Additionally, we have established the Taiwan International Graduate Program (TIGP), which covers over twelve subjects such as molecular medicine and neuroscience â?? each of which has its own university partner.

Another mission is to direct, coordinate and promote research activities to raise the academic standard in Taiwan.

After spending 30 years in the US, you returned to Taiwan to join Academia Sinica. As a scientist, what motivated you to come back and help lead such a prestigious institution?

Throughout the 30 years that I spent in the US, I often thought about coming back and contributing to Taiwanâ??s research environment but finding the right timing was typically a challenge. During this time, I saw the environment improving and becoming more competitive. Eventually, I got more involved by reviewing aspects like grants and university programs where I became more familiar and impressed with the research being done in the country. Finally, during my time at UC Davis, I was fortunate to obtain a position as a distinguished fellow and director at the Institute of Biomedical Sciences (IBMS) in Academia Sinica, which prompted my return to Taiwan.

As a scientist with a long career overseas, what do you see as the role of Taiwan in contributing to todayâ??s innovation environment?

In general, the fields of science and technology are quickly growing in Asia. In Taiwan, the resources, facilities, and talent in biomedical and biotechnology research have grown quickly. In my time, many of my peers left the region to go study and make their career in the US. Today most of the talent is staying within the region instead of going abroad like in the past. All of these factors combined, it is very evident that the biomedical and biotechnology research community in Asia and Taiwan is experiencing a phase of enhanced growth.

In your view, do scientists and scientific teams in this part of the world have a different approach to their work?

Looking at the similarities, many professors are coming back from the US and Europe, and Academia Sinica is not an exception to this phenomenon. For this reason, there are increasing similarities between our research environments as our scientists bring back their experience. Additionally, our research review systems and concept of core facilities are adopted internationally from countries like the US and UK.

On the other hand, the differences exist more on the level of the individual researchers, for example, methodology and how extensively they collaborate. This is not necessarily good or bad just a question of culture. There is also a difference in the scale of projects which is a matter of funding since some other more advanced countries have larger budgets.

From the outside view, Academia Sinicaâ??s president James Liao seems to be on a mission to revitalize fundamental research as the grassroots of Taiwan. How does Academia Sinica manage to balance this two-sided approach to application and basic research?

President Liaoâ??s vision for how Academia Sinica pursues science is represented by the Chinese characters â?? é??å¿? (Ambition), å?? (Responsibility), æ?º (Wisdom)â?•. We continue to emphasize the importance of fundamental research. While translation might be key in creating societal impact, basic research is the essential foundation of innovation. Basic research may not be something that you can feel every day in ordinary life, but it does shape our lives imperceptibly in the long term.

What role does biomedical research have within Academia Sinicaâ??s organization and what objectives do you have for the research field?

Biomedical research is relatively new to Academia Sinica as previously we had more traditional life sciences areas such as animal science and biology. The foundation of the Institute of Biomedical Science in 1981 marked recognition of the importance of biomedical sciences and we have reached a point in society where science can be related to the treatment of diseases. So, the biomedical field has been an increasingly important area for Academia Sinica in our recent history and we continue to see growth in the area.

An enhanced biomedical research ecosystem has also been the vision of the government as well. For example, Taiwanâ??s National Research Program in Genomic Medicine (NRPGM) was the first initiative taken by the government to boost the biomedical research field. This was followed by the National Research Program for Biopharmaceuticals (NRBP) which went on for six years. Academia Sinica has played a significant role in both of these programs to the extent that our previous vice president who is now the vice president of Taiwan, Chien-jen Chen, was the overall director of the NRBP. Past this era, Academia Sinica is still very involved in driving Taiwanâ??s biomedical research environment and several programs still exist to coordinate several principal investigators working together as a common effort.

Last year the National Biotech Research Park opened for operation after more than a decade of development and an investment of NT$22.5 billion. Please introduce the park to our

international readers.

The National Biotechnology Research Park was planned in the era of the Taiwan Biotechnology Takeoff Diamond Action Plan, during which the NRPGM was also being conducted. The land that was once used to house the Ministry of National Defenseâ??s 202nd Arsenal in was designated as the parkâ??s site and the construction project was launched in 2007. However, due to several different obstacles, it was not until 2014 that the parkâ??s construction began. This is the first cross-ministry research-driven biopark supported by the government for clustering and promoting Taiwan biotech industry. The organizations residing in the Park include Development Center for Biotechnology (affiliated with Ministry of Economic Affairs), Taiwan Food & Drug Administration (affiliated with Ministry of Health and Welfare), National Animal Laboratory Center (affiliated with Ministry of Science and Education), and Academia Sinica. Academia Sinica oversees the operations of the Translational Medicine Center, Thematic Core Center, Bioinformatics Center, and Innovation Incubation Center. With the five missions in Translation, Innovation, Incubation, Global Connect, and Sustainability, NBRP was inaugurated in October 2018. NBRP will facilitate the growth of innovative biotech companies in Taiwan and expansion of the collaborations with international Pharma.

Considering Taiwanâ??s existing Northern, Central, and Southern science parks, what was the need for yet another park in Taiwanâ??s bio network?

As you can see from its name, National Biotechnology Research Park, we are putting an emphasis on biotechnology and research-driven aspects. Additionally, if there are any bio organizations in other parks, they will likely be related to information and communications technology and medical devices, rather than biomedical or biopharmaceuticals. These biotechs are also more in the post-discovery phase working on product development or commercialization.

How will Academia Sinica and the National Biotechnology Research Park build the connection from fundamental to applied research all the way down to commercialization?

Academia Sinica cannot start a company itself but we have seen our research spin-out and reach commercialization, so we are quite familiar with IP and technology transfers. In fact, our success in translation has led Academia Sinica to be in charge to the Innovation Incubation Center â?? one of the key features of the park, in collaboration with Ministry of Economic Affairs (specifically, BPIPO (Biotechnology and Pharmaceutical Industries Promotion Office) and BMCC (Biomedical Commercialization Center). Academia Sinica has already been administering an incubation center in the Nangang Software Park, which has about ten companies, all of which started with technology from Academia Sinica. As an extension of this concept, we are aiming to further facilitate translation and increase our contribution to the biotech development of Taiwan.

Another important aspect is to create a strong translational environment which is why organizations like DCB and the TFDA are also in the park. Having the National Laboratory Animal Center and Thematic Core Center here is a strategy for establishing a centralized core facility infrastructure.

What incentives are you offering for companies to establish operations in the National Biotechnology Research Park?

Companies will have access to all the core facilities in one location at the National Biotechnology Research Park. This way there is no need to contract out for R&D services which would be necessary to do in other parks which are not specialized in biotech and biomedical research. Additionally, the environment that we are building at the park will be very conducive for building a strong collaborative innovation network. The park will regularly organize activities for networking, education, entrepreneurship, regulatory discussion, and knowledge exchange â?? all happening quarterly, semi-annually, and annually. These activities could be lectures and presentations by the TFDA, DCB, MOHW, etc. just to give a few examples.

Another essential factor for new drug development is the opportunity for researchers and physicians to come together and collaborate. Understanding the unmet medical needs is key to developing impactful drugs which can benefit patients. Furthermore, once the products have been developed this connectivity will help facilitate clinical trials. Our vision is to create this platform to build this crucial relationship.

With all these features, my hope for the National Biotechnology Research Park is for the biomedical sector to recognize the park as a unique pillar in Taiwanâ??s research system where innovation can flourish.

In the high-value field of innovation, securing a strong talent supply chain is critical. How is Academia Sinica preparing to cultivate Taiwanâ??s next generation of scientists and KOLs?

Many students and postdoctoral fellows worry about their career will be after their studies. At Academia Sinica there are always research projects where these young scientists can find opportunities to get involved. They are even encouraged to take own projects to NBRP for further development. Recent post-doctorate graduates have a chance to become principal investigators and even if their projects are very fundamental, by joining forums and taking part in the discussions happening at the park they may find a way in which their research can be applied that they had not considered before.

Brain drain is often regarded as the hidden dangers of the innovation environment in smaller markets. How do you see this phenomenon affecting Taiwanâ??s competitiveness in research and entrepreneurship?

As a matter of fact, I do not see this as a major issue for Taiwan. In reality, there has been more brain retainment in Taiwan than never. During my time, much of Taiwanâ??s young talent went overseas to countries like the UK or the US to study or find a career. Today, a majority of college students and post-graduate students chose to stay here in Taiwan. Moreover, even the scientists and doctors from my generation who left Taiwan are coming back in the same way that I did. While working in institutions like the IBMS, I have seen that many talented scientists return from their post-doctorate fellowships from overseas to bring their newly acquired knowledge back to Taiwan. This makes me very optimistic about the future of Taiwanâ??s innovation environment. As more biotechnology companies are established domestically, there will be even greater opportunities to accommodate Taiwanâ??s strong pool of talent.

Looking outside of Taiwan, how does Academia Sinica build international collaborations as a world-class research institute?

Academia Sinica has developed an extensive network of partnerships with over 410 top research institutions and universities among 44 countries around the world . Recent examples in the biomedical field include an MOU that we have signed with the Canadian Glycomics Network (GlycoNet) and with Tohoku Medical and Pharmaceutical University, Japan, both to advance research in glycoscience. Related to this, we have held International Symposia on Frontiers in Glycoscience in collaboration with Canada and Australia.

The traditional relationship between Taiwan and Japan has been growing strongly as well. We have been collaborating with Kyoto University, the leading university in Japan with the most Nobel Prize-winning faculty in Japan, in the field of biomedical research. Kyoto encourages its investigators to identify top institutions where they can set up â??on-site laboratoriesâ?•. We are excited to welcome a faculty from one of Kyoto Universityâ??s Institutes (Institute for Integrated Cell-Material Interface) to come to Academia Sinica to establish his â??on-site labâ?•.

In the US, we have collaborations with top universities like Stanford, UC San Diego, UC San Francisco, and UC Davis. For example, Academia Sinica has recently inked an MOU with UC San Francisco for the development of precision medicine.

Finally, we have been regularly hosting international conferences or symposia that rotate through different countries, including the 15th Human Proteome Organization (HUPO) World Congress in 2016. We will host the 26th International Congress in Glycoconjugates in 2021. Recently, we hosted a Keystone Symposium on Innate Immune Receptors, with participants from 22 countries. Most recently, Academia Sinica co-sponsored several events with the National Biotechnology Research Park at the recent BioAsia â?? Taiwan convention. Together, we inked two memorandums of understanding with Japanâ??s Shonan Health Innovation Park and the U.K.â??s AstraZeneca PLC at this yearâ??s event.

What vision does Academia Sinica have for the future of Taiwanâ??s biotech sector?

Academia Sinicaâ??s vision is to complete our governmentâ??s mission in development of the biotechnology industry by completing the development and implementation of the National Biotechnology Research Park. We want to facilitate the growth of biomedical research and incentivize applied research by seeing increased flexibility when it comes to translation. The whole country along with Academia Sinica needs to work together to achieve this goal. Through collaboration with stakeholders such as physicians, the existing biotech industry, and the new generation of talent we will cultivate the future of Taiwanâ??s biomedical sector.

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