Kobe University Global-Link Forum in Taipei

-Event Report-

報告書

2015 **December 3-4 in *Taipei***

巻頭言

神戸大学グローバルリンク・フォーラムは、国際的な知的情報リソースである海外同窓会ネットワーク及び海外協定機関との積極的な連携を通し、本学の教育研究活動を促進し、神戸大学ブランドを世界に発信することを目的としています。2011 年に、第 1 回をタイ・バンコクで開催したのを皮切りに、第 2 回は韓国・ソウル、第 3 回は中国・北京、第 4 回はベトナム・ホーチミン及びハノイ、第 5 回はマレーシア・クアラルンプールで開催し、今回で6回目を迎えました。

今回のフォーラムでは、国立台湾大学及び台湾神戸大学同窓会との共催、台北医学大学及び公益財団法人交流協会台北事務所のご後援をいただき、実現に至りました。そして、中華民国教育部、公益財団法人交流協会台北事務所、台湾神戸大学同窓会からご祝辞を賜り、御礼申し上げます。

また、国立台湾大学の Ching-Ray Chang 副学長の基調講演、さらには、国立台湾大学、台北医学大学、台湾経済研究院、中原大学から第一線で活躍しておられる著名な先生方にご講演を賜り、重ねて御礼申し上げます。

現在、本学で学ぶ留学生は 1,100 人を超え、そのうち台湾からの留学生は 26 人を数えます。

本学は台湾との研究交流も活発に行なっており、昨年度は 89 名の研究者を台湾に派遣し、台湾からは 14 名の研究者を受入れました。

近年のアジア経済の著しい発展に伴い、日本と台湾の間での協力関係がより一層重要度を増す中、今回のフォーラムにおいては、「日台関係の再認識－科学技術イノベーションにおける協力－」をテーマに、1 日目は人文・人間科学系と社会科学系、2 日目は生命・医学系と自然科学系のフォーラムを開催し、日台両国の専門家がそれぞれの立場から現状と課題を報告し、議論を行います。

神戸大学は、教育研究両面において、今後さらに、台湾の教育研究機関との連携を強化し、共に卓越した研究成果を創出していくとともに、本フォーラムにもご参加いただいた本学の卒業生のように世界で活躍する指導的人材を共に養成して参りたいと存じますので、今後もご協力のほどよろしくお願い申し上げます。

神戸大学長　武田　廣

Preface

This Forum aims to promote our education and research activities and the Kobe University Brand overseas by forming stronger links with overseas academic associations and the International Alumni Association Network, which provides an invaluable repository of knowledge for the University. We held the first Kobe University Global-Link Forum in Bangkok, Thailand in 2011. After the successful launch of KUGL, Kobe University held the second forum in Seoul, South Korea, the third forum in Beijing, China, the fourth forum in Ho Chi Minh City and Hanoi, Vietnam, and the fifth in Kuala Lumpur in Malaysia. This is now the sixth KUGL forum.

This Forum could not be held without the cooperation of our co-hosts, National Taiwan University and the Kobe University Alumni Association in Taiwan, and the support of Taipei Medical University and the Taipei Office, Japan Interchange Association. I would like to express my appreciation for the congratulatory messages from the Taiwan Ministry of Education, the Taipei Office, Japan Interchange Association, and the Kobe University Alumni Association in Taiwan. I would also like to express my gratitude to the Executive Vice President of National Taiwan University Ching-Ray Chang for his keynote speech, and to the other eminent professors who are speaking at this Forum from

National Taiwan University, Taipei Medical University, Taiwan Institute of Economic Research, and Chung Yuan University. Our speakers are celebrated professors who stand at the top of their fields, and it is an honor to have them with us.

Currently over 1,100 international students are studying at Kobe University, including 26 students from Taiwan. Our University is also actively engaged in collaborative research with Taiwan: last year 89 researchers travelled to Taiwan, and 14 researchers from Taiwan visited Kobe University.

With the recent rapid economic development in Asia, deepening cooperative relations between Taiwan and Japan is more important than ever. This year's Forum theme is "Re-realizing the Relationship with Taiwan and Japan: Cooperation in Science, Technology and Innovation." Experts from Japan and Taiwan will present their insights on contemporary issues, focusing on humanities and social sciences on the first day, and medicine and natural sciences on the second day.

Kobe University will continue to strengthen its education and research alliances with Taiwanese institutions, working together to yield excellent research results and foster human resources who can take on international leadership roles, just like the talented alumni gathered at this forum. I look forward to your continued enthusiastic support in these international partnerships.

TAKEDA Hiroshi, President of Kobe University

Programme

December 3-4 2015

Kobe Global-Link Forum in Taipei

【Opening Session】

【New Orientations in the Humanities and Social Sciences in East Asia】

・Humanities

・Social Sciences

【Advanced Research of Emerging and Reemerging Diseases in Asia】

【Advanced Membrane Technology Contributions to Resolving Energy and Environmental Issues】

Closing Remarks

Hiroshi Takeda	President, Kobe University

【Kobe University Alumni Networking in Taipei】

Opening Remarks

Professor Dr. Noriyuki Inoue
Executive Vice President, Kobe University

Good afternoon Your Excellency, Mr. Guan-chau Huang, Deputy Educational Counsellor, Ministry of Education, Taiwan, Mr. Takashi Hamada, Secretary-General, Taipei Office of Japan Interchange Association, Prof. Ching-Ray Chang, Executive Vice President of National Taiwan University, Mr. David Chang, President of Kobe University Alumni Association, Taiwan, distinguished Guests and ladies and gentlemen, At first, I must say very thanks for NTU's cooperation to hold this Symposium, and welcome you all to the Kobe University Global Link Forum 2015 in Taipei.

My name is Noriyuki INOUE, I'm Executive Vice President in charge of international affairs of Kobe University. It is great honor and pleasure for me to speak an opening remarks at today's Symposium as a representative of Kobe University.

Kobe University is the one of the globalized universities in Japan. Concerning the programs with which Kobe University is now engaging in order to enhance and deepen the globalization of researches and educations. Kobe University has a long history and proud tradition as an education and research institution established in the cosmopolitan city of Kobe. Ever since it was opened to the world, Kobe City has been daily witness to a cross-border exchange of people, goods, and capitals. Many foreigners also have lived in Kobe since Japan's modern period began nearly 150 years ago. Kobe has since become a very comfortable place for foreigners to live and also to pursue their education. These city's traditions and an awareness of the type of globally minded individuals required in the 21st century make us able to foster a network. Taking advantage of our location in this cosmopolitan and open-minded city, Kobe University, with its foundation based on an integration of theory and practice, has been striving to achieve global excellence as a core base for education and research and to become an interdisciplinary research intensive university. And moreover, it is very important thing, Kobe University's campus is recognized as one of the most beautiful in Japan.

Regarding student and researcher exchange, Kobe University will not only promote the mutual exchange, but also connect students and researchers in European and Asian/ASEAN countries at Kobe University as a core and connecting base for those exchanges. The University also aims to play a role as an interface between overseas institutions and corporations as well as public organizations based in Kobe with Kobe University serving as a hub-campus to realize such connections.

As I mentioned, our global programs are developing toward the two core regions, the countries in the European Union and East-Asia/ASEAN. Concerning the relationship between Asian Countries, Kobe University establishes now The Centre for Asian Researches and Studies with the aim of enhancing and expanding pre-existing student / researcher exchange. This KUGL is one of the most important events of that Centre. We are now holding KUGL once every year in order to strengthen our network with the Alumni Association and the collaborated research institutions in Asian countries. I hope that today's Forum can make the relationship between Japan and Taiwan more strong and deep.

Finally, thank you very much again to National Taiwan University for the excellent arrangement and preparation for this Symposium.

Congratulatory Address

Guan-chau Huang
Deputy Education Counsellor,
Department of International and
Cross-strait Education,
Ministry of Education

Deputy Education Counsellor Guan-chau Huang started by expressing his pleasure to be granted this opportunity to give a congratulatory address to the Kobe University Global Link Forum on behalf of the Ministry of Education. He stated that the forum would be a meaningful contribution to the bilateral development of education and the promotion of mutual friendship.

He went on to discuss the academic connections between Taiwan and Japan. According to statistics, the total number of Taiwanese students studying in Japan reached 6,200 in 2014, an increase of 2,000 students over the past ten years. Similarly, the number of Japanese students studying in Taiwan has risen from 2,200 ten years ago to 5,600 in 2014. Joint agreements signed between universities in Taiwan and Japan for student exchange or joint research total 1,200. Deputy Education Counsellor Guan-chau Huang emphasized that these developments illustrate the close bonds between Taiwan and Japan.

The Deputy Education Counsellor then touched upon the globalization of higher education and the resulting competitive relationship between universities. In order to advance the quality of education and research, each university must endeavor to recruit excellent teachers and students from around the world.

However, he went on to stress that mutual cooperation is more important than this competition. He quoted the words of Zeng Zi, “Gentlemen make friends through learning and enhance their virtue mutually”. These words can be applied to the Kobe University Global Forum, which not only contributes to academic cooperation between Taiwan and Japan, but also promotes mutual bonds of friendship between the two sides. Deputy Education Counsellor Guan-chau Huang concluded by expressing his sincere respect to all the attendees delivering speeches and sharing their wisdom.

Profile

1987 BA, Journalism, Chinese Culture University
1990 MA, Japanese Studies, Chinese Culture University
1991 Naval Officer
1993 Entered the Ministry of Education (MOE), Third Culture Secretary
1999 Second Culture Secretary
2001 Second Culture Secretary, Culture Division of Taipei Economic and Cultural Representative Office (TECO) in Japan
2007 Director of Office of Mainland Affairs, MOE
2009 First Education Secretary, TECO in Osaka
2015 Deputy Education Counsellor, MOE

Congratulatory Address

Takashi HAMADA
Secretary-General of the Interchange Association Japan (Taipei Office)

President Hiroshi Takeda, President Ching-Ray Chang, distinguished guests, ladies and gentlemen,
It is a great pleasure for me to be here and participate in the Kobe University Global-Link Forum in Taipei at National Taiwan University.

On behalf of Japan Interchange Association, I would like to express my sincere congratulations to Kobe University for hosting this important forum in terms of strengthening Japan-Taiwan academic exchange.

As you well know, Japan and Taiwan have shared a longstanding friendship that transcends the areas of economy, international trade, tourism, culture and academia.

We are close partners that stand united against various challenges, which is especially evident when Taiwan extended its generous and helping hands to Japan during and after 3.11, the East-Japan Earthquake. Many Japanese citizens still express their gratefulness toward Taiwan's generosity.

International exchange and mutual understanding as well as continued capacity building are indispensable for strengthening Japan and Taiwan's relationship. To nurture the next generation of leaders that will develop our future relationship, Japan Interchange Association has long promoted Japan studies and Japanese-language education in Taiwan.

Through hosting the Global Link Forum in several cities in Asia, Kobe University has been promoting international academic exchange all over the world. Today's forum in Taipei covers a variety of academic fields; humanities, social sciences, medical sciences, and energy and environmental issues.

The distinguished scholars from each field will bring diverse insights and perspectives. I am confident that this Global-Link Forum, in cooperation with National Taiwan University, is of great importance to both Japan and Taiwan.

Lastly, I sincerely wish the two-days forum a great success, and further development of academic exchange between Japan and Taiwan. Thank you very much.

Profile

1991 Graduated from Tokyo University of Foreign Studies, Japan
1991 Entered Ministry of Foreign Affairs of Japan
2002 Principal Deputy Director, United Nations Policy Division, Foreign Policy Bureau
2005 Deputy Consul General and Director of General Affairs and Political Section, Consulate General of Japan in New York, USA
2008 Principal Deputy Director, Personnel Division, Minister's Secretariat
2011 Director, Japan-China Economic Affairs Division, Asian and Oceania Affairs Bureau
2012 Director, Third Division, Intelligence and Analysis Service
2014 Secretary-General of the Interchange Association Japan (Taipei Office)

Congratulatory Address

David Chang
President of the Kobe University Alumni Association in Taiwan

Esteemed Kobe University President Takeda, Taiwan University Executive Vice President Chang, Ministry of Education Counsellor Huang, Japan Interchange Association Taipei Office Secretary-General Hamada,
Honored guests,

My name is David Chang and I am the President of the Kobe University Alumni Association in Taiwan. I would like to say a few words of greeting in Chinese and Japanese.

First, I would like to thank the organizers for inviting me to attend the sixth Kobe University Global-Link Forum. It is an honor to be giving these opening remarks, and I am truly grateful to you all for traveling from various parts of Japan and Taiwan to be here today.

Two years ago I visited Kobe University as a representative of this Alumni Association, and I was privileged to meet former University President Fukuda and request that the Global-Link Forum be held in Taipei. Thanks to the support and hard work of many people during the past two years, we have been able to achieve that goal, and hold this wonderful forum in Taiwan.

There are many regional and historical links between Taiwan and Japan. For a long time the two countries have collaborated and developed side by side in multiple areas including agriculture, production, and business. The theme of this years' forum is "Re-realizing the Relationship with Taiwan and Japan: Cooperation in Science, Technology and Innovation". I hope that this will be an opportunity for mutual exchange in the specialist fields of both universities, and for progress in research initiatives that will contribute to creating a better society for future happiness and prosperity.

I myself am not part of the academic sphere – I have been working in the IT industry now for a long time. During this time, I have done business with people from many different countries. I believe that in order to succeed in business, the most important points are mutual respect and valuing personal connections between individuals. I hope that we can use this Global-Link Forum as a chance to discover more common features between us in addition to our research, and build the foundations for increased collaborations in the future.

Finally, I would like to express my deep gratitude to those from Taiwan University and Kobe University who have worked very hard to make this forum possible. I wish this forum every success. Thank you for listening.

Profile

2000	Graduated from the Kobe University Department of Computer Science and Systems Engineering
2000	Joined Fujitsu Limited (Tokyo)
2004	Joined Foxconn Electronics Inc in Taipei, Taiwan)
2008	Founded Bayhub Inc in the USA (a service for corporations)
2011	Founded second company, Framy Inc (creator of mobile phone applications)

Keynote Speech

Hiroshi Takeda
President, Kobe University

Distinguished guests, honorable speakers, our wonderful alumni, ladies and gentlemen, welcome to the Kobe University Global-Link Forum in Taipei.
First of all, on behalf of Kobe University, I would like to express my profound gratitude to all the speakers and participants for attending today despite your busy schedules.

I consider it a great pleasure to be able to host this Forum at National Taiwan University over the next two days.

This Forum aims to promote our education and research activities and the Kobe University Brand overseas by forming stronger links with overseas academic associations and the International Alumni Association Network, which provides an invaluable repository of knowledge for the University. We held the first Kobe University Global-Link Forum in Bangkok, Thailand in 2011. After the successful launch of KUGL, Kobe University held the second forum in Seoul, South Korea, the third forum in Beijing, China, the fourth forum in Ho Chi Minh City and Hanoi, Vietnam, and the fifth in Kuala Lumpur in Malaysia. This is now the sixth KUGL forum.

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Keynote Speech

Ching-Ray Chang
Executive Vice President for Administrative Affairs, National Taiwan University

Executive Vice President Ching-Ray Chang focused on the topic of science, technology and innovation from the perspective of National Taiwan University. He spoke first about Taiwan as a whole. He stated that Taiwan's success was largely thanks to its advanced higher education system, which has undergone multiple reforms. Taiwan faces multiple issues: it is a densely populated country, with a low birth rate. Like Japan it experiences national disasters. It also lacks natural resources, so more than 97% of Taiwan's energy is imported.

The success of Taiwan despite these challenges is due to its human resources, and these depend upon the quality of its higher education. Taiwan invests about 3% of its GDP into higher education, and also has many research and development initiatives. These include industrial research institutes sponsored by the Ministry of Economic Affairs and the National Synchroton Radiation Research Center supported by MOST.

The speech then turned to National Taiwan University. The Executive Vice President named it Taiwan's most prestigious university. It is also the largest, with around 32,000 students, 11 colleges, and 3 professional schools. NTU owns about 1% of Taiwanese land, with four campuses including an Experimental Forest. It is engaged in world-class research in fields including biology, engineering, and disaster mitigation. He highlighted the importance NTU places on social contributions and producing talented individuals to work in local industry.

International collaboration is also key to NTU's strategy. NTU has three I-RiCE centers (International Research-intensive Centers of Excellence in Taiwan) and provides multiple language and training programs, including MOOCs. NTU also has 67 double degree programs and more than 700 MoUs with universities worldwide. In 2015 NTU sent 118 students to Japan and had 57 visiting Japanese students. As well as international collaborations, the university shares resources with two neighboring universities, Taiwan Normal University and the National Taiwan University of Science and Technology.

The Executive Vice President emphasized that universities are only as good as their members: to be a good university you need first-rate professors. Undergraduates are also a key resource, often overlooked. Finally, he emphasized the importance of international mobility and international collaborations in 21st century higher education.

Profile

1988 Taiwan Associated Professor, Department of Physics, National Taiwan University
1989 Chairman of Department of Physics, National Taiwan University
1994 Professor of Physics, Department of Physics, National Taiwan University General
2008 Director of International Cooperation Department, National Sciences Council
2011 Dean of College of Sciences, National Taiwan University
2013 Executive Vice President for Administrative Affairs

Historical Conciousness and the "Chinese Model"

Yasushi Ogata
Director, Center for Asian Studies
Professor, Graduate School of Humanities
Kobe University

1. From the "Beijing Consensus" to the "Chinese model"

The debate of the "Chinese model" began in an article entitled the "Beijing consensus" announced in 2004 written by an American writer Joshua Cooper Ramo. Ramo expected that only China could become a superpower to confront the United States in the near future. And the characteristics of the "Beijing consensus" would be the soft power (containing political) that not include the armaments factors, from this angle, it would be different from the "Washington consensus" which has been the world consensus till then.

When China escaped from a world financial crisis started from Lehman shock in 2008 quickly and accomplished rapid economic development, many people began to think that the secret of the success of China did not stem from "Beijing consensus," it was just from an more comprehensive concept: "Chinese model." Including Japan, many debaters of the Western countries considered that the "Chinese model" is one of the economic models of developmental dictatorship of the East Asia. But we should notice that the reform and door-open policies from 1978 in China learned a lot of experiences from not only the economy model of Japan but also of Korea, Taiwan, Hong Kong, Singapore called NIES. As a study of Jonathan Anderson clarified it, 7.5-8.0% a year of Chinese GDP from 1978 to 2000 is the almost same as 7.5-8.5% that Japan and NIES achieved at the same time.

Following Ramo, if we pay attention to the soft power (containing political) of both, we can realize that the two areas belong to the Confucius cultural sphere of Asia. Then can we clarify the characteristics of the "Chinese model" through considering the political culture in these areas from historical background?

2. The return to the tradition and the "Chinese model"

It is well known that Xi Jinping Administration attaches great importance to Chinese soft power. His slogan called "Chinese national dream (November 29, 2012) " showed it. However, Deng Xiaoping had mentioned that it was the feudal despotism inherited from traditional China had disturbed the modernization of China in his "Reform of the leadership systems of the Party and the state (August 18, 1981). " And in the 13th Congress of the Chinese Communist Party in 1987, Zhao Ziyang also stated that the feudal despotism should be overcome for a democratic revolution of China when the socialistic primary stage was submitted. The CCP has become to regard Confucianism as an important part of the socialism with the Chinese characteristics being the same as Marxism-Leninism and Maoism from 1993. Xi Jinping's remark was an extension of this thought, but his historical recognition to return to the soft power of traditional China gave us an impression that he had already revised a democratic reform and door-open policies which aimed at getting over the feudal despotism.

The "Chinese model" can express it in other words with "oppressive authoritarian rule." The characteristics may be summarized as: 1) democracy at the bottom, 2) experimentation between local and central levels of government, 3) meritocracy at the top. [1]But the system is controlled strongly by

the CCP, basic society, local governments, central government, staffs and the organizations of the bureaucracy, are all highly centralized hardly to become a pluralistic society. The new practice which tried to connect local and central levels called the "*Chongqing* model" promoted by Bo Xilai aimed to get supports of the public people which was organized for the Party groups to monopolize the vested interests did not any effective role to relieve social vulnerable groups called "*ruoshi qunti* (poverty minority) ."

The "Chinese model" had a great impact for the profit-sharing between various interest groups included peasants and workers from the end of 1970s to the mid 1980s, but in the late 1980s, the political interests between social groups has begun to be contradicted. The 1989 Tiananmen Square Incident was an outcome of such interests opposition, after this the reform came to a deadlock.

The collapse of the communism in the Soviet Union, and the Eastern European countries of the early 1990s became the origin of the "Chinese model." A modernization model that introduced capitalism while maintaining a one-party dictatorship system was established since then. Through watching and having controlled the national government, national economy, and private society thoroughly, an extremely effective power to perform a measure of the economic development was also born. This high effectiveness was a good point of the "Chinese model" also a bad point at the same time.

Power was unified highly, and the bureaucratic capitalist society where a few special interest groups in the CCP held real power of politics and economy was "low human rights, low environmental protection" commented by Qin Hui. [2]The attack of 75% of Chinese people is connected with water pollution so that WTO report points it out in 2009, and, in public sector formed in the 1980s, the most are on the verge of the extinction. The policy of "*guojin mintui* (a state-owned enterprise goes, and a private enterprise withdraws) " which led to high growth in China after 2008 is the one that has picked up the bud of the political reform in China.

In fact, to remove the model of democratic revolution which aimed at overcoming the feudal despotism which promoted by Deng Xiaoping and Zhao Ziyang, and the recent movements to consider the Confucianism being made much of as Marxism-Leninism as an ideology and to advertise soft power of the traditional culture abroad while rousing the "Chinese national dream" is the back and a list of the medal. It means to build up a bureaucratic capitalism with the Chinese characteristics from a model to coordinate the interests opposition of various social groups to switch to a model to centralize huge economic rights and interests in the state ownership sector. The reform and open-door policies since 1978 changed largely into the movement to aim at such a bureaucratic capitalism by the 1989 Tiananmen Square Incident. After 2008, the "Chinese model" has caught the eye of the whole world instead of the American world hegemony.

It may be said that the "Chinese model" gets an inspiration of the new rule from an inheritance of the principle of bureaucracy and commercial capitalism that former Confucius society built up consistently. The traditional Chinese soft power does not threaten the "Chinese model" anymore. The feudal despotism in the Confucius China became the required soft power when the special interest groups pursued to maintain their own power.

3. The return to the tradition ? Or the return to the revolution ?

However, the Chinese national dream includes another different connotations. Jin Guantao promoted attention in two facts when we consider the traditional Chinese word "revolution."[3]

First, in China before the 20th century, the use frequency of the word "revolution" was far behind "equality." The word "equality" born as a term for translation of the Buddhism sacred book prescribed

the rules of action and ethics of the people deeply who lived in traditional China. That was why Mao Zedong pursued to establish the society which is equal even if poor, as he had the historical recognition common to a traditional Chinese ethos deeply.

Second, the word "revolution" in traditional China was used in a meaning to confirm that *Tiandao* (law of the heaven) did not change. The dynasty relief was born at the frequency once in 300 years, and the revolution was not a daily event even if most people never had experienced in their life. The Chinese history of the 20th century from the 1911 Revolution to the Great Cultural Revolution was only an exceptional situation.

Meanwhile, the slogan which symbolized the 1990s was "say goodbye to the revolution (Li Zehou, Liu Zaifu,1995)" when the democratic revolution that Deng Xiaoping and Zhao Ziyang pursued was rejected. According to Jin Guantao's consideration, it was much nearer a traditional normal sense of China. However, paralleling to the "Chinese model" being noised a slogan "get back to the revolution" has begun to be advocated in China. What kind of reason will this depend on?

Zhu Xueqin thought that the turning point was in 2012. [4]In this year, peasants of NiaoKan village in Guang Dong Province gained villager self-government, and Sichuan public peace Director Wang Lijun who was the subordinate of Bo Xilai escaped into US Embassy. According to Zhu Xueqin, these two cases mean "the end of the times that giving priority to retaining stability for 20 years." Since the 1989 Tiananmen Square Incident, the threatening move to raise formal objection to the Party policy has been confined every corner under the principle of "giving priority to retaining stability." However, it was not going to protect the profit of the people in a true meaning. The record-breaking monitoring society characterized by the "Chinese model" was created from here.

The principle "giving priority to retaining stability" confined rational talks of social classes more than the social revolt. Therefore a "revolution" to bring back these talks cannot be revolution of violence. "It should be the organization of the rights-defense campaign since 2005 and the street protests, also the politicization (words of Teng Biao, rights-defense groups lawyer)."[5]

It is to be demanded for modern China is the "Chinese constitutional dream" not the "Chinese national dream."

[1] Daniel A. Bell, *The China Model: Political Meritocracy and the Limits of Democracy* (Princeton University Press, 2015) 179-180.
[2] Ding Xueliang, *The Chinese Model: for and against* (Oxford University Press [China], 2014) 207.
[3] Jin Guantao, "Zhongguoren keyi gaobie geming ma?" [Can the Chinese Say Goodbye to Revolution?],Teng Biao and Wang Tiancheng co-eds. *Huidao Geming* [*Get back to Revolution*] (Su Yuan Shushe, 2015) 245-247.
[4] Zhu Xueqing, "Gaobie huo yongbao geming doushi weixiande" [It is All Dangerous for Us to Say Goodbye to or Embrace Revolution?] *Huidao Geming* [*Get back to Revolution*] 240-244.
[5] Teng Biao, "Gongmin weiquan yundong yu zhongguo zhengzhi gaige" [Citizen Human Rights Movement and The Chinese Political Reform] *Huidao Geming* [*Get back to Revolution*] 324.

Why Speak of "East Asian Confucianisms"?

Chun-chieh Huang
National Chair Professor and Dean
Institute for Advanced Studies in Humanities and Social Sciences
National Taiwan University

1. Introduction

The theoretical foundations and future prospects of the new field of "East Asian Confucianisms" still await deep and extensive scholarly deliberations. Back in 2003, I examined some of the issues and problems in the article, "How is "East Asian Confucianisms" Possible as a Field of Study?" The present paper examines the related question, 'What is the Necessity of "East Asian Confucianisms"? Part Two discusses the special features of "East Asian Confucianisms." Part Three considers the prospects of "East Asian Confucianisms" as a new field in the present academic world as well as providing the foundation for a possible new Humanism for the 21st-century age of globalization. Part Four concludes the study.

2. What is "East Asian Confucianisms"？

The contents and special features of "East Asian Confucianisms" can be viewed from a variety of perspectives, the most significant of which are two: 1) the interaction between "part" and "whole," and 2) the contrast between "form" and "content."

As to the interaction between "part" and "whole," the term, "East Asian Confucianisms" is intended to stress that, within the rich diversity of the Chinese, Japanese, Korean, and Vietnamese cultures and traditions, within their variety of differing Confucianisms, lies a common core of shared intellectual and ethical factors. This special feature of "East Asian Confucianisms" has several dimensions:

First, "East Asian Confucianisms" refers to impact of Confucian values as manifested in indiginous thought and culture. The diversity of localized formations of Confucian thought and culture across East Asia is not a mere mosaic of these localized manifestations; for, as a matter of fact, the Confucianisms of the East Asian countries influenced one another through exchanges and interactions for centuries. Just as "Christendom" was formed through religious and cultural intercourse and interactions across Western Europe, thus featuring a plethora of distinctive localized forms, a similar sort of "Confuciandom" took shape across East Asia. The term "Confuciandom" underscores that, despite the rich variety of localized manifestations of "East Asian Confucianisms," there is a distinctive regional "wholeness" of shared intellectual and ethical factors that are held in common.

Next, the regional wholeness of "East Asian Confucianisms" does not exist as an abstraction over and above the concrete exchanges and interactions going on among the Confucian traditions of the

East Asian countries. Rather, it exists—and grows and develops—right in the midst of these exchanges and interactions among these diverse East Asian Confucian traditions. The watchword here is "in the midst of," again, this wholeness is not to be regarded as something "over and above."

Further, since "East Asian Confucianisms" exists in the midst of, and not over and above, the cultural exchanges and interactions among the East Asian countries; it cannot be regarded as a single, fixed, unchanging intellectual form that was originated and rigidly defined over 2600 years ago on the Shandong peninsula in China. Rather, we must appreciate that it has undergone a continuous, ongoing process of development for over 2000 years across East Asia. And, not only has East Asian Confucianisms progressed over time, it has been adapted to suit each different locale it has encountered so that the manifestations of Confucian tradition in each locale seamlessly reflect the special features of that place while still sharing the central core values of Confucianism.

As to the contrast between "form" and "content," the modes of Confucian intellectual and cultural transmission across East Asia were not at all uniform; they were highly diverse indeed. For example, while the transmitters of Confucian values in China were scholars or scholar-officials, in Tokugawa Japan they were common intellectuals, and in Choson Korea they were the "yangban" (feudal power holders). The transmitters of Confucian values in these three countries occupied very different positions in society and had highly different relations to political power. However, despite these differences, commonalties remained among the Confucian traditions of China, Japan, and Korea. To whit despite the different levels and scopes of Confucian transmitters (form) in the politics and societies of these three countries, they all shared the same core Confucian values in common (content).

The core Confucian values shared in common by the Confucians in the various East Asian countries include, at the very least, the following two: First, Confucians in all of the East Asian countries all firmly believe that the foundation and starting point of Confucianism lay in a "self cultivation" process that involves extending sympathy, proceeding along a continuum from "self" to "family," to "society," to "state," and on to "world." East Asian Confucians all hold, in effect, that the transformation of self is the starting point of transforming the world. Consequently, East Asian Confucian masters all passionately devoted themselves to developing deep profound theories of self-cultivation.

The second core value shared in common by the Confucians of each East Asian country and tradition is Confucius' teaching of *Ren* 仁, rendered variously in English as Humanity, humaneness, human-heartedness, benevolence, authoritative personhood, etc. The term *Ren* appears 105 times in 58 chapters of Confucius' *Analects* (Lunyu 論語). Taking *Ren* as the core value on which to arrange and construct the empire, the East Asian Confucian masters and students dreamed of realizing a Confucian utopia.

3. What is the Necessity of "East Asian Confucianisms"?

Now we are in a position to consider the fundamental question: "Why is the necessity of 'East

Asian Confucianisms'?" This question can be approached from two angles.

First, we can view the rise of the field "East Asian Confucianisms" on the new stage of scholarship in the 21st century as a reaction to the form of Confucian studies conducted in the Chinese-language academia of the 20th century. For example, the 20th century Chinese New Confucian philosophers tended to view Confucianism narrowly as a segment of their national and ethnic destiny, especially as bound up with the vast and far-reaching historical traumas and transformations of the early 20th century.

Against this 20th century background, an important function of the new field of "East Asian Confucianisms" is that it involves actively purging Confucian studies of the limitations (and prejudices) of ethnocentrism to ensure that Confucian studies will never again be confined within the study of single national histories, thus freeing Confucianism to be more broadly conceived and extending its spiritual mission to new heights in the 21st century age of globalization.

Freed of the 20th century ethnocentrism that characterized each East Asian country, scholars who sincerely pursue studies on "East Asian Confucianisms" will be free to kick away the twin limiting binaries of "center and periphery" and "orthodoxy and heterodoxy." Moreover, they will be freed of examining classical texts solely in the light of their single country's history. Furthermore, scholars in "East Asian Confucian" studies will be able to undertake open-minded analyses of the interactions and fusions of Confucianism and the society and cultural traditions of each host country and locale around East Asia. Indeed, the developmental vantage of Confucianism in each East Asian country could be said to seamlessly reflect the developmental process of cultural subjectivity in each of these respective countries.

4. Can Confucianism Transcend the East Asian Sphere？

"East Asian Confucianisms" is constructed from the terms "East Asia" and "Confucianisms." However, once the terms "East Asia" and "Confucianisms" have been combined to form "East Asian Confucianisms," two questions immediately arise: First, in the 20th century the peoples of East Asia, including the Japanese, wrote East Asian history with their own blood, sweat, and tears. The expression "East Asia" in the term "East Asian Confucianisms" genuinely carries too many sad and horrific 20th century "Memories of Imperialism." Second, since the term "East Asian Confucianisms" presents Confucianisms on the platform of East Asia, we might wonder whether and how Confucianism could transcend this platform of East Asia and become a source of universal values for the age of globalization?

The two above-mentioned questions touch upon two problems that warrant deeper discussion: 1) the problem of the conflict between political identity and cultural identity faced by Confucians in all of the East Asian countries, and 2) the problem of how the cultural subjectivity of Confucians in each East Asian country can manifest shared universal values.

The core of the first problem lies in whether "Confucian studies can transcend the confines of the state." The answer to this question is twofold. Viewed in the perspective of political identity, since the 17th century, after the rise of regional East Asian national identity, Confucian scholars have found it gravely difficult to leap away from the nationalistic platform of their respective countries. However, from the perspective of cultural identity, the Confucians in each of the East Asian countries also share the Confucian core values of *Ren*, self-cultivation, etc. in common. Hence, these Confucian common core values ultimately transcend national boundaries and can be regarded as values that might be shared by all of humankind.

Finally, the question remains: Can Confucianism shed its regional "East Asian" platform to provide truly universal values to be accepted by humanity around the world in the age of globalization. I consider the answer to this question to be in the affirmative.

The "universal values" of today, such as democracy, freedom, liberty, human rights, etc., all arose during the past 250 years in Europe and North America. Ironically, the western powers were controlling and ruthlessly exploiting colonies and peoples in Asia, Africa, Latin America, etc. at the very time that they were developing and promulgating such "universal" values. The Confucian traditions which arose and developed over time in East Asia, with their loftiness, breadth, and depth, naturally can be reinterpreted through the "interpretive," "bridging," and "normative" approaches and emerge as the source of more truly universal values for the 21st century age of globalization, most notably their shared core values of *Ren,* self-cultivation, kingly way, etc. In the civilizational dialogue of the new age, these values can offer new inspirations and new meanings.

5. Conclusion

This paper has explored several problems with regard to "East Asian Confucianisms" as a new field of study. Section 2 explored how the Confucian traditions that arose in various East Asian countries—China, Japan, Korea, and Vietnam—shared a common thread-- or tapestry-- of core values right in the midst of the exchanges and interactions among Confucian scholars in those different countries, but certainly not as a definite and fixed consciousness over and above each country's Confucianism. For this reason, "East Asian Confucianisms" advanced—and diversified--in accord with the times and was constantly adapted to suit local intellectual traditions and trends. Although the Confucians of each country in East Asia definitely held different specific values and had widely different attitudes and practices; they continued to share several fundamental core values, such as *Ren,* self-cultivation, etc., in common.

In section 3 it was pointed out that the field of "East Asian Confucianisms" provides a sort of broad intellectual prospect. It involves the commitment to shed the confines of the narrow

nationalistic ethnocentrism advocated by each of the East Asian country back in the 20th century, and moreover to adopt its broad purview to observe the development process of cultural subjectivity in each East Asian country and locale. The very idea of a field of "East Asian Confucianisms" should stir scholars to rectify the "reflexive Orientalism" of 20th century scholars in each East Asian country and anticipate that scholars in the 21st century will reexamine this East Asian cultural mainstream and its core values.

The political identity of Confucians in each East Asian country definitely should completely get rid of the limitations of their nationalistic ethnocentrism, and bear in mind that the Confucian intellectual world is an even more fundamental cultural homeland. In the 21st century age of globalization, this field of "East Asian Confucianisms" and its common core values, which were originated and developed in East Asia, bear tremendous potential for offering a platform for hosting civilizational dialogue in the new century.

Innovation made by Technology Entrepreneurs in Japan

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1. Abstract

Technology Startup (TS), which creates innovative products and services by utilizing technology and science such as IT, biotech, and energy, makes an important role for an economic growth of industrially advanced countries. Key successful factor for TS is to make Technology Entrepreneur (TE) appear in large numbers. Kobe University`s new department, Graduate School of Science, Technology, and Innovation (STIN), will challenge the difficult issue by providing interdisciplinary education of science, technology, and business.

2. Background

For last decades, global economy has been led by growing technology companies such as Apple, Google, Facebook, Amazon, Yahoo!, eBay, Genentech, Sentient Technologies, Parrot, Tesla Motors, Space X and Uber. Those technology companies have provided added values for a global market by creating innovative products and services based on novel technologies. The process is called "Technology Commercialization", and the technology ranges over various fields including information technology, communication, biotech, health care, clean energy, energy efficiency, agriculture, chemical, engineering, and material.

Most of technology companies are young Technology Startups (TS), which are unevenly distributed in USA, and managed by strong leadership by Technology Entrepreneurs (TE). As Japanese economy needs series of innovations in order to grow by overcoming hard competitions in a global market, it is quite important to identify and share knowledge how to produce successful TS in large numbers.

3. Technology Startup (TS) and Technology Entrepreneur (TE)

According to Christensen (1997), Disruptive Innovation is not made by main players in the traditional market but by outsiders of the market. Also, disruptive innovation is not made by big corporations, who usually pursuit sustaining innovation, but by small organizations such as TS who always tries to create something unique.

Especially, TS makes an important role in transferring university technology to a market. Since goals of a university and a company are different; the former is pursuing uniqueness and the latter is gaining profit, it is usually difficult to make an alliance between the two. TS, which is a young startup company creating innovative products and services by utilizing university`s intellectual properties, can be a bridge to connect the two contrastive organizations.

As TS has limited management resources, it should be led by strong initiative of management

person, which is called TE. Various kinds of persons can be TE, such as university researcher, engineer, product development professional, marketing specialist, salesman, and graduate student. Since TE should understand whole value chain of the business including technology and market, he or she usually establish a management team by combining multiple professionals of different expertise.

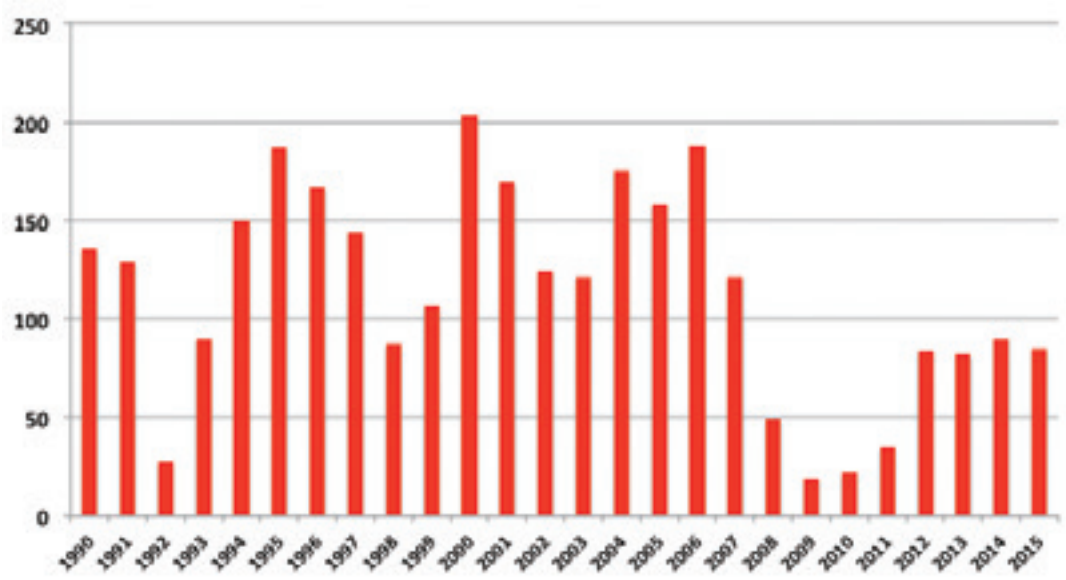

Figure 1, Historical numbers of IPO in Japan

2015 figure is until November 15th

Sources: Japan Exchange Group HP, and Tokyo IPO HP

4. IPO Market in Japan

Because of its business nature, TS needs much more capital and operating expense compared to non-technology startups in the area such as e-commerce, application development, and system consulting. Therefore, TS should make a solid financial strategy, which satisfies its long-term fund raising requirement. TE should investigate financial alternatives including Initial Public Offering (IPO) and Merger and Acquisition (M&A), and alliance with large corporations.

As Figure 1 says, In Japanese financial market, opportunities for IPO are now expanding. In 2015, approximately 90 companies are expected to go public. This figure is more than four times of the recent bottom in 2009 right after the global financial crisis. The result has come from easy-money policy by Bank of Japan and long-term effort by public and private to promote many successful entrepreneurs.

5. Management Issue for Growth Strategy

Every company has various management issues such as building management team, hiring talented research staff, creating and maintaining intellectual property, executing product development, designing manufacturing infrastructure, doing marketing research, establishing sales

team, and creating PR strategy. Since TS doesn`t have enough money, human resources, and brand, TE makes an important role in making up a shortfall. TE should work harder than any other staff in the company, and do multiple tasks in order to solve various management issues.

Unlike a big corporation, TS doesn`t have an organizational capability, and highly depends on individual ability and effort of TE.

6. Kobe University's Project

If you want to become a successful TE, what kind of education and training you should take? If you are going to invest in technology project, where you should go to find a talented TE? Those are difficult issues, which have to be solved.

Newly created educational department of KOBE University, Graduate School of Science, Technology, and Innovation (STIN), will come to grips with the challenging goal to educate students to become TE. As Figure 2 says, STIN provides an interdisciplinary education of multiple academic areas, which are the followings:

① Bio-production Technology
② Advanced Information and Communication Technology
③ Advanced Membrane Technology
④ Advanced Medical Science
⑤ Entrepreneurship, Strategy, Finance, and IP rights

STIN`s educational program is composed of regular class room, laboratory research, seminar, and project research of making business plan based on above mentioned technologies and basic researches. In the project, students will learn process of making a technology transferred to the market through discussion with professors, entrepreneurs, and business professionals.

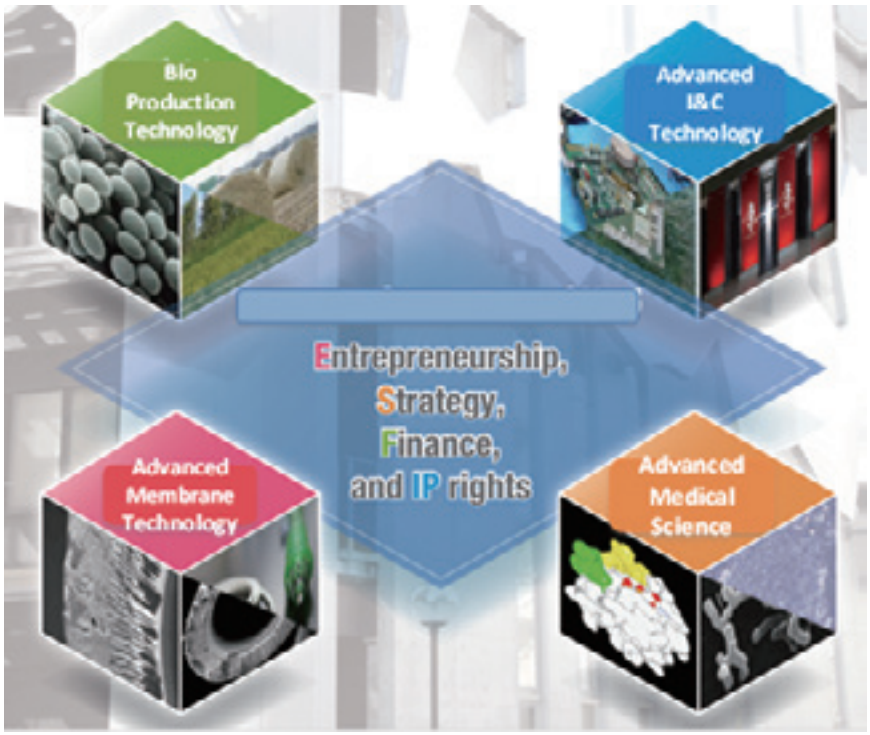

Figure2: Structure of STIN

7. Conclusion

For industrially advanced nations such as US, Germany, Japan, and Taiwan, it is critical to create innovative products and services in order to win in highly competitive global markets. It is one of the prevailing solutions for the issue to set up a situation to make TE appear in large numbers.

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Taiwan and Japan's industrial and economic outlooks and their prospect

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In the following I outline four parts in this short paper to describe Taiwan and Japan's industrial and economic outlooks and their prospect. The first part is Taiwan-Japan macroeconomic development. The second one is Taiwan-Japan investment and trade development. The third one is current Taiwan-Japan industrial cooperation and future opportunities, and finally the prospect of Taiwan-Japan industrial cooperation.

A. Taiwan-Japan Macroeconomic Development:

Taiwan and Japan both have very similar economic and industrial conditions due to their past historic and cultural factors. Taiwan and Japan suffered severe economic shocks post the 2008 global financial crisis hitting the worldwide. Development slack in manufacturing sector and weakening in service sector development in Taiwan resulted in Taiwan's inadequate economic growth momentum comparing to the periods before 2007. Similarly, Japan's economic recovery was slower-than-expected, although Abe's administration depreciated Yen sharply through its strong financial policies. However, it seemed unsuccessfully to stimulate its economy. Additionally, Japan's weak economic growth intensity could be also explained facing its internal structural reform and the global economic slowdown. According to Global Insight's forecasting data, Taiwan and Japan's forecasting GDPs in Q4-2016 are 2.66% and 1.25% respectively, showing that the growth rates are still in slump.

As for the export performance, Taiwan had negative growth for 10 consecutive months after February 2015 that is the first time to see such decline in its 2015 export annual growth rates (YOY); Japan's export growth rates showed recessions excepting for its January export growth rate of 2.8% due to weak export performance with limited contribution of depreciation in Yen, meaning that the slowdown in global economy weakened Taiwan and Japan's export performance.

Secondly, Japan's industrial recovery is less optimistic than Taiwan. Tightening in global investment demand depressed the growth in Taiwan's production, investment, and exports, resulting in 2009 growth rate dropped to 3.42%. However, due to hot sales in 2014 Taiwan's electronic products, metal and mechanic industries, helping manufacturing sector grow by 6.30%. Japan faced more server situation than Taiwan. 2009 Japan manufacturing sector declined by 17.70% even there was a rebound in 2010; Japan's manufacturing sector only grew up by 0.12% limitedly to 2013, which shows its manufacturing sector yet to recover to the level before global financial crisis.

Furthermore, the proportion of Taiwan's fixed capital investment decreased from 22.15% in 2013 to 21.58% in 2014, declines for 4 consecutive years, through the investment to GDP ratio measure, showing a weak momentum in Taiwan's investment. While Japan's gross fixed capital formation to nominal GDP ratio continuously increases, the proportion of fixed capital formation was 22.35% in 2014, to pre-financial crisis proportion level after Japan's 311 tsunami. Overall speaking, Taiwan and Japan's investment level still remain low, comparing the proportion of Korea's fixed capital formation of 29.11% in 2014.

Taiwan and Japan's industrial complementary relationship has been gradually changed along with Taiwan-Japan closed industrial cooperation. Taiwan-Japan industrial development was the one-way flying geese model in the past, which is simply an up/down streams supply chain. In which, Japan, a technical leader, provided core technique, OEM in Taiwan, then assembled in Mainland China or South East Asia. Nowadays, Taiwan-Japan bilateral industrial development has developed to a various cooperation model, which both countries compete with each other as well as use common resources and work to expand markets, along with improved industrial development and technique in Taiwan and South East Asia.

B. Taiwan-Japan Investment and Trade Development:

The data from Investment Commission shows that Japan is one of Taiwan's major sources of foreign investment countries. A significant drop on Japan to Taiwan investment value as well as a decrease in its proportion of Taiwan's foreign investment post the financial crisis; Japan to Taiwan investment of US$548 million with 9.51% of Taiwan's total foreign investment in 2014 and US$213 million in 1H16. On the other hand, Taiwan to Japan investment is relatively small, in which the historic high investment amount of US$1.089 billion due to the joint venture of Sakai Display Product (SDP) between Hon Hai and Sharp in 2012; second highest of investment amount of US$ 690 million was an acquisition of Tokyo Star Bank by China Trust Commercial Bank in 2014 and it was the first case

of Japan's bank taken by foreign bank.

Japan's investment in Taiwan's industries changed in recent years. In early period of Japan's investment in Taiwan was mainly in electronic parts and components, semiconductor and panel due to a consideration of Taiwan's low HR cost, developed high-tech OEM, and expanding emerging markets. However, Japan changes its investment strategy to key component parts and R&D centres. It's also notable that service industry is now the main stream of Japan's investment in Taiwan under the umbrella of ECFA and Taiwan-Japan investment agreement which stimulate growth in finance, insurance, wholesale and retail trade. And, manufacturing industry is still the main stream of Taiwan's investment in Japan.

Trade relation between Taiwan and Japan is extremely closed, that is Japan was the third largest trading partner to Taiwan in 2014, the first two largest trading partners were US and China. In the past, Taiwan had large and long-term trade deficit with Japan, but a trade deficit of US$ 33.9 billion in 2010 reduced to US$ 21.8 billion in 2014 shows that a reduction of trade deficit in-between Taiwan and Japan. Further to analyse the trade structure, Taiwan's export to Japan has steady growth, a growth rate of 3.55% yoy with US$ 19.9 billion and accounts for 6-7% of Taiwan's export value in 2014. Japan is the second largest importing country to Taiwan, the importing figures declines year by year regardless of importing value and its proportion to all import since 2011, the import growth rate dropped 3.40% with US$41.7 billion and accounts for 15.22% of Taiwan's import value in 2014.

In addition, more than 50% of products exported to Japan from Taiwan are machinery, equipment and electronic products, followed by basic metal and its products, plastic and rubber and its products and chemical products. Japan's products exported to Taiwan are mainly in machinery, equipment and electronic products. The proportion has been significantly decreased that is 47.17% in 2004 to 38.18% in 2014.

C. Current Taiwan-Japan industrial cooperation and future opportunities:

In recent years, Japan's large-size companies have a thinking of worldwide distribution supply chain while Japan faces long-term sluggish domestic demand, thus overseas market expansion is necessary indeed. Meanwhile, Taiwan and Japan's companies established a strong industrial partnership under long-term mutual trust to promote 2011 "Taiwan-Japan Industrial Collaboration Bridging Plan", which aims to enhance complementary partnership between companies in both sides. And Taiwan-Japan Industrial Collaboration Promotion Office (TJPO) successfully promoted 154 cases of Taiwan-Japan Industrial Cooperation with an injection of NT$ 22.6 billion since the office was established in 2012 as well as TJPO has also established contact pipeline with 30 Japan's local governments or industrial organisations.

In the trend of globalization, global industrial development trend as well as Taiwan-Japan future industrial development direction will be influenced by fast flows of traditional commodity trade,

capital, talents, technology in-between countries and the rise of emerging markets. Taiwan has completed hi-tech and manufacturing supply chain and commercialised capacity while Japan has forward-looking technology and design capability, if both sides could perfectly integrate with their advantages and complement each other's needs, such as medical and pharmaceutical treatment in aging society, cultural and creative industry, electric cars industry, and green industry, for jointly expanding new markets and developing new innovative industries.

Taiwan-Japan industrial cooperation opportunity, for example developing ASEAN region, ASEAN region is Taiwan second largest export destination since 2007 while Japan is the largest foreign investment source in ASEAN region. However, facing the challenges from China, Korea, and other countries Taiwan and Japan's import market shares in ASEAN have no significant increase, and Japan even has a consequence of reduction in its importing market share in ASEAN. Therefore, Taiwan-Japan must have further industrial cooperation, from division of industrial chain to joint R&D cooperation and business cooperation model, in order to strengthen development momentum in ASEAN.

Moreover, deepening bilateral industrial cooperation through the supply chain system or strategic alliances with the solid foundation of Taiwan-Japan economic and trade collaboration, such as some of Taiwan's motor vehicle and parts manufacturers cooperate with Japan in ASEAN market. Taking Eurocharm Group as an example, this company sees Asia region as a global major motorcycle market. Asian sales volume accounts for 80% of global motorcycle sales volume in 2012, china is the largest motorcycle market followed by India, Indonesia, Viet Nam, and Thailand. Honda, YAMAHA, Suzuki, KAWASAKI became global leading companies by entering into Viet Nam and supplying local motorcycle components for opportunities in ASEAN market.

On the other hand, CTCI Group achieved the mutual benefits by adopting strategic alliance. CHIYODA Coporation, a company specialise in natural gas business in Japan, acquired 10% of CTCI Group's stake for forming a strategic alliance in order to strengthen CTCI Group's competitiveness in the non-refining and petrochemical field. Besides endeavouring getting the construction plans of setting up new 20 private power plants and incinerators announced by Thailand government in 2011 for more revenue, CTCI Group actively process positioning and cooperation of the Indonesian natural gas projects with CHUYODA Coporation, aiming to make profits for both sides.

D. Prospect of Taiwan-Japan Industrial Cooperation:

Abe's administration processed Japan's economic structural reform through powerful financial policies since 2014, which drives a huge depreciation of Yen, but it seemed failed to benefit its economy. While inadequate economic momentum, export slump, and weak investment momentum facing to Taiwan, hence Taiwan and Japan should combine mutual advantages and compliment the needs with each other to enhance Taiwan-Japan industrial cooperation.

It is noteworthy that, China is conducting "One Belt, One Road" strategy. If Taiwan-Japan cooperation could jointly participate the business opportunities brought by "one belt, one road" for

further more business opportunities. However, Asian Infrastructure Investment Bank (AIIB) led by China remains cautious to Japan, thus Japan yet to submit its application for AIIB's membership. However, Japan is experienced in participating Asian Development Bank (ADB) and Greater Mekong Subregion (GMS) initiated by ADB contribute to increase the Japan's investment proportion in South East region.

Therefore, Taiwan and Japan should expand ASEAN market based on their experienced Taiwan's market expansion. Both Taiwan and Japan's enterprises could take Taiwan's market for market testing purpose as well as accumulate cooperation experience for both sides and then to increase the and confidence and success rate of expanding the third market. In terms of Taiwan-Japan industrial cooperation, different plans and collaboration directions should be adopted depending on each country's positioning in ASEAN region, for an example, Indonesia has large domestic demand market, thus Taiwan enterprises could help maintain local Chinese network then to penetrate into the Chinese market. Taiwan and Japan should form a strategic partnership, seeking complimentary nature of the enterprises, in order to enhance Taiwan-Japan collaboration bridging function. On top of that, both sides could further develop the industrial clusters in ASEAN region, such as 3C products, as well as establish a completed industrial supply chain for creating a WIN-WIN situation for Taiwan and Japan.

Sustainable Strategies for Recovery from Natural Disasters

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Introduction

It has been almost five years since the 2011 Tohoku Earthquake struck Japan. The recovery process has been moving forward, but it is far away from the completion. The central government of Japan has estimated that the recovery takes roughly ** years. As the recovery is expected to be such a long time, the sustainability of the recovery itself can be questioned. The recovery In the presentation I explore the recovery policies after the Great East Japan Earthquake and Tsunami comprehensively. By doing so, we assess how the disaster-affected cities' possession of their accommodation promotes the effectiveness of the policies.

The Japanese National Police Agency reported that the incident caused 15,883 of deaths, 6,143 of casualties, and 2,681 of missings. The report also confirmed physical damage of 129,225 totally collapsed, and 269,454 half-collapsed buildings. Different economic damage is about 5-7% of GDP. After the incident, the central government of Japan established Reconstruction Agency to replace Reconstruction Headquarters as a response to the incident created on June 24, 2011 and to support the local governments' recovery plans. The government prepared 25 million yen for the 5 years of the incident. The budget is allocated to four major projects of cleaning up the debris, reconstructing the damaged infrastructure, managing the nuclear related issues, and financial support for local businesses and employment creation in the disaster area.

In the current four years, interestingly, there have been differences among the disaster areas in the magnitude of successfulness in recovery plans although some of them have experienced the same

levels of devastation. The cities located in the southern area have recovered relatively faster than the one in the northern area.

One of the goals of the recovery plans is to achieve fast and sustainable recovery of the disaster area. However, if the severity or the coverage of the damage exceeds certain limits or ranges, the disaster area cannot find the undamaged areas in neighborhoods.

For an affected city, one of the keys to successfully recover from damage is to have neighboring cities that can accommodate its economy while it establishes the basis for its sustainable and self-driving recovery. If an affected city does not have such cities, the city cannot secure the labor supply and capital. The cities located in the southern area are close to the city of Sendai, which is the biggest city in the Tohoku region and the center of the business district was not severely damaged by the incident. Therefore, they had the accommodation for their economies. But the ones in the northern area are far from the city of Sendai and do not secure the resources.

I focus on this matter as a source of difference in the magnitudes of recovery considering nuclear plant nearby areas, and propose the necessity for the local cities to have their potential accommodation as a part of preparing for the smooth recovery.

A recovery of an economy of affected area can mean to put the economy back to what it was before the disaster. However, a great-scale disaster can be an opportunity to solve the fundamental problems in the economy and reshape the economy. Unless we take advantage of this opportunity, the recovery plan cannot be sustainable because of the fundamental problem, not because of the damages themselves.

Population Movement from Tohoku Region

The Tohoku Region has had experienced outward population movement even before the 2011 Tohoku Earthquake. Several literature has found the determinants of the residential location choices of the people in the Tohoku Region. People would stay in the Tohoku Region when the current income is high enough; when the occupation is associated with the original residences (the monetary opportunity cost for moving is high); when their length of residence is long enough; when their affection to the residential area is high enough (the social opportunity cost for moving is high), and when the health risk from the radioactive contamination is high (Munro and Managi, 2014; Sanaei, Horie and Managi, 2015; Horie and Managi, 2016).

The 2011 Tohoku Earthquake destroyed every determinants for most of the people in the coastal area. Tsunami destroyed the fishery industry, social capital, and increased people's fear for the health risks. The place that shows the complexity of the triple disaster is Fukushima. Tanaka and Managi (2015) show that the evacuee from Fukushima would put more weight on whether other people came back rather than on whether the radioactive contamination levels were low. To recover the economy agglomeration can be one of the most important element, but the three conditions can be satisfied almost simultaneous. The Tohoku Region need to have comprehensive policies to overcome these difficulties.

Radioactive Decontamination and Recovery of Major Industry

Besides these damages, the incident in Tohoku has significantly different aspect than other disasters, which is the major explosion of Fukushima nuclear power plant associated with the earthquake and tsunami. The leakage and contamination of radioactive have been affecting 12 cities and more than 8,8000 residents in Fukushima prefecture. The Tokyo Electric Power Company announced that they have a clear schedule to put the crisis under control and to demolish the nuclear reactor, and that it takes 40 years to complete it.

One of the most attractive policies for Japanese after the Fukushima incidence was decontamination. Both the central and the local governments have spent more than 2 trillion Japanese yen for the decontamination of neighboring cities of Fukushima. Because of their almost endless effort of decontamination, the health risk from radioactive can be low enough, but the families with small children are reluctant to come back to their original residences. Nonetheless, creating cities that are location-wise close enough but with risk-wise lower enough to their original residences. Such attempt can be more enforceable to attract the original residents to come back.

What about industry? The fishery industry has had experienced the severe levels of inefficiency in production. The production levels in fishery industry in Japan has been decreasing since late 80's because of the overcatch, and has been over-invested. By having 90% of the fisherman to close their business, the industry can decrease 400 billion Japanese yen, which simply increases the profit of fishery industry (Yagi and Managi, 2011).

The damages in fishery industry consist of ports (68%), boats (14%), aquaculture (12%) and processing factories (5%) (Demura,2011), which means that there are ports that were damaged themselves and their processing factories were damaged as well. To enhance the recovery process, the government could support the ports without the damaged processing factories. The industry has been over-equipped already and less numbers of fabric facilities can imply less cost.

As I mentioned at the beginning, one of the keys for successful recovery for the damaged economies is to have less or no damaged neighboring economies. As the coastal area of Tohoku Region is vastly damaged and it is very hard to find cities with small damages, the central and local government need to create such cities. In such situation prioritization matters.

Concluding Remarks

Natural disasters incur humongous unexpected extra cost to economics. Unfortunately, when the sources are very limited, the recovery cannot be done uniformly. To implement successful recovery, prioritization matters, and the prioritization should be based on cost efficiency. For policy makers, it must be very challenging to announce that the policies are based on cost efficiency because the people who are included in the fields with low priority will feel as if they were sacrificed. However, to have sustainable recovery plan, the principal needs to be cautious on the amount of resources. Once they successfully create the recovered cities with less structural economic problems that existed before the disaster, the people who are in the field with low priority can be helped. Meanwhile, the policy makers need to compensate such people and the compensation should be part of the recovery plan.

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Taiwan Agricultural Technology Foresight 2025

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The Role of Agriculture in Taiwan

Taiwan was one of the leading countries in subtropical agriculture several decades ago, but now agriculture has lost its importance in job creation, domestic production and international trade. However, agriculture is still at the root of the economy and has many functions beyond production – it provides the food we eat, conserves the environment we live in and is a force of social stability.
Taiwan, with a nominal GDP of $530 billion dollars and a GDP (PPP) per capita of $46 thousand US dollars in 2014, is known for its manufacturing capabilities today, but it used to export a large number of agricultural products and technologies to many countries a long time ago. Since 1959, more than 100 agricultural missions have been dispatched to more than 60 countries, about half of which are currently at work in Africa, the Middle East, Latin America and Asia-Pacific.
In fact, Taiwan's total land area is about 36,000 square kilometers, most of which is mountainous or sloped. Therefore, agriculture is practiced mainly in the plains, which comprise 29 percent of the country. As a subtropical island characterised by high temperatures and heavy rainfall, Taiwan offers biodiversity for agriculture but also lends itself to the breeding of insects and diseases. There are also frequent typhoons that cause natural disasters in the summer and autumn every year.
There have been significant changes in Taiwan’s agricultural exports over the years, however. Years ago, Taiwan exported sugar cane, rice and canned mushrooms or asparagus. Now Taiwan’s main exports are aquaculture products (e.g., tuna, eel, tilapia), leather and feathers, and its main agricultural imports include corn, soybeans, wine, tobacco, cotton, lumber, beef and wheat. In 1953, the average value of agricultural production increased by 7.3 per cent annually, and exports increased at a rate of 9.3 per cent. Beginning in 1970, however, agricultural exports fell behind agricultural imports. In 2010, imports were USD 12.8 billion and exports were USD 4 billion. The production value based on agriculture is estimated at approximately 11.2 per cent of GDP while primary production accounts for only 1.5 percent of GDP in Taiwan.

The Revitalisation of Agriculture in Taiwan

In order to revitalise the agricultural sector to meet the challenges of trade liberalisation, globalisation, the knowledge-based economy and, particularly, climate change, the Taiwanese government's Council of Agriculture (COA) commissioned a project – *Taiwan Agricultural Technology Foresight 2025* – to the Taiwan Institute of Economic Research (TIER). This four-year project (2008–2011), with an annual budget of USD 350,000, conducted foresight-related activities, including demand surveys, trend and policy analyses, horizon scanning, visioning, essay contests, training workshops, two-round Delphi surveys, roadmapping and the development of policy suggestions (short-, mid- and long-term development plans and priorities) (see Figure 1).

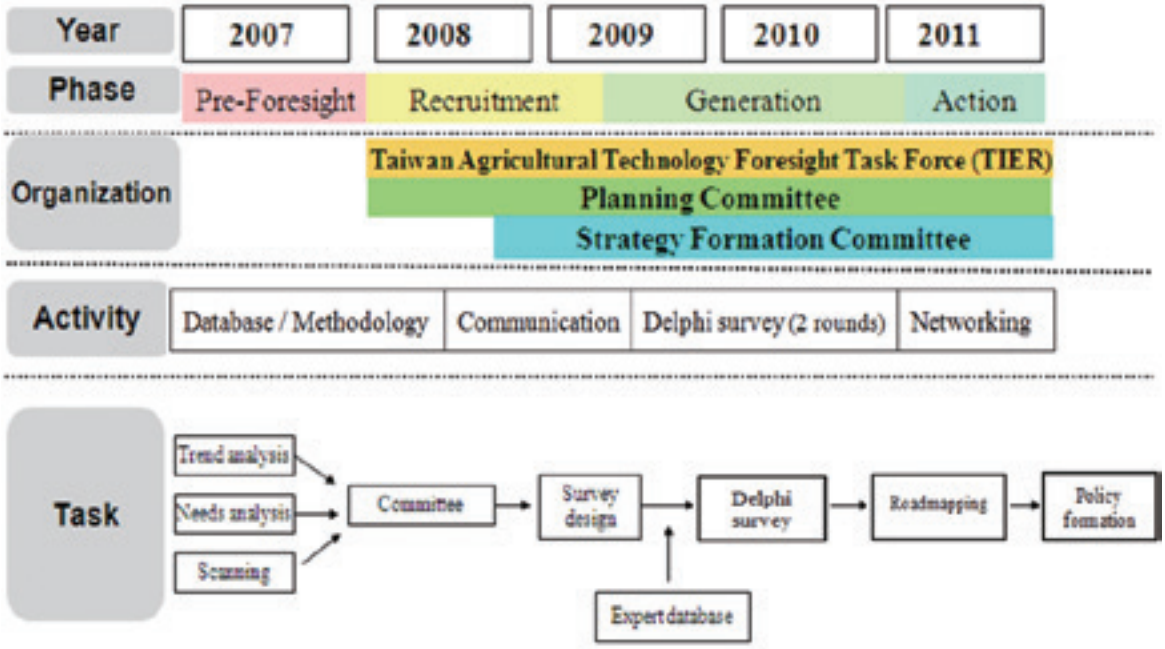

Figure 1. Structure of the *Taiwan Agricultural Technology Foresight 2025* project

The project aimed to identify R&D priorities to meet the long-term objectives for agriculture in Taiwan, such as to improve farmers' productivity and livelihoods, develop resource-efficient and environmentally friendly methods of farming, and ensure food safety by instituting a traceability system. These objectives were embedded in a vision of making Taiwan a better place to live in terms of industrial development, environmental protection and quality of life in general.

The Taiwan Agricultural Technology Foresight 2025 Project

In 2008, TIER set up a task force of six researchers and two assistants to learn foresight techniques, mainly from Japan. It compiled a database of social needs, technological trends, research resources, critical issues and agricultural policies nationally and worldwide.

Under the support and approval of COA, the project set up the Planning Committee consisting of government officers, agricultural experts and senior researchers, including social scientists and an economist. The Planning Committee decided that the project's target year was to be 2025 and that the purpose of the foresight was to identify R&D priorities to meet the long-term objectives for agricultural development in Taiwan stated above.

Visioning for Research Topics

In order to link the foresight and policy, the project set up the Strategy Formation Committee, with ten subcommittees corresponding to the ten research areas of COA, each of which was comprised of agricultural experts and senior researchers. The members of the Strategy Formation Committee were nominated by the Planning Committee and then approved by COA. The Committee's task was to depict a vision for 2025 in each research area and to figure out the research topics that need to be addressed to shape the future of agriculture in Taiwan as anticipated by the Planning Committee.
In 2009, the Strategy Formation Committee proposed more than 100 research topics for the project. The TIER task force tried to consolidate some of them and organise them in a uniform format. Then, the Planning Committee identified the final 74 research topics and the related key questions for the Delphi questionnaire.
In 2010, the TIER task force developed an online survey platform and carried out two rounds of Delphi surveys. There were 675 experts and researchers on the list of the first round, 546 of whom participated in the Delphi survey (response rate of 80 percent) and 512 of whom returned valid questionnaires, which were thus included in the analysis. For the second round, 546 experts and researchers were listed, 413 of whom participated in the Delphi survey (response rate of 76 percent); 407 of them returned valid questionnaires that were included in the analysis.
Based on the survey responses to the questions concerning the 74 research topics, the project compiled indices of industrial development, environmental protection, quality of life, national priorities and government support respectively to measure the research topics in different respects. The standard deviations of all indices turned out smaller in the second round than in the first round. This implies that the Delphi survey produced results converging toward a consensus.

Shaping the Future of Agriculture in Taiwan

The project particularly tried to compile a 'national priority' index composed of the factors industrial development, environmental protection and quality of life, each of which was given equal weight in creating a vision of a better life in Taiwan. The ten highest 'national priority' scorings among the research topics identified in the project are shown in Table 1. These research topics reflect the needs for shaping Taiwan's agricultural future in ways to improve farmers' livelihoods (priorities 2, 6, and 8), develop resource-efficient and environmentally friendly methods of farming (priorities 3, 5, 7, 9) and ensure food safety by instituting a traceability system (priorities 1, 4, 10).

Table 1. The top 10 research topics of the *Taiwan Agricultural Technology Foresight 2025*

1. Development of accurate, rapid and simple diagnostic kits for pesticide residues.
2. Research on the ecological restoration of polluted farmland, derelict rearing ponds, overdrawn groundwater areas, riverbeds and banks, and degraded forestland.
3. Elucidation of global climate change affecting Taiwan's agricultural ecosystem and the development of counter measures.
4. Improvement of integrated safety tests, a tracking system and certification for agri-food products.
5. Development of crop production systems with low energy consumption, low emission of greenhouse gases and efficient use of water resources.
6. Improvement of forecasting and monitoring techniques for slopeland debris slides.
7. Development of groundwater-saving aquaculture.

8. Development of agricultural environmental resources monitoring and early disaster warning technology.
9. Development of energy-saving and carbon-reducing preservation and shipping technologies for agricultural products.
10. Clarification of transmission modes and pathogenic mechanisms of animal and human infectious diseases.

The survey shows that the government should support those research topics with higher scores in environmental protection and quality of life, particularly due to the multifunctional nature of agriculture (positive externalities). By contrast, in regard to those research topics that scored high in terms of industrial development, the respondents considered less need for government supported research since the private sector can be expected to take charge in these areas (see Appendix). All of these research topics have been incorporated into COA's research agenda as evidenced by COA's call-for-projects announcement.

In addition, in order to attract the young generation to think about the future of agriculture, the project invited young people to participate in the ***Taiwan Agricultural Technology Foresight 2025*** contest (see Figure 2). The contest asked youngsters to depict images to reflect what agriculture will look like in the future in Taiwan.

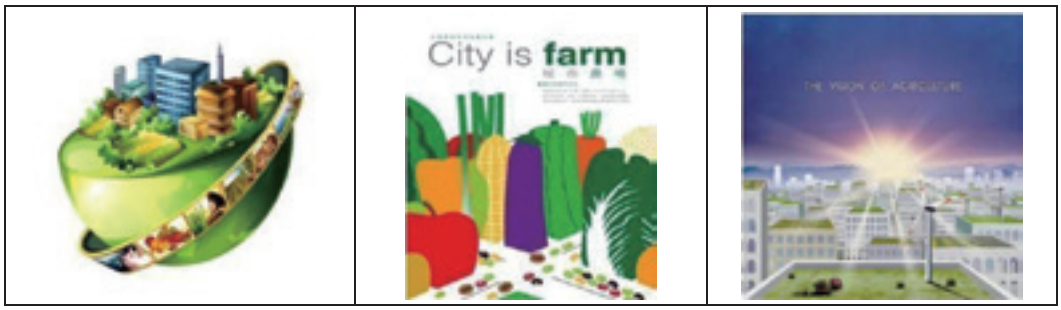

Figure 2. The winners of the *Taiwan Agricultural Technology Foresight 2025* contest

Foresight for Policy and as Policy

This was the first time that Taiwan conducted a large-scale expert opinion survey using the Delphi approach. The goal was to identify the research topics to meet the needs for shaping the future of agriculture in Taiwan. Based on roadmapping, the project presented policy suggestions at the end of 2011.

The project's major contribution has been the government's support for the research topics that have been identified as a 'national priorities' in terms of industrial development, environmental protection and quality of life. The project is expected to improve farmers' productivity and livelihoods, particularly for smallholders, develop resource-efficient and environmentally friendly methods of farming in Taiwan's limited land area and reinforce the links between production and consumption of agricultural products by implementing a traceability system.

International Collaborative Research on Infectious Diseases – J-GRID (MEXT), SATREPS (JST/JICA), A*STAR (Singapore), JSPS Programs –

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Graduate School of Medicine and Graduate School of Health Sciences, Kobe University, have been collaborating with top universities in ASEAN countries, such as Indonesia, Thailand, Singapore and the Philippines, since 1960's. Especially for the past 10 years, we made use of governmental grants, such as 1) Japan Initiative for Global Research Network on Infectious Diseases (J-GRID; 2007-2010; 2010-2015; 2015-2020) supported by the Ministry of Education, Culture, Sports, Science and Technology (MEXT), 2) Science and Technology Research Partnership for Sustainable Development (SATREPS; 2009-2014) from the Japan Science and Technology Agency (JST) and the Japan International Cooperation Agency (JICA), and 3) Re-inventing Japan Project for International Students Exchange (2012-2017) supported by MEXT and Japan Society for the Promotion of Science (JSPS). We also make use of other international grants, such as 4) A*STAR supported by Singapore and jointly by JSPS. In the J-GRID program, we have dealt with topics of a number of important infectious diseases, such as highly pathogenic H5N1 avian influenza, viral hepatitis caused by hepatitis B, C and E viruses (HBV, HCV, HEV), dengue and dengue hemorrhagic fever, HIV/AIDS and diarrhea. In this forum, Dr. Masanori Kameoka will talk about HIV/AIDS and dengue, and Dr. Toshiro Shirakawa about diarrheal diseases and novel therapeutic measures using biological products. To begin with, I will first explain the organization of the J-GRID and SATREPS programs and then present and discuss some of our important achievements on the study of HCV during the J-GRID, SATREPS, A*STAR and JSPS programs.

1) It is estimated that more than 170 million people are infected with hepatitis C virus (HCV) worldwide. Hepatocellular carcinoma (HCC) is the worst and common sequel of HCV infection. HCV exhibits heterogeneity in nucleotide sequences of the viral genome and amino acid sequences of the viral proteins. Currently, the possible clinical impact of the viral heterogeneity on HCC development is not fully understood. We investigated sequence heterogeneity in the core protein, NS3 and NS5A of HCV genotype 1b (HCV-1b) in patients who later developed HCC and in those who did not even after long-term follow-up. Sequence analysis revealed that glutamine at position 70 of the core protein (core-Gln^{70}), tyrosine at position 1082 *plus* glutamine at 1112 of NS3 (NS3-Tyr^{1082}/Gln^{1112}) and 6 or more mutations in the interferon/ribavirin resistance-determining region of NS5A (NS5A-IRRDR≥6) were significantly associated with development of HCC. Our results suggest that HCV isolates with core-Gln^{70} and/or NS3-Tyr^{1082}/Gln^{1112} are more closely associated with HCC development compared to those with Non-(Gln^{70} *plus* NS3-Tyr^{1082}/Gln^{1112}). This sequence heterogeneity can be used as a diagnostic tool to predict high or low risk of HCC development in patients infected with a particular group(s) of HCV-1b strains.

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2) Strong and sustained T cell responses against HCV, especially against the nonstructural protein 3 (NS3) of HCV, are important for recovery from acute HCV infection. Rapid and a wide range of specific $CD4^+$ helper and $CD8^+$ cytotoxic T cell responses are critical for HCV clearance. We generated recombinat *Bifidobacterium longum* displaying HCV NS3 peptides containing CD4 and CD8 epitopes and tested for its potential as an oral therapeutic vaccine against chronic HCV infection. The results demonstrated that oral administration of this vaccine could induce HCV NS3-specific T cell immune responses in mice probably through cross-presentation of the antigens in the intestinal mucosal immune system. This suggests the promising potential as a novel oral therapeutic vaccine against chronic HCV infection. The idea of an oral therapeutic vaccine can also be applied to chronic HBV infection, in which currently available direct-acting antiviral agents (DAAs) against HBV cannot eliminate the virus completely and an additional immune-stimulating agent(s) or immune-competence condition is needed to completely eliminate the virus from the patients. Safe, easy-to-

take and effective oral therapeutic vaccines against pathogenic viruses to cure chronically infected patients would open up a new paradigm of vaccine strategies. We would like to expand our mutual collaboration with researchers in National Taiwan University to develop a good oral therapeutic HBV vaccine.

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3) Cholesterol-lowering statins, such as lovastatin, have been shown to suppress HCV RNA replication in cell culture. In our attempt to search possible anti-HCV substances, we came across extracts from a microbe that unexpectedly enhanced HCV production in cell culture, and eventually identified lovastatin as a responsible compound for the enhancement. Mechanism-of-action analysis revealed that lovastatin and other cholesterol-lowering statins at high concentrations enhanced release of HCV infectious particles (virion) from infected cells compared to the control, without enhancing HCV RNA replication, HCV protein synthesis or HCV virion assembly in the cells. Lovastatin treatment increased the phosphorylation (activation) level of extracellular-signal regulated kinase 5 (ERK5). Lovastatin-induced increase of HCV virion release was partially abrogated by ERK5 inhibitors, BIX02189 and XMD8-92, or by ERK5 knockdown using small interfering RNA (siRNA). We can conclude that statins at high concentrations markedly enhance HCV virion release from infected cells, partly through activation of ERK5. The statin-induced enhancement of HCV virion release potentially may have an important clinical relevance; high viremia titers in HCV-infected patients who are concomitantly treated with statin and other drugs that are metabolized by cytochrome P450 isoenzymes, such as cyclosporine A, macrolides, azole antifungals, fibrates and antiviral protease inhibitors against HIV and HCV. It may also have a potential benefit in biomedical application; cost-effective production of an inactivated HCV whole virion vaccine on a commercial basis.

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4) We previously reported that HCV infection induced Bax-triggered, mitochondrion-mediated apoptosis. However, it was still unclear how HCV induced Bax activation. Recently, we showed that the HCV-induced activation and mitochondrial accumulation of Bax were significantly attenuated by treatment with a general antioxidant, *N*-acetyl cysteine, or the specific c-Jun N-terminal kinase (JNK) inhibitor SP600125. The results suggest that the reactive oxygen species (ROS)/JNK signaling pathway is upstream of Bax activation in HCV-induced apoptosis. We also demonstrated that HCV infection transcriptionally activated the expression of the pro-apoptotic protein Bim (three major splice variants Bim_{EL}, Bim_{L} and Bim_{S}). The HCV-induced increase in the Bim expression was significantly counteracted by treatment with the antioxidant or the specific JNK inhibitor. The results suggest the involvement of ROS/JNK signaling pathway in the Bim upregulation. Also, HCV infection resulted in a marked accumulation of Bim on the mitochondria and augmented interaction with Bax. On the other hand, downregulation of Bim by siRNA significantly prevented HCV-mediated activation of Bax and caspase 3. We conclude that HCV-induced overproduction of ROS and JNK activation transcriptionally lead to enhanced Bim expression, resulting in Bax activation and apoptosis induction in HCV-infected cells.

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Characterization of Southeast Asian type of HIV

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Human immunodeficiency virus (HIV) infection and acquired immune deficiency syndrome (AIDS) (HIV/AIDS) cause a serious health problem and have a big impact on the economic of several Southeast Asian countries. HIV type 1 (HIV-1) is the major causative agent of AIDS, and is prevalent all over the world. Thailand has the highest HIV-1 prevalence rate among Southeast Asian countries. In addition, the epidemic of HIV-1 is currently rapidly growing in Indonesia. In order to gain a better understanding of the HIV-1 situations in the countries, we have conducted collaborative studies with Thai and Indonesian researchers. HIV-1 is characterized by extensive genetic heterogeneity and divided into four groups, M (major), O (outlying), N (new or non-M, non-O) and P (pending). In addition, viruses in group M is further classified into many subtypes and circulating recombinant forms (CRFs). Of these, subtypes A, B, C, D and G, as well as CRF01_AE and CRF02_AG, are the major subtypes and CRFs responsible for the worldwide HIV-1 pandemic. While subtype B of HIV-1 is the predominant subtype in the Americas, Europe and Australia, the epidemic of non-B subtypes and CRFs is growing in Africa and Asia. CRF01_AE is prevalent throughout Southeast Asia and is responsible for most infected cases in Thailand and Indonesia.

Immunological characterization of Southeast Asian HIV-1 CRF01_AE viruses

The envelope glycoproteins (Env), gp120 and gp41, of HIV-1 play a central role in viral transmission and mediate attachment and incorporation of the virus into target cells through specific

interactions with the CD4 receptor and chemokine co-receptors. In addition, Env is a major target of humoral immune responses against HIV-1 and is therefore a candidate for a vaccine antigen. Env gp120 and gp41 are the most variable HIV-1 proteins with typical intersubtype and intrasubtype differences, reaching 35% and 20%, respectively; therefore, the humoral immune responses against Env potentially somewhat vary among different subtypes and CRFs. In addition, recent HIV-1 epidemiologic data show that non-B subtypes are more prevalent than subtype B in Asian and African countries where a protective vaccine against HIV-1 infection is needed urgently. Therefore, more information on the Env of non-B subtypes is required. In collaborative projects with Thai researchers, we studied the immunological characteristics of Env derived from HIV-1 CRF01_AE viruses (CRF01_AE Env) isolated in Thailand. Our study revealed that the neutralization susceptibility of CRF01_AE Env to previously established, broadly neutralizing antibodies against gp41 and HIV-1-infected patient plasma varied, while most viruses showed resistance to anti-gp120 broadly neutralizing antibody, IgG1 b12 (b12). Among the CRF01_AE Env clones we tested, 34 clones were resistant to b12, while a clone was susceptible to b12. So, we conducted molecular analyses in order to determine the responsible region(s) for b12 resistance of CRF01_AE Env using molecular biological techniques. A series of studies to evaluate the molecular mechanism(s) of how the HIV-1 CRF01_AE Env confer resistance to the antibody revealed that an amino acid substitution at position 185 in the V2 region of gp120 played a crucial role in regulating the b12-susceptibility of CRF01_AE Env by cooperating with 2 potential N-linked glycosylation (PNLG) sites at positions 186 (N186) and 197 (N197) in the V2 and C2 regions of Env gp120. The amino acid residue at position 185 and 2 PNLG sites were responsible for the b12 resistance of 21 of 23 (>91%) CRF01_AE Env clones tested. Namely, the introduction of aspartic acid at position 185 (D185) conferred b12 susceptibility of 12 resistant CRF01_AE Env clones in the absence of N186 and/or N197, while the introduction of glycine at position 185 (G185) reduced the b12 susceptibility of 9 susceptible CRF01_AE Env clones in the absence of N186 or N197. Our study revealed that 2 PNLG sites, N186 and N197, and an amino acid residue at amino acid position 185 of CRF01_AE Env gp120 are responsible for the neutralizing resistance of Southeast Asian strains of HIV-1 CRF01_AE viruses to the broadly neutralizing human monoclonal antibody, b12. In other words, information of the epitope of previously established neutralizing monoclonal antibody, b12 is not able to apply for vaccine development for HIV-1 strains prevalent in Southeast Asian countries. Therefore, we also have tried to establish anti-HIV-1 neutralizing human monoclonal antibodies by ourselves in Thai and Indonesian collaborations; however, candidates of broadly neutralizing monoclonal antibodies have not been successfully established yet so far.

Sero and molecular epidemiology of HIV-1 prevalent in Indonesia

According to the report from the Joint United Nations Programme on HIV/AIDS (UNAIDS), the

number of people newly infected with HIV-1 continues to fall year by year globally; however, rapid epidemic growth of HIV-1 is continuing in several countries. Among Southeast Asian countries, the annual incident rate of HIV-1 infection has declined in many countries, including Cambodia, Malaysia, Myanmar, Nepal and Thailand, whereas it has continuously increased in countries such as Indonesia, Bangladesh and the Philippines. In Indonesia, the number of people living with HIV-1 was estimated to be 380,000 at the end of 2011, and 55,000 people were newly infected with HIV-1 in 2011. In addition, the estimated number of people living with HIV-1 markedly increased (3166.7%) from 12,000 people in 2001 to 380,000 people in 2011 in this country. Furthermore, uncertainty in the estimation of the number of people living with HIV-1 in Indonesia is apparent, suggesting the importance of accumulating more epidemiological data in Indonesia. HIV-1 is a blood-borne virus that spreads through contaminated blood and other body fluid. In Indonesia, the sharing of needles and syringes is considered to be a major high-risk practice for HIV-1 transmission among injecting drug users (IDUs). In addition, the sexual transmission of HIV-1 has also apparently increased in Indonesia. Commercial sex plays a significant role in the spread of HIV-1; however, the coverage of HIV-1 prevention programs among commercial sex workers (CSWs) is reported to be less than 25% in Indonesia. As a sero-epidemiological study in collaboration with Indonesian researchers, we conducted an epidemiological study on the prevalence of HIV-1 among CSWs residing in Surabaya, the capital of East Java province of Indonesia with large communities of CSWs. In addition, an epidemiological study on the prevalence of other blood-borne viruses, hepatitis B virus (HBV), hepatitis C virus (HCV) and GB virus C (GBV-C), were carried out. The results showed that the prevalence rates of HIV-1, hepatitis B core antibody, hepatitis B surface antigen, anti-HCV antibodies and anti-GBV-C antibodies were 11%, 64%, 4%, 0.5% and 0% among CSWs involved in this study, respectively. In addition, most CSWs showed low awareness of sexually transmitted diseases and had unprotected sex with their clients. The HIV prevalence rate among CSWs was significantly higher than that among the general population in Indonesia (0.2-0.4%). In addition, CSWs were at a high risk of exposure to HBV, although chronic HBV infection was less frequently established. These results suggest the necessity of efficient prevention programs for HIV and other blood-borne viral infections among CSWs in Surabaya, Indonesia. In addition, we have studied the genotypic characteristics of HIV-1 strains isolated in Surabaya as well as in many other regions in Indonesia. PCR-amplification and sequencing analysis of viral genes revealed that HIV-1 CRF01_AE viruses are mainly prevalent in many regions in Indonesia; however, other subtypes and recombinant forms, such as recombinant viruses between CRF01_AE and subtype B viruses, an African CRF02_AG viruses and other unique recombinant viruses are also detected as minorities throughout the country. In addition, somewhat different pattern of HIV-1 subtype distribution is found in the Papua province compared to other regions of Indonesia. We are going to continue molecular epidemiological studies in order to reveal the distribution of HIV-1 subtypes and CRFs in Indonesia. Furthermore, as a part

of molecular epidemiological studies, we also studied the appearance of drug resistant viruses against antiretroviral therapy (ART) among HIV-1-infected individuals on ART in Surabaya, Indonesia. Although HIV-1 drug resistance is a major obstacle in Indonesia, information on drug resistance is limited in the country. Therefore, appearance of drug resistance mutations in the HIV-1 protease (PR) and reverse transcriptase (RT) genes were studied among ART drug-treated, HIV-1-infected patients in Surabaya. HIV-1-infected individuals who are on ART more than 2 years were randomly recruited regardless of the viral load or ART failure. Fifty-eight HIV-1 PR genes and 53 RT genes were PCR-amplified and sequenced. CRF01_AE viruses were identified as the predominant strain, as described above. Major drug resistance mutations were not detected in the PR genes. In contrast, 37.7% (20/53) of the participants had 1 or more major drug resistance mutations in the RT genes, predominantly M184V (28.3%), K103N (11.3%) and thymidine analogue mutations (TAMs) (20.8%). The high prevalence of drug resistance mutations in RT genes indicated the necessity of monitoring the effectiveness of ART in Indonesia.

We believe that the research outcomes of these collaborative studies may provide important information for better understanding the characteristics of HIV-1 strains prevalent in Southeast Asian countries.

Development of the novel oral vaccine platform utilizing *bifidobacteria*

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Abstract:

We have been developing the novel oral vaccine platform efficiently and safely to induce mucosal and systemic immunity against various infectious pathogens (e.g. *Salmonella* Typhi, hepatitis C virus, influenza type A virus, and others). Our proposed vaccine platform utilized bifidobacterium displaying antigen, including CD4 and CD8 epitopes of the pathogens on the cell-surface. The health-promoting benefits and safety of bifidobacterium have long been recognized. In addition, comparing to Lactobacillus, bifidobacterium has the higher adhesive ability to human epithelial cells and the better effect on activating human immune systems. Bifidobacterium can be freeze-dried and encapsulated in PH-dependent seamless capsule. Encapsulated bificdobacterium can be delivered to intestine with resistance to gastric acid, and be stored at room temperature. The advantages of this novel oral vaccine platform are efficient cellular and humoral immunities expected, less side effects (pain, pathogenisity), no necessity of needles, stored at room temperature, easy to administer to children even in poor hygiene conditions.

Background:

The majority of vaccines in use today are delivered by injection to the intramuscular, subcutaneous, or intradermal spaces, although this practice is painful, requires a needle and syringe, and poses a risk

of transmission of infections among patients, health workers, and the community, especially in developing countries [1]. The initial infection with most human pathogens occurs at the gastrointestinal, respiratory, or genital mucosa. Theoretically, oral vaccines could induce effective mucosal and/or systemic immunity, and could be easily and safely administered without a needle and syringe to a large number of people in a short period of time. Despite these advantages, oral vaccines have been used relatively infrequently against infectious diseases such as poliomyelitis, typhoid, rotavirus, and adenovirus infections. In most cases, oral vaccines are employed against enteric infections using attenuated live pathogens. These facts suggest the difficulty of inducing systemic immunity using oral vaccines. Recently, several attenuated bacterial strains, including *Salmonella* strains, have been used as heterologous antigen carriers for oral mucosal vaccines[2]; however, a major concern is that the attenuated pathogen is not suited for use in immunocompromised or weak hosts, for whom it can potentially be pathogenic[3]. Therefore, the use of probiotic bacteria as an antigen delivery vehicle has been considered as a key component of a novel oral mucosal vaccine[4]. Several antigen-expressing systems to a specific location in the cytoplasm, cell wall, or extracellular medium were previously tested for their efficacy in antigen-presentation for mucosal immunity, and it was confirmed that the antigens expressed on the cell-surface were better recognized than those expressed intracellularly[5]. We successfully developed a novel *Bifidobacterium* antigen cell surface displaying system using the GLBP as an anchoring matrix as for the novel efficient oral vaccine platform.

Typhoid vaccine:

Although typhoid fever, caused by the enteric pathogen Salmonella enterica subsp. enterica serovar Typhi (S. Typhi), has long been controlled in industrialized countries, it still represents a significant socio-economical burden in developing countries[6]. According to the World Health Organization (WHO), 16 to 33 million people are affected by this disease worldwide, which causes 500,000 to 600,000 deaths annually [6]. In 1948, the introduction of chloramphenicol for the treatment of typhoid fever decreased the mortality rate from 10-30% to 1-4%, but outbreaks of chloramphenicol-resistant S. Typhi began to emerge in 1972[7]. Since the 1990s, fluoroquinolones have replaced chloramphenicol as the drug class of choice for suspected typhoid fever, but S. Typhi strains with resistance to fluoroquinolones are now increasingly reported in several countries [8]. The infection is spread by the fecal-oral route and is closely associated with poor food hygiene and inadequate sanitation. The control of typhoid fever by vaccination of high-risk populations is the most cost-effective means of containing this disease [9].

S. Typhi causes typhoid fever in humans, but is avirulent in most animals, including mice. By contrast, *S.* Typhimurium causes enteric fever in mice, with symptoms similar to those observed in humans after infection with *S.* Typhi[10]. Therefore, *S.* Typhimurium infection in mice is widely accepted as an experimental model for typhoid fever, and this murine typhoid fever model is very suitable for evaluating the efficiency of typhoid vaccine[11]. we investigated the efficiency of the vaccine of recombinant *B. longum* displaying *Salmonella*-flagellin in a murine typhoid fever model, and demonstrated that this vaccine could protect mice from a lethal challenge of *S.* Typhimurium. We

also confirmed that no *S.* Typhimurium was grown in the spleens of the vaccinated mice, using quantitative real-time PCR. These data suggested that this novel vaccine efficiently induced adaptive immunity enough to eliminate *S.* Typhimurium from our murine typhoid fever model.

HCV vaccine:

It is estimated that more than 170 million people are infected with the hepatitis C virus worldwide, and these chronic carriers are at risk of developing liver cirrhosis and cancer [12]. HCV is an enveloped, plus-strand RNA virus of the family Flaviviridae and is classified into six major genotypes [13]. Genotype 1b is the most prevalent in Japan and is widespread in the United States and Europe. This genotype also has a high rate of resistance to interferon-based treatments. The standard treatment for HCV infection is based on a combination of pegylated (PEG)-interferon (IFN) and an antiviral agent, such as ribavirin (RBV), although the virus eradication rates do not exceed approximately 50% with HCV genotype 1b infection, while that for genotypes 2 and 3 approaches 80% [14]. A strong T cell response against the nonstructural protein 3 (NS3) is important for recovery from acute HCV infection, and an early multi-specific CD4+ helper and CD8+ cytotoxic T cell response is critical for HCV clearance. In the present study, we successfully constructed a genetically modified *Bifidobacterium longum* (*B. longum*) displaying recombinant HCV-NS3 peptides containing some CD4 and CD8 epitopes located in the HCV-NS3 region as an oral vaccine against chronic HCV infection. The oral administration of this vaccine could induce NS3-specific immune responses in mice through intestinal mucosal immunity. Our findings suggest that this novel oral vaccine has great potential as a novel oral vaccine against chronic HCV infection.

Conclusion:

We have developed the novel oral vaccine platform using bifidobacteria, and constructed the typhoid vaccine using recombinant *bifidobacterium* displaying *salmonella* flagellin and the HCV vaccine using recombinant *bifidobacterium* displaying NS3 peptides containing several CD4 and CD8 epitopes, and we confirmed that these vaccines could induce both humoral and cellular immunity in a mouse experimental models. In the future, this needle/syringe-free and cold-chain-free oral vaccine could be applied to the large number of patients with various infectious diseases to markedly improve the world public health.

Note:

This presentation is based on our previous studies of following.

1: Takei S, Omoto C, Kitagawa K, Morishita N, Katayama T, Shigemura K, Fujisawa M, Kawabata M, Hotta H, Shirakawa T. Oral administration of genetically modified Bifidobacterium displaying HCV-NS3 multi-epitope fusion protein could induce an HCV-NS3-specific systemic immune response in mice. Vaccine. 2014 May 23;32(25):3066-74. doi: 10.1016/j.vaccine.2014.03.022. Epub 2014 Mar 21. PubMed PMID: 24657718.

2: Yamamoto S, Wada J, Katayama T, Jikimoto T, Nakamura M, Kinoshita S, Lee KM, Kawabata M, Shirakawa T. Genetically modified Bifidobacterium displaying Salmonella-antigen protects mice

from lethal challenge of Salmonella Typhimurium in a murine typhoid fever model. Vaccine. 2010 Sep 24;28(41):6684-91. doi: 10.1016/j.vaccine.2010.08.007. Epub 2010 Aug 13. PubMed PMID: 20709009.

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Telemedicine and Emergency Air Medical Services

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Introduction:

Emergency Air Medical Service (EAMS) is a limited resource in most countries. The balance of the outcomes in literature shows a mortality benefit to helicopter emergency medical service over ground transport. Appropriate use of EAMS seeks to maximize utilization of a scarce resource to improve patient outcomes. Overtriage of EAMS has been found in a number of countries and exposes a system to increased costs. Overtriage may also expose the program to unjustifiable safety risks. Rural and remote islands of Taiwan has benefited from the availability of the EAMS for interfacility transfers. The demands for Emergency Air Medical Services (EAMS) have increased worldwide in recent years. The geographical limitations in Taiwan main-island and unequal development of medical manpower and facilities on remote islands have resulted in a growing need of EAMS to the main island of Taiwan. A lack of the preflight screening mechanism has resulted in rapid growth of unnecessary flights. On account of cost containment, the Taiwan Department of Health established the National Aeromedical Approval Center (NAAC) for the preflight screening of patients requesting EAMS in 30 remote locations.

Methodology:

Retrospective analysis of all interfacility air medical transport flight records from Oct 2002 to Jul 2015 was performed. All materials were collected from the databank of Taiwan National Aeromedical Approval Center (NAAC). The NAAC is a physician-based 24-hour control center

coordinating the transport of severely injured or critically ill patients between Taiwan and its surrounding islands. Before NAAC was established, all EAMS were dispatched upon request of local physician.

The data were analyzed with Microsoft EXCEL and SPSS v. 11.0 softwares. We compared characteristics of patients in terms of general demographics, diagnosis, transferring time, approval rate, mortality rate within three days and location. Special consideration was made in regards to infectious diseases. Cost analyses involved direct costs, including operating costs, claims to National Health Insurance and indirect costs. Operating costs included personnel, capital, operations, National Health Insurance and administration. We aimed to identify practice patterns in EAMS related to resource utilization and clinical outcomes among patients undergoing interfacility transfer for definitive care. We hypothesize that patients benefit from to helicopter transport with incorporation of preflight video-telemedicine screening system, and we compare costs before and after NAAC was established.

Results:

Between Oct 01, 2002 and Jul 31, 2015, there were 4658 EAMS requests (avg. 0.99/day). Among them, there were 3952 requests for interhospital transports. A total of 3421 interhospital transports were approved, with overall approval rate of 86.56%. Among all completed cases, male patients outnumbered female patients (M:F= 2:1). Mean age of patients was 49.5 years. Medical and surgical conditions comprise 72% and 28% respectively. Stroke was the most common medical condition of EAMT; while head injury was the leading cause in surgical cases. There has been no patient safety or flight safety issue in 3421 flights. Cost is based on the difference between expenditures for the decreased in number of flights after NAAC was established, the cost of NAAC, video-telemedicine equipment and the fares for commercial flights and shuttle ferry. The average cost for each patient transfer was NT$200,000 (US$6,250). The annual budget of NAAC including physicians is 13,000,000 NTD (US$ 406,250). The operating cost of telemedicine system, including the equipment in 30 locations, is 6,500,000 NTD (US$203,125). The cost of transport by scheduled

commercial flight was $120 for round-trips and regular shuttle ferry of $ 70 for round trip. Costwise, the savings of government expenditure is US$43,700,066 during the twelve years and ten months period. The indirect cost includes the productivity loss due to patient disability, loss of future productivity due to premature death, social impact, family burden and risk of air crash. We were not able to quantify the indirect cost savings. Contrast to many reports that infectious diseases are contraindications to EAMS, our study showed infectious diseases are transportable with careful selection and preflight assessment. Because of the strict criteria on suitability for air transport of patients who have infectious diseases, even those with severe acute respiratory syndrome (SARS), the benefits of air transport clearly exceed the risk. During the SARS outbreak in Asia, patients with suspected SARS were safely transported by air with the use of an airtight portable isolation unit. Negative-pressure portable isolation units are equipped with air-purifying respirators. The construction is light and durable and has working ports through which the medical crew can monitor patients and perform procedures. So far, many patients with active pulmonary tuberculosis have also been safely transported in such novel isolation units, with an average flight time of 8 hours. The medical crews reported no problems during or after transport (and unpublished data). Meticulous preparation for air transport and post-transport monitoring are mandatory for transporting patients with communicable diseases who require respiratory isolation. In addition to SARS, Middle East Respiratory Syndrome Coronavirus (MERS-CoV) outbreak is associated with considerable morbidity. Prompt patient isolation and active monitoring of clinical progress are important principles. Patient disposition to designated medical centers may be inevitable. How to control infection and protect medical personnel who are responsible for patient movement is even more important. We have used portable medical isolation unit (PMIU) with successful experiences in transporting SARS and open tuberculosis. It can also apply to current escalating avian flu situation. It is made of clear lightweight polyvinyl chloride (PVC), weighted only 5 kg. Prior to assembly, it folds up into a valise. Fully assembled, it is 200cm in length, 55 cm wide and 65cm high. Fresh air enters the unit through three ports fitted with disposable PAPR-P3 HEPA filters. This PMIU provides seamless care and safety of hospital staffs. It can be re-used after disinfection. For current MERS-CoV situation, it can be used in selected cases for proper infection control.

Conclusion:

In an era of healthcare spending reform and scrutiny, the patterns in the mode of transportation for patient transport must be examined. There are numerous prerequisites for optimal outcome: a central coordinating authority, a well equipped ambulatory service, seamless communication between the ambulances and the receiving hospital, predefined arrangements between hospitals in the same geographical area, adequately trained paramedics and strict protocols of action are only few of these. The shortage of manpower and facilities in remote hospitals has necessitated EAMS for prompt and definitive treatment of critical patients. EAMS is becoming an increasingly important factor in improving the quality of primary care and avoiding medicolegal issues. The analysis of monthly EAMS applications and actual flights showed a significant decrease after NAAC was established. The physicians in the NAAC played crucial roles in this aspect. One of the major roles the physicians is being a gatekeeper for EAMS approval and transport quality. The system, including the protocols used, screening criteria, and the use of video telemedicine, is thought to have caused the reduction of EAMS applications. Our study demonstrates the physician-assisted preflight screening using video-telemedicine significantly reduced the frequency of unnecessary air medical transports, achieve better infection control and consequently led to reduced costs. Video-telemedicine can be an essential tool to support physicians in decision-making for patient screening.

Optimized Immunotherapy to Cure Chronic HBV Infection by Using a Convenient Immuno-competent Mouse Model

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Chronic hepatitis B claims about 240 millions patients by WHO's current assessment. To control CHB, two main approaches have been undertaken: the first is vaccination of naïve newborns or other subjects; the second is to treat chronic hepatitis B patients. The universal vaccination has been promoted since year 1984, and covered more than 75% of countries in the world. It is widely expected a notable decline of HBV carriers after the launching of vaccination program. Nevertheless, even in Taiwan where universal HBV vaccination began from year 1986 and covered more than 99% of newborns, the total HBsAg carriers only reduced from 3 millions in year 1982 to 2.4 millions in year 2005. More surprising, the estimated world HBsAg carriers increased from 224 millions in year 1990 to 240 millions in year 2005. The paradoxical increase of total HBsAg carriers, despite of decreasing HBsAg prevalence, after vaccination is largely contributed by the aging of world population, that resulted in more HBsAg carriers in the adult or senior people sectors. Therefore HBV vaccination has to be continued meticulously.

Regarding CHB load in Japan, new epidemiological survey showed hepatitis B as an emerging infection, and even taking over hepatitis C as the main chronic viral hepatitis. A recent survey from children to senior citizens discovered a 1.5-3 folds higher prevalence of CHB than that of CHC, especially among younger than 60 year-old group. The acute viral hepatitis sentinel report also showed the annual acute hepatitis B cases around 3000-4000 versus 100-800 cases of acute hepatitis C. Both findings indicated a big hepatitis B susceptible population in Japan, accounting for the higher risk of acute or chronic hepatitis B cases. Thus it deserves to take more active intervention steps, especially revising the HBV vaccination policy from selected immunization of newborns from HBV carrying mothers to a universal immunization of all newborns, irrespective of mothers' HBsAg status. It is expected Japan may adopt the new universal HBV vaccination in newborns in the near future.

For chronic hepatitis B carriers, they are t at high risk of developing end-stage liver diseases.

From REVEAL study, the male HBsAg carriers have a life-time risk of HCC up to 30% whereas the risk of female HBsAg carriers as 10%. Therefore these CHB patients do need effective antiviral therapies to control the hepatitis B virus activity. Currently there are two approved regimens for CHB treatment. One is the small molecules inhibiting HBV reverse transcriptiase, so-called nucleos(t)ide analogs, such as Entecavir or Tenofovir. These drugs are very effective in shutting down HBV replication and rapidly clear HBV virions from patients' circulation. However, the drugs cannot stop the gene expression of HBV in already-infected hepatocytes, so there are little reduction of infected hepatocytes from the patients. This makes the discontinuous of antiviral drugs almost impossible, as this will be followed by a rapid replication of HBV and a new round of HBV infection. Many treatment guidelines thus advocate life-long therapy that becomes very difficult for compromising drug compliance. Only about 1% of NA-treated patients can clear HBV after long-term therapies. The other therapy is the immune-modulator, namely the interferon-alpha. A 24- or 48 weeks IFN therapy can result in prolonged hepatitis B suppression in 20-30% of patients. However, only in around 10% of patients can clear HBV after IFN therapy. Therefore there is a clearly unmet demand for a curative therapy against CHB, aiming to clear HBsAg from patients, that is a serological cure.

In order to reach a serological cure of CHB, the most effective approach can be the cytotoxic lysis of HBV-infected hepatocytes by cellular immunity. Among CHB patients, they retained a low and modest immunity against HBV but insufficient to clear all infected hepatocytes. The oligo-clonal and exhausted T cells toward HBV has been the fundamental deficiency in failure to eliminate chronic hepatitis B.CHB is involved the complicated interaction between evolving hepatitis B virus and the host immune responses. Current antiviral Nucs effectively control new cycles of viral replication, but do not upgrade the host anti-viral immune responses. However, to study the HBV-specific immune responses and to optimize immune-therapy, we need a simple immune-competent animal, especially mouse, model.

There are several mouse models relevant to HBV immunological experiments, including HBV-transgenic mice; human hepatocytes-chimera mice; or blood-hepatocytes chimera mice. However, these systems are quite complicated and difficult to maintain for more than one year, necessary for chronic hepatitis B experiments. We adopted the hydrodynamic injection of HBV DNA system. The platform can efficiently deliver viral genome into the mouse liver to initiate viral gene expression, viral replication, and to release the complete virions and HBsAg into the circulation. Though there are no new cycles of HBV infection, this approach can stimulate the host anti-HBV immune responses. Depending upon the strains of mice, certain strains of mice clear the HBV rapidly but others cannot so the HBV become persistent. In the Balb/c, the mouse rapidly clears HBV 4 weeks after HDI of HBV DNA. In contrast, mice of CBA or C3H strains keep HBV and HBsAg in 80-90% of HDI-HBV treatment for more than 6 months. The commonly-used B5 mice cleared HBV in an intermediate rate.

By using this system, it is possible to study the mechanism of HBV persistence, and also tested a variety of new immonu-modulators. For example, we evaluated the role of individual HBV gene in the immune reaction. By simple in-situ mutagenesis, we could create HBV mutants losing a single viral gene. These single-gene knock-out HBV mutants were then injected into B6 mice to evaluate the HBV clearance. The results indicated HBV core and HBx gene playing essential role in HBV immune clearance. Next, we can assess the individual gene in HBV clearance by exploring a library of gene knock-out mice. The knock-out of B cells and IFN did not change HBV clearance, but knock-out of CD4 or CD8 did prolong HBV persistence, as anticipated. There are many genes involved in innate immunity also assayed. It turned out the TNF-alpha pathway to be essential for HBV immune clearing in the mice model. The third application of this mouse model is the ability to selective depletion of individual non-parenchymal cells to interrogate their relevance in HBV immune clearance. When the Kuppfer cells depleted by chlodronate, the HDI-HBV treatment resulted in a more rapid clearance. This suggested KC likely playing an immune-suppressing role for HBV clearance. In contrast, when the NK cells depleted by anti-sAGM antibodies, the HBV clearance was much delayed, indicating a pro-immuno clearing activity. All these experimental approaches are only possible in this HDI-HBV mice models. Now the model started generating new directions about HBV immunity. The in-depth analysis of murine anti-HBV immune responses may shed new lights on the mechanisms. In the end, we will like validating these findings in the HHB patients.

Finally, the HBV-persistence mouse models allow the testing new immune-therapies against CHB. We have shown both anti-HBV NAs or IFN insufficient to clear HBV from these mice models, consistent with current clinical experiences. The model can be applied to test or study novel anti-HBV approaches. For example, new TLRs ligands or therapeutic antibodies (against HBsAg or immune-inhibitory molecules ,PD1 or PDL1), are now studied in this system. In addition, exploratory therapies, such as reactivating exhausted NK cells, or preferential killing of HBV carrying hepatocytes by cIAPs antagonists, have been updated. In the future, we are interested in studying other new immune-therapies against hepatitis B, including the new oral vaccination approach developed in Kobe University. Prof. Hotta and Shirakawa recently constructed the bifidobacteria carrying HCV NS3 or other human cancer antigen, which can be easily taken orally

to stimulate specific immunity in the mice models, showing a possible and practical platform. We looked forward to test and study this new approach in the immune-competent CHB mouse model.

Development of Water Treatment Membrane for the Resolution of World Water Shortage

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Professor

Graduate School of Engineering, Kobe University

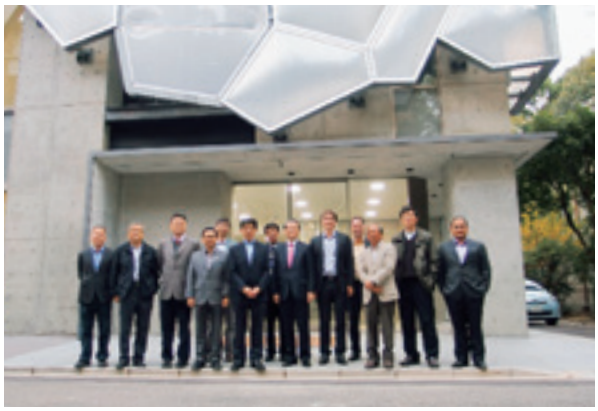
Water shortage is widely recognized as one of the major social issues in 21st century. According to a number of research, it is estimated that 2/3 of the people in the world would suffer from shortages of water by 2015. Hence, it is believed that 21st century is the age of water, shifting from the age of petroleum in 20th century.

In Kobe University, with the aim at tackling the global issues such as water shortage, the Center for Membrane and Film Technology (MaFTech center) was established in 2007, along with Kobe University's strategic focus on environmental studies. Within this presentation, firstly an introduction on the center and its recently activities including international linkages will be presented. Secondly, research on the water treatment will be focused. Throughout the content, we hope you can easily obtain an overall understanding on the MaFTech center's activities and seek collaboration opportunity with Kobe University.

The MaFTech center is now the largest academia-driven membrane research center in Japan. In April of 2015, it opened its newly constructed research facility, with totally 6 floors and 6000 m^2 space. At MaFTech center, currently there are 28 faculty as well as over 100 students engaging in membrane engineering research. They are mainly divided into 5 research groups: 1.Bio-process group, 2.Organic membrane group, 3.Gas separation group, 4.Water treatment group, 5.Film and membrane coating group. By integrating the work of these groups, MaFTech covers a great variety of membrane research from basic to applied perspectives. Now the research is conducted intensively and synergistically at the new building.

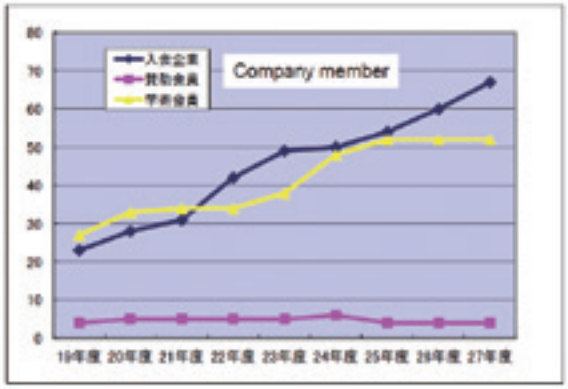
MaFTech's academic focuses are not only domestic but also international. It has been paying effort on building up connections with world renowned membrane research centers. Currently, it has established official linkages with 10 famous membrane research centers in Asian, Oceanian and European areas (Taiwan, Korea, China, Hong Kong, Australia, Indonesia, Malaysia and Europe). In order to enhance research and educational

collaboration among MaFTech and its overseas partners, MaFTech center initiated an annual international membrane workshop called iWMK in Kobe in 2014. It is a Kobe University based academic event supposed to be held every year at Kobe University. Within iWMK, we invite all of our partners with MOU (Memorandum of Understanding) signed to give presentations on their latest research. Then all of the members have closed discussion and exchanges on such presentations. We welcome all people from academic and industrial domains to join the iWMK. Apart from academia, MaFTech center also play a key role in collaboration with industry.



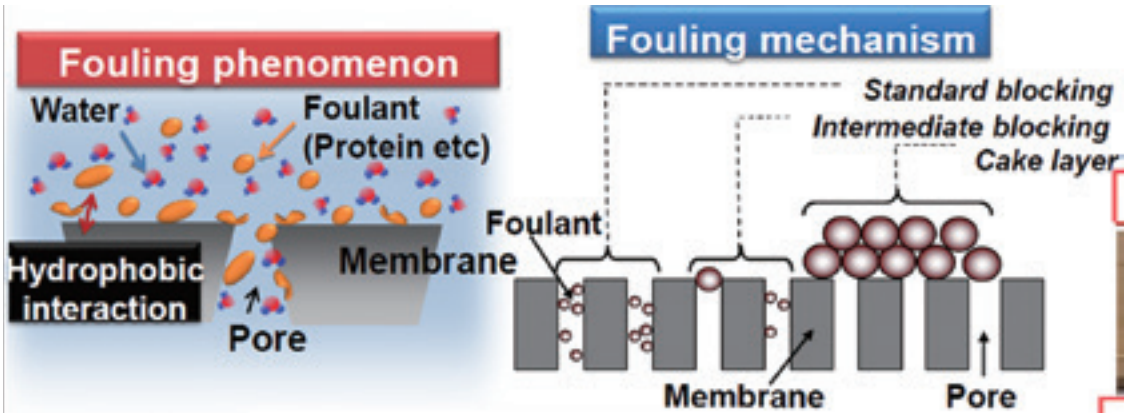
By cooperating with the off-campus organization called Organization for Membrane and Film Technology, it is now collaborating with more than 68 membrane related companies in Japan. Over tens of co-research projects are now in progress by utilizing MaFTech's latest research facilities.

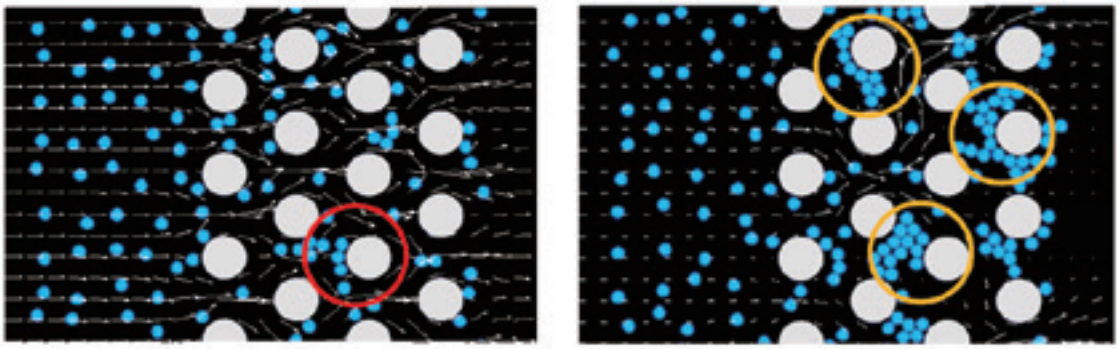
Regarding the research which focuses on membrane utilized water treatment, now we are implementing the research mainly via the following aspects, 1) membrane for water reuse and desalination with considerably low energy consumption, 2) strong anti-fouling membrane based on new materials, 3) energy production by membrane process, 4) innovative separation system by using our newly developed membrane. The major activities will be introduced as the following.



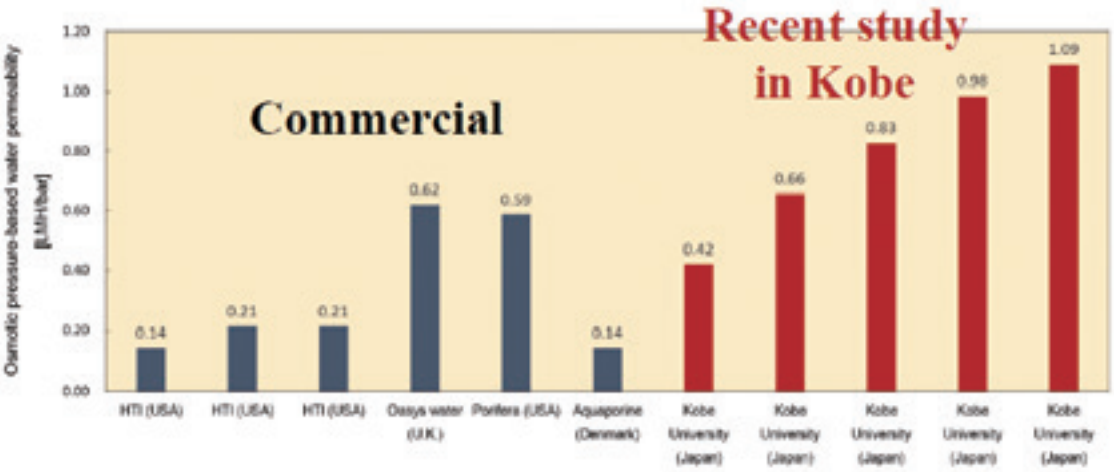
The membrane process for water treatment such as desalination, wastewater treatment and enrichment of products mainly includes three processes, i.e. reverse osmosis (RO), forward osmosis (FO) and membrane distillation (MD). In principle the transport mechanism of RO and FO is basically the same. The MaFTech center focuses on the development of novel materials and membranes such as mixed matrix membrane, biomimetic membrane to applications environmental and economic processes.

One of the MAFTech's focused membrane research is on membrane fouling. Membrane fouling is caused by the adsorption of organic macromolecules to the membrane surface. It results in a severe permeability decline during the water filtration. To improve the antifouling property of the membrane, MaFTech center aim to develop novel blend or copolymer membranes. Since nowadays there are still too many factors in the membrane fouling not yet understood, we pay a large amount of effort on the study of fouling mechanism. In order to have a comprehensive understanding of membrane fouling, our research covers experimental and theoretical perspectives. Additionally, via co-research with companies, the outcome of our study is not only limited to the laboratory level but close to the industrial use.





The fabrication of membrane is another major field in our research. Regarding the FO membrane research, we have successfully developed high performing FO membrane with the highest fluxes in world, not only the FO flux can be controlled as desired but also it suits the configuration of flat sheet and hollow fiber flexibly. Moreover, when considering the industrial use, since the module analysis is important to design and optimize full-scale FO desalination plant, our research also covers the FO module performance analysis. This approach will accelerate the laboratory research outcome to real industrial application.



Other research such as the study on biomimetic membrane and its fabrication method is also conducted at MAFTech center. We believe the research outcome will help develop the next generation membrane with great performance increase. Also, we propose hybrid system with low

energy, cost as well as high recovery ratio for waste water treatment and desalination process, as FO/RO, NF/FO/RO hybrid system, moreover, investigate fouling behavior and mechanism on the membrane surface through molecular dynamics (MD) and three dimensional phase-field simulations.

As an integrated large scale research unit of membrane technology, MaFTech center's research is highly diverse and multi-perspective. Apart from water-centric research, we also conduct advanced research on gas separation, organic thin films, coating process etc. Our goal is to contribute to the achievement of a sustainable society in future, by utilizing membranes and the innovations in membrane processes.

Morphology Control of Polymeric Membranes --- Roles of Polymer Chain Entanglement

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Nonsolvent-induced phase separation (NIPS) has been used for decades to prepare polymeric membranes for different membrane separation processes. For NIPS, homogeneous polymer solution is cast on a substrate and then immersed in a coagulant (polymer nonsolvent) bath, where phase separation of the polymer solution occurs because of the exchange of solvent and nonsolvent, and the resulting polymer-poor phase becomes the membrane pores and the polymer-rich phase forms the membrane matrix. Though the method has been widely used, a clear insight into how membrane forms still remains a challenge.

It has been noticed by many that the morphology of the polymer membranes prepared by NIPS is strongly influenced by the mass transport of solvent and nonsolvent during membrane formation and its interplay with phase separation. Analysis of the mass transport has therefore attracted much research attention. Most researches in this area are theoretical work focusing on determining the composition path and superposing it on the ternary phase diagram of polymer, solvent, and coagulant. It was usually presumed that phase separation occurred once the composition path intersected the binodal and the associated phase separation mechanism was nucleation and growth. However, phase separation via the mechanism of nucleation and growth may not occur if there is not enough time for the nuclei to form. Therefore, the time given for the nuclei to occur plays an important role in the formation of membrane pores. If the solution stays in the meta-stable region long enough for the nuclei to occur, phase separation via the nucleation and growth mechanism occurs and results in cellular pores. On the other hand, if the time the solution stays in the

metastable region is not long enough, the polymer solution does not phase separate in the meta-stable region and the following intake of nonsolvent would bring it to the unstable region (inside spinodal) and make it phase separate via the mechanism of spinodal decomposition. Inter-connected pores can thus be obtained. On the basis of the above discussion, the time that the solution stays in the meta-stable region is an important time scale in determining the membrane morphology.

The time that the casting solution stays in the meta-stable region is strongly related to the exchange rate of solvent and nonsolvent and is not easy to be determined experimentally. Our laboratory has been working on measuring the change during membrane forming in concentrations of polymer, solvent, and coagulant by using FTIR microscopy. An FTIR microscope equipped with a liquid cell was used for detecting the composition change at different positions during membrane formation. A drop of a polymer solution was placed in the cell and the nonsolvent was injected from the side of the cell. The IR beam was then focused at a position in the polymer solution and the spectra were taken at different times. The focused spots were varied so that the information at different positions was obtained. By identifying the characteristic peaks corresponding to the polymer, solvent and nonsolvent used, we were able to determine the compositions of the solution at different times and positions. We could then construct the composition path on the ternary phase diagram of polymer, solvent, and nonsolvent. With the procedures discussed above, the time the solution stays in the meta-stable region (between binodal and spinodal) could be determined. The time is referred to as t_m in the following.

It was found that the solution at the location near the interface of casting solution and nonsolvent bath stayed in the meta-stable region much shorter than the solution located deeper, because the mass transfer in the solution near the interface was faster than that in the deeper locations. We observed that the solution near the surface stayed in the meta-stable region too short to allow for the nuclei to occur. It thus crossed the meta-stable region without phase separation and underwent spinodal decomposition as its composition path entered the unstable region. The solution located deeper in the casting solution stayed in the meta-stable region long enough for the nuclei to occur. Therefore, the pores were inter-connected near the membrane surface and turned into cellular at deeper positions. And at a certain position, the porous structure changed from inter-connected to cellular. The t_m at the structure transition position can be interpreted as the time needed for the nuclei to occur, referred as t_{mc}.

The results we obtained indicate that two time scales are important in determining the pore structure. One is the time given for the nuclei to occur (t_m) and the other is the time needed for the nuclei to occur (t_{mc}). With $t_m > t_{mc}$, the phase separation was via nucleation and growth and the pores were cellular. On the other hand, with $t_m < t_{mc}$, the phase separation was via spinodal and the pores were inter-connected. For a casting solution, t_{mc} is constant and t_m is dependent on where the solution locates. t_m is higher as the solution locates further from the interface. Therefore, it was observed that transition from interconnected to cellular occurred at a deeper location in the prepared membrane for the casing solution with higher t_{mc}, since longer t_m was needed for the nuclei of polymer-poor phase to occur.

We investigated several factors affecting t_{mc}, including polymer concentration, polymer molecular weight and the solvency of the solvent used to prepare the casting solution. With higher polymer concentration, higher polymer molecular weight and lower solvency, t_{mc} was higher and

membranes with interconnected pores were easier to be obtained. By choosing suitable solvent, polymer molecular weight and polymer concentration to prepare casting solution, we were able to obtain membranes with interconnected pores throughout the cross section.

With a specific polymer and a solvent to dissolve it, the t_{mc} of the polymer solution was observed to be strongly dependent on the polymer concentration: as the polymer concentration was lower than a transition concentration (C_T), t_{mc} was not sensitive to the concentration and the value was about 1 sec; as the polymer concentration was higher than C_T, t_{mc} increased dramatically with increasing polymer concentration and could be as high as 10 sec. With higher polymer concentration, t_m also increased for two reasons: higher solution viscosity and larger gap between binodal and spinodal in the phase diagram. With increasing polymer concentration, the increase in t_{mc} would make the solution easier to perform spinodal decomposition (less easy to form nuclei), but the increase in t_m would make the solution easier to phase separate via nucleation and growth (staying longer in the metastable region to form nuclei). The two effects competed with each other and resulted in an interesting behavior as the polymer concentration crossed C_T. With a polymer concentration (C) lower than C_T, the effect of polymer concentration on t_m dominated since t_{mc} was not sensitive to polymer concentration with $C<C_T$; therefore, the solution was less inclined to preform spinodal decomposition with increasing polymer concentration. On the other hand, with $C>C_T$, the effect of polymer concentration on t_{mc} dominated since t_{mc} increased dramatically with increasing C as $C>C_T$; therefore, the solution had higher tendency to preform spinodal decomposition with increasing polymer concentration. On the basis of the above discussion, the transition concentration C_T can be interpreted as a polymer concentration that the solution has the lowest tendency to perform spinodal decomposition when it is used to prepare membranes. Also, it was observed that the value of C_T depends on the polymer used to prepare membranes, its molecular weight and the solvent used to dissolve it. C_T decreased with increasing polymer molecular weight and lower solvency.

C_T is the polymer concentration at which t_{mc} begins to increase dramatically with increasing polymer concentration. We also observed a transition polymer concentration (C_e) at which the solution viscosity begins to increase dramatically with increasing polymer concentration. The reason for the dramatic increase in viscosity is known to be related to polymer chain entanglement. As the polymer concentration in a solution reaches a threshold (the entanglement concentration), the solution viscosity begins to increase dramatically because of the occurrence of chain entanglement. On the basis of the above discussion, the transition polymer concentration C_e can be interpreted as the entanglement concentration. Our results also show that C_e coincided well with C_T, indicating that the dramatic increase in t_{mc} with increasing C as $C>C_T$ was caused by the occurrence of polymer chain entanglement in the polymer solution. With increasing polymer molecular weight or using lower quality solvent (lower solvency), chain entanglement started to occur at a lower polymer concentration (lower C_e), resulting in lower C_T. By using the normalized polymer concentration (C/C_e), we obtained a superposed curve of t_{mc} versus C/C_e (all the data collapsed into a single curve), indicating that the time needed for the nuclei to form (t_{mc}) is strongly related to the degree of polymer chain entanglement in the casting solution. By using the superimposed curve of t_{mc} and a simple diffusion model for t_m, we can calculate the position in a membrane where the porous structure changes from inter-connected to cellular. The calculated results agree well with the experimental data.

We will give examples showing that by varying solvent quality, polymer concentration, polymer molecular weight, we can change the degree of polymer chain entanglement and thus change the phase separation mechanism and the resulting membrane morphology. Also, examples will be given to show how the knowledge about the interplay of mass transfer and phase separation can lead to the preparation of highly porous membranes with inter-connected pores.

Tough Ion Gel Membranes Containing Amino Acid Ionic Liquid as a CO_2 Carrier

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Increase of CO_2 in the atmosphere causes serious environmental impacts including global warming and climate change. Hence, development of an economically viable and environmental friendly CO_2 capture technology is inevitable. During the last two decades, membrane technology has drawn considerable interests due to its potential and possibility to realize a CO_2 capture process with low energy consumption and low capital and operating costs. A feasible and desirable CO_2 separation membrane with high CO_2 flux but without sacrificing of CO_2/N_2 selectivity should be developed to fulfil the practical requirements.

In this context, room temperature ionic liquids (RTILs) have been proposed as an attractive CO_2 permeation media for supported ionic liquid membranes (SILMs), because of their distinct properties such as high CO_2 absorption capacity, negligible vapor pressure, huge chemical diversity, and high thermal stability. However, the poor mechanical stability under pressurized condition inherent to SILMs limits their application to low trans-membrane pressure systems. Incorporation of non-polymerizable ionic liquids (free ILs) into the matrix of functional cross-linkable ILs, called poly (RTIL)/RTIL composite membranes, was considered as a promising strategy to overcome mechanical stability issue of SILMs. However, despite mechanical stability improvement, the poly(RTIL)/RTIL composite membranes suffer from the low CO_2 permeability because of the low CO_2 absorbability of RTILs. Recently, use of amine-functionalized task-specific ILs (TSILs) for CO_2 capture, which have at least a CO_2 reactive amino moiety in the molecule, have been considered as an attractive approach to overcome the poor CO_2 absorbability challenge [1].

By taking the advantage of a selective reaction between CO_2 and the TSILs, we recently have reported a new class of SILMs containing amino acid ILs (AAILs) [2]. The AAILs-based SILMs demonstrated remarkably fast and selective CO_2 permeation based on facilitated transport mechanism. The advantages of AAILs over widely used conventional non-IL type CO_2 carriers made them a promising candidate as a CO_2 carrier as well as a diffusion medium for facilitated transport membranes. However, similar to conventional SILMs, the AAIL-based SILMs cannot be used under pressurized conditions because AAILs were held in a porous support with weak interactions and easily leaked out from the support.

To resolve the aforementioned issue related to pressure stability of AAILs-based SILMs, we proposed a straightforward approach to fabricate polymer gel membranes containing AAILs (AAIL-gel membranes) [3]. Developed AAIL-gel membranes with high AAIL content revealed acceptable CO_2 separation potential nearly analogous to AAIL-based SILMs. However, to achieve desirable CO_2 separation performance, a large amount of AAILs must be incorporated into the AAIL-gel membrane, which is accompanied by the decrease of mechanical strength as well as pressure resistance of the AAIL-gel membranes. That is, the trade-off between mechanical strength and CO_2 separation performances still remains a challenge which should be explored. Moreover, the low mechanical strength of the gel membrane hinders the preparation of thin gel membranes with high CO_2 flux for practical applications.

To address this issue, here we propose a novel tough AAIL-gel membranes with excellent mechanical strength based on a specific double-network gel matrix [4] which allows to improve the pressure resistance of the gel membrane containing a large amount of AAIL and also fabricate a thin membrane with high CO_2 permeance [5].

The AAIL-based Double network (DN) gel membranes were prepared via multi-step preparation method; (1) DN hydrogel preparation, (2) impregnation of an AAIL/water mixture into DN matrix, and (3) remove water from the gel by evaporation. DN gel membranes with different AAIL contents were prepared by using aqueous solutions with different concentrations of AAILs. The AAIL content in the prepared gel membranes reached up to 80 wt% and became constant towards the increase of the AAIL concentration in the aqueous solution. One of the most outstanding features of the AAIL-based DN gels is the extraordinary mechanical strength. The DN gel membranes containing 80 wt% AAIL were mechanically strong enough to be easily manipulated by hand and also their gas transport properties be evaluated under pressurized conditions. We measured the fracture stress of the DN ion gels consisting of with different AAIL contents. It is worth to mention that even the DN ion gels with ca. 80 wt% of AAIL content were not broken at more than 25 MPa of compression stress, which is more than 25 times higher than those previously reported for AAIL-based ion gels consisting of single polymeric gel networks prepared in our group. During compression, no AAILs leakage from the gel network was observed as a consequence of good compatibility between the polymer networks and the AAILs. From the above mentioned results on the excellent mechanical strength, it was expected that the fabricated AAIL-based DN ion gel membranes could be used under pressurized conditions. The pressure resistance of the DN gel with ca. 80 wt% of AAIL content was evaluated at elevated

temperature of 373 K and a constant permeate side pressure (atmospheric pressure) through changing the feed side pressure from 100 to 500 kPa. From the investigation, it was confirmed that the CO_2 permeability, the N_2 barrier property and CO_2/N_2 selectivity of the AAILs-based DN gel membrane remained constant at high level in whole range of trans-membrane pressure difference investigated in this study. Especially, the observed CO_2 permeability and CO_2/N_2 selectivities were more than 4000 barrer and 100 at high pressure difference conditions, respectively. These results indicated that the AAIL-based DN ion gel membranes withstood pressurized condition due to their tough double-network structure. In addition, the AAIL-based DN ion gel membranes showed stable CO_2 and N_2 permeation for 5 days at elevated temperature under pressurized conditions. The high and selective CO_2 permeability, the superior pressure resistance and the long term stability of the fabricated AAIL-based DN ion gel membranes make them an attractive option for a broad area of CO_2 capture application.

The tough AAIL-based DN ion gel has the potential of being fabricated in thinner form with keeping the high CO_2 permselectivity as the rate-controlling step of CO_2 permeation through AAIL-based membranes would be intra-membrane diffusion of the CO_2 complex. Therefore, we fabricated the AAIL-based DN ion gel membranes with thinner thickness and measured the CO_2 and N_2 permeances. The CO_2 partial pressure dependency of CO_2 and N_2 permeances for the thinnest AAIL-based ion gel membrane (58×10^{-6} m) prepared in this study almost same to those of the AAIL-SILM although the thickness of the ion gel membrane was thicker than the AAIL-SILM. This result indicates that the diffusion resistance in the DN ion gel network is smaller than that of the porous support used for AAIL-SILMs because of the low polymer content in the DN ion gel membrane. Furthermore, from the relationship between the CO_2 permeance and inverted thickness of the membrane, $1/\delta$, it was found that the CO_2 permeance linearly increased with the decrease of $1/\delta$, which indicates that the CO_2 permeation through the thinner DN ion gel membrane is still controlled by the intra-membrane diffusion. This raises the possibility of achieving higher CO_2 flux through the further reduction of the membrane thickness.

In summary, we successfully developed the AAIL-based DN ion gel membranes with the advanced properties as a facilitated CO_2 separation membrane. The prepared membranes were tough and had high pressure resistance as well as high CO_2 permeability and CO_2/N_2 selectivity. Many possibilities to improve the mechanical strength as well as reduce the polymer content for achieving much higher CO_2 permeability is still remaining. Optimization of the AAIL-based DN ion gel membranes would

provide feasible and desirable CO_2 separation membranes for various practical CO_2 separation processes.

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Development of Novel Aerogel Membranes to Resolve the Carbon Abundance and Water Scarcity Issues

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In this talk, I will report the development of novel aerogel membranes and operation modes for various process applications with membrane contactors (MCs). In particular, it will focus on the development of tuned hydrophobic, hydrophilic and asymmetric wettability membranes. Membrane contactors are membrane systems that can find application in different fields of industrial interest, covering, for example, gas-liquid operations, liquid-liquid extractions and vapor-liquid distillation. In past decade, the use of membrane absorption to capture carbon (membrane absorption, MA), to prepare emulsions (membrane emulsification, ME), to recover resources from sea (membrane crystallization, MCr) to carry out distillation processes for water scarcity issue (membrane distillation, MD) has been subject of many research activities worldwide. Focus of this talk will be placed on the applications of the developed novel aerogel membranes for MA and MD processes to resolve the carbon abundance and water scarcity issues, respectively, for achieving an ultimate goal toward a sustainable planet.

The past few decades has seen the rapid development of silica aerogels in many applications such as drug releasing, heat insulation, separation. Silica aerogels are classified as mesoporous material showing the characteristics of high thermal resistance, large surface areas, high porosity6. Several attempts have been made to synthesize silica aerogel via sol-gel processes using tetramethyl orthosilicate (TMOS), tetraethyl orthosilicate (TEOS) and other organosilane compounds as the precursor. However, a major problem with these silica aerogels is that they are intrinsically hydrophilic and appropriate surface chemical modifications are needed to render them hydrophobic. In 2006, Rao et al. have developed a direct synthesis of water-repellent silica aerogels using methyltrimethoxysilane (MTMS) precursor by a two-step sol-gel process followed by the supercritical drying. The synthesized polymethylsilsesquioxane (PMSQ) aerogels are inherently superhydrophobic due to the hydrocarbon functional group on the MTMS precursors. A number of researchers have reported that the key parameters such as the MeOH/MTMS molar ratios, gel aging time in the silica aerogel synthesis process contributed to different porous structures and physicochemical properties.

The hydrophobic SiO_2 aerogel membrane was prepared using a MTMS precursor in a sol-gel process. First, the reactants of MTMS (0.01 M), ethanol (0.03 M), HCl (0.007 mM) and H2O (0.01 M) were mixed homogeneously in a flask by stirring for 90 min, after which ammonia (2.2 mM),

ethanol (0.01 M), and H2O (0.02 M) were added to the resulting solution, following by the stirring for 30 min. Al_2O_3 membrane supports, purchased from Kinik company in Taiwan, with a diameter, thickness, pore size, porosity and specific pore volume of approximately 47 mm, 2.4 mm, 1 μm, 46 % and 0.23 cm3/g were immersed in the prepared solution. After gelation, the MTMS-derived hydrophobic SiO_2 aerogel membrane was aged in the ethanol solution at 25ºC for two days. The resulting SiO_2 aerogel membrane was then transferred to an n-hexane solution for one day to remove the ethanol. Then, the drying process was carried out at room temperature in a flask covered by parafilm to evacuate the solvents gradually. Hydrophobic surface modification of the hydrophilic Al_2O_3 membrane support was also carried out using fluoroalkylsilane (FAS) in an n-hexane solution to demonstrate the advantage of the MTMS-derived silica aerogel coating on an Al_2O_3 membrane support. To modify the surface, the Al_2O_3 membrane support was soaked in a 0.02 M FAS/n-hexane solution at 40°C for several hours and then dried using the same procedure described above.

The membrane distillation was conducted in a vacuum membrane distillation (VMD) mode. The NaCl solution of the feeding concentration was 3.5% corresponding to sea-water salinity. Deionized water was used as the water source. The feed solution was heated by the pump and maintained at 70ºC under atmospheric pressure. The membrane surface temperatures on two sides were detected by the inserted thermocouples. The flow rate of was kept constant at 1L/min. On the permeate side, the vacuum pressure was regulated with the aid of the vacuum gauge controller and the vacuum pump. The permeate side was controlled at room temperature with the gauge pressure ranging from -70 to -98kPa. The permeate water was condensed at the trap bottle cooled with liquid nitrogen. The flux was measured by collecting the permeate water in the trap every 10 minutes. In the CO_2 absorption experiments, AMP (1 M)/PZ (0.2 M) amine absorbents are flowed into one-side of the MTMS-derived SiO_2 aerogel membrane and FAS-modified Al_2O_3 membrane support with a flow rate of 100 sccm and 9 vol% CO_2/N_2 gas mixtures are flowed into the other sides of the membrane with a flow rate of 200 sccm. The CO_2 output concentration was measured using a nondispersive infrared (NDIR) sensor to calculate the amount of CO_2 absorbed and CO_2 absorption flux. For the washing procedure between each cycle, pure N_2 gas is flowed into the gas-side of the membrane with flow rate of 200 sccm for 2 h while no amine absorbent exists in the liquid-side of the membrane.

For water sacristy concern, membrane distillation (MD) is an emerging technology for desalination of sea water18 which is also used in organic and heavy metals removal from aqueous solution, waste water treatment and many other separation processes. Among the various separation

technologies such as reverse osmosis (RO), electro-dialysis (ED), MD is a cost effective separation process utilizing alternative energy sources and low-grade waste. MD is a thermally driven membrane process, in which water vapor molecules transported through porous hydrophobic membranes separating the heated feed solution and a cooled permeate side. The membranes used in MD systems must be hydrophobic to prevent wetting phenomena. Also addition factors such as mass transfer resistance, thermal stability, thermal conductivity and wetting phenomena are crucial factors in MD separation performance. In most of the MD systems, non-wetting polymeric membranes are widely used and commercialized, including polytetrafluoroethylene (PTFE), polyvinylidene difluoride (PVDF), polypropylene (PP). However, it was found that polymer membranes are thermally and chemically susceptible and showed morphological changes when being contact with solvents. On the contrary, inorganic porous ceramic membranes are known for their mechanical stability and high thermal resistance. The only difficulty is to modify the original surface of the ceramic membrane from hydrophilic to hydrophobic. Thus, a variety of modified membrane were obtained in the previous studies. The MTMS derived PMSQ aerogels membranes were successfully utilized in membrane distillation process. The TGA results demonstrated the thermal stability of the PMSQ aerogel. By varying the molar ratios of $EtOH_{2nd}$, MTMS and the HCl and HN_4OH concentrations, we investigated the surface morphologies and hydrophobicity of the as-prepared aerogel membrane in different synthesis condition. The permeate flux in the membrane distillation process using the best modified PMSQ aerogel membranes in our study was up to 20LMH. This flux is much higher comparing with other modified inorganic membrane in the literature. Thus, the MTMS derived PMSQ aerogel membranes have proven to be a potential modified material for membrane distillation processes.

For carbon abundance issue, highly mesoporous and hydrophobic SiO_2 aerogel membranes were successfully coated onto macroporous Al_2O_3 membranes using MTMS precursors via a sol-gel process. The surface contact angles of the MTMS-derived SiO_2 aerogel membrane and FAS-modified Al_2O_3 membrane support were both approximately 142°, demonstrating the hydrophobic characteristics of the membrane surfaces. The highly mesoporous MTMS-derived SiO2 aerogel coating not only prevented membrane wetting by aqueous amine absorbents but also enhanced the CO_2 absorption flux at least 500% compared to the uncoated MTMS-based SiO2 aerogel membrane. Thus, the CO_2 absorption flux of the MTMS-derived SiO_2 aerogel membrane is larger than that of the FAS-modified Al2O3 membrane. The durability of the MTMS-derived SiO_2 aerogel membrane in capturing CO_2 was also demonstrated under continuous operation for at least

four days. The results indicate that the as-prepared MTMS-derived SiO_2 aerogel membrane can be used for reusable and continuous long-term CO_2 absorption. This study suggests that the MTMS-derived SiO_2 aerogel membrane can be used in membrane contactors for CO_2 capture. Large-scale CO_2 capture should be the next important topic for future research. Hydrophobic MTMS-derived SiO_2 aerogels could be coated on tubular and ceramic hollow fiber membrane supports to increase the CO_2 absorption quantity in the future.

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Polymeric membrane microstructure characterization by positron annihilation spectroscopy

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Abstract

The concept of correlating the physical defects at the atomic and molecular level, such as vacancy or free volume with membrane performances, such as permeability and selectivity, for optimal design of membranes is very important. In general, atomic probes, SEM, and AFM are powerful tools for detecting static defects near the surface. However, the above instruments are difficult to be used to analyze the fine structure under the membrane skin-layer. One important approach is to study the free-volume properties of polymeric membrane systems, the very origins of physical structure of polymers, i.e., from the Å to 1 nm level and 10^{-6} - 10^{-15} s time scale of motion. In this presentation, we introduced a special physical technique, positron annihilation spectroscopy (PAS), it is a special nondestructive evaluation (NDE) technique for materials characterization. During the recent decades, PAS was developed as a useful tool to probe the fine structure of polymeric membrane. Especially, PAS was used to measure physical properties of defects, i.e., free volumes at the atomic and molecular levels as a function of chemical changes and molecular modifications in a polymeric membrane system

Positron annihilation theory and Characterization of Polymeric Membrane Fine Structure

Traditional Characterization Method

The concept of correlating the physical defects at the atomic and molecular level with membrane

separation performances for optimal membrane structure is the central idea of research. Thus, the characterization of the chemical and physical structures of polymeric membrane is very important. Methods for characterizing chemical structures, such as Fourier transform infrared spectroscopy (FTIR), NMR and Electron spectroscopy for chemical analysis (ESCA) etc., detect configuration and conformational variations. Characterization of physical structures for polymeric membranes has been pursued by scanning electron microscopy (SEM), transmitting electron microscopy (TEM), atomic force microscopy (AFM), X-ray, electron, neutron, and ion diffractions, etc. Each of these analytical techniques has its advantages and shortcomings in structural determination. For example, SEM and AFM are powerful tools for detecting static defects near the surface, but they are difficult to explore the fine structure under the membrane skin. One important approach is to study the free-volume properties of polymeric membrane systems, from the Å to 1 nm level, the very origins of physical structure of polymers.

However, how to measure the free volume of the polymeric membrane precisely is the key-point of membrane characterization?

A. Theoretical Free Volume Estimation

Conventional methods to obtain free volume information are Bondi's group contribution and Molecular dynamics simulation. Both methods are theoretical calculations to estimate free volume. But how do we directly obtain free volume?

B. Positron Annihilation Spectroscopy

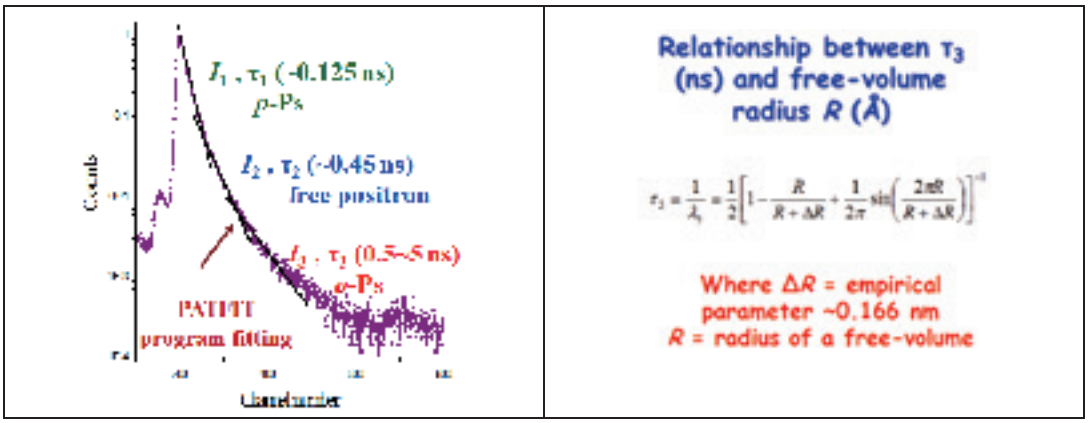
In this presentation, we introduced a special physical technique, positron annihilation spectroscopy (PAS), to measure physical defects at the atomic and molecular levels in a polymeric membrane system. PAS is a special nondestructive evaluation (NDE) technique for materials characterization. During the recent decades, PAS was developed as a useful tool to probe the fine structure of polymeric membrane. Positron, an antiparticle of electron (anti-electron), can be obtained from the radioisotope decay. For example, Sodium-22 (^{22}Na) is most widely used because of its long half-life (2.6 years) time. When ^{22}Na nucleus decays, a proton in that transforms into a neutron. ^{22}Ne and β^+ particle (positron) are formed, coupling with the emission of a 1.28 MeV gamma ray (γ-ray) as a start signal. Then, when positron diffuses into a material and annihilates in low momentum defects, two 0.511-MeV γ-rays are emitted as a stop signal. Detectors measure the time difference between start and stop signals. This measured time is known as the positron annihilation lifetime. Generally, larger free volume has longer positron annihilation lifetime.

C. **Positron Annihilation Theory**

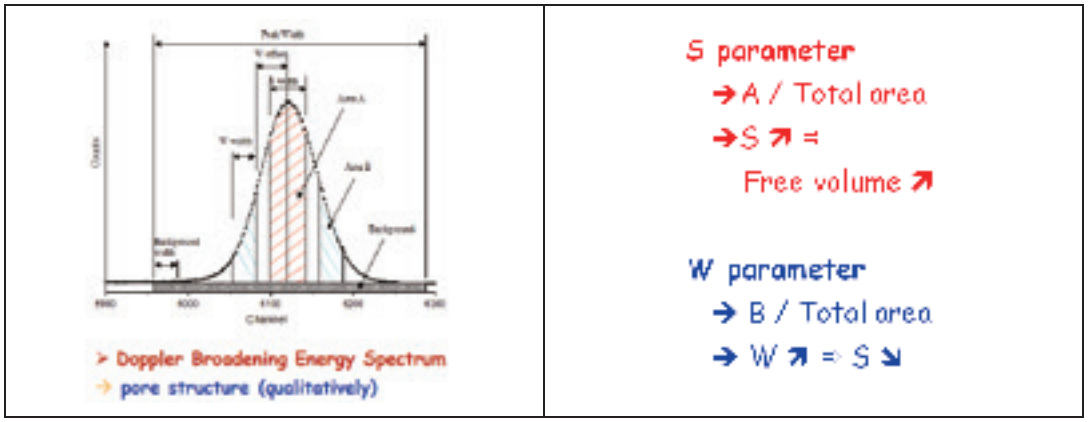
When a positron meets an electron, two phenomena occur. One is the positron-electron annihilation. The other is the formation of positronium (Ps). Owing to the different combinations of positron and electron, Ps has two states. One is the para-Ps (p-Ps) from the anti-parallel spin. The other is the ortho-Ps (o-Ps) from the parallel spin. The p-Ps has a shorter lifetime than the o-Ps and it undergoes 2γ annihilation, however, the o-Ps undergoes 3γ annihilation. The intrinsic lifetime for the free p-Ps and

o-Ps is 0.125 and 142 ns, respectively. Moreover, the Ps can pick off electrons with anti-parallel spin to undergo 2γ annihilation. The pick-off annihilation of o-Ps shortens the o-Ps lifetime from 142 ns (free o-Ps) to a few ns (about 0.9 - 8 ns). The o-Ps lifetime analysis is one of the most useful methods for positron and positronium chemistry.

The o-Ps lifetime and intensity can be analyzed by PATFIT program from Positron annihilation lifetime spectrum. The Relationship between τ_3 (ns) and free-volume radius R (Å) can be analyzed by Tao's equation. PALS can be used to probe the pore size and distribution quantitatively



In VMSPB system, two very important parameters should be defined: The *S* parameter is defined as the ratio of the central part of the annihilation spectrum to the total spectrum; it reflects positron annihilation with low momentum valence electrons. The *W* parameter is defined as the ratio of the edge of the annihilation spectrum to the total spectrum; it reflects positron annihilation with high momentum electrons (core electrons). The *W* parameter is related to the chemical environment where the annihilation takes place.



D. **Positron Annihilation Technique**

Two kinds of position annihilation techniques were used to analyze the fine structure of polymeric membrane. One is the Fast-Fast coincident PAL spectrometer that is focused on the characterization of the microstructure of symmetric membrane system. The other is slow positron beam system that is a powerful tool to probe the thin-layer structure in depth profile of

asymmetric membrane system. It includes two major parts : Doppler Broadening Energy Spectrum (DBES) focused on the pore structure (qualitatively) analysis; Positron Annihilation Lifetime Spectroscopy (PALS) focused on pore size and distribution (quantitatively) analysis.

Fine Structure Analysis by PAS

A. Nuclear medicine

The positron technology can be used to analyze the fine structure of inorganic material, organic material and organic/inorganic hybrid system**.** In 1970, PET (Positron Emission Tomography) scanning was used in a nuclear medicine. PET is the best imaging technique to assist in the diagnosis of tumor. In addition, the control release is a very important research topic in medicine field. Thus, how to prepare a smart membrane to control the drag releasing rate in patient is a valuable issue. Much kind of gating membranes was prepared by grafting thermo-responsive monomer onto the high porosity support membrane. For example, NIPAAM are widely used to prepare thermo-responsive gating membranes, as temperature increases the PNIPAAM chains shrink, resulting in the pore open. These phenomena can be further confirmed by PALS.

B. Polymeric membranes

a. Bulk positron system

The radioisotope ^{22}Na decays and generates the positrons coupling with the emission of 1.28 MeV γ-rays (start signals). The generated positrons insert into the materials and trap into the space. Then, the positron or positronium annihilations occur in the space of materials and simultaneously emit the 0.511 MeV γ-rays (stop signals). The lifetime of the positron from generation to annihilation is dependent on the size of the space in materials. Bulk positron system can be used to analyze the plasticization effect、chemical structure effect and swelling effect of polymeric membrane on the free-volume and free volume distribution.

b. Variable monoenergy slow positron beam (VMSPB)

- A variable monoenergy slow positron beam (VMSPB) is a powerful tool to probe the microstructure and depth profile in metals. However, continuously implanting positrons onto insulating materials, a serious positive charge accumulating on the surface, commonly called as charging effect results the system doesn't work. Removal of the charging effect is necessary. Two existing techniques are used to partially overcome this problem. One is filling air or dry N_2 to the beam (typically several hours), the other is implanting electrons into insulators using an electron gun. To solve such problems, a technique of depositing an ultra-thin layer of sputtering noble metals on insulators is developed by CMT. The sputtering technique for PALS measurements, made it possible to conduct depth profiling and obtain free volume information. Moreover, VMSPB was also used to analyze the depth profile and the thin-film growth direction of thin film composite membrane. A newly developed method, which combines the technique of PECVD and PALS to overcome the problem during the wet state measurement under the high vacuum condition by VMSPB. The PALS results for the TFC membrane in the wet state have the same trend as the dry membrane. The important information we observed is that the τ_3 and I_3 for the membrane in the wet state are higher than those for the membrane in the dry state. This result indicates that PALS and the developed plasma polymerized methods can be used to probe the asymmetric membrane fine structure in the wet state.

However, Positronium (Ps) can chemically react with molecules and different functional groups by two processes, chemical quenching (nitroaromatics, quinones, maleic anhydride, and ions) which decreases o-Ps lifetime (τ_3) and chemical inhibition (polyimides and carbon) which decreases the probability of o-Ps formation (I_3). To further investigate the quenching or inhibiting effect on positronium interacting with chemical functional groups, a newly modified equation has been developed following the Tao's equation and using the free positron component (τ_2) of PALS.

To improve the energy resolution, a combination of DBES and PALS technique, the so-called age-momentum-coincident (AMOC) spectroscopy was developed. AMOC has a much better energy resolution. Only the AMOC results could reflect the correct amount of voids in composite membranes since it is derived from 3γ annihilation.

Conclusion

The application of PAS in polymeric sciences is still in its developing stage. Existing PAS is a sensitive tool to measure free-volume and void properties. For polymers which have no or very small o-Ps components, a new calibration equation between the positron lifetime (τ_2) and free-volume is available. 2D-PAS techniques coupled with VMSPB can enhance the analysis ability of PALS.

Kobe University Alumni Networking in Taipei

Ministry of Economic Affairs
Information and Communications Research Laboratories, Industrial Technology Research Institute (ITRI), Committee of Communications Industry Development
Project Manager

Yeachi Chen

The Collaboration Between Taiwan and Japan in Mobile Innovation

The Committee of Communications Industry Development (CoCID) is under the Ministry of Economic Affairs, Taiwan. CoCID serves as the contact window to promote general affairs of the communications industry, such as 4G/5G, wearable/IoT, and smart city related technologies. It aims at promoting industrial cooperation, business opportunities and innovative applications and services. In this session, Yeachi Chen will introduce what Taiwanese government does for promoting the communications industry and what opportunities lie in the collaboration between Taiwan and Japan in mobile innovation.

Academic Background: Graduate School of International Cooperation Studies, Kobe University
Academic Degree: Master of Economics
Career: Project Manager of Committee of Communications Industry Development, Ministry of Economic Affairs

Kobe University Alumni Networking in Taipei

Ki A Peng Sian (枝仔冰城)
Shop Manager

Jeng Ju Chuan

Comparison between northern and southern Taiwanese cuisine

Although Taiwan is not a big country looking at the geographic area, Taiwanese cuisine has developed into very distinct food culture and taste between northern and southern region. This shows the wide variety and multi-facet of Taiwanese food culture, and it is one of the reason that Taiwanese cuisine has attracted many visitors to Taiwan.

The speaker intend to introduce this distinctive food culture through introduction of the famous restaurants in both the northern and southern Taiwan, their history and interesting facts.

Academic Background: Graduate School of Humanities, Kobe University
Academic Degree: Master of Art
Career: Shop Manager of "Ki A Peng Sian (枝仔冰城)"

Kobe University Alumni Networking in Taipei

Tunghai University
Department of Industrial Engineering
and Enterprise Information
Professor

Ren-Jye Liu

The frontier of Taiwanese manufacturing innovation

Over the past decade, facing severe business environment changes, especially the impact of fierce competition in China and other emerging countries, the continued challenge manufactures innovative Taiwanese companies are gradually attracting attention. Here, I will clarify the frontier of Taiwanese manufacturing innovation.

Recent innovation theory is constantly emphasized the importance of research and development, joint development, co-production and joint marketing with external organizations through collaboration. Concrete presentation is modularization in design or production. Furthermore, it is also emphasized the inter-organizational relationship and open innovation by cooperation with suppliers, competitors, customers, and external research institutes.

Based on these two dimensions, I will present two innovative patterns through the frontier cases of Taiwanese bicycle and Panasonic notebook computers production in Taiwan. Firstly, it will co-create new products, new processes and new markets with affiliating companies overall supply chain-related organizations including of a competitor and module production companies. Secondly, it will cooperate with component, part and modular suppliers to develop new products through module design, production and to create high customer value. Such development patterns, based on Taiwanese companies' customer value creation, is considered as a co-creation model, a new concept of manufacturing innovation.

Profile:
Professor Ren-Jye Liu received his Ph.D in Business Administration from Kobe University in Japan in 1991. Liu was Chairman of his department at Tunghai University (1998-2001) and an advisory committee member for the Taiwan Economic Ministry (1993-98). In the global academic field, he has been a Visiting Professor in the Business School, Kobe University (2006), Osaka City University (2010-), and was a visiting faculty member in the Wharton School, University of Pennsylvania (2002-03). In the private sector, Liu has been the director of the Precision Machinery R&D Center and the Taiwan Machine Tool Foundation.

He is the author of eleven books in Taiwan as well as eight expertise articles in academic books in both Japanese and English. He is the winner of many academic awards, including Carolyn Dexter Award Nominee (2007, the Academy of Management), the Best paper Award (1997, Association for the Study of Industrial Management in Japan), the Excellent Book for Business Award (1997,1998, 2009, the Taiwan Economic Ministry).

Kobe University Alumni Networking in Taipei

Acknowledgement

The 6th Kobe University Global-Link Forum held at National Taiwan University on 3-4 December 2015 was a great success. I would like to take this opportunity to express my heartfelt thanks to everyone at National Taiwan University who was involved in organizing this symposium. In addition to hosting the symposium they also provided a great deal of support. I would also like to thank the members of Kobe University and our Alumni Association in Taiwan who assisted with the organization of the forum.

Kobe University held the first of these forums in January 2011 in Bangkok, Thailand. Since then we have continued to hold academic symposiums throughout Asia, supported by our Kobe University Alumni Associations. Kobe University is located both in Japan, a member of the Asian region, and in the outward-looking port city of Kobe. In order to increase our international presence, every year we have held Global-Link Forums, six in total, and strengthened our ties with researchers from many countries for exchange and collaborative research. Kobe University, our Institute of Promoting International Exchange Programs, and our Centre for Asian Studies will continue to collaborate with the Alumni Associations and strengthen our links with research organizations throughout Asia. I ask for your continued support and collaboration in this mission.

INOUE Noriyuki
Executive Vice President of Kobe University

Re-realizing the Relationship with Taiwan and Japan: Cooperation in Science, Technology and Innovation

Organized by: Institute of Promoting International Exchange Programs, Kobe University
Co-hosted by: National Taiwan University
Kobe University Alumni Association in Taiwan
Nominal Supporting Institutions: Taipei Office, Japan Interchange Association
Taipei Medical University

Forum - Day 1 -

Date: Thursday 3 December 2015
Venue: Liang Kuo-Shu International Conference Hall, College of Social Sciences, National Taiwan University

10:00-11:20 Morning Session (Opening Session)

Opening Remarks
Noriyuki Inoue, Executive Vice President in Charge of International Exchange and Internal Control, Kobe University

Congratulatory Address
Guan-Chau Huang, Deputy Education Counsellor, Department of International and Cross-strait Education, Ministry of Education
Takashi Hamada, Secretary-General, Taipei Office, Japan Interchange Association
David Chang, President, Kobe University Alumni Association in Taiwan

Keynote Speech
Hiroshi Takeda, President, Kobe University
Ching-Ray Chang, Executive Vice President for Administrative Affairs, National Taiwan University

13:30-16:50 New Orientations in the Humanities and Social Sciences in East Asia

Commentator
Lin Huang, Director of Kobe University China Office/ Professor of Graduate School of Business Administration, Kobe University

13:30-14:30 Humanities *This session will be held in Chinese.

Historical Consciousness and the China Model
Yasushi Ogata, Director of Centre for Asian Studies/ Professor of Graduate School of Humanities, Kobe University

Why Speak of "East Asian Confucianisms"?
Chun-chieh Huang, National Chair Professor and Dean, Institute for Advanced Studies in Humanities and Social Sciences, National Taiwan University

[Discussion: 20mins]

14:30-14:50 Coffee Break

14:50-16:50 Social Sciences

Innovation Made by Technological Entrepreneurs in Japan —Challenge of KOBE's Interdisciplinary Education—
Hiroyuki Ozaki, Professor, Graduate School of Business Administration, Kobe University

The cooperation of industries between Taiwan and Japan
Chien-Fu Jeff Lin, Professor of Department of Economics/ Associate Dean of Institute for Advanced Studies in Humanities and Social Sciences, National Taiwan University/ President, Taiwan Institute of Economic Research (TIER)

Sustainable Strategies for Recovery from Natural Disasters
Shinya Horie, Project Associate Professor, Graduate School of Economics, Kobe University

The Development of the Biotechnology Industry in Taiwan
Julie C. L. SUN, Director, Biotechnology Industry Study Center, Taiwan Institute of Economic Research

[Discussion: 40mins]

16:50-17:00 Closing

Closing Remarks
Yasushi Ogata, Director of Centre for Asian Studies/ Professor of Graduate School of Humanities, Kobe University

Forum - Day 2 -

Date: Friday 4 December 2015
Venue: Liang Kuo-Shu International Conference Hall, College of Social Sciences, National Taiwan University

9:20-12:30 Advanced Research of Emerging and Reemerging Diseases in Asia

Opening Remarks
Satoshi Takada, Dean and Professor, Graduate School of Health Sciences, Kobe University

International Collaborative Research on Infectious Diseases ― J-GRID (MEXT), SATREPS (JST/JICA), A*STAR (Singapore), JSPS program ―
Hak Hotta, Professor and Endowed Chair, Graduate School of Health Sciences, Kobe University

Characterization of Southeast Asian type of HIV
Masanori Kameoka, Associate Professor, Graduate School of Health Sciences, Kobe University

Development of the novel oral vaccine platform utilizing bifidobacteria
Toshiro Shirakawa, Professor, Graduate School of Health Sciences, Kobe University

Telemedicine and Emergency Air Medical Services
Shin-Han Tsai, Dean of College of Public Health and Nutrition/ Professor and Chair of Department of Emergency Medicine, Shuang Ho Hospital, Taipei Medical University

Novel Immunotherapy to Cure Chronic HBV Infection by Using a Convenient Immuno-competent Mouse Model
Pei-Jer Chen, Professor of Graduate Institute of Clinical Medicine, Medical College/ Professor of Hospital Hepatitis Research Center, National Taiwan University

[Discussion: 30mins]

13:30-16:50 Advanced Membrane Technology Contributions to Resolving Energy and Environmental Issues

Keynote Speech: ***Development of Innovative Membranes for Water Treatment and CO_2 Separation***
Hideto Matsuyama, Director of Center for Membrane and Film Technology/ Professor of Graduate School of Engineering, Kobe University

Report 1: ***Morphology Control of Polymeric Membranes --- Roles of Polymer Chain Entanglement***
Da-Ming Wang, Professor and Chairman, Department of Chemical Engineering, National Taiwan University

Report 2: ***Tough Ion Gel Membranes Containing Amino Acid Ionic Liquid as a CO_2 Carrier***
Eiji Kamio, Assistant Professor, Graduate School of Engineering, Kobe University

Report 3: ***Development of Novel Aerogel Membranes to Resolve the Carbon Abundance and Water Scarcity Issues***
Kuo-Lun Tung, Professor, Department of Chemical Engineering, National Taiwan University

Report 4: ***Polymeric membrane microstructure characterization by positron annihilation spectroscopy***
Kueir-Rarn Lee, Director of Center for Membrane Technology/ Professor of Department of Chemical Engineering, Chung Yuan University

16:50-17:00 Closing

Kobe University Alumni Networking in Taipei

Date: Friday 4 December 2015
Venue: World Trade Center Club

[Registration Open: 17:30]

18:00- Panel Discussion

The Collaboration Between Taiwan and Japan in Mobile Innovation
Yeachi Chen, Project Manager, Information and Communications Research Laboratories, Industrial Technology Research Institute (ITRI), Committee of Communications Industry Development, Ministry of Economic Affairs

Comparison between northern and southern Taiwanese cuisine
Jeng Ju Chuan, Shop Manager, Ki A Peng Sian (枝仔冰城)

The frontier of Taiwanese manufacturing innovation
Ren-Jye Liu, Professor, Department of Industrial Engineering and Enterprise Information, Tunghai University

19:00- Reception

Organized by: Institute of Promoting International Exchange Programs, Kobe University
Co-hosted by: National Taiwan University
Kobe University Alumni Association in Taiwan
Nominal Supporting Institutions: Taipei Office, Japan Interchange Association
Taipei Medical University

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