Nishina Memorial Lecture

Human Society in a Cross Road
- A Perspective of a Scientist -

Yuan T. Lee

Academia Sinica, Taiwan

December 2008

Professor Dr. Yuan Tse Lee of Academia Sinica, Taiwan, a 1986 Nobel Prize Laureate of Chemistry, invited by the Japan Academy, gave a Nishina Memorial Lecture at Japan Academy on December 13, 2008. The title was "Human Society in a Cross Road－A Perspective of a Scientist". This booklet NKZ-49 records this lecture and also includes a short summary in Japanese of the RIKEN Nishina Memorial Symposium "Charging Molecules: Fundamental Chemical Physics and Analytical Applications" held on December 15.

Nishina Memorial Lecture

Human Society in a Cross Road
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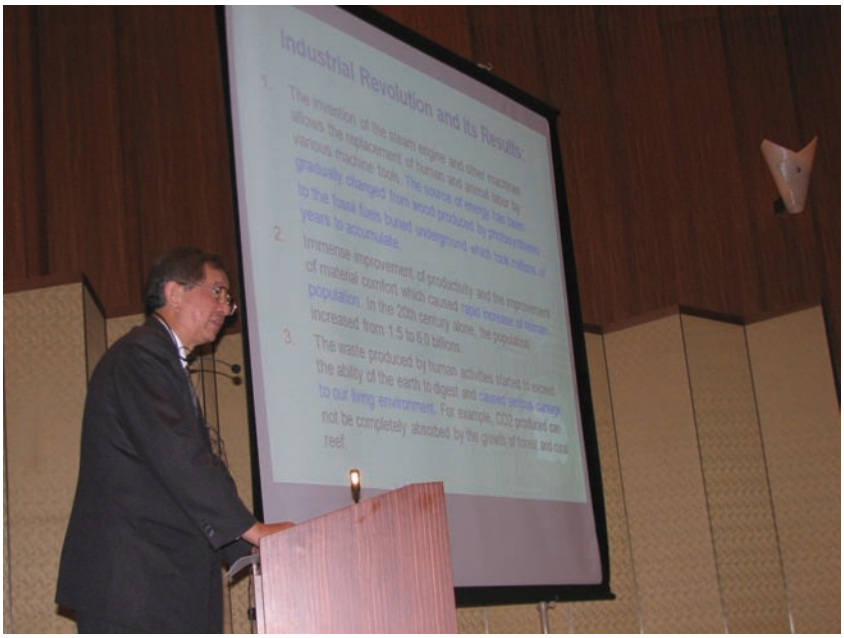
Tokyo, December 2008

Professor Yuan T. Lee at the Nishina Memorial Lecture

The entrance to the Japan Academy

Audience



Professor Yuan T. Lee at the Nishina Memorial Lecture

From the right, Mrs. Lee, Prof. Yuan T. Lee and Prof.
T. Yamazaki in a Yoshio Nishina's old laboratory of RIKEN,
now an archive room of the Nishina Memorial Foundation.

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仁科記念講演会＜第５４回定例＞
李　遠哲 客員来日記念講演会
（日本学士院）

Human Society in the Cross Road - A Perspective of a Scientist

2008年12月13日(土) 14：00～16：00
日本学士院議場
聴／講／無／料

ユアン・ツェー・リー（李遠哲）博士
Professor Dr. Yuan Tseh Lee
台湾中央研究院名誉院長

1986年　ノーベル化学賞受賞

ユアン・ツェー・リー（李遠哲）博士の研究の主軸は分子線発生装置を開発して速度や角度を制御された二つの分子線を衝突させて反応させ、加えて光を照射して分子状態を制御して反応の基礎素予過程を解明するもので、この分野の解明に初めて成功したものと言える。結果として化学反応と物理学との間に融和の新分野を築いたことになる。

同博士は国立精華大学で日本の教授の指導のもと修士論文を提出した。その後、日本の若手研究者の指導や学界交流のため頻繁に来日し、多くの成果を挙げ、名古屋大学や早稲田大学等より名誉博士号を授与された。また理化学研究所アドバイザリーカウンシルの委員（コアメンバー）でもある。

講演は「英語」で行われます

故　仁科芳雄　博士

この講演会は、
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http://www.nishina-mf.or.jp/

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Human Society in a Cross Road
- A Perspective of a Scientist -

Nishina Memorial Lecture
(13th December 2008, Japan)

Yuan T. Lee

Academia Sinica, Taiwan

It is a great honor and a great privilege to present a Nishina Memorial Lecture this afternoon. Although I am a chemist, my scientific training and my research in the experimental investigation of atomic and molecular processes have been deeply influenced by the advancement of modern physics in the 20th century. I was quite aware of the great contributions made by Dr. Nishina in the advancement of modern physics as well as his leadership in establishing scientific institutions and in educating young generation of scientists. I respect him greatly.

When I received the invitation letter from the President of the Nishina Memorial Foundation, Dr. Toshimitsu Yamazaki, I thought at first that I should give my lecture on crossed molecular beams studies of dynamics of chemical reactions, which is a subject closer to the research interests of Dr. Nishina. However, I decided that I should talk about something which is of great concern to all of us, and picked a title "Human Society in the Cross Road – a Perspective of a Scientist". I will discuss my recent research works in the symposium organized by Dr. Toshinori Suzuki in RIKEN on December 15.

Before I start my lecture, I want to thank Nishina Memorial Foundation for sponsoring this lecture and the Japan Academy for the honor of accepting me as an Honorary Member of the Japan Academy and hosting my extensive visit of various institutions in Japan. I would also like to thank all of you for coming here to share some of my thoughts together.

(1) The Development of Human Society on Earth

After the appearance of our ancestor on the heavily forested planet a couple of million years ago, the development of the human society as a whole, was in harmony with nature. Mankind was indeed a part of nature, reliant on the sun for the creation of most of what was needed to survive. Since the population of mankind was small, for a long period of time their limited activities seemed to have affected neither the biosphere nor the living environment of mankind to any great extent. Figure 1 shows a painting which was done more than 200 years ago depicting the livelihood of aboriginal tribe in Taiwan. At that time,

people live almost entirely on biomass created by sunshine.

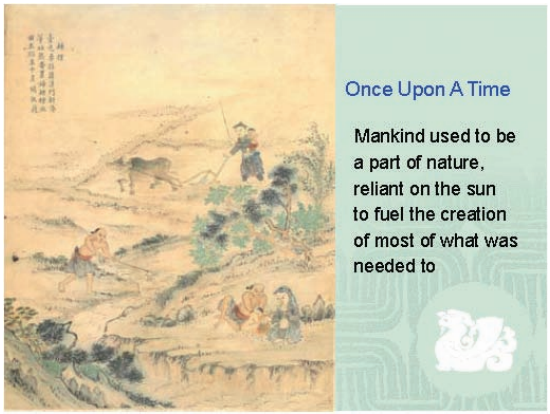

Fig. 1

However, the development of mankind took a new turn after the industrial revolution, which began about two hundred fifty years ago. As mankind learned to transform energy from one form to another – from chemical, thermal, electrical to mechanical – and invented various machines that could perform work thousands of times more powerfully, more precisely and more reliably than could be possibly done with human and animal labor, the productivity of mankind increased immensely and an unprecedented improvement of living standards was achieved. The success of mankind on the surface of the earth had been quite remarkable. But, during this process, mankind became addicted to the use of a large amount of energy, and since the energy from the biomass created by sunshine no longer satisfy our need, we began to depend more and more on fossil fuels—coal, natural gas and petroleum—which were buried under the ground and took millions of years to accumulate. In USA in 1850, 90% energy depended on wood burning, but 80 years later by 1930, 90% energy came from the combustion of fossil fuel. Fossil fuels also provided energy and feed stock needed for the production of various new materials, such as plastics, fertilizer, synthetic fibers, steel and cement, and regrettably man had drastically changed the intimate relation between man and the nature. In the picture shown in Figure 2, almost everything is created by transforming the materials dug out from underground using fossil fuels.

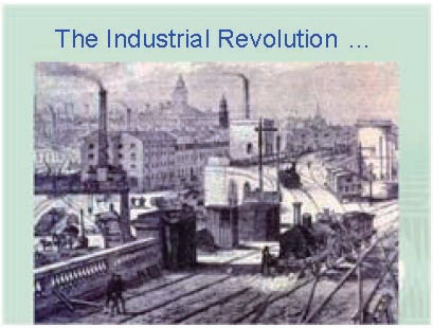

Fig. 2

Harmonious relation between man and the biosphere was disrupted, and the important role played by the sun in the development of mankind or the philosophical view of Confucius "Man and Nature are but one (天人合一)", somehow seemed to have been forgotten.

As we entered the 21st century, we began to realize that the current development patterns of human society are not sustainable. Problems related to population explosion, natural resource depletion and the damage done to the living environment have become quite serious. In a sense, the earth was once regarded as "infinite" or "unlimited" for mankind, not only because of the resources available, but also due to the ability of the earth to digest all the waste produced by mankind. However, from the point of view of the damage done to the ecosystem or the living environment, the earth as a whole should be considered "limited" and "overdeveloped" at present. For example, carbon dioxide produced by human activities is far exceeding the capacity of the earth to absorb through the growth of the forest or coral reefs and other mechanism, and the global warming trend is threatening the very existence of human being on earth. It is quite ironic that during the 20th century not only are the "developed" countries overdeveloped, so-called "developing" countries are also overdeveloped. It is unfortunate that so-called "developing" countries are following in the footsteps of "developed" countries, and marching along the unsustainable path established by "developed countries" in the past when the earth was still "unlimited". Traffic congestions seen in Figure 3 are happening in many so called "developing countries."

Fig. 3

It is extremely important for mankind to wake up immediately and accede to the fact that the human society as a whole is living beyond its means. We must learn to work together as a community to find new, sustainable ways to re-establish an intimate relation with biosphere, live in harmony with nature, and to return to a more direct relationship with the mighty power of the sun. After all, it was the sun which brought us altogether here on

the surface of the earth.

(2) Dilemma of living in a partially-globalized world

Although we have witnessed the process of the globalization of human society during the last few decades, the process is only half complete, and because of this, we are suffering from the consequences. Owing to highly-developed transportation and communication technologies, our world is relatively shrunken than it once was, and it appears that the concept of global village is slowly taking root as a number of human activities, most notably in the economic sphere, become globalized. The spread of disease around the world is another example. With thousands of airplanes daily crossing oceans and continents, loaded with people and goods, disease causing bacteria, viruses, and other microbes certainly will not be confined to specific locations. Similarly, environmental problems such as the depletion of the ozone layer by chlorofluorocarbons and global warming trends caused by greenhouse gases are problems that must be addressed on a global scale. On the other hand, in spite of the increased international collaboration in the areas of science and technology, high-tech based economic competition is still largely carried out on a national basis. Currently, in the partially globalized world, it is quite clear that only those people who are able to stage their activities on a global scale are benefiting enormously. For that reason it is not surprising that we will have to tackle such problems as the widening gap between the rich and poor, both among countries and people in a country, nor that threats to solve problems by military force have not disappeared. These problems might be avoided if the entire world were to become "one community".

We should also realize that though the globalization of the world economy is driving us toward a borderless society, it will not reduce the differences among peoples in various regions overnight. Establishment of a new, common global culture, together with more effective ways of communicating among all the peoples, will certainly take time. The differences among cultural heritages, languages, and religions that make this world so rich and colorful will not, and should not, be made to disappear. As the world shrinks in relative terms, and contact between peoples becomes more frequent, whether or not the difference in civilization are likely to cause an inevitable crash (as suggested by the well-known scholar Huntington), would seem to be entirely dependent on how well people around the world learn to communicate and to understand, appreciate, and respect cultural heritage. To become good citizens of the global village, we need to learn quickly and also to teach our young people, to take a global view and to respect, appreciate, and understand the different cultures of different peoples. In this aspect, scientists certainly can lead the way.

(3) Science and Technology in Society Forum in Kyoto

In the fall of 2004, Mr. Omi, the former Minister of Finance of Japan, organized a very important annual forum in Kyoto, with the title of "Science and Technology in Society forum". More than five hundred leading scientists, business leaders and policy makers were invited every year from all over the world to discuss problems related to the subject matter of the forum. The forum aroused great enthusiasm among participants and has since become a very successful and important annual event. During the past October, in the fifth 2008 forum was held with more than 600 attendees.

Mr. Omi made two important points when he described the fundamental concept of this forum in the opening ceremony of the first forum. He mentioned positive and negative aspects of the rapid progress of science and technology, and noted that the benefits of science and technology have not yet reached everyone equally, which, as he said, "is really what symbolizes the lights and shadows of science and technology." While the negative aspects must be properly controlled, the positive features of science and technology should be promoted.

Mr. Omi's other important point was stated thus: "Today's problems are global and can not be solved by any single country or by scientists alone." He went on saying that "Boundaries between nations are merely lines on a map; nature makes no such distinctions. We should think of ourselves as members of humankind, whose very existence will be at risk if we do not live in accordance with the principles of Mother Nature." Indeed, as an astronaut observes the beautiful earth as shown in Figure 4 from the spacecraft, the astronaut will not find any national boundaries.

Fig. 4

I believe most of us sitting in this room would support this idea without hesitation. However, if we do not try to answer some other questions related to the fact that the earth is "limited' and the world is only "partially globalized", our efforts to find solutions might encounter some difficulties. For example, we must also ask, "How many people can the planet support if we were to extend the living standard of the people in the so called "developed countries" to everyone on earth?" It is interesting to note that when India became independent, in response to the question of how the people in that country could catch up with the living standard of the people in Great Britain, Gandhi, shown in Figure 5, rightfully recognized that it would take the natural resources of many Planet Earths, if the people in India were to have the British way of life. It is just impossible.

Fig. 5

If we do not fully appreciate and understand the boundary conditions of the planet of earth, the rules of the game and the consequences of competition in a globalized market-driven economy, practicing the so called "good sciences" for the greater good can still produce miserable losers among us when these "good sciences" are used mainly as a tool for global economic competition, especially when science and technology are used for the domination of some countries over others. Scientists as a whole should take full responsibility to ensure that science and technology bring benefits to everyone equally. If we are not careful, we might predict that even if science and technology were to advance in faster pace along with the excellent material comforts and improvement in healthcare, the continuing population explosion and excessive usage of natural resources might overload the planet of earth, and the sustainable development might not be possible.

(4) Issues on Energy and Environment

One of the most urgent problems man faces today is the problem related to the relationship between energy and the environment, especially global warming trends caused by the emission of greenhouse gases, and the energy crises caused by the widening gap between the limited supply and rapidly growing demand for petroleum and other fossil

fuels. The other problem, which menaces to wipe out large portions of humanity in a short time, is the spread of infectious diseases, like those caused by virus H_5N_1.

It is comforting to know that, at present, energy received by the surface of the earth in one hour is approximately equal to the total energy consumption of the entire world in a year. In other worlds, the amount of energy the surface of the earth received is approximately ten thousand times the energy consumed by the human society. It means that if we were to be clever enough, we can depend entirely on solar energy. For example, if an inexpensive practical photovoltaic cell, which converts 10% of solar energy to electricity becomes available it will only take 1% of planet's land area to generate enough electric energy to satisfy the energy needs of the entire world. If the electrical energy generated by a photovoltaic cell could be effectively stored or used to electrolyze water into hydrogen and oxygen—or to even more directly dissociate water by using a combination of photovoltaic cells—it is not inconceivable that countries with large land masses could become energy exporting countries, nor that hydrogen gas might then become a major energy source as we enter the age of the "hydrogen economy". If we learn to develop biofuel more efficiently or to invent efficient "artificial leaf", the photosynthesis might provide enough biomass on earth to satisfy the need of liquid fuel and other chemical feed stocks now provided by petroleum.

To make it possible for the world to achieve sustainable development, we must do the following things to reduce our dependence on fossil fuel.

(A) Increase of our energy efficiency, and improve the recyclable usage of materials.
(B) Develop efficient renewable energy sources, e.g. photovoltaic cells, wind power generators, utilization of geothermal, ocean current and thermal energy conversion, and various biofuels.
(C) Develop new generation of safe nuclear reactors and appropriate waste disposal technology and fusion reactors.
(D) Examine our population policies and the way of life. We need to learn to live simpler and frugal life.
(E) Protect our living environment and ecosystems and maintain biodiversity.

Although our current scientific knowledge and technology enables us to get it started, there are many challenging scientific problems awaiting a solution. For example, in photosynthetic processes, most of the solar energy is stored in fiber of the plants rather than carbohydrates. Although the production of alcohol from sugar cane or corn has been effective and successful, the challenge lies in the effective production of alcohol from fiber

through hydrolysis and fermentation. For harvesting energy from geothermal, ocean flow and thermal energy conversion, new engineering technologies need to be developed.

With concerted efforts, which include the development of various renewable energies, the change of the way of life and the social structure, forty to fifty years from now, we could become largely free from the use of fossil fuels. We will be again like our ancestors directly reliant on the power of the sun; perhaps supplemented by new generation of nuclear fission reactors or micro suns, in the form of fusion reactors.

But during the transition period of the next 30 years, especially before the fusion reactor becomes successful, while nuclear fission reactors still play a role, we probably will continue to depend on coal to a great extent, and the sequestering of CO_2 will remain to be a problem in need of a solution.

In recent years, the long neglected development of vaccine for infectious disease is finally picking up some momentum with international efforts. The race lies between the perfection of H_5N_1 vaccine and the mutation of H_5N_1 virus which initiate the transmission from people to people. More research works need to be carried out in this area. However, we do have to pay attention to the fact that in the past the fund which has been spent for medical research globally has only been targeted to problems related to 10% of the population. It is quite obvious that if we do not pay more attention to the deteriorating situation in developing countries, there is no way that we can combat infectious decease effectively.

(5) Sharing of Scientific Knowledge and Technologies in a Globalized World

For centuries, the scientific knowledge accumulated by mankind has been shared quite freely among scientists. Scientists generally still believe firmly that the knowledge accumulated through their efforts should be shared by all – as advocated by Francis Bacon long time ago. Early last century, when Madame Curie, shown in Figure 6, was asked why she didn't apply for patents on her discoveries (after all, if she had done so, she would have been as wealthy as Thomas Edison at that time), her reply was quite simple. She did not want to take that advantage because she believed that scientific knowledge should belong to all mankind. In fact, it was her idealistic way of life which attracted me so much that I decided to become a scientist when I was young. In a modern society, however, when scientific knowledge is further developed, transformed into technology and put to use in society, it becomes the basis for economic competition. Protection of patents and intellectual property rights has become a very important issue, and the sharing of

knowledge now stops at basic scientific knowledge and so called "pre-competitive" technology. Competitive technology is not freely shared. However, the gap, or time lag between scientific discovery and technology in the marketplace has become shorter and shorter. Now, in certain areas of scientific investigation, it is no longer possible to make clear distinction between basic research and associated competitive technology.

Fig. 6

As the relationship between science and technology has become closer, the dilemma of "to share or not to share" has become an important issue – not only for application of technologies, but also for the basic scientific discoveries themselves. It certainly does not seem fair if some countries produce most of the public scientific knowledge, while others mainly dedicate themselves to protected, mission-oriented technological development to gain economic competitiveness. Certainly, in a market-driven economy, free and open economic competition and adequate protection of intellectual property rights are deemed to be necessary for development. Yet, we must ask seriously, in a highly globalized world, whether we can find a new and better way to allow both the creation and sharing of knowledge as well as technology to be carried out in a more orderly fashion for the promotion of sustainable development of the entire world. Strong global public support for the advancement of science and for the development of technology, and shortening the patent protection period, might move along in that direction. In recent years, in the field of high energy physics and astronomy, scientists share their knowledge quite freely and have been more willing to help each other across national boundaries. On the other hand, in the field of biomedical areas, scientists tend to protect their intellectual property rights more tightly. Whether this is due to the fact that high energy physics and astronomy are mainly supported by public funds while the profit-making pharmaceutical industries dominate certain areas of biological research is worth studying in detail.

(6) Concluding Remarks

Many of the problems we face today are problems that cannot be solved with current scientific knowledge and technologies – they await the accumulation of new knowledge and the development of new technologies. That is why it is so important to continue our efforts for the advancement of science and technology, and for the education of a new generation of creative scientists.

During the long history of mankind, our ancestors invented various technologies in order to survive better or to improve the quality of life. Their curiosity and their desire to understand the natural phenomena were the basis of the advancement of science. Until about one hundred years ago, the advancement of science was driven by the available technology; only during the last century have technological advances been led by the results of scientific research.

In recent years, we have observed encouraging improvement in the international scientific collaboration. Many projects were initiated, many agreements were signed. Year after year, we have discussed the "capacity building" of science, technology and education for developing countries, but the worsening situation of the entire world has yet to find its turning point. For example, the rain forest which is often compared with the lung of a human body is continuing to disappear from the surface of the earth. For the past decade, every summer we witnessed the thick dark smog generated by the forest fire in Indonesia contaminated not only the air in Indonesia, but also their neighboring countries. It is not realistic to blame or to expect Indonesia to be able to keep their rain forest from disappearing. Unless we consider the protection of the rain forest in Indonesia is "our responsibility", and raise enough funds to help Indonesia to establish a protected "global rain forest", no matter how serious we engage in the international scientific collaboration, the rain forest will continue to disappear.

We should all recognize the fact that the increasingly interconnected world cannot be a safe place if a large portion of its population still suffers from grinding poverty, disease stricken, illiteracy, derived of education, unemployment, and other barriers to survival. Scientists can play key roles in finding the solutions to these problems. Especially, if we learn to solve problems together, learn to share knowledge, new technological options and the limited resources available, learn to respect and understand different cultural heritages, then it will be possible to realize the establishment of a genuine global village that enables sustainable development for all.

In order for science and technology to solve the problems man faces in the 21st century, it is not enough to advance science and technology at a faster pace. The advancement of

science and technology certainly will solve many problems we are facing today and will also shape the development of human society of the future. However, unless we pay special attention to the roles play by science and technology in this "finite" and "half-globalized" world, and learn to work together beyond the national boundaries, and pay more attention to our "global competitiveness" for solving problems of the entire world, rather than continue to worry about "national competitiveness" for their own countries, the serious problems related to the sustainable development will not be solved.

At present, the entire world consists of more than one hundred nation-states. One of the duties of the government of a nation-state is to collect the tax from their citizen and business to solve their problems and redistribute the wealth. As the world became more and more globalized, it became obvious that there is a need to have some sort of a "global government" which can resolve the conflict between the interests of nation- states, and the interest of the entire world.

The best way to work together beyond national boundaries is to make national boundaries to disappear all together. Although it might take a long time, our future certainly will depend on how soon all of us in different countries learn to operate as "one community" for the entire world, and we do not have much time to waste. Perhaps, the European Union is a step toward that direction, and half way through the 21st Century, the formation of the "Global Union of the Planet of Earth" might become a reality, then the sustainable development of the entire world might become possible. Otherwise, the solar system might send the farewell message to mankind on earth in not too distant future.

RIKEN–NISHINA MEMORIAL SYMPOSIUM

"CHARGING MOLECULES : FUNDAMENTAL CHEMICAL PHYSICS AND ANALYTICAL APPLICATIONS"

PLACE: RIKEN, WAKO CAMPUS, SUZUKI UMETARO HALL (MAP)
DATE: DECEMBER 15, 2008
TIME: 10 AM – 6 PM

場所：理化学研究所・和光キャンパス・鈴木梅太郎ホール
日時：2008年12月15日　午前10時～午後6時
開場：午前9時30分
主催　理化学研究所　　共催　日本学士院　　後援　仁科記念財団

参加費は無料です（~~11月20日までに~~お申し込みください）。
是非ご参加ください。

PLENARY LECTURERS:

Yuan T. Lee

1936年台湾生まれ。
「化学反応素過程の動力学的研究」により1986年ノーベル化学賞受賞。1994年から2006年まで台湾中央研究院院長。
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1959年富山県生まれ。2002年ノーベル化学賞受賞。受賞理由は「生体高分子の同定および構造解析のための手法の開発」。現在、島津製作所・田中耕一記念質量分析研究所所長。
日本学士院会員。

PROGRAM:

10:00 – 10:05	WELCOME ADDRESS : RYOJI NOYORI (RIKEN)
10:05 – 11:05	KOICHI TANAKA (SHIMADZU CORPORATION)
11:05 – 11:50	HARUO SHIROMARU (TOKYO METROPOLITAN UNIVERSITY)
12:10 – 13:30	LUNCH RECEPTION
13:45 – 14:45	YUAN T LEE (ACADEMIA SINICA)
14:45 – 15:30	MAKI KAWAI (RIKEN)
15:30 – 16:00	COFFEE BREAK
16:00 – 16:45	HISANORI SHINOHARA (NAGOYA UNIVERSITY)
16:45 – 17:30	TOSHINORI SUZUKI (RIKEN)
17:30 – 17:35	CLOSING ADDRESS : TOSHIMITSU YAMAZAKI (NISHINA MEMORIAL FOUNDATION)

アクセスマップ(広域)

[電車] 東京駅から和光市駅
東京駅 ― 池袋駅 (東京メトロ 丸の内線(約17分)
又は JR山手線 (内回り) (約23分))
池袋駅 ― 和光市駅 (東武東上線・急行(約12分)
又は 東京メトロ 有楽町線(約19分)、
副都心線・急行(約14分)
[車] 首都高速から 首都高速5号線 高島平ランプ下車
三園2丁目交差点を左折 笹目通り直進　和光陸橋下交差点を右折 国道254号線(川越街道)沿い左側

アクセスマップ (和光市駅からのアクセス)

和光市駅(南口)から鈴木梅太郎記念ホールまで
[徒歩] 和光市駅－(15分)－西門守衛所－(10分)－ホール
[タクシー] 和光市駅－(10分)－西門守衛所－(5分)－ホール
[バス] 和光市駅－(大泉学園駅行 10分 広沢下車)－(徒歩5分)
－西門守衛所－(徒歩10分)－ホール

守衛所で入構証を受け取ってからお越し下さい

参加申し込み・問い合わせ先

11月20日までに kmatsumoto@riken.jp (松本) まで、電子メールにてお名前、所属、メールアドレスを書き添えてお申し込み下さい。
ホームページアドレスは右記のとおりです。http://www.riken.jp/chemdyn/nishina/
理化学研究所基幹研究所　TEL 048-467-1433　FAX : 048-467-1403

理研・仁科記念シンポジウム
“Charging Molecules: Fundamental Chemical Physics and Analytical Applications”
開催報告

１．経緯

日本学士院外国人客員である李遠哲教授が 2008 年 12 月に学士院の招聘で来日することを契機とし、日本学士院での一般講演と李遠哲先生の研究に関連したワークショップを開催したいとの計画が日本学士院において為された。学士院会員であり仁科記念財団理事長である山崎敏光先生から、基幹研究所主任研究員である鈴木に対して、ワークショップ主催の依頼と、仁科記念財団としての後援のお申し出を頂いた。李先生は理研にとってアドバイザリーカウンシルのメンバーであり、理研ゆかりの仁科記念財団からのお申し出でもあることから、お引き受けすることとした。また、野依理事長からも、理研として充実したワークショップを是非開催するようにとのご意見を頂いた。

ワークショップを理研および基幹研にとっても有意義なものとするため、ワークショップの科学的な内容は、物理、化学、生物を俯瞰できるような境界領域的なものとすることが望ましいと判断した。その意味で、李遠哲教授が最近手がけておられるソフトイオン化質量分析の基礎過程の研究をコアにして、基礎物理化学、分析化学、生命科学、材料化学などに関連する最先端の研究を議論する会合を企画した。この過程において、ソフトイオン化への貢献によってノーベル化学賞を受賞している田中耕一氏をも招聘し、特に基礎科学と工学応用あるいは企業化という別の視点からも、重要な講演を頂くことができるようになった。基幹研究所からは、川合真紀、鈴木俊法の 2 主任研究員が講演した。全ての講演は英語で行われた。

２．科学的内容

分子を帯電させるという一見なんでもないワークショップの題目は、様々な物理を包含する。電子数を減らし、分子を正に帯電させる方法は光電子分光やイオントラップに応用され、電子数を増大させ負に帯電させる方法は、固体表面に吸着された分子へのトンネル顕微分光に通じる他、電子輸送、導電性の観点からカーボンナノチューブなどの物質科学にも繋がる。このような研究分野は、理研の中でも特に基幹研が中心となって取り組んでいるものであり、多くの聴衆が集まり、国際会議としての実を上げることが出来たと考え

ている。

まず、基調講演として田中耕一氏は、自身のソフトイオン化法の開発の経緯に触れ、一つの革新的な技術の開発が多くの研究者の共同研究あるいは友好的な競争に基づいて為されることを述べられた。また、米国の研究開発の活力が、常に大学と企業との非常に近い距離感に基づいており、基礎研究から実用化までの死の谷を乗り越える努力が必要との意見があった。この点は、まさに理研の R&D や企業との融合連携と符合する。城丸春夫博士は、首都大学東京の静電型イオンストレージリング（TMU-RING）を用いた、イオンのレーザー分光について述べた。特に原子物理の分野では、デンマーク、スエーデン、ドイツなどが同様の研究を推進しており、その中にあって、TMU-RING はポルフィリンなどの巨大分子や酸素などの小さな分子の消滅寿命などを測定する努力を傾注していることが報告された。午後は李遠哲教授が、マトリックス支援レーザー脱離イオン化法（MALDI）の基礎過程を研究するために、固体表面から発生する正イオンや負イオンの質量を同時測定する実験等について述べられ、レーザー励起によって極めて高い温度の気体衝撃波が表面から伝搬する様子や、その中でのイオン分子反応を指摘された。生命科学に広く利用されている MALDI が、その基礎物理化学過程の観点からは未だ十分理解されて居らず、基礎研究を傾注すべきことが指摘された。川合真紀主任は、固体表面に吸着した分子に対して走査型トンネル電子顕微鏡からの電子付着を利用することで、吸着分子の振動を励起し、吸着分子の移動や化学反応を制御できることを明快に示した。また、固体表面上でのポリマー生成から、電子輸送素子開発の可能性に言及した。篠原久典教授は、カーボンナノチューブ中にフラーレンを封入したピーポッドの生成過程、その電子物性について報告すると共に、ガドリニウムなどの重元素を内包したフラーレンがX線造影剤として注目すべき特性を有している点などを指摘した。フラーレンは、飛行時間質量分析法によって、Smalley，Kroto，Curl らがノーベル化学賞を受賞した分子で、篠原氏も質量分析から物性研究まで長年にわたってフラーレンの化学を開拓してこられた。最後に、鈴木が時間分解光電子イメージング法が飛行時間質量分析法と共通した技術に基づいて成立している点を指摘し、化学反応のリアルタイムな追跡が可能になったことを報告した。20 fs という世界最高レベルの時間分解能と光電子の 3 次元分布の撮像による、超高速電子状態変化の動画が示された。

3．総括

非常に多数の参加者が理研内外から集まり、非常に活発な議論が為された。昼食の最中も議論が続き、田中耕一氏も昼食があまり取れないほどであった。第一線の研究者が和光に多く集まり活発な議論を行ったことで、理研や基幹研究所についても高い評価が得られ

たものと考えている。開催経費については、理研基幹研究所が２／３、仁科記念財団が１／３ の負担となった。仁科記念財団にもお礼を申し上げたい。

本国際会議は通常の科学的な会合として当初提案されたが、最終的には理研として開催するような公式な会合となった。一研究室でオーガナイズすることはなかなか大変であったが、学士院や他の研究室からも応援の方に来ていただいて、何とか無事に開催出来たことは幸いであった。写真撮影については、理研広報部のご助力を頂いた。謝意を表する。

野依理事長挨拶（左）
鈴木梅太郎ホール（下）

食事を取る暇もなく議論している田中さん

左から、田中耕一、李遠哲、野依良治、城丸春夫、川合眞紀、篠原久典、山崎敏光、鈴木俊法の各氏