The 9th Japan Korea China Women Leaders Forum for Science & Technology

Gender Equality for Sustainable Development Goals

9:00-17:00, Friday, October 11, 2019

Ochanomizu University

Session 1: Evaluation Systems for Gender Equality Activities
_session 1_

Session 2: Career Development Programs for Next Generations
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Session 3: Role of Chemistry for SDGs
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Welcome Message

On behalf of the organizing committee, I am honored and delighted to welcome you to the 9th Japan-China-Korea Women Leaders Forum in Science and Technology held on October 10-12, 2019 in Japan.

Women Leaders Forum started in 2008 and held every 1-2 year in one of the three countries. The forum 2019 is organized by the special committee on this forum including JNWES and EPMEWSE, co-sponsored by Ochanomizu University, supported by Ministry of Education, Culture, Sports, Science and Technology (MEXT), Japan Science and Technology Agency (JST) and National Center for Women’s Education (NWEC).

The full program of the forum is as follows.

Thu. Oct.10: Arriving at Haneda Airport, move to the Hotel. Welcome Dinner.
Fri. Oct.11: Main Symposium at Multi-purpose Hall, Hisao & Hiroko TAKI Plaza, Ochanomizu University (Otsuka, Bunkyo-ku, Japan) on the theme “Gender Equality for Sustainable Development Goals”.
Session 1: Evaluation Systems for Gender Equality Activities
Session 2: Career Development Programs for Next Generations
Session 3: Role of Chemistry for SDGs
Sat. Oct.12: The 17th Annual Symposium of EPMEWSE at Ochanomizu University (Otsuka, Bunkyo-ku, Japan) on the theme “Nurturing the next generation in science and technology and creating an environment”.

I am proud to inform you that we have invited distinguished speakers and chairs from Japan, China and Korea. I believe this year’s forum provides a great opportunity to discuss how we strengthen our trilateral cooperation and network among the women scientists in Japan, China and Korea.

Chikako Yoshida-Noro, PhD.
Professor, Nihon University
Chair of the Organizing Committee,
The 9th Japan-China-Korea Women Leaders Forum in Science and Technology
Program
The 9th Japan-China-Korea Women Leaders Forum
For Science & Technology
Ochanomizu University, Otsuka, Bunkyo-ku, Japan
October 10-12, 2019
Official Language: English
Sponsored by JNWES & EPMEWSE
Co-sponsored by Ochanomizu University & supported by MEXT, JST, NWEC

Date: Thursday, October 10, 2019
Arrival: Tokyo International Airport (Haneda) in the afternoon.
Move to Sunshine Prince Hotel (Ikebukuro, Toshima-ku, Tokyo) by shuttle bus. Check-in.
Accommodation: Sunshine Prince Hotel (Ikebukuro, Toshima-ku, Tokyo)
18:30-20:30 Welcome Party at Japanese Restaurant Musashino in the Hotel

Date: Friday, October 11, 2019
Venue: Multi-purpose Hall, Hisao & Hiroko TAKI Plaza, Ochanomizu University (Otsuka, Bunkyo-ku, Japan)
Title: The 9th Japan-China-Korea Women Leaders Forum
Theme: Gender Equality for Sustainable Development Goals

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<td>09:00-09:30</td>
<td>Opening Ceremony</td>
<td>Dr. Hitomi Kumagai, Next President of EPMEWSE</td>
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<td>Welcome address by Prof. Chikako Yoshida-Noro</td>
<td>Professor, College of Bioresource Sciences (CBS),</td>
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<td></td>
<td>Chairperson of the 9th JCK-WLF Organizing</td>
<td>Nihon University</td>
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<td>Opening remarks by Mr. Akira Kusume</td>
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<td></td>
<td>Director, Office of Human Resources Development</td>
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<td>for Science and Technology, Human Resource Policy Division</td>
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<td>Science and Technology Policy Bureau, MEXT</td>
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<td></td>
<td>Opening remarks by Prof. Kimiko Murofushi,</td>
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<td></td>
<td>President of Ochanomizu University</td>
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<tr>
<td></td>
<td>Opening remarks by Prof. Mihoko Nojiri</td>
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<td>President of EPMEWSE, KEK</td>
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<td>Opening remarks by Ms. Ryo Kimura</td>
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<td>President of JNWES, Sakae Design</td>
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<td>Opening remarks by Dr. Myeong-Hee Yu,</td>
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<td>President of KOFWST, KIST</td>
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<td></td>
<td>Opening remarks by Prof. Jihong Yu,</td>
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<td></td>
<td>Head of CWAST Delegation, Jilin University, Member of CAS</td>
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<td>09:30-10:00</td>
<td>Coffee Break, Group Photo</td>
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<td>10:00-12:00</td>
<td>Session 1: Evaluation Systems for Gender Equality Activities</td>
<td>China: Prof. Mei Tian, Deputy Director, Zhejiang</td>
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<td>Time</td>
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| 10:00-10:25 | Un. Medical Center | Japan: Chikako Yoshida-Noro, Nihon Univ.  
“Assessment of Gender Equality in Academia: Promoting Activity of Female Researchers in Japan and Overseas” |
| 10:25-10:40 |               | Yasuko Sasaki, Ochanomizu Univ.  
“What Promotes Gender Equality on Campus?” |
| 10:40-11:10 | Korea:          | Korea: Dr. So Young Kim, Grad. Sch. of Science & Technology Policy, KAIST  
“Evaluating Progress in Gender Equality in S&T in South Korea” |
| 11:10-11:40 | China:          | China: Dr. Ruomei Li, Adviser, Former Secretary-General, Chinese Society for Electrical Engineering (CSEE)  
“Investigation and Analysis of the Status of Chinese Women in Science and Technology” |
| 11:40-12:00 |               | QA & Discussion |
| 12:00-13:00 |               | Lunch & Poster Viewing |
| 13:00-14:50 | Korea:          | Session 2: Career Development Programs for Next Generations  
Korea: Dr. Heisook LEE, Principal Research Fellow, GISTeR, KOFWST, Professor Emeritus, Ewha Womans Univ. |
| 13:00-13:30 | Japan:          | Japan: Rie Yamaguchi, JWEF  
“Work-Style Reform and Women's Career Promotion as a National Policy and Efforts to Practical Solutions in Companies” |
| 13:30-14:00 | Korea:          | Korea: Prof. Suk Kyeong Lee, The Catholic Univ. of Korea, School of Medicine  
“The KOFWST’s Journey to Foster Females in STEM fields” |
| 14:00-14:30 | China:          | China: Erfan Ju, Senior Engineer, Resin/paint Marketing, Director, GE Toshiba Silicones, Great China  
“Shanghai next generation female engineer career planning and success in new high technology industry” |
| 14:30-14:50 |               | QA & Discussion |
| 14:50-15:10 |               | Coffee Break |
| 15:10-17:00 | Session 3:      | Session 3: Role of Chemistry for SDGs  
Japan: Dr. Akiko Itakura, Group Leader, NIMS |
“CSJ committing to SDGs” |
| 15:40-16:10 | Korea:          | Korea: Prof. Heesun Chung, Dean, GRAST, Chungnam National Univ.  
“Role of Chemistry for Sustainable Development Goals” |
| 16:10-16:40 | China:          | China: Prof. Zhimin Liu, Research Fellow, The Institute of Chemistry, CAS  
“Green Chemistry promotes Sustainable Development” |
<p>| 16:40-17:00 |               | QA &amp; Discussion |</p>
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<td>17:50-18:00</td>
<td>Closing Remarks by Fusako Utsumi, President of NWEC</td>
<td>Yumiko Nagoh Vice president of JNWES</td>
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<tr>
<td>18:30-20:00</td>
<td>Banquet (arranged by JNWES) (at Ochanomizu Univ., Tokyo)</td>
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<td>Accommodation: Sunshine Prince Hotel (Ikebukuro, Toshima-ku, Tokyo)</td>
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**Date:** Saturday, October 12, 2019  
**Venue:** Common lecture building 1 & 2, Ochanomizu University  
**Title:** The 17th Annual Symposium of EPMEWSE (in Japanese) ; Canceled due to Typhoon 19  
**Theme:** Nurturing the next generation in science and technology and creating an environment  
**9:50-12:00 Attending the Symposium (with whisper interpreter)**  
**Back to the Hotel**  
**Move to Tokyo International Airport (Haneda) by shuttle bus. Departure**  

JNWES: Japan Network of Women Engineers and Scientists  
EPMEWSE : Japan Inter-Society Liaison Association Committee for Promoting Equal Participation of Men and Women in Science and Engineering  
KOFWST: Korea Federation of Women's Science & Technology Associations  
CWAST: China Women Association for Science & Technology  
CAS: Chinese Academy of Sciences
Opening Ceremony
Opening Ceremony Chair (Japan)

Hitomi Kumagai  
Professor, Department of Chemistry and Life Science, College of Bioresource Sciences, Nihon University  
Member of Science Council of Japan

Education
Degree: BS, Description: in Food and Nutrition, Ochanomizu University, Japan, 1982  
Degree: MS, Description: in Food and Nutrition, Ochanomizu University, Japan, 1984  
Degree: PhD, Description: in Agricultural Chemistry, The University of Tokyo, Japan, 1988

Research Field
Food Science, Food Chemistry, Food Engineering

Career History
Just after Dr. Hitomi Kumagai entered the graduate school of Ochanomizu University, she started to work as a part-time teacher at Ferris Girls’ Junior & Senior High School where she used to attend. She also had experience to teach at several other high schools and colleges while studying as a graduate student. After Dr. Kumagai finished the doctor’s course of the University of Tokyo, she joined College of Bioresource Sciences at Nihon University as the second ever female faculty member after 20-year hiatus in 1990. She was assigned to an Overseas Researcher and has been to The University of Nottingham, UK from 2000 to 2001 taking two of her children. She was promoted to Professor in 2011 after serving as Assistant, Lecturer, and Associate Professor for several years each. After commencement of the activities on gender equality through the Gender-Equality Promotion Committee in her College, the number of female faculty members has been increasing and has become 51 at present.

Certification
Teacher’s License at Junior and Senior High School

Awards
Society Award by The Japanese Society for Food Science and Technology, 2016  
Study on Improving Sensory and Processing Properties as well as Health-promoting Functions of Foods
Research-Paper Award by Japan Society for Food Engineering, 2008  
Ando-Momofuku Award, 2007  
Study on the Improvement of Food Protein Functionality by Cation-exchange Resins
Outstanding Paper Presentation at the 95th AOCS Annual Meeting & Expo, 2004, Cincinnati, Ohio, USA  
Deamidation of Soy Proteins by Ion Exchangers to Provide New Functions  
- Enhancement of Calcium Absorption by Deamidated Soy Proteins –
Achievements

Dr. Hitomi Kumagai has published about 20 book chapters and 100 articles including reviews and original papers. Some of her research findings have been applied for patents, and two of them was granted as international patents.

Civic, Political, and Philanthropic Activities

Dr. Kumagai has been serving as a councilor of several scientific societies and as a refree of grant-in-aids supplied from various foundations and governments.

Science Council of Japan: Member of Section II (Life Science) (2017-): Chair of Bioscience, Biotechnology, and Agrochemistry Subcommittee (2017-); Secretary of IUNS (International Union of Nutritional Science) Subcommittee (2017-); Member of Gender Equality Subcommittee (2017-); Secretary of Life-Science Gender-Diversity-Promotion Subcommittee (2019-)
Japan Inter-Society Liaison Association Committee for Promoting Equal Participation of Men and Women in Science and Engineering (EPMEWSE): Member (2017-
Japan Society for Bioscience, Biotechnology, and Agrochemistry: Councilor (2012-2019); Chair of Diversity Promotion Committee (Formerly, Gender Equality Committee) (2019-); Associate Editor of Bioscience, Biotechnology, and Biochemistry (2017-); Associate Editor of Kagaku to Seibutu (Society Journal of Chemistry and Biology) (2014-2017); Member of Public Relations Committee (2011-2019); Member of Female-Researcher Award Committee (2016-2018); Fellow (2016-
Japanese Society of Nutrition and Food Science: Councilor (2006-); Member of International Academic Cooperation Committee (2008-)
Japanese Society for Food Factors: Councilor (2006-)
Japanese Society for Food Science and Technology: Member of Awards Committee (2012–2014, 2018-)
Japan Society for Food Engineering: Councilor (2007-)
American Oil Chemists’ Society: Organizer of Protein and Co-Products Session in Annual Meeting (2007-)
IUFoST-Japan: Councilor (2014-)

Current Memberships

Science Council of Japan (2014-)
Japan Society for Bioscience, Biotechnology, and Agrochemistry (1983-)
Japanese Society of Nutrition and Food Science (1990-)
Japanese Society for Food Factors (1996-)
Japanese Society for Food Science and Technology (1999-)
Japan Society for Food Engineering (2000-)
Japanese Society of Applied Glycoscience (2018-)
American Oil Chemists' Society (2005-)
American Chemical Society (2006-)
Akira KUSUME
Director, Office of Human Resources Development for Science and Technology, Human Resource Policy Division, Science and Technology Policy Bureau
Ministry of Education, Culture, Sports, Science and Technology (MEXT)

Education
1996: Bachelor of Law, the University of Tokyo, Japan
2002: Master of Law, Graduate School for Law and Politics, the University of Tokyo, Japan

Career History
2003: Senior Specialist, International Affairs division, Minister’s Secretariat, Ministry of Education, Culture, Sports, Science and Technology, MEXT
2006: Director, School Policy Planning Division, Tokushima Prefectural Board of Education
2010: Deputy Director, Child and Youth Development Promotion Division, Cabinet Office
2012: Deputy Director, Nuclear Liability Division, Research and Development Bureau, MEXT
2015: Director for Policy Planning, Day Care Division, Child and Family Policy Bureau Ministry of Health, Labour and Welfare
2018: Director, Office of Human Resources Development for Science and Technology, Human Resource Policy Division, Science and Technology Policy Bureau, MEXT
Opening Remarks (Chair of EPMEWSE, Japan)

Mihoko Nojiri
The Chair, EPMEWSE
Institute of Particle and Nuclear Studies, KEK

**Education**
- 1990  Graduate School, Division of Natural Science, Kyoto University
- 1985  Faculty of Science, Kyoto University

**Career History**
- Oct 2007 - Today PI, IPMU, Tokyo University
- April 2007 - Present Professor, High Energy Accelerator Research Organization (KEK)
- Jan 2006 - Mar 2007 Associate Professor, High Energy Accelerator Research Organization (KEK)
- Oct 1997 - Dec 2007 Associate Professor Yukawa Institute for Theoretic. Physics, Kyoto University
- July 1993 - Sep 1997 Associate Professor, National Laboratory of High Energy Physics (KEK)

**Research Areas**
Physics / Particle/Nuclear/Cosmic ray/Astro physics /

**Research Interests**
Theoretica. Particles Physics

**Civic, Political, and Philanthropic Activities**
- Oct 2017 - Present Member, Science Council of Japan
- Oct 2014 - Sep 2017 Associated member, Science Council of Japan
- April 2017 - March 2019 Board member, the Physical Society of Japan (JPS), Chair for the committee of gender equality promotion of JPS
- April 2017 - March 2021 Advisory Board member of Yukawa Institute for Theoretical Physics, Kyoto University.
- April 2009 - March 2010 Advisory Committee member of ICRR, Tokyo University
Opening Remarks (President of JNWES, Japan)

Ryo KIMURA
President of Japan Network of Women Engineers and Scientists
Co., Sakae Design company
Tokyo University of Agriculture and Technology

Qualification

Professional Engineer for Agriculture 「Rural Environment」
First-class architect
First-class landscaping construction management engineer

Education

Degree: BE, Architecture, School: Musashino Art University, 1976

Career History

1976-1978: Co., Central consultant (Building Department)
1978-: Co., Sakae Design Environmental improvement section
Public buildings design Community- center. Pump station, Individual residence
Various Parks design Children’s park, City park, Botanical garden, Disaster evacuation park
Rural environment improvement Rural Environment Management Project
Rural planning Village development Rural activation KI

Civic, Political, and Philanthropic Activities

Japan Society for Professional Engineers of Women (JSPEW) member in 2008-
Japan Network of Women Engineers and Scientists in 2015-
2011-2018: President of JSPEW
2012-: The Geo Ecological Conservation Network Audit & Supervisory Board Member
2018-: President of Japan Network of Women Engineers and Scientists

Current Memberships

JSPEW Member,
INWES member
Opening Remarks

As the President of JNWES (Japan Network of Women Engineers and Scientists), I am very proud to invite you to “the 9th Japan-China-Korea Women Leaders Forum for Science and Technology” in Tokyo, Japan.

The Forum started in Seoul, Korea in 2008 and will be the 9th this year and the 3rd in Tokyo. In the course of conferences, we picked up various issues and compared, and directly discussed them among the three countries. After repeated discussions, it was confirmed that the problems of women in all countries, especially East Asia, were similar. We also learned that it is very effective for three countries with similar tasks to learn effective measures from each other's examples. I think the face-to-face meeting is very effective.

The theme of the 9th Forum is “Gender Equality for Sustainable Development Goals”. The Forum, which began with raising issues, today ... discuss future policies. Although it is difficult to improve the female environment at once, the steady efforts of female scientists and engineers overcome them.

A good example is this venue ... this Ochanomizu University, which provide the conference venue, has been established with a women's university and has 150-years history that was first established in Japan in 1874 for nurture female teachers. At that time, there were very few female teachers, so I think it was a very advanced school. Women in that era were hard on all sides. Today's Forum, I can feel the historic linking, to be able to hold such a meaningful meeting. I hope to remember,100 years later, women will look back on our this current situation and maybe says that "Women in the 100years before era were hard on all sides".

Finally, I would like to express my sincere thanks to all of the speakers, guests and attendees from China, Korea, and Japan. Also my deep thanks to all of our sponsors and supporting organizations and volunteers, for their generous contributions for ensuring this conference be a great success. We wish all attendees to have a wonderful and memorable experience.

Ryo Kimura
JNWES President
Opening Remarks (President of KOFWST, Korea)

Myeong-Hee Yu
President, KOFWST (Korean Federation of Women’s Science and Technology Associations)
Principal Research Scientist, Biomedical Research Institute of KIST (Korea Institute of Science and Technology)

Education

Degree: BS, Dept. of Microbiology, Seoul National University, Korea, 1977
Degree: Ph.D. Dept. of Microbiology, the University of California, Berkeley, USA, 1982
Degree: MBA, KAIST Business School, Korea, 2008
Degree: LLM, Northwestern University, School of Law, USA, 2014

Research Field

The structure-function relationship of proteins
Proteomics
Cancer biomarker

Career History

Postdoctoral Fellow, the Massachusetts Institute of Technology (MIT), USA, 1982-1985
Korea Research Institute of Bioscience & Biotechnology (KRIBB), Korea, 1985-2000
KIST (Korea Institute of Science and Technology), Korea, 2000 ~ Present
Senior Secretary for the Future Strategy at the Presidential Office of Korea, 2010-2013

Awards

Mock-Am Award from the Korean Society of Molecular and Cellular Biology, 1996
L'Oréal-UNESCO Award for Women in Science, 1998
The Seoul City Cultural Award, 2001
The Role Models in Science, from the Korea Science Foundation & DongaScience, 2003
The Order of Science and Technology and the Ungbi Medal, from the Korean Government, 2004
60 Women in 60 Years History of UNESCO, 2006

Achievements

disorder resulting from alpha-1-antitrypsin deficiency, is associated with a hepatic block in the protein folding process. Since July 2002 Dr. Yu had been the Director of Functional Proteomics Center, one of 21C Frontier R&D Initiatives of Ministry of Science and Technology, to build up national infrastructure of emerging proteomics technology. In July 2010 she was appointed as the Senior Secretary to the President of Korea for national future strategy, and had served the position till February 2013. Dr. Yu had been the President of KOGO (The Korean Genome Organization), The Korean Biophysics Society, and KSBMB (Korean Society for Biochemistry and Molecular Biology).

### Civic, Political, and Philanthropic Activities

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<tbody>
<tr>
<td>Member, L’OREAL-UNESCO Award International Jury</td>
<td>2001-2006</td>
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<td>Member, The National Science &amp; Technology Council</td>
<td>2008-2010</td>
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<tr>
<td>Board Member, Korean Cancer Association</td>
<td>2014-2016</td>
</tr>
<tr>
<td>Member, Scientific Advisory Board, Institute for Basic Science</td>
<td>2015-2021</td>
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<tr>
<td>Chair, Committee on Women Scientists, The Korean Academy of Science and Technology</td>
<td>2016-2019</td>
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<tr>
<td>Co-chair, Bioeconomy Forum of The Korean Federation of Science and Technology Societies</td>
<td>2017-2020</td>
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<tr>
<td>President of the Korean Federation of Women’s Science and Technology Associations</td>
<td>2018-2019</td>
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<tr>
<td>Advisory Committee, National Assembly Futures Institute</td>
<td>2018-2020</td>
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<tr>
<td>Board Member, KC Mirae Scholarship Foundation</td>
<td>2018-2021</td>
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### Current Memberships

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<th>Organization</th>
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<tr>
<td>The Korean Academy of Science and Technology (KAST)</td>
<td>2002- Present</td>
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<td>The National Academy of Engineering of Korea since (NAEK)</td>
<td>2014-Present</td>
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<tr>
<td>Citizens’ Coalition for Scientific Society (CCSS)</td>
<td>since 2005, one of founding members</td>
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Opening Remarks (Head of CWAST Delegation, China)

Jihong YU  
Academician of Chinese Academy of Sciences  
Academician of TWAS, Member of Academia Europaea  
Associate Editor of Chemical Science  
Director of International Center of Future Science, Jilin University  
Professor, State Key Laboratory of Inorganic Synthesis and Preparative Chemistry, College of Chemistry, Jilin University

Education
Degree: BS, Description: in Inorganic Chemistry, School: Jilin University, Location: Changchun, China, Year: 1989  
Degree: Master, Description: in Inorganic Chemistry, School: Jilin University, Location: Changchun, China, Year: 1992  
Degree: PhD, Description: in Inorganic Chemistry, School: Jilin University, Location: Changchun, China, Year: 1995

Research Field
Synthesis and application of zeolitic nanoporous materials involving designed synthesis of new type of zeolites, developing new synthetic routes, mechanistic study and the application of zeolitic nanoporous materials in catalysis, separation and other emerging fields.

Career History
Prof. Jihong Yu is from the State Key Laboratory of Inorganic Synthesis and Preparative Chemistry, Jilin University, China, and is the director of International Center of Future Science, Jilin University. She received her BS (1989), MS (1992), and PhD (1995) from Jilin University, and worked as a postdoctoral fellow first at the Hong Kong University of Science and Technology and then at Tohoku University in Japan during 1996-1998. She has been a full professor in the Chemistry Department, Jilin University since 1999. She was awarded the Cheung Kong Professorship in 2007 and elected as the Member of the Chinese Academy of Sciences in 2015, the Fellow of TWAS in 2016, and the Member of Academia Europaea in 2019.  
Her main research interest is in the designed synthesis and application of zeolitic nanoporous materials in energy, environment and other emerging fields. She has co-authored over 350 research papers including Science, Nat. Commun., Sci. Adv., Chem, JACS, Angew Chem. Int. Ed., etc.; obtained over 20 authorized Chinese Invention Patents; published 7 books. She has delivered over 60 Plenary/Keynote/Invited lectures in international conferences. From 2014 to 2018, she was recognized as the Elsevier Most Cited Chinese Researchers for Exceptional Research Performance in the Field of Chemistry. She was the winners of the National Prize for Natural Science, and the IUPAC 2017 Distinguished Women in Chemistry/Chemical Engineering Award, etc. Currently, she serves as the Associate Editor of Chemical Science, the Editor-in-Chief of Chemical Research in Chinese Universities, and Editorial/Advisory Board Members of Materials Horizons, Materials Chemistry Frontiers, National Science Review, ACS Central Science, ACS Mater. Lett., Inorg. Chem., Chem, Matter, etc. She is the Chair of Chinese Zeolite Association, and Vice President of Chinese Chemical Society.
Opening Remarks (President of Ochanomizu University, Japan)

Kimiko MUROFUSHI
Academic Name: Kimiko Murakami-Murofushi
President, Ochanomizu University

Education

Degree: B.S. in Biology from Ochanomizu University, 1970
Degree: M.S. from Ochanomizu University, 1972
Degrees: Ph.D. in Medicine from the University of Tokyo, 1976

Research Field

Cell Biology, Biochemistry, Science Education

Career History

Joining Ochanomizu University in 1983, she became a professor, specializing in Life Science and Science Education, in 1996, after working as an Assistant Professor and Lecturer. She was appointed Dean of the Faculty of Science in 2002 and successfully coped with various issues arising from the government’s initiative to turn all Japanese universities into institutions with cooperative status as a Director and Vice-President in 2004. Also, she conducted promotional activities to improve people’s science literacy and supported girls’ education in developing countries while striving to establish Japan’s first “Genetic Counseling Course” as a graduate course. She became a Professor Emeritus in 2013, and assumed her current position in 2015. In 1999 and 2005, she served as a Visiting Professor at Université Louis Pasteur (now known as Université de Strasbourg), and received the Ordre des Palmes Académiques (the Order of Academic Palms) for her contribution to promoting interactions between researchers and students in Japan and France in 2013. Besides, she held various posts such as a Council Member of the Science Council of Japan, a working group member of the Ministry of Education, Culture, Sports, Science and Technology/Ministry of Economy, Trade and Industry/Cabinet Office, Board Member, Governors of the Japan Broadcasting Corporation (NHK), Member of the Board of Bridgestone Corporation, Auditor of the Japan Agency for Medical Research and Development, and Vice-Chairperson of the Japan Association of National Universities.
**Major Awards**

2011: The Commendation for Science and Technology by the Minister of Education, Culture, Sports, Science and Technology

2013: Chevalier dans l'Ordre des Palmes Académiques (from the government of France)

**Research Pursuits**

She has studied the mechanisms of cell proliferation, cell differentiation and stress responses. Now, she focuses on the studies to apply cyclic phosphatidic acid to the medical use for the regulation of cancer invasion and metastasis, for the improvement of neurogenerative diseases, and for the suppression of pain.
Session 1: Evaluation Systems for Gender Equality Activities
Session 1 Chair (China)

Mei Tian
Professor, Zhejiang University School of Medicine
Vice President, Zhejiang University Medical Center
Distinguished Professorship of Nuclear Medicine and Molecular Imaging
Vice President, the Zhejiang Association for Science and Technology

Education
Degree: MD. in Clinical Medicine; Shanxi Medical University, Taiyuan, China; 1991-1996
Degree: MSc.: in Medical Imaging; Shanxi Medical University, Taiyuan City, China; 1998-2001
Degree: PhD. In Internal Medicine; Gunma University, Maebashi, Japan; 2001-2004

Research Field
Medical Imaging Diagnosis and Molecular Imaging-based Precision Medicine,
Novel Medical Imaging Agent Development,
Stem Cell or T-Cell Trafficking.

Career History
Career: Prof. Tian has 23 years’ post-MD training and practice in radiology, nuclear medicine and molecular imaging, served in academic positions as a clinical fellow at Dana-Farber Cancer Institute / Brigham and Women’s Hospital, Harvard Medical School, an Assistant Professor at MD Anderson Cancer Center, and a Distinguished Professor of nuclear medicine and molecular imaging granted by the Ministry of Education of China. Prof. Tian has spent 12 years for her professional training and working experience in Japan and the USA.
Prof. Tian has received the multiple national and international awards, including the Women in Science Award.
Chikako Yoshida-Noro
Professor, Department of Applied Molecular Chemistry, College of Industrial Technology, Nihon University
Division of Cell Regeneration and Transplantation, Nihon University School of Medicine
Chairperson of the 9th Japan-China-Korea Women Leaders Forum Organizing Committee

Education
Degree: BS, Description: in Biology, Chiba Univ., Japan, 1979
Degree: PhD, Description: in Science, Kyoto Univ. Grad. Sch., Japan, 1984

Research Field
Developmental Biology, Cell Biology

Career History
Visiting Scientist, Senior Research Associate Wellcome / CRC Institute, University of Cambridge, UK.,
1991—1993; Research Fellow, Precursory Research Embryonic Science and Technology. JRDC,
Research Fellow, Senior Research Scientist, Experimental Animal Division, BioResource Center, RIKEN,
Tsukuba, 2000—2005; Associate Professor, Advanced Research Institute for Science and Humanities,
Nihon University, Tokyo, 2005—2013; Department of Applied Molecular Chemistry, College of Industrial Technology, Nihon University 2008—; Department of Functional Morphology, Division of Cell Regeneration and Transplantation, Nihon University School of Medicine 2008-; Chairperson of Gender-Equality Committee, College of Industrial Technology, 2010-2017; Professor, 2012-; Member of Gender-Equality Committee, Nihon University 2008-2013, 2019-

Certification
Senior Radiation Protection Supervisor

Awards
Educational Contribution to College of Industrial Technology Award 2009, 2016
Development Growth & Differentiation Paper Award 2013
Albert Nelson Marquis Lifetime Award 2017
Achievements

Achievements include first to identification and characterization of the Cadherin family of cell adhesion molecules; invention of name 'cadherin' combining elements from 'calcium' and 'adhere'; invention of shuttle cell culture chamber for in vitro and in vivo stem cell research; Clinical application of dedifferentiated fat cell (mesenchymal stem cell) for regenerative medicine; development of experimental system for the stem cell research in asexual and sexual reproduction of *Enchytraeus japonensis*;

Civic, Political, and Philanthropic Activities

Member of Japan Inter-Society Liaison Association Committee for Promoting Equal Participation of Men and Women in Science and Engineering (EPMEWSE), 2005—; Chair, Science Summer School for Girls at National Women's Education Center (NWEC), Japan, 2012; Member of Promoting Communication Committee, NWEC Forum, 2008—; Referee of Grants-in-Aid Science Research., 2008—2011, Member of Gender Equality Committee, JST 2011-2015; Board Member of NPO STEM Career Path Project for Girls (GSTEM-CPP), 2018-

Current Memberships

Assessment of Gender Equality in Academia: Promoting Activity of Female Researchers in Japan and Overseas

Chikako YOSHIDA-NORO, Ph.D.
“International investigation of policies and effects promoting participation of female scientist and engineers” Working Group, EPMEWSE, Department of Applied Molecular Chemistry, College of Industrial Technology, Nihon University 1-2-1 Izumi-cho, Narashino, Chiba 275-8575, Japan. E-mail:noro.chikako@nihon-u.ac.jp

Abstract: Diversity and inclusion are important for the future of science and technology, and sustainable social development. This fact is recognized in many countries, and measures has been taken to promote gender equality in STEM field. The proportion of female researchers in Japan is lower than other developed countries, especially in STEM field. However, as the government introduced the national policies, “Gender Equality Basic Plan” and “Science and Technology Basic Plan”, and set numerical targets for expanding women's participation in the policy-making process, measures for the female researcher support model projects started in FY2006. These projects has been continued to date, changing the name and system. These measures contributed to the promotion of gender equality in universities and research institutions. These organizations created a better environment for female researchers, and the employment rate of female researchers has increased. The proportion of female researchers increased to 15.3% in 2016, but the number of senior positions are still low, especially in the appointment of executives. Therefore, we would like to make basic data for further development of female researchers activities by organizing the ex-post evaluation results for the past 10 years that are conducted individually for model projects and collecting good examples. We would also like to investigate the gender equality assessment system of academia that has been introduced overseas and propose that it be reflected in future measures in Japan.

Keywords: Gender equality assessment, Female researcher support model project, International comparison of assessment system

1 CURRENT SITUATION IN JAPAN, LAWS AND MEASURES

(1) Female Researchers in Japan

The future of STEM field in Japan and the maintenance and enhancement of the country's international competitiveness depend on the capabilities of people in Japan. It is important to cultivate an environment that makes a diverse pool of individuals including female researchers highly motivated and exercise their capabilities.

The ratio of female researchers in Japan has been gradually increasing, increased from 11.9% in 2006 to 15.3% in 2016. However it is much lower than that of European countries and the US (UK 37.4%, Germany 28.8%, France 26.1%, the United States 34.3%), and especially low in STEM fields. It is important to promote activities by female researchers not only in order to promote gender equality but also to broaden the base of STEM-related competent persons.

(2) Laws and Basic Plans

“The Act on Promotion of Women’s Participation and Advancement in the Workplace” was promulgated and enforced in September 2015 (effect on April 1, 2016). This act aims to promote the participation and advancement of women in labor force. Government agencies, local government and private sector corporations with more than 300 employees will be imposed the following on, with the guidelines by the national government. 1) collect and analyze the data on issues of gender and employment; 2) devise and disclose action plans to improve gender equality with concrete objectives and measures based on these analyses; 3) announce the data regarding women’s participation and advancement

“The 5th Science and Technology Basic Plan” covers the 5-year period between FY2016-FY2021. Japan’s science and technology innovation polices will be promoted based on the 5th Science and Technology Basic Plan. In Chapter 4 Reinforcing the “Fundamentals” for STI, it is described that the numerical targets of the proportion of female researchers among new hires listed in the Fourth Basic Plan (30% of the total in the natural sciences overall, 20% in the physical sciences, 15% in engineering, 30% in agriculture, and 30% in
medicine, dentistry and pharmacology combined) have yet to be achieved, and that in order to quickly achieve these during the period of implementation of the Fifth Basic Plan, Japan is comprehensively promoting all related initiatives through a concerted effort by industry, academia, and the government [2].

On the other hand, in “the Fourth Basic Plan for Gender Equality” (FY2016-2020), one of the performance objectives for 2020 is “Women’s participation and advancement in all fields of society”. There are particularly few women researchers in engineering and science fields that make up the majority of researchers. The percentage of women out of all researchers is 16.2%, which is lower compared to other countries. The percentage of women in engineering field, which has the largest number of researchers (about 420,000 researchers) is 6.2% (university, etc., 11.1%, companies 5.6%). Making it easier for female researchers to work. It is necessary to be able to continue research activities even when reaching life stages of childbirth and childrearing [3].

(2) Female researcher support model project

Prior to the above, the second Basic Plan for Gender Equality (Approved in December 2005) based on the Gender Equality Society Basic Law (enforced in June 1999) suggest that women should occupy leadership positions by 2020 in all fields of society at least about 30%. In response, the government (Ministry of Education, Culture, Sports, Science and Technology) took measures from 2006 to support the efforts of universities and research institutions that help female researchers balance research and childcare and continue their research activities. Although the contents, purpose, and period of the project have changed, the budget has been continued. Now promoting the active participation of female researchers is emphasized as a part of the development of human resources for science and technology innovation, as “Human Resource Development Program for Science and Technology,” which is aimed at reforming systems involved in the fostering of STEM personnel [4].

As a result, the environment for female researchers improved, and recruitment and research activities were promoted. The percentage of female researchers increased from 11.9% in FY2006 to 15.3% in FY2016. In particular, the number of female researchers at universities, etc., accounting for 35.5% of female researchers, increased from 20.4% to 26.3%. The recruitment ratio of female teachers in the natural sciences is increasing, but it varies between fields and is particularly low in engineering. The proportion of female teachers in the universities decline as they become higher ranks. In particular, the proportion of women in the president or vice president of the universities, and professor is still low [4]. How to increase women in leadership positions is still an issue. Companies have introduced numerical targets for executives and are actively improving under the guidance of the Ministry of Economy, Trade and Industry. It is also important to introduce some guidance in academia.

2 SUMMARY OF 10-YEAR EVALUATION OF SUPPORT PROJECTS AND COLLECTION OF GOOD PRACTICES

Interim evaluation and ex-post evaluation are conducted for model projects, and the results are listed on the website. As the project changed, both the issues and the evaluation points changed. Therefore, the projects for which ex-post evaluation was completed (started in 2006-2016) were organized by evaluation items and summarized in a matrix table. From this result, important issues were organized; such as System development, awareness reform, environmental improvement, compatibility support, increase in female researchers, leader development, executive appointment, strengthening of research capabilities, next generation development, collaboration and network construction.

In the initial program, a female researcher support model development project (started in 2006-2010) by the Science and Technology Promotion Coordination Fund, 55 institutions were selected. Emphasis was placed on the development of a system in which female researchers can play an active role, the environment and work-life balance, and the increase in female researchers. Therefore, it was encouraged to conduct research support staff for female researchers during life events. Evaluation points included the next-generation girls’ advancement rate to the undergraduate / graduate school of natural sciences and the increase in the advancement rate of doctoral programs for female graduate students. Under the leadership of the president and others, a system reform was required to create a system for increasing female researchers throughout the university.
In the next program, the Female Researcher Training System Reform Acceleration Project (started in 2009-2010), the 12 organizations that had already been adopted as the first project and the environment had been improved were actively working to increase the number of female researchers.

The third program, Female Researcher Research Activity Support Project (21 projects started in 2011-2012), in addition to the above, establishes a support system and consultation system for female researchers, and worked to improve research capabilities such as support for obtaining research funds. Implementation of career path consultation and enlightenment activities for students was introduced to expand the support of female researchers. In the next period, in addition to the conventional type (19 cases adopted in 2013-2014) applied by individual institutions, the project of base type and collaborative type (14 cases started in 2013-2014) were introduced. Since 2015, it has been renamed the Diversity Research Environment Realization Initiative, and two types of projects are running; featured and collaborative. In recent years, the strengthening of research capabilities and the promotion to higher rank have become evaluation points. An analysis was introduced whether or not the research performance of female researchers has improved as a result of such supports. Compared to environmental improvements and system reforms, the number of papers and presentations is easier to quantify, which may be easier to measure as an evaluation. Furthermore, a project to create a nationwide network from 2018, and a project to conduct survey analysis in 2019- were launched.

In the evaluation matrix table analysis, the horizontal axis shows important issues, the vertical axis summarizes the activities of each institution, the items with low evaluation are shown in red, and the good practices that each institution has characteristically displayed in blue. Good practices include the following; Effective use of the President's discretionary post and a personnel point system for the recruitment of female researchers such as Hokkaido University; Ochadai Index (investigation with evaluation items common to institutions) for institutional survey; Regional cooperation in the Kyushu/Okinawa or Tsukuba area; Leader training programs including mentor system and career development portfolio for female researchers by institutional cooperation.

We would like to summarize these evaluation results, share the good examples with other institutions and discuss how to improve the insufficient points. Furthermore, it is thought that a better system can be achieved by learning not only Japanese methods but also methods from other countries.

### 3 GENDER EQUALITY ASSESSMENT SYSTEM IN OVERSEAS

In Gender Summit 10 (JST sponsored) held in Japan in May 2017 [5], six working groups (WG) were established and parallel sessions (PS) were held for each theme. One of them, “Presentation of Evaluation Methods for Diversity Promotion” WG (Leader: Ryoichi Fujii, Director of Information and Systems Research Organization) held the PS “Developing Evaluation Methods for Diversity in Research”. The current situation and evaluation methods of gender equality in Germany, China, US., Malaysia and the UK were discussed. Finally, as a recommendation, important requirements for the evaluation system were summarized.

The Sasakawa Peace Foundation (SPF) symposium “Advancing Research Excellence Through Gender Equality” was held in March 2018 [6]. On the first day, talks on “Catalysing Policy and Practice through Assessment: understanding the impact of assessment frameworks and policies on advancing gender equality in research” had been given. On the second day, “Gender equality assessment framework design: A Japan higher education and research sector-wide strategic planning” workshop was held, and discussed on designing a Japanese evaluation framework.

On these occasions, we learned about the gender equality assessment system overseas. To understand it better, the Working Group “International investigation of policies and effects promoting participation of female scientist and engineers” of the Japan Inter-Society Liaison Association Committee for Promoting Equal Participation of Men and Women in Science and Engineering (EPMEWSE) conducted the investigation by the support of SPF. The authors of the description of evaluation systems and outlines are as follows.

1) Athenswan, UK
Yoshiko Nakamura, Research Organization of Information and Systems, Female Researcher Activity Support Office / Coordinator
The Athena SWAN Charter, which has been continuously implemented for over 10 years in the UK, was established in 2005 as a certification system for promoting gender equality in the field of STEM. This report summarizes the evaluation methods of research institutions under this certification system, the transition from the start of the system to the present, and the ripple effects within and outside the UK. In addition, evaluations and issues regarding the system itself were described centered on the official opinion of the evaluation side with the opinions from both the UK and overseas as well as voices from researchers.

2) US ADVANCE

Hisako Otsubo Senior Researcher, Faculty of Pharmaceutical Sciences, Nihon University

ADVANCE is an abbreviation for “Increasing the Participation and Advancement of Women in Academic Science And Engineering Careers”, and the program aimed at increasing the number of women and minority researchers by focusing on organizational changes in universities and research institutions. The flag of the “organizational change” was “recognition and overcoming of "Unconscious Bias". The reason why the strategy was switched from supporting individual female researchers to changing the organization and consciousness of university and research institutes was that the effect of the support measures in the first 20 years did not rise as expected. In other words, it became clear that the percentage of female researchers would not increase only by taking care of “pipeline leaks”. The history and achievements are summarized in detail.

3) US SEA Change

Sanae M. M. Iguchi-Ariga, Research Faculty of Agriculture, Hokkaido University

SEA Change, a new evaluation and certification system for promoting organizational, structural change in diversity, equality and conjugation in academic research institutions in the United States. It is headquartered by the American Association for the Advancement of Science (AAAS) that officially started in January 2018 with the support of multiple foundations. Higher education institutions and their departments remove all sorts of systematic, structural discrimination and disability against women, blacks, Latin Americans, Native Americans, disabled people and so on. The goal is to enable talented human resources to participate, continue and succeed in their careers at school and in the institution. The program structure of SEA Change consists of self-evaluation, evaluation criteria, certification and awards, and is largely based on Athena SWAN in the UK.

We are also investigating Spain (EU Horizon2020, Sanae Ariga) and Asia (China, Korea, etc., Noro Chikako Nihon University). We would like to further improve Asian descriptions by exchanging information at this forum.

4 TOWARD THE INTRODUCTION OF GENDER EQUALITY ASSESSMENT TO STRENGTHEN RESEARCH POWER OF JAPAN

In the 13 years since 2006, gender equality in the science and technology field in Japan has progressed in the academic field with planned measures and budgets. But it is still not enough for improving the ratio of female researchers and increasing the number of female leaders in STEM field. We must share information with other countries and find social issues. It is also important to demonstrate the benefits of gender equality for society and the future with specific examples. Our survey data is an excellent tool for that.

In 2019, A research and analysis project was newly introduced in the Diversity Research Environment Realization Initiative, and the proposal of the Research Organization of Information and Systems was adopted. This is a project that conducts surveys and analyzes on examples of outstanding efforts at overseas universities and research institutions, as well as systems in multiple countries where advanced efforts are seen, which contribute to the promotion of female researchers. It is hoped that this research and analysis will further develop gender equality in Japanese academia.

REFERENCES

Gender Equality for Sustainable Development Goals
Session 1: Evaluation Systems for Gender Equality Activities
Assessment of Gender Equality in Academia: Promoting Activity of Female Researchers in Japan and Overseas

Chikako YOSHIDA-NORO, Ph.D.
“International Investigation of Policies and Effects promoting participation of female scientists and engineers” Working Group, JPMENIGE
9:00-10:00, Friday, October 11, 2015
Okinawa University
2014010811 (6) 9:00-10:00

1. CURRENT SITUATION IN JAPAN, LAWS AND MEASURES

The Act on Promotion of Women's Participation and Advancement in the Workplace

- The 5th Science and Technology Basic Plan
  "The Act on Promotion of Women's Participation and Advancement in the Workplace"
  "The 5th Science and Technology Basic Plan"

- Current numerical targets in the 4th Basic Plan (30% of the total in the natural sciences in total)

(1) Female Researchers in Japan

The number of female researchers in Japan is significantly lower compared to the overall population.

The 9th Japan Korea China Women Leaders Forum for Science & Technology

Gender Equality for Sustainable Development Goals
Session 1: Evaluation Systems for Gender Equality Activities

2. SUMMARY OF 10-YEAR EVALUATION OF SUPPORT PROJECTS AND COLLECTION OF GOOD PRACTICES
Assessment after the project

http://www.aagp.com/gs10-about2

Assessment Matrix Table

2) Female Researcher Training System Reform Acceleration Project

Good Practices

- Effective use of the President’s discretionary post and a personnel point system for the recruitment of female researchers such as Hokkaido University
- Ochadai Index (Investigation with evaluation items common to institutions) for institutional survey
- Regional cooperation in the Kyushu/Okinawa or Tsukuba area
- Leader training programs including mentor system and career development portfolio for female researchers by institutional cooperation.

The 9th Japan Korea China Women Leaders Forum for Science & Technology

Gender Equality for Sustainable Development Goals
Session 1: Evaluation Systems for Gender Equality Activities

3. GENDER EQUALITY ASSESSMENT SYSTEM IN OVERSEAS

Parallel Session 4
Developing Evaluation Methods for Diversity in Research

<Chair>
Nyocchi Fujii (ROST, Japan), Elizabeth Pollock (Parma Ltd, U.K.)

<Keynote Speakers>
Sorai Oosterhuis-Kop (GSI, Germany)
Liwen Zhang (CAS, China)
Katherine M. Craig Henderson (ROST, U.S.A.)
Rahayu Fadilah (UTM, Malaysia)
Sarah Dzikson Ngoy (ABR, SAWN, ECU U.K.)

<Working Group Members>
Mutsuki Edwards (QST, Japan), Irih Yotsua (QST, Japan)
Yoshiaki Nakamura (ROST, Japan), Hidesa Chiba (ROST, Japan)
Gender Equality Assessment System Overseas

1) Athena Swan, UK
   Yoshiko Nakamura, Research Organization of Information and Systems, Female Researcher Activity Support Office / Coordinator
2) US ADVANCE
   Hisako Otsubo Senior Researcher, Faculty of Pharmaceutical Sciences, Nihon Univ.
3) US SEA Change
   Sanae M. M. Iguchi-Ariga, Prof. Research Faculty of Agriculture, Hokkaido Univ.
4) EU Horizon2020, Spain
   Sanae M. M. Iguchi-Ariga, Prof. Research Faculty of Agriculture, Hokkaido Univ.
5) Asia (China, Korea, etc.)
   Chikako Yoshida-Noro, Prof. College of Industrial Technology, Nihon Univ.
Summary

- In the 13 years since 2006, gender equality in the science and technology field in Japan has progressed in the academic field with planned measures and budgets.
- still not enough for improving the ratio of female researchers and increasing the number of female leaders in STEM field.
- share information with other countries and find social issues.
- demonstrate the benefits of gender equality for society and the future with specific examples.
- New project that conducts surveys and analyzes on examples of outstanding efforts at overseas universities and research institutions by ROIS
Session 1 Speaker (Japan)

Yasuko SASAKI
Trustee and Vice President, Ochanomizu University

**Education**

- MA (Japanese Literature), Graduate School of Humanities and Sciences, Ochanomizu University, Japan 1978
- MA (Humanities and Sciences), Graduate School of Humanities and Sciences, Ochanomizu University, Japan 1991

**Research Field**

- Sociolinguistics

**Career History**

- Assistant, Graduate School of Humanities and Sciences, Ochanomizu University 1993-1995:
- Assistant Professor, Faculty of Letters and Education, Ochanomizu 1997-2000:
- Associate Professor, Faculty of Letters and Education, Ochanomizu 2000-2001:
- Associate Professor, Foreign Student Center, Ochanomizu University 2001-2005:
- Director of Foreign Student Center, Ochanomizu University 2004-2005:
- Associate Professor, International Education Center, Ochanomizu University 2005-2007:
- Director of International Education Center, Ochanomizu University 2005-2010:
- Professor, Graduate School of Humanities and Sciences, Ochanomizu University 2007-2019:
- Councilor of International Affairs, Ochanomizu University 2007-2010:
- Principal of Primary School attached to Ochanomizu University 2011-2015:
- Visiting Professor, Strasbourg University 2015:
- Councilor of International Affairs, Ochanomizu University 2015-2016:
- Vice President of International Affairs, Ochanomizu University 2016-2019:
- Trustee of Gender Equality and Vice President of International Affairs, Ochanomizu University 2019-

**Achievements**

- As a vice president of international affairs at Ochanomizu University, I have promoted the internationalization of Ochanomizu University and established its oversee’s partner universities.
- As a trustee of gender equality, I have promoted gender equality of Ochanomizu University, expanded the global network of research collaboration on Female Leaders and leadership and held international symposiums and forums.
What Promotes Gender Equality on Campus?

Yasuko SASAKI

(1) Ochanomizu University, 2-1-1 Otsuka, Bunkyo-ku, Tokyo, 112-8610, JAPAN.

E-mail: sasaki.yasuko@ocha.ac.jp

Abstract: The 'Ochadai Index' was created based on the results of the Support Program for Women Researchers (FY2006-2008) financed by the Special Coordination Fund for Promoting Science and Technology from MEXT. It is a self-evaluation index of the educational as well as research institutions’ employment environments. By examining the evaluation results with COSMOS WorkBook, we can improve the employment environment for women. Moreover, we will continuously try to ameliorate the index based on our research results.

Keywords: Ochadai Index, Self-evaluation, COSMOS WorkBook

1. Introducing the Ochadai Index

The 'Ochadai Index' was created based on the results of the Support Program for Women Researchers (FY2006-2008) financed by the Special Coordination Fund for Promoting Science and Technology from MEXT. It is a self-evaluation index of the educational as well as research institutions' employment environments. It is divided into four main categories, and further into subcategories. Each participating institution applied the index to assess their present situation, based on a 3-point grading system. By examining the evaluation results with COSMOS WorkBook, we can work on the improvement of the employment environment for women.

<table>
<thead>
<tr>
<th>MAIN CATEGORIES</th>
<th>SUBCATEGORIES</th>
<th>ITEMS TO GRADE (0, 1, OR 2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>School-wide support system</td>
<td>Organization</td>
<td>Established an organization to support women researchers; 8 more items</td>
</tr>
<tr>
<td></td>
<td>Work system</td>
<td>Made efforts to increase work efficiency; 5 more items</td>
</tr>
<tr>
<td>Support for women researchers</td>
<td>Child-rearing support</td>
<td>Created a women’s lounge; 5 more items</td>
</tr>
<tr>
<td></td>
<td>Research and education support</td>
<td>Created flexible work systems during child-rearing; 10 more items</td>
</tr>
<tr>
<td>Information support</td>
<td>Building an information bank</td>
<td>Disseminated information via websites; 5 more items</td>
</tr>
<tr>
<td>Raising awareness</td>
<td>Next-generation development</td>
<td>Held sample lectures on and off campus for middle school and high-school girls; 3 more items</td>
</tr>
<tr>
<td></td>
<td>Raising awareness</td>
<td>Informed all staff about support for women researchers; 7 more items</td>
</tr>
</tbody>
</table>
2. Referring to the AKKA Program of Lund University and Humbert, Kelan, and Clayton-Hathway (2019)

We are living in an ever-changing world where the continuous updating of measurements is imperative. The following approaches are worth referring to:

2.1 The AKKA Program of Lund University, Sweden

The AKKA program at Lund University contributed to the significant progress of gender equality, thereby raising the understanding of gender and gender awareness. It held workshops and seminars on those two areas and lasted more than ten years from 2004 to 2014.

2.2 Humbert et al. (2019)

According to Humbert et al. (2019), they conclude that for further and faster progress of gender balance to be made, the introduction of legislated board quotas shows excellent potential, but only in combination with a striving for a gender-equal society and using hard sanctions.

3. Discussion/Conclusion

As for the Ochadai Index, since 2010, we have conducted a survey of educational and research organizations, including Ochanomizu University using the Ochadai Index. We have analyzed the results and shown it on our homepage every year since 2010. So, what was the result of the evaluation of Ochanomizu University among the participating 41 universities? Ochanomizu University was 6th among the 41 national and private universities in 2017. Unfortunately, we were not the first. However, regarding the proportion of female to male faculty members among other national universities, Ochanomizu is in the first place. That is, Ochanomizu University is the most advanced university in gender equality of national universities. Since Ochanomizu University implemented a variety of measures, such as seminars, workshops, research, and other events, we believe these contributed to raising gender understanding and awareness, as well as implementing various measures to develop a gender-equal environment.

Though the result of the assessment by the Ochadai Index of Ochanomizu University, the AKKA program and Humbert et al. (2019), we learned that not only one measure can develop institutions’ gender equality but an amalgamation with other measures such as the development of the working environment through raising awareness of gender understanding and legislated board quotas.

REFERENCES


What Promotes Gender Equality On Campus
Yasuko SASAKI

CONTENTS
1. The Ochadai Index – An Overview
2. Notable Attempts to Promote Gender Equality on Campus:
   1) Athena SWAN at University College London
   2) The AKKA Program of Lund University
3. A New Orientation of Gender Equality on Campus

1. The Ochadai Index
An Overview

We now plan to improve the Ochadai Index based on the previous survey. A specific question is how to design the recognizing system of our competency to promote gender equality on campus.

2. Notable Attempts to Promote Gender Equality on Campus

1) Athena SWAN at University College London
An Interview with Professor Sara Mole

- UCL found that there was a gender bias as students' and staff's positions increased.
- In order to clarify the cause and improve this situation, UCL decided to use the Athena SWAN.
- UCL has 17 departments, and their goal is for all departments to apply to Athena SWAN and get Silver.
- UCL organizes the Gender Equality Team, and people of various ages and positions within the university participated in the team of their own will.

The reasons for their success:
- The top of the university has taken the strong initiative and then tackled the whole university.
- The result of the evaluation of Athena SWAN is linked to a subsidy from the government.

An Interview with Professor Lövkröna

- The proportion of women rapidly decreases as they advance to the careers of lecturers, associate professors, and professors.
- In order to clarify the cause and improve this situation, Lund University implemented the AKKA Program.
- When the program spread, men were actively invited to participate to train male leaders who understand gender and gender awareness in order for women to be active.
- The program provided opportunities for learning about leadership by holding seminars, workshops, and project work.
- As a result, in 2005, when the program started, there was only one woman out of eight deans, but in 2014 their number was 50:50.

The program sees leadership as something that can be learned rather than inherited.

2. Notable Attempts to Promote Gender Equality on Campus

2) The AKKA Program of Lund University

3. A New Orientation of Gender Equality on Campus

Discussion/Conclusion

![Graph showing women's and all staff's scores over the years]

![Bar chart showing percentage of women and all staff over the years]
Through the result of the assessment by the Ochadai Index of Ochanomizu University, the Athena SWAN at UCL, and the AKKA program at Lund University, we learned that not only one measure can develop institutions’ gender equality but an amalgamation with other measures such as the development of the working environment through raising awareness of gender understanding and legislated board quotas.
Session 1 Speaker (Korea)

So Young KIM
Chair, Long-Term Policy Committee, KOFWST
Head, Graduate School of Science & Technology Policy, KAIST

Education
Degree: B.A. English Education, Seoul National University, Seoul, Korea, 1993
Degree: M.A. Political Science, Seoul National University, Seoul, Korea, 1996
Degree: M.S. Mathematical Methods in Social Sciences, Northwestern University, Evanston, U.S., 1999
Degree: Ph.D. Political Science, Northwestern University, Evanston, U.S., 2004

Research Field
Science and Technology Policy (R&D Policy, S&T Workforce Policy, Women in Science Policy)
International Political Economy, Quantitative Methodology

Career History
2014-present, Kenya KAIST Project Coordinator (Deputy Director for the Center for Establishment of Kenya Advanced Institute of Science and Technology), KAIST
2012, Visiting Professor, Georgia Institute of Technology, Atlanta, U.S.
2004-2006, Assistant Professor, Florida Atlantic University, Boca Raton, U.S.
2004, Data Archivist, Social Science Computing Center, University of Chicago, Chicago, U.S.

Appointments
2019-present, Co-Chair, Science Diplomacy Committee, Korea Federation of Science and Technology Associations (KOFST)
2018, National R&D Review Committee, Ministry of Science and ICT
2018, Vice President, Korea Technology Innovation Society
2018, Board Member, Korea Society for Innovation Management and Economics (KOSIME)
2017-present, Deputy Director for the Fourth Industrial Revolution Intelligence Center, KAIST
2017-present, Member of University Gender Equality Committee, Ministry of Gender Equality
2017-present, External Advisory Member, Institute for Public Understanding of Risk, National University of Singapore
2016-present, Editorial Member, *East Asian Science, Technology, and Society* (SSCI)
2016-present, Member of Global Future Council of World Economic Forum
2016-present, Co-Chair, Fourth Industrial Revolution Net, KOFST
2014-present, Project Coordinator for the Establishment of Kenya KAIST Project

**Awards**
2018, KAIST International Collaboration Award
2010, KAIST Faculty Service Award

**Current Memberships**
American Political Science Association, International Political Science Association, Korean Political Science Association, Korean Technology Innovation Society
Evaluating Progress in Gender Equality in S&T in South Korea

So Young KIM

(1. Graduate School of Science & Technology Policy, KAIST, 291 Daehak-ro, Daejeon, 34141, KOREA, soyoungkim@kaist.ac.kr)

Abstract: Despite various programs and policies to promote women in S&T in the last two decades in South Korea, there still exists much room for improvement in the effort of both the government and the community of women scientists and engineers to attract and advance more women in S&T. This paper reviews the achievements and limitations of the implementation outcomes of the three governmental five-year plans in South Korea to foster and support women in S&T. Major focus is on a reflective evaluation of key results and structural limits rather than a simple summary of what went well and what went wrong. The paper then makes three recommendations for the future effort including the fourth plan that just began, especially to compensate for uneven progress across different areas and career levels of women in S&T.

Keywords: women in science and technology, gender equality, S&T workforce, South Korea

1. Introduction

Much effort has been made since the 1990s in South Korea to promote women in S&T, with the most outstanding example being the series of systematic government-wide five-year plans now entering the fourth phase. As revealed in the review of the most recent Third Five-Year Plan for Fostering Women in S&T, the rate of female students graduating from S&T degrees increased from 23.9% in 2006 to 29.4% in 2017. Also, the share of women scientists or engineers hired in full-time permanent positions arose from 14.9% to 22.2% for the same period.

There still exists much room for improvement, however. In particular, women remain significantly under-represented in many fields of engineering. While the rate of female students admitted to departments or programs of natural sciences now reaches 52.7% on average, only one in four students is female in engineering departments with some engineering departments showing even much lower ratios (e.g., 8.3% for mechanical engineering, 9.1% for electrical engineering).

This paper provides a reflective evaluation of South Korean effort to recruit, retain, and advance women into S&T based on the reviews of the aforementioned five-year plans with a focus on unbalanced progress across different areas and career levels.

2. Remarkable but Uneven Progress

With the Framework Act for Fostering and Supporting Women in S&T enacted in 2002, the South Korean government promptly embarked on the implementation of the Act in the form of five-year plan of strategies and tasks. Though this was a government plan, the actual implementation largely depended on women scientists and engineers who participated – more or less voluntarily – in various public or quasi-public programs and organizations that sprang up to support women in S&T. Therefore, the outcomes of the five-year plans can be
considered not simply as the result of government policy implementation but as the collective effort of the South Korean community of women in S&T. This implies that an evaluation of whatever progress or setback made during the last 15 years in the promotion of women in S&T in South Korea should not be an aloof criticism of government policy but a sincere reflection of why some areas witness visible progress and others remain resistant to change.

2.1 First Plan (2004~08): Laying the Ground

Looking back after fifteen years, the first five-year plan was relatively straightforward in the sense that most tasks addressed the recruitment of women into S&T, namely fixing numbers [1]. One of the most outstanding goals of this plan was to attract more women into S&T, especially school-age girls. The so-called 4W programs (WISE, WIST, WIE, WATCH21) activated during the years of the first plan generally targeted female students enrolled in secondary and tertiary schools. The WISE Program ran activities mostly for middle-school and high-school students, while WIST and WIE focused on post-secondary students enrolled in undergraduate and graduate programs. The WATCH21 Program supported team activities connecting secondary and tertiary students.

Such effort to attract more girls into S&T had very visible outcomes including the increase of the WISE Program beneficiaries (from 22,349 in 2004 to 36,992 in 2007) and of the WATCH21 teams from 40 to 60 in the same period. Notably, the percentage of female students in S&T doctoral recipients rose from 16.0% in 2000 to 19.5% in 2007. The percentage of female students in S&T master’s degree awardees also increased from 17.2% in 2000 to 24.5% for the same period. The first plan is therefore assessed to have laid the ground for the recruitment and promotion of women in S&T, given such a noticeable significant increase in the number of female students studying S&T fields or subjects in secondary and tertiary schools.

Yet there were still notable areas for further improvement. Despite the inflow of female students into S&T, the top-rank female students were still attracted to medical fields (including dentistry and oriental medicine) with the increasing preferences for stable jobs due to worsening economic insecurity. In particular, engineering fields kept suffering from low rates of female students.

2.2 Second Plan (2009~12): Aiming at More Ambitious Goals

The second five-year plan set out a very clear goal in the areas of recruitment by aiming to increase the share of female students in engineering up to 25% and to produce annually 1,000 female doctoral recipients in S&T [2]. The plan also suggested a similar quantitative target in the utilization of the women S&T workforce by proposing to secure 10% of S&T jobs for women scientists and engineers and to raise the percentage of women project investigators (PIs) of national R&D projects to 10%.

Some of such ambitious goals saw only partial success. The rate of female students admitted to engineering programs reached 20.4% in 2012, which fell far below the proclaimed goal. In fact, the share of high-school girls in S&T remained virtually unchanged during the period of the second plan (34.7% in 2007 to 35.3% in 2011). Yet, other goals were
successfully achieved, which include the share of women PIs increasing to 11.6% in 2012 (from just 9.1% in 2008) and the number of female S&T doctoral recipients reaching 1,127 in 2012 (from 705 in 2007).

Though the second plan saw mixed success in the recruitment goals of women in S&T, one of the new attempts that left indelible legacy was to reform existing institutional practices concerning the hiring and promotion of women scientists and engineers. Due to various policies to promote women in S&T workplaces such as the employment quota, retraining of women in S&T, and support for women of career-breaks, the share of women in new employees of S&T organizations rose from 22.4% in 2007 to 24.6% in 2012, with the portion of women in regular/permanent positions also rising from 9.8% to 12% in the same period.

2.3 Third Plan (2014~18): Refinement and Sophistication

Beginning in just ten years since the first plan was implemented, the third plan had abundant data and records to evaluate before setting out goals and activities. The review of the second plan at the time of formulating the third plan pointed out three limitations of the previous effort to attract and advance women in S&T [3]. One was the uneven recruitment pattern of female students across S&T fields. For example, female students were not only under-recruited in engineering in general but significantly under-represented in those fields of engineering of great economic potentials such as electrical engineering and computer science. Secondly, the persistently low quality of employment in addition to the shortage of jobs remained to be a big hurdle for the retention and advancement of women in S&T, with disproportionately large number of women scientists and engineers hired in temporary positions. Finally, due to the persistent culture of over-work and male-dominant work practices, women successfully launching their S&T careers in universities, research institutes or companies were forced out to stay home.

While the third plan still kept some quantitative targets, it placed more focus on the refinement of policy targets and goals to affect the organizational behavior and culture of schools and work places. One of the most outstanding programs pursued in the third plan was the Program for Career Returns of Women in S&T that provided monetary support for the training and hiring of women returning to R&D work after career breaks. A policy evaluation study of this program reveals that the program made a significant in-road into public and private research institutes absorbing such women as full-time permanent researchers, though universities did not show similar performance in terms of hiring career-break women in R&D positions [4].

3. Recommendations for Long-term Success

Now with the fourth plan just starting [5], it is time to build longer-term sustainability of the policy to recruit and retain women in S&T from candid evaluations of the success and limitations of the past effort at the fostering of women in S&T. Based on the review of the past implementation of three plans presented above, at least three recommendations can be made. Firstly, given the limited budget and personnel, more effort must be geared towards
strategic distribution of the available resources across different areas of S&T and different career levels. Secondly, although the third plan took a very serious note of the retention program, much more effort must be leveled at the later parts of the leaky pipeline, which implies a shift of policy focus from the recruitment to the retention and advancement stages in those fields that already achieved quantitative targets. Finally, as is recently emphasized in the vast literature and effort for gendered innovation, more effort must be made to fix not only numbers or institutions but knowledge, the very content of S&T research. In that regard, it is quite encouraging to see the fourth plan expanding several goals for gendered innovation that was first introduced into a policy document in the third plan.

REFERENCES

Evaluating Progress in Gender Equality in S&T in Korea

So Young Kim
Head of the Graduate School of Science, Technology, and Policy, KAIST
Chair of the Long-term Policy Committee, KOFWST
October 11, 2019

Five Years Ago...

- KOFWST developing the Long-term Policy Roadmap for Women Scientists and Engineers, which was the first bottom-up effort of Korean women in S&T to canvass the current landscape of policy for women in S&T and to identify key issues to be addressed in the long run.

(Women in S&T) Urgent Need to Minimize Career Breaks of Women in S&T in the Age of Jobless Growth

(Women for S&T) Increasing Demand for Active Roles of Women for Welfare, Safety, Environment, Quality of Life, etc. beyond Industrial Growth

Long-Term Policy Roadmap for Women Scientists & Engineers

Proposing to Proceed in Steps

Recommending Further Effort

- To implement policy tasks identified as important and urgent
- To continuously update on major issues of women in S&T
- To create a sustainable system of policy and institutions integrating the two aspects of women S&T (women in S&T and women for S&T)

Still Fixing Numbers and Institutions

- Still leaky pipeline
  - Small # of female students choosing engineering
  - Many female graduates hired in temporary jobs
  - Difficult to survive graduate schools
  - Career breaks due to childbirth
  - Slow promotion to higher leadership positions
  - Limited R&D opportunities for women researchers
**Areas of the Slowest Progress**

**Education**
- Unbalanced shares of female students across S&T fields
- Difficult lab conditions for female grad students
- Female graduates accounting for only 1/4~1/3 of new hiring in R&D workforce
- Female graduates tending to be hired in temporary positions

**Career Advancement**
- Very small share of women researchers among large-scale R&D PIs
- Under-representation of women in S&T leadership

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**Grad Survey Result**

- Female doctoral students spending roughly the same amount of time in labs but being paid less

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**Grad Survey Result**

- Female grad students having more difficulty in work-life balance & personal relationships and worrying more about careers/jobs

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**Education**

- KOFWST running the first survey of the comparison of educational environments of female vs. male graduate students this year
  - Pilot survey of major universities (representative of different types of universities – public vs. private, general vs. S&T-focused, Seoul vs. other regions)
  - Responses: 645 (male: 61.4%, female: 38.6%)

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**Career Entry**

- Share of women in new R&D hiring (share of women in temporary positions in parenthesis)
Permanent Positions (New Hiring)
- Share of women in R&D hired in permanent positions by degree

Temporary Positions (Existing Jobs)
- Share of temporary positions 2.5 times larger among female S&T workers than in male S&T workers

Career Advancement
- Women holders of leadership positions in universities

Unfair Payment?
- Women new hires getting smaller payment
  - 24.8% of those new hires getting less than 30 million KRW are women (vs. 14.8% of men)
  - 85.3% of those new hires getting more than 30 million KRW are men (vs. 75.2% of women)

Inconvenient Truth: WLB Only on Paper
- Significant imbalance between mandatory and elective measures of WLB

More but Smaller Projects?
- More women PIs
Inconvenient Truth: More but Smaller?

• But doing smaller projects

<table>
<thead>
<tr>
<th>Project Size (in KRW)</th>
<th>Share of Women (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 billion or more</td>
<td>8.8%</td>
</tr>
<tr>
<td>100 million ~ less than 1 billion</td>
<td>7.5%</td>
</tr>
<tr>
<td>30 million ~ less than 100 million</td>
<td>12.3%</td>
</tr>
<tr>
<td>Less than 30 million</td>
<td>10.2%</td>
</tr>
</tbody>
</table>


In Lieu of Conclusion

• Still more work to do to fix numbers and institutions
• Big pictures important but need more refined approach looking into details (e.g. survey of young researchers)
• Need to identify areas of slow progress and address the root causes to develop right kinds of policy to incentivize relevant stakeholders (e.g., moving from supplementary/temporary payment for career-break women of S&T to re-structuring of work and culture for them to sustain their careers)

Thank you.

• soyoungkim@kaist.ac.kr
Ruomei LI
Dr., Adviser, Former Secretary-General, Chinese Society for Electrical Engineering

**Education**
Degree: B.E., School: Hefei University of Technology, Location: Anhui, China, Year: 1982
Degree: M.E, School: China Electric Power Research Institute (CEPRI), Location: Beijing, China, Year: 2000
Degree: PhD, School: University of Bath, UK, Location: UK, Year: 2000

**Research Field**
Electrical engineer career for system analysis and operation control

**Career History**
She started her electrical engineer career for system analysis and operation control in the Anhui electric power dispatch Center during 1982-1986. In China electric power research institute (1989-1994, 2000-2004), she was engaged in the research and management work, for power system digital simulation and analysis, operation control strategy, planning and power electronic technology. In recent years, her focus is in promotion of clean energy in China. Her interested areas also include energy revolution and humanity. She served as Deputy Secretary General/Secretary General of Chinese electrical engineering society (CSEE) during 2004–2013. She was member of CIGRE Administrative Council/Steering Committee (2005/2006-2014). She was the AORC-CIGRE chair (2010-2012) and CIRED steering committee member (2007-2017). She is the initiator and organizer of female engineers' activities in China's power & energy field, from 2012. She is the first chair of CIGRE WIE Task force and the main organizer of WIE event in CIGRE Paris Sessions since 2014. She initiated the IEEE PES WIP activity in China in 2018.
**Awards and Scholars**
The second prize of the Science and Technology Progress award by China Ministry of Energy in 1991 (No.4)
The first prize of the China National Science and Technology Progress Award in 2008 (No.4)
Honorary member of CIGRE 2014
The “2019 IEEE PES Wanda Reder Pioneer in Power Award”

**Current Memberships**
Senior member of IEEE
Chair of Women in Power Committee (WIP) of IEEE Power & Energy Society (PES)
Executive Council member of World Federation of Engineering Organizations (WFEO)
Council member of China Women’s Association for Science and Technology (CWAST)
Invited Research fellow of Energy Internet Research Institute of Tsinghua University since 2015

Up to now, she is a member of the Editorial Advisory Board of Tellus B-Chemical and Physical Meteorology, Atmospheric Environment, the Editorial Board of Acta Chimica Sinica, Acta Scientiae Circumstantiae (Chinese). She is also the member of several scientific program, including China SOLAS (the Surface Ocean – Lower Atmosphere Study), China IGAC(International Global Atmospheric Chemistry) China iLEAPS (Integrated Land Ecosystem- Atmosphere Processes Study) , and China ABC (the Atmospheric Brown Cloud).
INVESTIGATION AND ANALYSIS OF THE STATUS OF CHINESE WOMEN IN SCIENCE AND TECHNOLOGY

RUOMEI LI
Chinese Society for Electrical Engineering, China
ruomei-li@csee.org.cn, ruomeili@icloud.com

Abstract: In order to realize UN SDG 5, to achieve gender equality and empower all women and girls, it is necessary to understand the current status, problems, expectations and needs of women. This report has shown the survey data of China's women workers of science and technology, the analysis of the professional women's growth path, the career bottleneck and challenges facing. It points out that a new generation of science & technology and social development trend of diversity, would give women more growth opportunities. However, despite equal educational opportunities, the existing employment and retirement policies for women, as well as the lack of self-confidence caused by the social and cultural environment, still hinder women's career development. This paper points out that the policy makers should adjust policies in consideration of women's special responsibilities in family and next generation cultivation, to provide equal development opportunities for males & females. On the other hand, special education/training and social activities can also play the key functions. Women have a great potential capability which can produce a greater impact on the sustainable development.

Keywords: investigation of women's status, demand and bottlenecks in career, policy needs, role of social activities, opportunities and prospects.
OUTLINE

• SDG 5-goal for Women
• What is the Status of Women?
• Women in Power, Why & How?
• The Speciality of Women, Advantages & Challenges
• To Empower Women

SDG 5- Goal for Women

How far it is to reach our goal?

• For all the efforts on SDG 5, we should know firstly the current status of women, especially women in science & technology, to find out feasible paths for our goal.

• China is a country with the largest population and also the largest numbers of women professionals in STEM field. The challenges and experiences could be useful for sharing.
What is the Status of Women?

- China is the country with No. 1 population in the world. The women of Science & Technology in China has also the largest number. Here, the data is from the report of the China Ministry of S&T in 2016.

Chinese Women data in S&T (2014)

Male: 51,427,000 (63.4%)
Female: 29,713,000 (36.6%)
The data comes from the graduates and undergraduates

Female %

<table>
<thead>
<tr>
<th>No.</th>
<th>Types</th>
<th>Female %</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Undergraduate</td>
<td>51%</td>
</tr>
<tr>
<td>2</td>
<td>Post Graduate</td>
<td>49%</td>
</tr>
<tr>
<td>3</td>
<td>Female Researcher</td>
<td>40%</td>
</tr>
<tr>
<td>4</td>
<td>Top Scholars</td>
<td>5.6%</td>
</tr>
</tbody>
</table>

Statistics of women in Engineering and Science (2015)

- In China, it takes about 30,000USD to cultivate one BSc graduate. The cultivation cost of a MSc or PhD student is higher.
- 56% of the scientific and technical staffs are women
- 67% of them have BSc & BE degree.
- 6% have master degree.
Women in political positions (2000–2009)

<table>
<thead>
<tr>
<th>Year</th>
<th>Province</th>
<th>City</th>
<th>County</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000</td>
<td>17%</td>
<td>13.7%</td>
<td>16.4%</td>
</tr>
<tr>
<td>2003</td>
<td>8%</td>
<td>10.8%</td>
<td>15.1%</td>
</tr>
</tbody>
</table>

2009年，正式在职干部中女性占比例为：县级以上17.2%，地市以上15.4%。

第十八届中央委员会中，女性16人，比例为4.5%；在中央政治局委员中，女性仅到7名，其中7%。

各级主要岗位中政治局成员中，女性22人，占总数45%。

Why the Career of Women is so hard?
- Long time social culture
- Family education and expectation of parents
- Women’s physiological reason and family responsibilities
- Public services have lagged behind
- Retirement system (Majority of Chinese professional women retired at 50–55 years old, men retire at 60 yrs)
- Social culture

Less Opportunities for Women to have Career Promotion
- Entry Level of a company, Male% / Female% = 52% / 48%
- Manager Level, Male% / Female% = 62% / 38%
- VP Level, Male% / Female% = 71% / 29%
- SVP Level, Male% / Female% = 76% / 24%
- C-SUITE Level, Male% / Female% = 77% / 23%

Women have much less opportunity to have internal promotion like men, although when they enter the workforce, in about equal number.

What Women Lose when not being in Power?
- The direct expression of power is economic status. Promotions to management positions means the payment rise, which bring the decrease of women’s income. The gap known academically as the “gender wage gap”.
- Men dominate the politics, culture, family, society, administration, private sector, etc.
- Without the financial independence, women can only depend on men in the family.
Why we need “Women in Power”?

Remarks of UN Secretary General, António Guterres:
- Gender equality is fundamentally a question of power, as we still live in a male-dominated world with a male-dominated culture.
- When women have equal opportunities at work, development accelerates tremendously.
- And we also need change in power relations to advance peace and security for all, as gender equality is a key instrument of peace and security.

Women in Power, How to be in Reality
- Firstly, we need fair policies for women, from government and companies/universities. The women has play an important function not only for families but also for social society. Its responsibility should be shared.
- The current retirement policy in China should be changed as women retire 5 years earlier than men.
- Encourage and training women for their capability of leadership.

Specialties of Women
- Their natural intuition allow them to capture the fact behind the scenes according to the feeling;
- Determination - have a sense of urgency, dare to break the routine
- Social skills - better understanding of human nature, communication and coordination skills
- Natural love - compassionate, love to help others
- Care for the environment - naturally close to nature

Women’s Disadvantage
- Lack of self-confidence. High dependence & strong obedience on their boss or male colleagues;
- More focus on the details and without consideration the key points. “It is my boss’s business not mine”
- Not wide mind, more emotional.

Women’s disadvantage
- Most women not participate very often the social activities. The private message between females become the only way to communicate. More gossips in the company or divisions dominated by females.
- Some females can accept their male colleagues to get promotion, but not the female in the same position, because it hurt their self confidence.

Opportunities for Woman to be successful
- Mentor is the key point.
- First of all there should exist the opportunity, and then can we explore. The favor and promotion from important figure can greatly accelerate the growth of young people.
- There will be more opportunities when you maintain active participation in social activities.
Never be too late to go ahead

- You would never know how far you can go in your life. You could realize much higher value than you expected.
- In this world, it is never too late for you to make decisions.
- Be independent, be yourself.
Session 2: Career Development Programs for Next Generations

次世代キャリア開発プログラム
Session 2 Chair  (Korea)

Heisook LEE
Principal Research Fellow, GISTeR, KOFWST
Professor Emeritus, Ewha Womans University

Education
Degree: B.S.(With Distinction), Mathematics, Ewha Womans University, Seoul, Korea, 1971
Degree: M.Sc. in Mathematics, University of British Columbia, Canada, 1974
Degree: PhD, in Mathematics, Queen’s University, Kingston, Canada, 1978

Research Field
Associative Algebras, Applied Algebra, Algebraic Coding Theory
Science Policy: Gendered Innovations, HRD in STEM, Science Education, Science Communication

Career History
Major Faculty Appointments at Ewha Womans University
1988-2014.2 Professor, Department of Mathematics
2007.8-2010.7 Dean of College of Natural Sciences
2006.8-2008.7 Dean, Graduate School,
2002-2010 Founding Executive Director, Center for WISE
1997.3-2001.1 Dean for Research Affairs
1995.9-1997.2 Dean of College of Natural Sciences
2011.1-2016.3 President of Center for Women in Science, Engineering and Technology(WISE)

Appointments
2017.3-2019.2 WE-UP Professor, Handong Global University
2013.9 -2014.9. Member of Presidential Advisory Council on Science & Technology
2010.10 - 2013.2. Member of National Science & Technology Commission
2012.7-2018.10. Board Member of KAIST
2013.6-2017.6 Audit of Pohang university of Science and Technology
2012. 6-2015.4 Science Committee member of Korean National Commission for UNESCO
2009. 6 - 2011. 6. Board member of National Research Foundation
2008.1 - 2011.2. Vice President, Korea Federation of Science & Technology Societies
1888. 10 - 1990.10. Chief Editor of Communications of KMS

**Awards**

2016.11 Samsung Awards for Creative Woman Leader
2014.10 Achievement Award, Korean Women in Mathematical Sciences Society
2014.2. Okjo Geunjeong Medal by the President of Korea
2008. 10 Achievement Award, Korean Mathematical Society
2007.12 Seoul City Culture (Natural Science Field) Award
2006. 12 Duke of Edinburgh Fellowship, Korea British Society
2003 The Year Award for Woman in Science & Engineering of the year, Minister of Science and Technology
2003 National Science Medal, President of Korea

**Current Memberships**

Mem.: Korean Mathematical Society, Korean Women in Mathematical Sciences Society, KOFWST (Korean Federation of Women’s Science & Technology Associations), KOFST (Korean Federation of Science & Technology Societies)
Rie YAMAGUCHI  
Diversity and Inclusion Consultant  
Japan Network of Women Engineers and Scientists

### Education

Master of Science (Computer Science)  
University of Southern California

### Career History

June 2010 – Present  
Diversity and Inclusion Consultant  
- Undertake training to parents dealing with career and child-raising  
- Undertake training to managers dealing with empowerment female employees

May 2006 – June 2010  
Business Cube and Partners  
- Marketing Senior Director

Apr 1984 – Jan 2006  
Hitachi,Ltd. Software Division  
- Software Planning  
- Software Development

Joined a general electronics manufacturer in 1984 and engaged in software development, design and product planning for 24 years.  
Took childcare leave twice and work as a general manager.  
In June 2010, became an independent consultant and now provided more than 200 seminars in a year.  
Book:” Let’s start after childcare leave” “Communication that makes use of childrearing employees”

### Current Memberships

JWEF Member,
Work-Style Reform and Women's Career Promotion as a National Policy and Efforts to Practical Solutions in Companies

Rie YAMAGUCHI

Japan Women Engineers Forum, 2-1-30, Kudan-Minami, Chiyoda-ku, Tokyo 102-0074, JAPAN, E-mail yamaguchi@1995consultant.com

Abstract: In 2016, the Act on Promotion of Female Participation and Career Advancement in the Workplace was established in Japan. Also, the Acts to Promote Work Style Reform took effect in 2019. According to these laws, efforts to promote female careers in companies have been actively carried out. In particular, female employees who return to work after childcare leave after childbirth and continue to work are increasing year by year, and trial and error continue on how to support activities for employees who work differently than before in the workplace.

The author joined an ICT company in 1984 as a new graduate and worked for 24 years after having taken childcare leave twice. Encountered various problems in balancing work and childcare, and then experienced a managerial position. Served as a leader of the Women's Achievement Promotion Project for two years from 2006, also had the opportunity to practice problem-solving as the promotion side.

Based on these experiences, the author has provided practical information to organizations and individuals as “Diversity and Inclusion Management Consultants”. This paper introduces the background behind these activities and to provide the latest status of women's career promotion in STEM field in Japan.

Keywords: Work Style Reform, Women’s Career Promotion, Childcare Leave, Gender Equality, Work Life Balance, Diversity and Inclusion Management

1. Executive Summary

In 2016, the Act on Promotion of Female Participation and Career Advancement in the Workplace was established in Japan. And also, the Acts to Promote Work Style Reform took effect in 2019.

According to these laws, efforts to promote female career in companies have been actively carried out. In particular, female employees who return to work after childcare leave after childbirth and continue to work are increasing year by year, and trial and error continue on how to support activities for employees who work differently than before in the workplace.

The author joined an ICT company in 1984 as a new graduate and worked for 24 years after having taken childcare leave twice. Encountered various problems in balancing work and childcare, and then experienced managerial position. Served as a leader of the Women's Achievement Promotion Project for two years from 2006, also had the opportunity to practice problem solving as the promotion side.

Based on these experiences, the author has provided practical information to organizations and individuals as “Diversity and Inclusion Management Consultants”. I would like to introduce the background behind these activities and to provide the latest status of
women's career promotion in STEM field in Japan.

2. **Introduction**

There are few female engineers in Japan. According to the 2012 White Paper on Gender Equality published by the Cabinet Office, only 14% of Japanese researchers (including engineers engaged in development in companies) are advanced in international comparison. Near the lowest in the country. In addition, about two-thirds of male researchers belong to companies, whereas only one-third are female.

According to the survey results of the reasons why there were few female researchers, the most common answer for both men and women was “difficult to balance home and work” followed by “difficult to return after childcare” In terms of female responses, the top three reasons were related to family balance. From this, it can be easily imagined that improving the environment related to balance increases the number of female engineers and leads to success.

3. **Approach and Methodology**

There are the following two problems that women after childcare leave face back to work.

- Difficult to produce work results in a limited time
- Difficult to get an understanding from the workplace about working with the work-life balance support system

It is an urgent task for companies seeking to promote the active participation of women in order to make them aware of these issues during childcare leave or after returning to work, and how to deal with them.

The training program was devised. These are the “return to work seminar after childcare leave,” “seminar for managers,” “seminar with partner,” and “seminar for young female employees.”

3.1 **Seminar for returning to work after childcare leave**

3.1.1 **Needs from companies**

In companies where the number of employees returning to work from childcare leave is increasing, there are many cases where they are aware of the problem of how to work after returning to work. Two major problems are depending on the type of company.

The first is a company that wants to do something because employees who are raising children think of the use of the work-life balance support system as a natural right and tend not to be grateful for the surrounding coverage. This has been actively promoted "family-friendly" measures, but it is often found in companies that have a low "proportion of gender equality." For example, companies that have improved the childcare leave system and short-time work system in a direction that allows them to rest as long as possible, but still have a personnel management system by course.

The second is, in contrast, companies that are expected to produce high results even while raising children, and those who cannot do so feel extremely negative or cannot continue their work. This is high in “type of equality promotion” but low in “family-friendly” type
companies. Although there is a place to play an active part according to ability regardless of gender, there is still a strong idea that long working hours are natural and that working for a long time contributes to the organization.

In either case, the way the company has been so far has had a strong influence on the way employees think after childcare leave, so simply changing the mindset and awareness of female employees will not solve the problem. This is well understood by the person in charge of the personnel / diversity promotion department who is the client of the training, and the seminar is undertaken.

3.1.2 Seminar Program

At the beginning of the seminar, there is always time to explain the purpose of the seminar to managers above the Human Resources Department. The reason is that the person who has authority to say that the company expects the success of employees who are raising children in the future, and of course, can improve their careers, as long as it seeks the results of their work in a high load of balancing work and childcare. This is because it is necessary to have a declaration. This affects that the seriousness of the company is communicated to the students and has a positive effect on the attitude of attending the seminar.

In lectures on attitudes to balancing work and childcare, even if there is a period when the burden of childcare is temporarily high, it is noticed that there is a period of work over a long period. This lecture can contribute to Students who are busy with day-to-day childcare tend to be unable to draw a vision of their future career, but this approach makes it possible to grasp the current situation objectively from a long-term perspective.

3.1.3 Cooperation with partners and family

Women are more likely to choose time-restricted work styles when they return to work, but at the same time they tend to think that childcare and housework should be primarily responsible. However, as a matter of course, it is impossible to play an active role at work, aiming at a high level of childcare and housework. Therefore, he explains the necessity of sharing childcare between couples. In particular, the emphasis is on the necessity of sharing between the nursery school and the sharing of the call handling and nursing when the child is ill.

If the same person (a mother or a father) performs pick-up at a nursery school, it tells us that there is no freedom of time both in the morning and evening, and that the burden on both mind and body is heavy. We propose that both couples can pick the child up. It is not uncommon for the students to respond that they were unaware of entrusting them to their husbands because they believed that they were going to take care of the nursery. I was surprised by this reaction. This is because the couple who worked together around 20 years ago, such as my family, flexibly shared the nursery. However, as a real problem, as long as modern mothers are still bound by stereotypes.

3.1.4 Effect of seminar

In this training, the effect of changing the student's consciousness as follows is recognized, and high satisfaction is obtained every time.

- I thought it would be good to aim for higher working hours
- Because I was going to do all my childcare and housework even after returning to
work, it was an opportunity to think about what my husband would do

- I thought that I had to take care of my child
- I wanted to actively use home appliances and housework services
- I want to think about my future growth

In the future, we are considering the evolution of content that can be communicated to both men and women, based on the fact that male employees taking childcare leave are gradually increasing.

3.2 Seminar for managers

3.2.1 Background of starting seminar for managers

In 2012, a full-scale seminar for returning to work after childcare leave was started. There was a clear common point in the free description column of the post-seminar questionnaire for any company. That is, "I want managers to hear this story."

When the author first saw this impression, felt that it was difficult to squeeze the contents to be conveyed in the seminar for managers. However, because of the increasing needs, finally decided to provide it.

The research results of the Institute of Social Sciences, the University of Tokyo, published in 2013 summarizes what should be done to users of the short-time work system, and this was a great reference. In addition, the role-playing scenario created for the “Ikuboss Training Course” in April 2014 is now offered as a set with lectures. The number of requests for seminars for managers has increased rapidly since 2014, because the idea that “direct managers are the key to the success of employees after childcare leave” has been made known to corporate personnel. It was.

3.2.2 Seminar contents for managers

The following three points are the most important things to convey in the seminar for managers.

(1) To improve work efficiency throughout the workplace and promote work-style reform for all employees

(2) Do not lower the quality of work (difficulty) for subordinates who work in time-constrained ways (work volume is adjusted as necessary)

(3) As with other subordinates, develop future-oriented subordinates who are working with time constraints in a planned manner.

In order to carry out the above (2) and (3), communication between the supervisor and subordinates during childcare is essential. However, some managers give too much consideration to subordinates who are raising their children (excessive consideration), making it challenging to assign jobs appropriately and give them opportunities to encourage growth. Many people feel it. Therefore, we have devised and proposed the return-to-work interview sheet as a communication support tool. It is the same as the one made for cafe participants after childcare leave.

This sheet is composed of items for knowing what kind of work environment the subordinates work after returning to work after childcare leave, and enthusiasm and requests for work, and covers information that the subordinates should convey to the supervisor during
the interview. Yes. By knowing such information specifically by the boss, it is possible to estimate the burden of subordinates who are raising children, not knowing only at the workplace.

### 3.2.3 Role-playing between managers and subordinates

Managers are lack of knowledge for how to communicate with subordinates who were raising children. They need to get hints by having a conversation with a subordinate during an interview. Therefore, we devised role-playing that consists of a set of three people: a supervisor, a subordinate, and a referee who observes the correspondence of the supervisor.

Seven examples of interview scenarios were created as listed below.

1. Report of pregnancy from female subordinates
2. Consultation on childcare leave acquisition from male subordinates
3. Talk with subordinates returning from childcare leave
4. Consultation from subordinates one month after returning to work
5. Complaints from colleagues of short-time workers
6. Consultation to increase workload for short-time workers
7. Talk to a child-caring subordinates

The most commonly used are 3, 4, and 5. The purpose of 5 is that a colleague working with a subordinate who is raising a child and working with a short-time work system is annoyed because the workload increases due to the short-time work. Some managers have experienced this, and people often hear about their feelings.

Role-playing is very exciting every time, and even after the end, participants can discuss their thoughts and communicate more actively, and satisfaction is high.

### 3.2.4 Effect of seminar

The managers who attended the seminar expressed the following impressions and thought that the original purpose was achieved.

- I was too careful about my subordinates
- I learned a lot from what I heard for the first time
- I want to improve long working hours for employees without time constraints
- I want to incorporate a return-to-work interview sheet
- Role-playing was helpful

As future issues, we would like to add items such as evaluation methods for subordinates who are raising children and the prevention of maternity harassment.

### 4. Conclusions and recommendations

For seven years since 2012, we have provided training (seminars) for corporations. In the last few years, there has been a significant movement in promoting women's active participation and work style reform, and the workplace is changing at an unprecedented rate. The government started to discuss the upper limit on working hours. Workplace problems that make it difficult for women to work are rooted in Japanese employment practices, which existed 30 years ago, and have continued for a long time. However, as if it were a heavy stone that began to roll, reforms that began to move in a specific direction would increase in speed and never go back.
In the future, based on the efforts so far, we plan to enhance training to cultivate female manager candidates and support for female leaders to play active roles as management.

The speed of change varies from company to company and individual, and there is resistance from the layer that loses vested interests. Based on this situation, we will continue to provide optimal solutions that meet the needs of the workplace in order to create a workplace where all working people, including women who work while raising children, can demonstrate their abilities naturally.
Work-style Reform and Women’s Career
Practical Solutions in Companies

October 11th, 2019
Rie Yamaguchi (Japan)

Today’s Topic
• Introduction
• “Work-style Reform” in Japan
• Practical Solutions in Companies
• Conclusion

INTRODUCTION

Self Introduction (1)
• Born in 1961
• Graduated from Tsukuba University, majored in Computer Science
• Entered Hitachi, Ltd. as an software engineer in 1984
  — Equal Opportunity Law 1985 —
  — Child Care and Family Care Leave Act 1991 —
• Engaged in software development team

Self Introduction (2)
• Gave birth in 1994: child care leave by one year old
• Back to work in 1995 and entered so-called mommy track (by 1998)
• Gave birth in 1996: child care leave by four month
• Promoted to a managerial post in 1998
• Worked as a manager and then senior manager in the product planning section

Self Introduction (3)
• Nominated a Diversity and Inclusion Project Leader in 2006
  — Realized that mommy track problems still unchanged
  — felt responsible in part for the situation as a first-generation
  — My daughter was 10 years old at that time and I did not want this problem remain pending in her future
• Started Independent consultant in 2010
"WORK-STYLE" REFORM IN JAPAN

Why Work-style Reform

In Japan
- Birthrate is declining
- Aging population increasing
  -> Labor force is declining rapidly
- We need
  - To expand employment opportunities for more people
  - To maximize their motivation and abilities

What is Work-style Reform

- Redress long working hours
  - Engaging women and elderly in work
- Create environment for easier changing jobs
  - Establishing universal rules for dismissals
  - Supporting career changes
- Redress disparities
  - Equal pay for equal work
  - Narrowing gaps in working conditions between regular and non-regular workers

Japanese Women in Workplace

Each Age Group

Source: White paper on gender equality 2019

Japanese Women in Workplace

After Giving Birth

The proportion of women who continue to work before and after giving birth to their first child increased from around 40% to 53.1%. The number of men taking parental leave increased but remains low. The length of leave is less than one year in Japan for women, according to the report.
Japanese Women in Workplace

After Giving Birth (Permanent Employee)

Source: White paper on gender equality 2019

While there isn’t a large discrepancy in the proportion of women employed between Japan (44.2%) and other countries, the proportion of women in managerial positions in Japan (14.9%) is lower than other countries.

Solutions from My Viewpoint

• To address engaging women in workplace, it is necessary to increase managerial position women in everywhere
• Only experienced employee can promote to managerial positions
• For women in 20s to 40s, which are very important period for their career, giving birth and child-raising are highly important issues for their entire life
• They thought it should be almost impossible to both raise children and become managers, but I know they can because I did
• Therefore I developed Corporate in-house training for mothers which enables both child-raising and career enhancement

Practical Solutions

Corporate in-house training for mothers

• Main Target
  – Working at private companies or public organizations
  – Permanent employed
  – Willing to continue working
  – Partners also employed
• Contents
  • Raise awareness of their career
  • Encourage communication with their bosses and colleagues
  • Inform importance to collaborate in child care and house management with their partners

PRACTICAL SOLUTIONS IN COMPANIES

Impressions from Trainees

• Satisfaction level was very high
• Impressions
  “I thought that I had to take care of my child only by myself but I can call help”
  “Interested in home appliances and housework services!”
  “I need to think about my future growth”
  “I want managers to hear this story”
  “I think my boss should take this training”
  “Please give this training to our bosses”
Practical Solutions
Corporate In-house Training for Managers

• Main Target
  - Managers who’s subordinates are pregnant or child-raising
• Contents
  - Give chances to child-raising workers to prove their selves
  - Consider to time constraints of child-raising
  - Keep good communication with child-raising workers
  - Interview child-raising employees and ask what kind of
    managerial support is helpful for both child-raising and career
    enhancement
  - Roleplaying
  - Case Study

Practical Solutions
Impressions from Trainees

• Satisfaction level was very high
• Impressions
  "I was too careful about my subordinates but now I know it was
  too much"
  "I learned a lot from what I heard for the first time"
  "Roleplaying was helpful"
  "Since I do not want to be doubted to sexual/power/maternity
  harass, difficult to ask private issues to my subordinates"

Practical Solutions:
Back-to-work Interview Sheet

• Most Efficient tool I created : “Back to work Interview
  Sheet”
• It contains working conditions of workers which bosses
  should know to assign appropriate about of job to them.
• Since the managers feel fear for harassment charge too
  much, this kind of guideline is very helpful.
• This sheet is very popular and have been introduced to
  major companies.
• It includes commuting time, nursery school location,
  partner commitment, parents cooperation, and so on.

Practical Solutions
Up-to-date Corporate In-house Training Menu

• Unconscious Bias Seminar for Managers
  – What is unconscious Bias
  – Examples of unconscious Bias
  – How to avoid negative effect to recruiting and promoting?
• Promoting paternity leave
  – Management challenge
  – Fathers’ challenge

Working Conditions of
Child-raising Employee

<table>
<thead>
<tr>
<th>Condition</th>
<th>Effect</th>
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<tbody>
<tr>
<td>Commuting time: where you live</td>
<td>Work Hours</td>
</tr>
<tr>
<td>Location of your nursery, how much time the child spend at the nursery</td>
<td>Work Hours</td>
</tr>
<tr>
<td>Your spouse’s work hours/work style</td>
<td>Work Hours/ Time-off Frequency</td>
</tr>
<tr>
<td>Support from your parents/services available for use</td>
<td>Work Hours/ Time-off Frequency</td>
</tr>
<tr>
<td>Health of your children</td>
<td>Work Hours/ Time-off Frequency</td>
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CONCLUSIONS
Conclusions

- Work-style Reform is Urgent Problem in Japan
- From my own experience, I have been developing practical solutions for employed mothers and fathers which is one of the most challenging part of Work-style Reform
- Corporate in-house training has been proved to be effective
- “Back-to-work interview sheet” is supporting managers a lot
- I believe women proportion of Managerial position rate achieved to be 30% soon

Thank you!

Business Model

In 2018 about 200 trainings were conducted
Session 2 Speaker (Korea)

Suk Kyeong Lee  
Professor, the Catholic University of Korea, School of Medicine

<table>
<thead>
<tr>
<th>Education</th>
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<tr>
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<tr>
<td>Degree: M.S. in Pharmaceutics) Seoul National University/College of Pharmacy, Seoul, Korea, 1988</td>
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<tr>
<td>Degree: Ph.D. Molecular Pharmacology and Biological Chemistry, Northwestern University Medical School, Chicago, U.S.A, 1994</td>
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<tr>
<td>Mechanistic role of virus in tumorigenesis</td>
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<tr>
<td>Noncoding RNAs (miRNA, long noncoding RNA) network in tumor and immune disorder</td>
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<tr>
<td>Effect of sex/gender on pathology and treatment</td>
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<table>
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<tr>
<th>Career History</th>
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<tbody>
<tr>
<td>1994.6-1997.2</td>
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<td>1997.5-2004.2</td>
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<tr>
<td>2004.3-2009.2</td>
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<td>2010.3-present</td>
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<th>Appointments</th>
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<td>2017.10-present</td>
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<td>2017.11-2018.10</td>
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<td>2018.10-present</td>
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<td>2018.11-present</td>
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Awards

2015: Presidential Award (improving gender equality)

Current Memberships

KOFWST (Korean Federation of Women's Science & Technology Associations)
Korean Society for Molecular and Cellular Biology
Korean Society for Biochemistry and Molecular Biology
The Korean Cancer Association
The Pharmaceutical Society of Korea
American Society for Microbiology
International Association for Research on EBV and Associated Diseases
Women's Bioscience Forum
The KOFWST’s Journey to Foster Females in STEM fields

Suk Kyeong LEE
(Department of Medical Life Sciences, Department of Biomedicine & Health Sciences, College of Medicine, The Catholic University of Korea, Seoul, 06591, Republic of Korea, sukklee@catholic.ac.kr)

Abstract: The scarcity of female STEM role models negatively influences girls in two ways. First, when girls consider entering higher schools such as universities or graduate schools, choosing STEM fields is not reinforced by respected role models. Second, the lack of female role models solidifies somewhat negative stereotypes held by girls and young women about STEM fields. KOFWST (the Korea Federation of Women's Science and Technology Associations) composed of 65 member organizations in the field of S&T has tried to encourage girls in entering to STEM fields. The KOFWST has published biography series ‘Women in Science’ about Korean women in STEM fields and the scientific careers they have pursued with passion. In addition, Korean editions of ‘Women’s Adventures in Science (Volume 1~10)’ by National Academy Press have been published. The authors and translators of those books gave lectures to girl students to convey their lively stories about their dreams and experiences in the path to fulfil their dreams. To fix the women’s problems in S&T, girl friendly science education and programs for promoting and keeping more women in S&T are urgent. Many problems are rooted on the fact that women have been excluded from the decision making and the positions in charge of managing research projects and institutions in S&T. To overcome this problem, the KOFWST has run 8 week female leadership program since 2015. Cumulative total about 150 female S&T personals have benefited from the programs to cultivate their leadership and to establish network with other female leaders in STEM fields. This paper overviews the KOFWST’s journey to inspire girls to enter to STEM fields and to help female S&T scientists to grow as leaders in the society.

Keywords: STEM, Role Model, Book Talk, Female Leadership, Women in Science and Technology

1. Introduction

The Korea Federation of Women's Science and Technology Associations (KOFWST) was established in 2003 with 4 associations for the purpose of fostering alliances among women’s science and technology organizations. The mission of KOFWST is to enhance status of women in science and technology, to achieve equal employment of women in science and technology, and to expand national capacity of science and technology. As of September 2019, KOFWST consists of 65 member associations: 23 women’s committee, 9 general, 3 regional, 9 vocational, 14 society, and 7 cooperative members.

Activities of KOFWST include supporting associations in science and technology, annual conference, leadership program for women leaders in the science and technology field, forums, international cooperation, laboratory safety management for women scientists, fellowship award programs, publications, gendered innovations in research, and social responsibility programs.
This paper summarized stepwise activities of KOFWST to foster women in S & T for career development. First of all, KOFWST tries to encourage girls to enter STEM fields by publishing books providing role models for girls.

2. **Career Guidance Program**

KOFWST tries to encourage girls to enter STEM (Science, Technology, Engineering, and Mathematics) fields by publishing good science books. For this purpose, KOFWST have renowned female scientists to write about their stories to let girls know what they experienced and how they achieved their dream. KOFWST also has translated English biographies of respectable foreign female scientists in Korean so that girls as well as boys can read and learn from their lives. The authors and translators of the books also have visited middle/high school to give lectures regarding the books and share their own stories with the students. In addition, book essay contests have been held every year for students who read the books KOFWST have published.

2.1 **Publishing Books in STEM**

Research on the gap between men and women in STEM fields points out the paucity of role models for girls when they consider STEM careers. KOFWST tries to encourage girls to enter STEM fields by publishing series of books regarding female STEM scientists.


In 2017, the first book of ‘Women in Science’ series was ranked among the 10 best sellers in science sector. The same book was also designated as 2017 Sejong Book, a privileged book award granted by Ministry of Culture, Sports, and Tourism. Five authors were invited to give lectures at Seoul Science Center.

2.2 **Author Lecture Series**

Book Talk series has been carried out to reach out girls and to give them chances to meet female scientist role models in person. The authors and translators of the books KOFWST published visited middle/high schools, gave lectures regarding the books, and shared their own stories with the students.

In 2017, 11 female scientists visited 4 middle schools and 4 high schools scattered in various provinces. In 2018, 11 female scientists visited 5 high schools where they graduated from. Over 1,000 girl students who were interested in STEM fields had met the female STEM researchers and listened to what the role models have experienced and how they reached where they are now.
2.3  Book Essay Contest for Students

Book essay contests have been held every year for students who read the books published by KOFWST. In 2017, 18 middle/high school students were selected and awarded for their book essays. In 2018, 36 out of 152 book essays were chosen as awardees. Prizes were also given to two of the schools where many good essays were applied from.

3. Career Advancement Program

KOFWST have developed an 8 week leadership cultivating program and trained women leaders since 2015. The leadership program pursues 1) to strengthen leadership of female S & T personnel who are in the pre-participation stage of major committees as well as women science leaders in the early stages of committee participation, 2) to boost cooperation between S & T leaders and public leaders, 3) to establish the nation's best technology and policy network for female leaders in STEM fields.

As present Korean government aims to fulfill 40% female ratio in every governmental commission, many female STEM scientists who were trained in KOFWST leadership program have been newly appointed as government committee members.

3.1  Leadership Program in Science and Technology

The first leadership program aimed for ‘Leadership Development & Training’ and 30 female scientists participated in that in 2015. Total 26 members participated the second leadership under the subject of ‘The Essence of Leadership’ in 2017. In 2018, there were the third and fourth leadership programs. Thirty six female scientists participated the third program for ‘Public Leadership’, while 30 members joined for the fourth leadership program under the subject of ‘Public Leadership in the Fourth Industrial Revolution’. This year, 29 STEM scientists were trained in the fifth leadership program for ‘Public Leadership in the Transformation Era’.

A scientific leader today is required to be not only an excellent researcher, but also a good manager. To be a leader in the society, scientists need to gain the experience and ability to analyze various information and then to integrate them into a policy. KOFWST are helping female scientist for that by running the leadership program.
The KOFWST’s Journey to Foster Females in STEM Fields

Suk Kyung Lee
Department of Medical Life Sciences, Department of Biomedicine & Health Sciences
College of Medicine, The Catholic University of Korea

The 9th Japan-China-Korea Women Leaders Forum for Science & Technology on Oct. 11, 2019

The number of members of KOFWST as of October 2019 are ~75,000 from 65 associations.

KOFWST was established in 2003 with 4 associations for the purpose of fostering alliances among women’s science and technology organizations.

The mission of KOFWST is to:
- enhance status of women in science and technology
- achieve equal employment of women in science and technology
- expand national capacity of science and technology.

1. Activities

   1. Supporting Associations in S&T
   2. Annual Conference (Since 2001)
   3. Leadership Program
   4. Forums
   5. International Cooperation

2. Collaboration

   1. Laboratory Safety Management
   2. Fellowship Award Programs
   3. Publications
   4. Gendered Innovations in Research
   5. Social Responsibility Programs

3. Publishing Books in STEM

   - Publishing Books in STEM to encourage more girls to pursue STEM fields
   - Author Lecture Series: giving lectures and sharing their own stories with students
   - Book Essay Contest for Students: featuring students who read the books KOFWST have published and write essays

KOFWST - Korea Federation of Women’s Science & Technology Associations

Career Guidance Program

- Publishing Books in STEM
- Author Lecture Series: giving lectures and sharing their own stories with students
- Book Essay Contest for Students: featuring students who read the books KOFWST have published and write essays

Activities

- Supporting Associations in S&T
- Annual Conference (Since 2001)
- Leadership Program
- Forums
- International Cooperation

Collaboration

- Laboratory Safety Management
- Fellowship Award Programs
- Publications
- Gendered Innovations in Research
- Social Responsibility Programs

Publishing Books in STEM

Research efforts to close the gender gap between men and women in STEM fields points out the scarcity of role models for girls when they consider STEM careers. KOFWST tries to encourage girls to enter STEM fields by publishing series of books regarding female STEM scientists.
Leadership Program in Science & Technology

- **First Leadership Program**
  - APR 14 ~ JUN 6, 2015
  - Over 1,000 girls (students) were interested in STEM books and STEM researchers.

- **Second Leadership Program**
  - MAY 15 ~ JUL 3, 2017
  - 36 out of 152 books were awarded for their contents.

- **Third Leadership Program**
  - MAY 15 ~ JUL 3, 2018

Over 1,000 girls who read STEM books were interested in STEM researchers.

**Book Essay Contest for Students**

Girls' high school students were applied for 36 books.

**Author Lecture Series**

11 female scientists invited 5 high schools where they graduated from.

**Book Talk Series**

Girls' high school students who read the books published by KOFWST.

**Career Advancement Program**

Leadership Program in Science & Technology

- APR 14 ~ JUN 6, 2015
- MAY 15 ~ JUL 3, 2017
- MAY 15 ~ JUL 3, 2018

Girls' middle/high school students were interested in STEM researchers.

Over 1,000 girls who read STEM books were interested in STEM researchers.

Girls' middle/high school students who read the books published by KOFWST.

Girls' middle/high school students who read STEM books were interested in STEM researchers.
Thirty-six female scientists participated the third program for 'Public Leadership' in 2018.

This year, 29 STEM scientists were trained in the fifth leadership program.

Activities
- Supporting Associations in S&T Development
- Annual Conference
- Fellowship Award Programs
- Publications
- Mentoring of Young Scientists
- Gendered Innovations in Research
- Social Responsibility Programs
- Professional Education Program & Scholarships for Women in Science
Session 2 Speaker (China)

Er-Fan Ju
Senior Engineer,
GE Toshiba Silicones, Resin/paint Marketing Director.

Education

Education Background:
Bachelor’s degree: Graduated from East China University of Science and Technology, Major: Chemical engineering and technology.
Master’s degree: Graduated from Shanghai Jiao Tong University MBA, Senior Engineer

Research Field

Innovation and research special chemical materials in the High performance application. Epoxy resin and amine, polyamide curing agent, Oxygenated Solvents and Anionic Surfactants in water-based Coating, Silicone Resin in TV-LED light diffusion application; Silane; siloxanes in 500°C heat resistant coating, Special functional additive for water-based electrolyte slurry in Lithium battery negative and ceramic diaphragm film.

Career History

1. Shanghai Coating & Paint Research Institute ---- Technical Team Leader, Research Director,
2. Dow Chemical Company --- Great China Technical Manager
   Technical Research & Developing for Epoxy resin formulation: Composite materials; Electronic laminate; insulation slurry; Mariner & Container Coating; Automobile Coating; CED Coating; Anti-corrosion Coating. Research on Oxygenated Solvents and Anionic Surfactants both products Focus on emulsion latex, water-based coating, functionality textile slurry.
   Obtain Company Science and Technology progress two Awards in 1998.
3. GE Toshiba Silicone Chemical -----Great China Technical & Marketing Director
Silicone Resin; Silane; siloxanes; Coating Additive; leading China Marketing & Technical team
support & developing new Biz in Great China , Developing Silicone resin in heat resistant coating in
500°C; silicone oil for personal care; LCD-TV, LED light diffusion application ; PI film of flexible
copper clad laminate for electronics & insulation , composites & polymer industry ;silicone
modified epoxy as major composites in wind mill , Silane functional additive for carbon fibre and
UV resistance coating , technical support on formulation to adjust on curing agent , like Pt catalyst
and amine special coating on the wind mill surface for UV resistance , water Repellent working on
low temp. (-50C) , Obtain China Coating Science and Technology Awards in 2008.

4. Lithium battery Industry,
Technical Manager for Sanyo Chemical Special functional additive for water-based electrolyte slurry,
developing formulation for negative and ceramic coating film, Research the influence of additive on
Lithium battery properties have been examined by cyclic voltammetry discharge at constant
current. non-ionic wetting agent and dispersing for carbon nanometre paste and stabilizer.
Research different additive performance in Lithium battery non-Newtonian Liquid system .

**Awards and Scholars**

Obtain the second Award of Shanghai Science & Technology Development in 1992.
Obtain Dow Chemical Company Science and Technology progress Awards in 2000.
Obtain China Coatings Association Coating Science and Technology Awards in 2010.
Obtain China Coatings Association Coating Outstanding Talents Awards in 2015.
Obtain 40th Anniversary of Reform and Opening China Coatings Science and Technology Awards in
2019.

**Current Memberships**

Up to now, Social posts :
1. Expect of Shanghai government new project evaluation group ;
2. Expert of China Coatings Industry Association;
3. Expect of Chinese Society for Corrosion and Protection
4. Editorial board member of < China Coating >Magazine ;
5. Editorial board member of < China Coating Industry>Magazine ;
6. Editorial board member of < Shanghai Coating >Magazine ;
7. Shanghai Women Engineer Association , executive director
SHANGHAI NEXT GENERATION FEMALE ENGINEER CAREER

PLANNING AND SUCCESS IN NEW HIGH TECHNOLOGY INDUSTRY

ERFAN JU
Shanghai Woman Engineer Association, Executive Director
jef2008jef@hotmail.com, 13916045398

Abstract: This paper explores Shanghai next generation female engineer career planning and development in the new high technology industry. The Global Gender Gap Report, 2018, shows that females are underrepresented in more and more areas of work that require knowledge or skills in science, technology, engineering and mathematics (STEM). The female gender gap in the STEM is becoming more obvious. Indeed young females tend to be more reluctant to choose STEM and engineering jobs that are both intellectually and physically challenging. What have we done to change this situation?

As a professional female society organization, Shanghai Woman Engineer Association has implemented a series of actions since 2000. The young female engineer members share 65%. Eighty percent of these young female engineers are married and 70% with children. During the past decades, the Association has paid long-term attention to the physical and mental health of young female engineers as well as their career development. Based on the national regulation and developmental strategy, the Association helps young female engineers to analyze the requirement of the society and choose suitable jobs accordingly. Specifically, multiple channels have been established to help young female engineers to obtain technical skills for their jobs. In the high technology industry, the Association helps them set up proper career plans and achieve a successful career step by step. They also suggest young female engineers well balance the relationship between career and family. Most of young female engineers grow fast and become experts in their fields.

For example, in the Shanghai metro industry, many young Association members expressed that the Association help become Science and Technology (S&T) professional talent and get the win & win on both family and career.

At the same time, the Association also provide a platform on which young female engineers can share professional technical information, having entertainment together, and support each other. After enrolled in the association, many young female engineers not only become experts in the STEM area but also make great progress as leaders in the management filed. These progress and achievements make young female engineers really capable and enjoy the STEM and high technology jobs.

Keywords: young female engineers, female career values, balance, multiple way and different channel, technology expert, become Science and Technology (S&T) professional talent,

Conclusion:
The balance is the gold! Most of young female engineers are doing very well from the
following career balances:
  Balance between national policy and the security of female job;
  Balance between country development needs and young female’s own advantages,
  Balance between the high-tech emerging industry requirement and the young female’s personal career development;
  Balance working hours and careers with young female’s marriage and give birth period,
  Balance and succeed in changing different roles among the family, the career and society,
  Balance and proper arrange time for young female own careers and the education of their children
1.1 China Young Women Career Development Situation

1.1.1 Female labor participation rate in China

In 2017, the Hurun Rich list released a list of self-made women from all over the world. 88 rich and powerful women from 12 countries are on the list. Chinese women hold 56 seats, up to 64% of all in the first place.

The advantages of the young women growth in China:

1. China's social system—very democratic, open and inclusive. There are various laws and regulations for protecting women. Women's desire for independence can be realized. Even surpassing men in many areas.

2. Chinese women are generally highly educated—those young women who graduate from university or college will be more diligent, independent, wise and thoughtful.

3. The EQ is high.—Chinese women seem to be naturally skilled at dealing with complex relationships. Balance the various relationship between family and occupation. It's a great test of EQ.

1.1.2 Professional Young Women in China

The purpose: unite and support all Science and Technology female worker, rise up the professional science and technology skill, make the great contribution for our country.

1.1.3 The advantages of the Development of Young Professional Women in China

1.3.1 Chinese Professional Women and Wealth

In 2017, the Hurun Rich list released a list of self-made women from all over the world. In China, 88 rich and powerful women from 12 countries are on the list. Chinese women hold 56 seats, up to 64% of all in the first place.

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3. The EQ is high.—Chinese women seem to be naturally skilled at dealing with complex relationships. Balance the various relationship between family and occupation. It's a great test of EQ.

1.2 Organizational guarantee for the Development of Professional Young Women in China

1.2.1 All-China Women's Federation

The organization was established in March 1949, was defined as a non-governmental,

Social function: representative and protect women and children’s right and interests, Men and women are equal; rise up all Chinese Women's social position : educate women grow up and self-respect, self-improve, women have power of participate social management,

Chinese Women's Association for Science and Technology

The purpose: unite and support all Science and Technology female worker, rise up the professional science and technology skill, make the great contribution for our country.

1.4 China Young Career female Development Situation

1.4.1 The young working women take multiple roles at the same time

1. The labor role—their age 22-45 years old, young and have dream & target, also with liven and technology;

2. The economic role—not only a job make money but also successful in career

3. The family role—bear children, family balance, respect elders, to raise and educate a child, and have a full-time job

4. The social role—take responsibility same as the man, achieved the world-famous China rise up with man together.

Chinese women, they’re the freest, Self-reliance, The most independent, the best, the heart of struggle, most hardly. They should have more respect and applause than women in any country.
2.1 The Development of Shanghai Women's Engineers

2.1 Brief introduction of Shanghai Women Engineers Association (SWEA)

SWEA was founded in 1984. Since the establishment, they have done a lot of innovation jobs, built up and enriched the professional atmosphere of work. There are sixteen technical and academic groups, and more than 500 members come from industries such as aerospace, aviation, construction, subway traffic, chemical industry, instrument, pharmacy, medicine, textile, metallurgy, light industry, petrochemical engineering, project supervision, etc. They are representatives of excellent women engineers in all major industries of Shanghai. 60% of them are young female engineers.

The SWEA actively cooperates with Shanghai Women's Federation and Shanghai Science and Technology Association to help the next generation of female engineers plan their career and develop. A new woman who has made a contribution to society with a sound and healthy body. These great young women engineers, 80% have a family. 70% have children. They take care of both careers and families. In family: daughter, wife, mother, daughter-in-law, etc. In career: technical expert, business director, chief scientist, president in company, general manager, director of R & D, etc. They are the elite of China's economic and social development!

2.2 Shanghai young generation Female Engineer career guidance and orientation

2.2 SWEA helps young generation female fixed career direction.

It is important and necessary to provide early career guidance, orientation, planning and training for young women.

1. women's career needs

- The job young female is sensed of achievement
- The job young female is suitable
- The job young female is qualified

2. motivation with relevance and value

- Career balance of young women in Shanghai
- The new social role of women's engineers
- The SWEA actively cooperates with Shanghai Women's Federation and Shanghai Science and Technology Association, helping the next generation of female engineers plan their career and develop.

3. career needs

- The job young female is glad
- The job young female is suitable
- The job young female is qualified

4. career needs

- The job young female is glad
- The job young female is suitable
- The job young female is qualified

The SWEA actively cooperates with Shanghai Women's Federation and Shanghai Science and Technology Association, helping the next generation of female engineers plan their career and develop.

2.3 Shanghai young generation Female Engineer career value chain

2.3 SWEA helps young generation female establish positive career values. The goal is ambitious and solid work.

1. sense of achievement

- The job young female is suitable
- The job young female is qualified

2. motivation with relevance and value

- Career balance of young women in Shanghai
- The new social role of women's engineers
- The SWEA actively cooperates with Shanghai Women's Federation and Shanghai Science and Technology Association, helping the next generation of female engineers plan their career and develop.

3. career needs

- The job young female is glad
- The job young female is suitable
- The job young female is qualified

4. career needs

- The job young female is glad
- The job young female is suitable
- The job young female is qualified

The SWEA actively cooperates with Shanghai Women's Federation and Shanghai Science and Technology Association, helping the next generation of female engineers plan their career and develop.

2.4 Shanghai young generation Female Engineer career needs

2.4 SWEA created a lot of opportunity for young generation Female to improve their career skills.

1. career planning integrate with world development—join international event

- Career planning integrate with world development—join international event

2. career depth need expertise and technical—professional technical seminars

- Career depth need expertise and technical—professional technical seminars

3. career width require scope of knowledge—cross-industry learning each other

- Career width require scope of knowledge—cross-industry learning each other

4. career training ask for continuous training—Singapore Female School have regular training from experts, visited the subway new technology

- Career training ask for continuous training—Singapore Female School have regular training from experts, visited the subway new technology

5. career show need provide platform—young generation Female show versatile
2. What we done for SH young generation Female Engineer career


2. Career longness link to physically and mentally healthy — State leader Chairman of All-China Women's Federation Ms. Shen Yue-Yue take care young female engineers healthy in 2018.


4. Career width require scope of knowledge — Cross-industry learning each other, learning finance and banking knowledge in 2018.

5. Career training ask for continuous learning — Shanghai Female School have regular training from expert, visited the subway company, learning new technology.

6. Career inherit senior will be support — Senior and junior female engineer one to one support, take care the next generation female.
2. What we done for SH young generation Female Engineer career

Career show need provide platform—young generation Female show versatile and diversity performance;

3.1 The Development history of Shanghai Metro Network

3.2 Emerging industry—Introduction newest operation situation of Shanghai Metro

3.3 Structure of female staff and Workers in Shanghai Metro Group

3.4 Young women’s right of professional development
3.5 Young women’s right for career security

- Establish a female working Committee mentors by Trade unions of each immediate subordinate Unit
- Formulate the Standard of "Special Inspection for female Labor Rights"
- Following Regulations on Labor Protection of Female Workers
- Sign the special collective contract for protecting the female rights.

3.6 Young women’s right for democratic management

- Proportion of female representatives rate in staff congress:
- Investigate the situation of female labor protection:
- Ensure equal treatment for female career promotion:

3.7 Young women’s right for career health:

- Focus on the work issues in the field
- Train female with good culture and stable sentiment
- Care for the physical and mental health of female
- Care about single parents.

4. Balance is gold: Country, Society, Company, Family, Personal

Country, Society, Policy: Men and women get equal, pay for equal job, National policies care for women.

Family, Personal, Children career planning, family planning, Child growth development planning.

Company, Career: Multi-way and diversify to discover the value of young women, give training and learning opportunities, build-up experience.

4.2 Conclusion 1.—young women should be have professionals knowledge and skill

Young women becoming talents—— Career learning, Career planning, Career successful;
1. Equality of men and women----- An Open, fair and inclusive social environment in Shanghai. Society and companies provide all channels for women to grow their talents,
2. Professional career lady—— In emerging industry, not only women have jobs but also they do outstanding;
3. Technical career lady —— most young lady have technology skill, to contribution their intelligence with career lady;
4. International standards career lady—— more and more capable lady works in Top 50 global international companies, same as men in the daily work and management;
5. State-level senior career lady—— some excellent young lady into the national leadership, make a contribution to the country's political and policy, become the model for all Chinese women.
4.3 Conclusion 2.--young women successful balanced various relationships

They succeeded in achieving the following career balance:

- Balance the relationship between national policy and job security for young women;
- Balance the relationship between EXPD and women's own advantages in the country development needs;
- Balance the relationship between new high-tech industries require and women's personal career development;
- Balance working hours with women's marriage, birth time nodes;
- Balance and succeed in changing different roles between the family, the career, and society;
- Balance the time distribution of the female become a talent and the growth of their children.
Session 3: Role of Chemistry for SDGs
Session 3 Chair (Japan)

Akiko N. ITAKURA
Group Leader, Surface Physics and Characterization Group,
National Institute for Materials Science

**Education**

Degree: BS, Description: of Toho University, Location: Japan, Year: 1986
Degree: PhD, Description: in Sci., Gakushuin University, Location: Japan, Year: 1991

**Research Field**

Surface and Interface Physics, Vacuum Science, Material Science

**Career History**

She has been focusing on surface science. First, she had been studied two dimensional phase transition of rare gas films measured by ellipsometry in an ultra-high vacuum. She was a researcher in National Research Institute for Metal (NRIM) from 1991 to 1996 in the field of ultra- to extremely high vacuum. From 1997, she had researched semiconductor materials to investigate surface stress of thin oxide layers on silicon in Reaction & Excitation Dynamics Group. She is currently in National Institute for Material Science (NIMS), Surface Physics and Characterization Group, where she is investigating molecular sensors by using surface stress of a film coated micro cantilevers. And her work around hydrogen visualization is a big topic in the field of materials around hydrogen energy. She has been a visiting professor at Tokyo Medical and Dental University, Yokohama City University, and Charles University (Czech Republic).

**Certification**

Director of the Vacuum Society of Japan, 2014-2017,
Director of the Physical Society of Japan and a chair of Gender Equality Committee, 2015-1017
Director of the Japan Society of Surface Science, 2015-2017,
Member of Science Council of Japan, 2018-,
Fellow and Director of the Japanese Society of Vacuum and Surface Science, 2018-,
Director of the Society of Japanese Women Scientists, 2019-.
**Awards**

Best Paper Award, The Surface Science Society of Japan, Appl. 2002  
Best Poster Award, Asia-Pacific Surface & Interface Analysis Conference (APSIAC02), Oct. 2002

**Achievements**

Achievements include academic papers more than 60, management of research group in NIMS, and activities in four academic societies of Japan and so on. As a visiting professor, she taught PhD students in Charles University and under graduate students in Tokyo Medical and Dental University. She has helped five students to get doctoral degrees as a doctoral instructor.

**Civic, Political, and Philanthropic Activities**

“The Japan Inter-Society Liaison Association Committee for Promoting Equal Participation of Men and Women in Science and Engineering (EPMEWSE)” was established in order to overcome gender gaps in Japan over a long period of time, in 2002. She had supported the activities at the time of its establishment as a committee member. In 2008, she established a gender equality promotion team in NIMS and created a support system for female researchers. In 2015-2017, he was the director of gender equality at the Physical Society of Japan.

**Current Memberships**

A member of Science Council of Japan, Fellow of the Japanese Society of Vacuum and Surface Science and a vice chair of Gender Equality Committee of the VSS society, Director of the Society of Japanese Women Scientists.
Session 3 Speaker (Japan)

Director General, Institute for Molecular Science, Japan
President, Chemical Society of Japan
Member, Science Council of Japan
Professor Emeritus, The University of Tokyo,
Honorary Scientist, RIKEN
Honorary Fellow, Royal Society of Chemistry
Fellow, American Physical Society

Maki Kawai

Education
Degree: Ph.D., Chemistry, Faculty of Science, The University of Tokyo, Tokyo, Japan 1980

Research Field
Surface Science, Physical Chemistry

Career History
1988-91  TDK Professor, Tokyo Institute of Technology, Yokohama, Japan
1991-10  Chief Scientist, Director of Surface Chemistry Laboratory, RIKEN, Saitama, Japan
2004-17  Professor, Department of Advanced Materials Science, The University of Tokyo, Chiba, Japan
2010-15  Executive Director, RIKEN, Japan
2016 -- Director General, Institute for Molecular Science, National Institute of Natural Sciences, Japan
2018 -- President, Chemical Society of Japan

Certification
Awards
**Achievements**

Single molecule spectroscopy utilizing inelastic tunneling process and extracting vibrational spectra from action of molecules (Action Spectroscopy) using STM. Interplay between the localized spin at adsorbed molecule and electrons at the Fermi sea of metal substrate is another topic where Zeeman splitting or the Kondo resonance are resolved in sub-atomic resolution in space.

**Civic, Political, and Philanthropic Activities**

CSJ committing to SDGs

Maki KAWAI 1, 2
(1. Director General, Institute for Molecular Science, Myodaiji, Okazaki 444-8585, Japan, 2. President, Chemical Society of Japan, 1-5, Kanda-Surugadai, Chiyoda-ku, Tokyo 101-8307, Japan. E-mail maki@ims.ac.jp)

Abstract: Brief introduction to activity of Chemical Society of Japan towards Sustainable Development Goals will be given.

Keywords: SDG's, CSJ,

Introduction to Chemical Society of Japan [1]

The Chemical Society of Japan (CSJ), initially named the Chemical Society, was founded in 1878 by approximately twenty motivated and enthusiastic young scholars wishing to advance research in chemistry. Later, it was renamed The Tokyo Chemical Society, and eventually given the present English name of "The Chemical Society of Japan."

In 1948, it merged with the Society of Chemical Industry, founded in 1898. Thus the CSJ has a history encompassing 140 years, with a current membership exceeding 27,000, and is one of the most affluent academic societies in Japan, covering most areas of pure and applied chemistry.

It has contributed and circulated the results of chemical research to chemists and industry throughout the world. The prime mission of the CSJ is to promote chemistry for science and industry in collaboration with other domestic and global societies. Above all, the overriding purpose of the Society is to contribute to the betterment of human life.

To pursue these missions, the Society holds various academic conferences, lecture meetings and publishes journals and books. Today, the world shares common pressing issues, interests relating to energy, food, environmental problems, safety, human health and education, which require a rapid exchange of information in every field of research with other countries.

The CSJ has a long history in chemical education and in its outreach program to the public. These activities have recently been redoubled to heighten public awareness, and to stress the importance of chemistry's role in solving the many problems besetting people and the environment today.

REFERENCES

Akira Yoshino received the 2019 Nobel Prize in Chemistry

- Dr. Akira Yoshino (Asahi Kasei Fellow and Honorary Member of the Chemical Society of Japan) received the Nobel Prize in Chemistry 2019.
- Dr. Yoshino shared the prize with two other researchers for the development of lithium-ion batteries. The co-winners are Dr. John Goodenough of the University of Texas, and Dr. M. Stanley Whittingham of Binghamton University, State University of New York.

Congratulations!

Mission and History

Mission
Our goal is to contribute to the development of society through the advancement of research and learning, development of technology, promotion of industry, spread of knowledge, and education of those supporting these endeavors.

History
1876: The Chemical Society founded, renamed the Tokyo Chemical Society the following year.
1899: The Society of Chemical Industry of Japan established.
1921: The Tokyo Chemical Society renamed the Chemical Society of Japan.
1949: Integration with the Chemical Society of Japan and The Society of Chemical Industry of Japan.
1991: The current office building completed.
2011: Public Interest Incorporated Association authorized.
2018: The 140th anniversary celebrated.

Topics
- International Relations
- Journal Publication
- Approach for SDGs
- Activities for Gender Equality

About CSJ
Topics
- International Relations
- Journal Publication
- Approach for SDGs
- Activities for Gender Equality

Kawai
Produced by APCTP

Happy People Doing Science

SDGs : Activity of CSJ
The Chemical Society of Japan

Maki Kawai
President, The Chemical Society of Japan
Director General, Institute for Molecular Science
SEC member, IBS Korea
Science Advisory Board member, Quantum NanoScience Research Center, Ewha Womans University, Korea

Dr. Akira Yoshino (Asahi Kasei Fellow and Honorary Member of the Chemical Society of Japan) received the Nobel Prize in Chemistry 2019.

Dr. Yoshino shared the prize with two other researchers for the development of lithium-ion batteries. The co-winners are Dr. John Goodenough of the University of Texas, and Dr. M. Stanley Whittingham of Binghamton University, State University of New York.

Congratulations!

Press conference Oct 10th, 2019 @ CSJ
International Collaborations

- 4th CS3, Chemical Science and Societies Symposium
  Nov. 11-13, 2019 @ London, UK

- IUPAC Paris 2019
  July 5-12, 2019 @ Paris, France

- 10th RSC-CSJ Joint Symposium
  Sept. 7, 2019 @ Sendai, Japan

- IYPT 2019 Closing Ceremony
  Dec. 5, 2019 @ Tokyo, Japan

- 19th ACC (The Asian Chemical Congress)
  Dec. 8-12, 2019 @ Taipei, Taiwan

- PACIFICHEM 2020
  Dec. 15-20, 2020 @ Hawaii, USA

The Chemical Society of Japan

Approach for SDGs

- Recognition of current situation
  (from SDG Index and Dashboards Report 2018)
  - Japan ranks 157/160 countries
  - High ranking in the following items:
    Goal 4 (Quality Education)
    Goal 5 (Gender equality)
    Goal 12 (Responsible consumption and production)
    Goal 13 (Climate action)
    Goal 14 (Life Below Water)
    Goal 17 (Partnerships for the goals)

- The efforts in Japan
  - Government: Ministry of Education, Culture, Sports, Science and Technology (MEXT)
    April 2018: Basic Policy on Promotion of Science, Technology and Innovation for SDGs (BTI for SDGs)
  - Private enterprises (ex: Sumitomo Chemicals)

- So, in the chemical society?

The 2018 Global SDG Index ranking and scores

<table>
<thead>
<tr>
<th>Rank</th>
<th>Country</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Sweden</td>
<td>91.0</td>
</tr>
<tr>
<td>2</td>
<td>Germany</td>
<td>86.4</td>
</tr>
<tr>
<td>3</td>
<td>Finland</td>
<td>86.0</td>
</tr>
<tr>
<td>4</td>
<td>Norway</td>
<td>82.8</td>
</tr>
<tr>
<td>5</td>
<td>France</td>
<td>81.8</td>
</tr>
<tr>
<td>6</td>
<td>Denmark</td>
<td>81.0</td>
</tr>
<tr>
<td>7</td>
<td>Netherlands</td>
<td>80.9</td>
</tr>
<tr>
<td>8</td>
<td>Estonia</td>
<td>80.0</td>
</tr>
<tr>
<td>9</td>
<td>Belgium</td>
<td>80.0</td>
</tr>
<tr>
<td>10</td>
<td>Sweden (Scania)</td>
<td>79.3</td>
</tr>
<tr>
<td>11</td>
<td>Belgium (Brussels)</td>
<td>78.2</td>
</tr>
<tr>
<td>12</td>
<td>Czech Republic</td>
<td>78.1</td>
</tr>
<tr>
<td>13</td>
<td>United Kingdom</td>
<td>76.4</td>
</tr>
<tr>
<td>14</td>
<td>Japan</td>
<td>76.0</td>
</tr>
<tr>
<td>15</td>
<td>France (Alsace)</td>
<td>75.7</td>
</tr>
<tr>
<td>16</td>
<td>France (Bretagne)</td>
<td>75.6</td>
</tr>
<tr>
<td>17</td>
<td>New Zealand</td>
<td>73.0</td>
</tr>
<tr>
<td>18</td>
<td>Ireland</td>
<td>72.5</td>
</tr>
<tr>
<td>19</td>
<td>Korea (Northeast)</td>
<td>72.4</td>
</tr>
<tr>
<td>20</td>
<td>Ghana</td>
<td>70.0</td>
</tr>
</tbody>
</table>

SDG Dashboard for OECD countries

SDG Index and Dashboards Report 2018.
The Chemical Society of Japan

Approach for SDGs in Japan

Recognition of current situation
(from SDG Index and Dashboards Report 2018)
- Japan ranks 157/156 countries
- High rating in the following items
  Goal 4 (Quality Education)
  Goal 5 (Gender equality)
  Goal 12 (Responsible consumption and production)
  Goal 13 (Climate action)
  Goal 14 (Life Below Water)
  Goal 17 (Partnerships for the goals)

The efforts in Japan
- Government: Ministry of Education, Culture, Sports, Science and Technology (MEXT)
- April 2018: Basic Policy on Promotion of Science, Technology and Innovation for SDGs (STI for SDGs)
- Private enterprises (e.g.: Sumitomo Chemicals)

So, in the chemical society?

Science, Technology and Innovation (STI) for implementing the SDGs

Practice in Japan from HP of JST*

(*Japan Science and Technology Agency)

Sustainability Highlights 2018

Management for Sustainability

## CSJ Efforts for SDGs

### GOAL 6 Water and Sanitation

**Discussion at CS3**

<table>
<thead>
<tr>
<th>Date</th>
<th>Year</th>
<th>Place</th>
<th>Theme</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>2015</td>
<td>Leipzig/DE</td>
<td>Chemistry and Water</td>
</tr>
</tbody>
</table>

### GOAL 7 Reliable, Sustainable and Modern energy

**Discussion at CS3**

<table>
<thead>
<tr>
<th>Date</th>
<th>Year</th>
<th>Place</th>
<th>Theme</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2009</td>
<td>Kloster Seeon/DE</td>
<td>Sunlight to Power the World</td>
</tr>
<tr>
<td>2</td>
<td>2010</td>
<td>London/GB</td>
<td>Sustainable Materials</td>
</tr>
<tr>
<td>4</td>
<td>2012</td>
<td>San Francisco/US</td>
<td>Chemistry for Next-Generation Sustainable Electronics</td>
</tr>
<tr>
<td>5</td>
<td>2013</td>
<td>Nantes/F</td>
<td>Efficient Utilization of Elements</td>
</tr>
<tr>
<td>7</td>
<td>2017</td>
<td>Dalian/CN</td>
<td>Solar Energy &amp; Photonics for a Sustainable Future</td>
</tr>
</tbody>
</table>

## CSJ Efforts for SDGs

### GOAL 4 Quality Education, Lifelong Learning

- **Activities for Education & Promotion**
  - International Chemistry Olympiad (IChO)
  - Chemistry Grand Prix

### Approach for SDGs in Japan

- **Recognition of current situation**
  - SDGs, Diversity and Inclusion
  - Low rating in the following items
  - Goal4 (Quality Education)
  - Goal5 (Gender equality)
  - Goal12 (Responsible consumption and production)
  - Goal13 (Climate action)
  - Goal14 (Life Below Water)
  - Goal17 (Partnerships for the goals)

- **The efforts in Japan**
  - Government: Ministry of Education, Culture, Sports, Science and Technology (MEXT)
  - April 2018: Basic Policy on Promotion of Science, Technology and Innovation for SDGs (STI for SDGs)
  - Private enterprises (ex: Sumitomo Chemicals)

- So, in the chemical society?

---

*“Green light of hope to overcome Striga-triggered food insecurity in Africa — fluorescent turn-on probe identifies the ‘wake-up protein’ in witchweed seeds.”*

GOAL 14  Oceans, Seas and Marine Resources

Discussion at CS3

<table>
<thead>
<tr>
<th>Year</th>
<th>Theme</th>
</tr>
</thead>
<tbody>
<tr>
<td>2019</td>
<td>Plastics</td>
</tr>
</tbody>
</table>

Chair person: Professor Charlotte Williams, University of Oxford

Sub-topics:
1. New types of plastics
2. Degradation
3. Recycling
4. Measuring the impact of plastics?

The CS3 brings together leading researchers to discuss how the chemical sciences can help to tackle some of the most daunting challenges that our world faces. Previous summits have tackled topics as diverse as water resources, human health, and sustainability.

<table>
<thead>
<tr>
<th>Country</th>
<th>Collaboration between</th>
<th>Supported by</th>
</tr>
</thead>
<tbody>
<tr>
<td>China</td>
<td>Chinese Chemical Society (CCS)</td>
<td>The National Science Foundation of China (NSFC)</td>
</tr>
<tr>
<td>Germany</td>
<td>German Chemical Society (GDCh)</td>
<td>German Research Foundation (DFG)</td>
</tr>
<tr>
<td>UK</td>
<td>Royal Society of Chemistry (RSC)</td>
<td>UK Engineering and Physical Sciences Research Council (EPSRC)</td>
</tr>
<tr>
<td>USA</td>
<td>American Chemical Society (ACS)</td>
<td>U.S. National Science Foundation (NSF)</td>
</tr>
<tr>
<td>Japan</td>
<td>Chemical Society of Japan (CJS)</td>
<td>Japan Society for the Promotion of Science (JSPS)</td>
</tr>
</tbody>
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The Chemical Sciences and Society Summit (CS3)

The Chemical Sciences and Society Summit (CS3)

Approach for SDGs in Japan

- Recognition of current situation
  - Japan ranks 159/156 countries
- Low rating in the following items
  - Goal 5 (gender equality)
  - Goal 12 (responsible consumption and production)
  - Goal 13 (climate action)
  - Goal 14 (life below water)
  - Goal 17 (partnerships for the goals)

- The efforts in Japan
  - Government: Ministry of Education, Culture, Sports, Science and Technology (MEXT)
    - April 2018: Basic Policy on Promotion of Science, Technology and Innovation for SDGs (STI for SDGs)
  - Private enterprises (ex: Sumitomo Chemicals)

- So, in the chemical society?

Ratio of Female Researchers (OECD Countries)

Further effort necessary for the private sector
**Breakdown of Respondents by Profession**

- [Image]

**CSJ Efforts for Gender Equality**

**GOAL 5 Gender Equality**

- Activities by Gender Equality Committee
  - CSJ Gender Equality Committee (GEC)
    - Make a real gender equivalent society in the field of chemical science and engineering
    - Established in 2002
    - Member: 12
    - Activities:
      - Symposia
      - EPMEWISE
      - Events
      - The CSJ Award for Women Chemists

---

**CSJ Efforts for Gender Equality**

**GOAL 5 Gender Equality**

- Activities by Gender Equality Committee
  - Summer School
    - Held annually
    - For female junior and senior high school students
  - Career Consultation
  - Chemical Experiment
  - Seminar for female students
    - Job-hunting seminar
    - Held annually
    - For undergraduate and master students

---

**CSJ Efforts for Gender Equality**

**GOAL 5 Gender Equality**

- Activities by Gender Equality Committee
  - Gender Equality Symposium
    - Held annually
    - “Activities of women and men for a society of great diversity” (March 18, 2019)
  - EPMEWISE
    - One of the three founding societies of EPMEWISE
    - Cooperation to Large-Scale Surveys on Gender Equality in STEM
    - Core society of science course choice project for women’s junior and high school students

---

**CSJ Efforts for Gender Equality**

**GOAL 5 Gender Equality**

- Activities by Gender Equality Committee
    - Goals:
      - Ratio of board and committee members: 20%
      - Establish an award for female researchers
    - 2019
      - Must include at least one female board member (3 as of 2019)
      - First female president: Prof. Maki Kawai (2018-)
      - First female vice president: Prof. Masako Kato (2019-)
      - The CSJ Award for Women Chemists established (2012-)
Heesun CHUNG  
Professor, Dean, Graduate School of Analytical Science and Technology, Chungnam National University, South Korea

**Education**

Degree: BS, Pharmacy, Sookmyung Women’s University, Korea, 1978  
Degree: MS, Pharmacy, Sookmyung Women’s University, Korea, 1980  
Degree: PhD, Pharmacy, Sookmyung Women’s University, Korea, 1987

**Research Field**

Drug testing in biological fluids (Urine, hair, blood, oral fluids)  
Forensic Toxicology  
Determination of biomarker for the postmortem interval

**Career History**

2013- present professor, dean, graduate school of analytical science and technology, Chungnam National University  
2010 - 2012 Director General (Grade 1) National Forensic Service  
2008 - 2010 Director General (Grade 2) National Institute of Scientific Investigation  
2002 - 2008 Head, Department of Forensic Science, National Institute of Scientific Investigation  
1996 - 2002 Director, Narcotics Analysis Division, National Institute of Scientific Investigation  
1993 - 1996 Director, Drug-Toxicology Division, National Institute of Scientific Investigation  
1990 - 1991 Postdoctoral course, King’s College London, UK

**Appointments**

2019  President-elect, Korea Federation of Women’s Science & Technology Associations  
2019  Advisory committee member, National Police Agency  
2018  Committee member, Bioethics appointed by the president  
2016  Committee member, DNA Management committee by Prime minister  
2011 - 2014  President, The International Association of Forensic Sciences  
2014 - 2017 President, The International Association of Forensic Toxicologists
Awards

2014  Honorary Commander of the Most Excellent Order of the British Empire  (CBE)
2012  Medal for the Distinguished Service  (Korean Government)
2010  Bichumi Woman Award  (Samsung Life Insurance Company)
2009  Medal of Mongolian Government  (Ministry of Home Affairs and Justice)
2007  Year of Woman Scientist  (The Ministry of Science and Technology)

Current Memberships

Board member: The International Association of Forensic Toxicologists
Member, Korean Association of Forensic Sciences
Editorial board, Forensic Science International
Editorial board, Forensic Toxicology
Role of Chemistry for Sustainable Development Goals

Heesun Chung, CBE, Ph.D
(Graduate School of Analytical Science and Technology, Chungnam National University, 99 Daehak-ro, Yuseong-gu, Daejeon, Korea, hschung@cnu.ac.kr)

Abstract: The United Nations provided a shared blueprint of peace and prosperity for people and the planet in 2015 and set the 17 Sustainable Development Goals (SDGs). Among 17 goals, there are goals which need the support from Chemistry such as Peace, justice and strong institutions as well as sustainable cities and communities. In this talk, the role chemistry in justice and peace will be addressed by introducing Forensic chemistry, especially forensic toxicology. By using all different and state of art technology, poisons and chemical substances are identified in biological fluids of deaths or living people for determining the cause of deaths or the trends of harmful and abused drugs in society or effect of drugs on human being. The role of forensic toxicology for justice will be discussed by the definition of poisons, and the gender difference in drug related deaths and drug use. Recently there are so many drug related deaths worldwide, mostly opioid-related deaths. It is very important to note that women are more likely to use prescription opioids compared to men, because women have a greater sensitivity to pain than men. So, there is a possibility for women to begin the misuse of opioids through medical treatment and increase the likelihood of an overdose. The gender difference in drug related deaths will be showed by statistics and data from literatures and articles. The deaths from opioids will be discussed along with the abuse of Zolpidem which is the most commonly detected drug in emergency room as well as in acute intoxication cases.

1. INTRODUCTION

Sustainable Development Goals (SDGs) by United Nations needs action from both developed and developing countries with a global partnership. Among 17 goals there are goals which need the role of chemistry to achieve goals such as Climate action, Life below water and life on land. In addition to these, Chemistry also plays important role in Peace, justice and strong institutions as well as sustainable cities and communities.

In this talk the role of forensic chemistry in Justice and Safety will be addressed by introducing Forensic Science. Society with Peace and Justice is where we dream to live and a society where there is no threat from crime and drugs is the one we want to live. To build a society free from drugs and crimes, forensic chemistry as a part of chemistry plays a pivotal role to support the crime investigation as well as the justice system by identifying the physical evidences collected from crime scene.

Forensic science is the application of science to criminal and civil laws in the criminal investigation, as governed by the legal standards of admissible evidence and criminal procedure. There are many disciplines of Forensic science such as anthropology, criminalistics, digital sciences, Engineering sciences, odontology, pathology, biology, behavioral science, questioned documents and forensic chemistry.

In forensic chemistry, there are also many sub-divisions of drugs of abuse, toxicology, alcohol, explosives, polymers and many more. Among these sub-divisions, toxicology is the one to be discussed mainly in this talk.

Forensic toxicology is the science that deals with medical and legal aspects of the harmful effects of the chemicals, toxic substances or poisons on the human body. Forensic toxicology divided into five major sub-divisions: death investigation (post-mortem), human performance, workplace drug testing, doping control, and drug-facilitated crimes. The trend of increasing crimes and deaths related to drugs and other toxic materials, as well as drug abuse and misuse, makes forensic toxicology essential in peace of society. By examining the nature and extent of chemical involvement in a potential human poisoning, it plays pivotal role in determining the cause of death.
2 DRUG RELATED DEATHS IN CHEMISTRY

To begin with, the definition of poison is given based on Paracelsus’s theory. He said, “All substances are poisons; there is none which is not a poison. The right dose differentiates a poison and a remedy.” It means that the only difference between a poison and a remedy is the amount. Poisons are generally defined as chemicals that damage health and destroy life itself.

To explain the meaning of poisons easily, the books by Agatha Christine will be introduced. She wrote 80 books and killed 300 people in her books. Among them 100 was killed by 30 different of poisons. She used many plant poisons, chemicals as well as something novel to kill people. There was a very interesting story regarding her knowledge of poisons. In 1976, 19-month old baby came to London from Iraq for the treatment of mysterious symptoms such as lethargy, numbness, black-outs, slurred speech, general debility. When a nurse saw her symptoms, she remembered the book “Pale horse” by Agatha Christie, in which victim’s symptoms were exactly same as what a baby showed. So she asked a doctor to test the presence of Thallium in the baby’s biological specimens. Surprisingly Thallium was positive and the baby was cured by a proper treatment. This story shows how knowledgeable Agatha Christie was in description of poisons in her books. This story was published in the British journal

In order to determine the cause of death, especially by poisons, forensic toxicologists must analyze the biological fluids from the deceased to identify poisons. Recently there are so many drug related deaths worldwide. UNODC reported that there were a minimum of 190,000 drug related deaths worldwide in 2015, mostly opioid-related deaths. The largest numbers of deaths were in Asia followed by America. However, North America had the highest drug-related mortality rate, followed by Oceania. The highest rate for a country was 245 per 1 million people in the US, followed by Iceland and El Salvador. In 2016, 63,632 drug-related deaths were reported in the US and of these 42,249 cases involved opioids. The number of deaths due to synthetic opioids increased sharply since 2014, as well as the number of deaths due to semi-synthetic opioids and heroin. This was because synthetic opioids were sold as or mixed with semi-synthetic opioids and heroin. Of the opioid-related deaths, 46% were linked to synthetic opioids, while of the heroin-related deaths, 37% were linked to synthetic opioids. Many fentanyl-related deaths have been recorded due to their variable purity and potency. The report of NIH showed that deaths due to the synthetic opioids in the US reached over 70,000 now. It is very important to note that women are more likely to use prescription opioids compared to men, because women have a greater sensitivity to pain than men. So, there are possibility for women to begin the misuse of opioids through medical treatment and increase the likelihood of an overdose.

Unfortunately, overdoses related to opioids have greatly increased in women compared to men. Furthermore, women develop a dependence on opioids faster than men due to a heightened dopamine response in the brain.

Between 1999 and 2016, overdose deaths from opioid prescriptions increased by 404% for men and 583% for women. In 2016, 27 men died per day from prescription opioid overdose, compared to 19 women per day. Conversely, the rate of opioid-related deaths among women climbed 596% between 1999 and 2016 (deaths among men increased 312%).

In addition, women exposed to an addictive substance develop a drug use disorder more rapidly than men. Men are more likely than women to use almost all types of illicit drugs, and illicit drug use is more likely to result in emergency department visits or overdose deaths for men than for women. Drugs associated with homicide (marijuana, cocaine and amphetamines) are stronger among males, while drugs associated with suicide are stronger among females (antidepressants and opiates).

The data accumulated by toxicologists are very important to predict the trends of drug overdose as well as to maintain a healthy society.

3 ZOLPIDEM RELATED CASES

Zolpidem is the most prescribed sedative-hypnotic and a non-benzodiazepine hypnotic agent which has been shown to be effective in inducing and maintaining sleep in adults. It is very important to note that the Food and Drug Administration (FDA) in US claimed the existence of new data showing women to be at risk for excessive daytime sedation and impaired driving proficiency following bedtime doses of zolpidem. Also zolpidem clearance is lower in females than in males indicating there is a big gender difference in the effect of the drug. Zolpidem has been marketed in Europe since 1987, and was approved by US Food and Drug Administration (FDA) in April 1992. It is the 15th most prescribed drug in the US and as a result, a
high number of acute intoxication has been reported and the most commonly detected drug in emergency room worldwide. In accordance with the tension and/or temptation from rapid changes in society, intoxication of drugs is significantly increasing year by year and there are so many patients admitted in emergency room due to the drug overdose. In Korea, zolpidem was detected in many autopsy cases conducted by National Forensic Service and used for suicide attempt due to acute intoxication. Also zolpidem was the most frequently detected drug in emergency room. By using a fast and accurate screening method to identify zolpidem in biological fluids, the blood concentration of zolpidem was measured to determine the cause of death and prevalence and harm of Zolpidem in society.

4 CONCLUSION

In conclusion, Forensic toxicology as a part of chemistry plays an important role for identifying chemicals and substances in biological fluids for the cause of deaths and trends of drug related deaths. By identification of drugs and substances, it provides information of gender differences in drug related deaths which is very important to prevent misuse and treat pain. Because women and men experience different paths and different treatment needs, it is important to understand the gender differences in drug use, risks and harms. Over all, chemistry is a very important supporter for keeping peace and safety of society to achieve Sustainable Development Goals

REFERENCES

2. Women and drugs, World Drug Report 2018, UNODC
6. Determination of Zolpidem in Blood Samples from Emergency Patients Using GC-MS, Hantae Moon, Youngki Hong, Junhui Lee, Ahra Go, Wonjoon Jeong, Heesun Chung, Forensic Science and Technology, 2018
Hello, Tokyo!

6th meeting in China 2014

Wonderful time in China 2014

Role of Chemistry for SDGs

Heesun Chung, GRAST
Chungnam National University, Daejeon, Korea
Sustainable Development Goals

Chemistry for SDGs

Chemistry for SDGs

Chemistry for SDGs

What Chemistry for Justice?

Justice

Forensic Science
When do you think my life in Forensics began?

1978 Forensic Life Began!

30 Years Later

Life in Forensic Science
IAFS president (2011-2014)

TIAFT President (2014 – 2017)
Agenda

- Role of forensic toxicology in Justice
  - poison
  - Hair drug testing
- Gender differences in drug related deaths and drug abuse

What is Forensic Toxicology?

Forensic toxicology
(American Board of Forensic Toxicologists)

The science that deals with medical and legal aspects of the harmful effects of the chemicals, toxic substances or poisons on the human body.

Poison?

Who is this woman?
Agatha Christie

80 books
300 people killed
100 poisoned
30 poisons

What was her favorite poison?

Cyanide: it kills quickly
200-300mg Potassium cyanide is lethal

Thallium

In 1976, 19-month-old girl
Nurse recognized Mysterious symptoms
Requested Dr. to test for tallium
Published in the British Journal

How did she learn?

WWI Nurse
Pharmacy Exam
Self-study

Is she a real expert?

Give me a decent bottle of poison and I’ll construct the perfect crime
High-profile case in 2019

- K-pop singer and actor was suspected for taking methamphetamine
- He denied to take any drug
- He tried to destroy evidence by dyeing and shaving of the hair from all his body before undergoing the drug test

Police collected hair sample from his leg.
- National Forensic Service conducted a drug test and the result was positive for methamphetamine
- Later he confessed to take it.
Gender and drugs

A Minimum of 190,000 Drug Related Deaths
Mostly opioid related overdoses
UNODC 2015

Regional variation in drug-related deaths

The regional drug related mortality rate in 2015

Overdoses per 1 million people

Europe 24
Middle East 15
Asia 62
North America 172
Oceania 102
South America 56
Drug related death rates in countries

Drug related death in the US

What are synthetic opioids?

Opioids Classification

What is Fentanyl?

How powerful are Fentanyl Analogues?

Drug related death rates in countries

Overdoses per 1 million people

Drug related death in the US

What are synthetic opioids?

Opioids Classification

What is Fentanyl?

How powerful are Fentanyl Analogues?

A family of synthetic opioids
Some are incredibly strong
Effective at very small doses and difficult to detect
Less Than
One Pill Can Kill

Is there any gender difference in opioid use?

DEATH FROM OPIOID OVERDOSE  
IN 2016

Deaths by prescription opioid overdose

Opioid overdoses increased more rapidly for women

Why women use opioids more?
Women are more sensitive to pain than men.

Women are more likely to have chronic pain.

Women are more likely to use prescription opioids compared to men.

Drug use rates by gender.

Gender differences in drug use:
- Men are more likely than women to use cannabis, cocaine and opiates.
- The prevalence of the non-medical use of opioids and tranquilizers, antidepressants, and anti-anxiety drugs.
Antidepressants and anti-anxiety or sleep drugs

- Women are more likely to die from overdoses involving medications for mental health conditions, like antidepressants.
- Antidepressants and anti-anxiety or sleep drugs send more women to emergency departments than men.

Annual prevalence of tranquilizers among those aged 15–64, 2011-2016 in Europe

Anti-anxiety medications or sleeping aids

- Antidepressant use has increased
- Women are more than twice as likely to use the drug as their male counterparts

Use of Antidepressants

Why women are more at risk than men for anxiety and insomnia?

- Women are being prescribed more of these types of medications
- Greater access can increase the risk of misuse
- Lead to substance use disorder or overdose

Consequences of Drug use by Women

- Women often suffer more than men with serious long-term consequences
- Women may be more susceptible to craving, relapse, which are key phases of the addiction cycle.
- Women are just as likely as men to develop a substance use disorder.
What are problems on women and drugs?

- Women seek help for substance abuse at much lower rates than men
- 33 percent of the individuals admitted for treatment in 2011 were female, while 67 percent were male
- It also reflects a reluctance among women to admit the need for help or to believe that they deserve recovery services.
- Women may also refuse treatment because of childcare responsibilities,
  - lack of financial resources to pay for treatment,
  - lack of adequate transportation.

Women and Drug in SDGs

- Ensuring healthy lives and promoting well-being at all ages
- Achieving gender equality and empowering all women and girls
- Promoting sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all
- Reducing inequality within and among countries
- Promoting peaceful and inclusive societies for sustainable development

Conclusion

- Understanding gender differences related to Drug abuse and deaths
- Differences in drug use by gender can result in differential consequences that matter such as serious morbidity and mortality
- For women
  - Building self-esteem
  - Setting boundaries with partners and children
  - Managing stress
  - Improving communication skills

Do you know where?

2021
The 10th Korea-China-Japan Women Leaders Forum For Science & Technology

Yes, Korea
See you in Seoul 2021
Thank you very much
Session 2 Speaker (China)

Zhimin LIU
Professor, Institute of Chemistry (IC), Chinese Academy of Sciences (CAS)

Education
Degree: BS, Description: in Chemical Engineering, School: Qingdao University of Science and Technology, Location: Qingdao, Shandong, China, Year: 1990
Degree: Master, Description: in Chemical Engineering, School: Qingdao University of Science and Technology, Location: Qingdao, Shandong, China, Year: 1993
Degree: PhD, Description: in Chemical Engineering, School: China Petroleum University, Location: Beijing, China, Year: 1997

Research Field
Green chemistry, Utilization of CO₂, Chemical transformation of biomass to chemicals, fuels and materials, Ionic liquids

Career History
Zhimin Liu is a professor and a group leader of CAS Key Laboratory of Colloid Interface and Thermodynamics, ICCAS, China.
After she received Ph.D in 1997, she worked as a postdoc in ICCAS for 2 years, and was hired as an associate professor by ICCAS in 1999. She visited Nottingham University (UK) and Tohoku University (Japan) as a visiting scientist in 2003 and 2006, respectively. Since 2007, she has been working as a full professor in ICCAS. Her research interest is green chemistry with focus on green solvents and chemical conversion of CO₂ and biomass.
Awards and Scholars

- China National Natural Science Foundation for Distinguished Young Scholars in 2011
- The Second Prize of the National Science and Technology Progress Award in 2011 (Rank No. 2)
- Leading Talent in Science and Technological Innovation of Ministry of Science and Technology in 2016

Current Memberships

- Vice Chairman of Committee on Supercritical Fluid Technology of Chemical Industry and Engineering Society of China
- Member of Committee on Ionic Liquids of Chemical Industry and Engineering Society of China
- Member of Committee on Green Chemistry of Chinese Chemical Society
- Member of Committee on Chemical Thermodynamics and Thermal Analysis of Chinese Chemical Society
- General Secretary of Supercritical Fluid Association of Asia
- Editor-in-Chief of Current Opinion in Green and Sustainable Chemistry
- Editorial board member of Sustainable Chemistry and Pharmacy
- Editorial Advisory Board of Industrial & Engineering Chemistry Research
- Editorial board member of Chinese Science Bulletin
- Editorial board member of Acta Physico-Chimica Sinica
GREEN CHEMISTRY PROMOTES SUSTAINABLE DEVELOPMENT

ZHIMIN LIU

Institute of Chemistry, Chinese Academy of Sciences, China. liuzm@iccas.ac.cn

Abstract: Sustainable development is one of the most important issues for our society and is a great challenge. Green chemistry, which is the design of chemical products and processes that reduce or eliminate the use or generation of hazardous substances, will promote the sustainable development of our society. Herein, the important aspects of green chemistry including atom economic reaction, green catalysis, green solvent, green carbon science and green product are introduced, which may provide solutions to achieve the sustainable development goals.

Keywords: green chemistry, atom economic reaction, green solvent, green catalysis, green carbon science, green product, education

1. Introduction

Chemistry is a central science that creates new materials and deals with the composition, structure, and properties of substances and with their transformations. Chemistry has greatly contributed to modern civilization, which provides about 97% products in the world and makes our lives better. For example, the invention of ammonia and related fertilizers renders the production of enough foods to meet needs of people all over the world. The medicines protect the health of people, and lengthen their average life span. Man-made materials make the world colorful and wonderful. However, we have to admit that chemistry also has polluted our planet and depleted natural resources greatly, so the sustainable development of our society is confronted with great challenges.

Green chemistry, which is the design of chemical products and processes that reduce or eliminate the use or generation of hazardous substances [1], guides the development directions of chemistry using the well-known “Twelve Principles”. The core of green chemistry is to save resources and energy, convert feedstocks into products as far as possible, and reduce or eliminate pollution to environment from the beginning. Green chemistry will promote sustainable development and realize the sustainable development goals (SDGs).

2. Green chemistry for SDGs

2.1 Atom economic reactions

To achieve sustainable development, we need enough and sustainable resources, but the resources in the earth are fixed and limited. Therefore, the utilization of the natural resources with high efficiency is of great significance for the sustainable development. An important goal of green chemistry is to maximize the efficiency of use of raw materials and to minimize the creation of waste. For a chemical reaction, atom efficiency is defined as the conversion efficiency of a chemical process in terms of all atoms involved and the desired products. Atom economic reaction is considered with high ratio of atom utilization, in which the conversion of raw materials is maximized and the waste emission is minimized. That is, atom economic reaction can generate more product using less feedstocks, thus reducing or eliminating the pollution caused by waste emission from the beginning. The strategies to improve atom economy mainly include designing alternative synthetic methodology, improving selectivity towards target products, and making good use of byproducts. It is crucial to develop robust and environmentally friendly catalysts to achieve a real atom
economic reaction. The highly effective economic reaction not only saves resource but also prevents the pollution, which affords a significant way for sustainable development.

2.2 Green catalysis

Catalysis represents one of the most important way to achieve the goals established by 12 principles of green chemistry, and is also providing pathways to a sustainable development [2]. Catalysis also plays important role in environmental applications including the destruction of wastes and purification of gases, waters and soil. Noble metal catalysts are widely applied in chemical industry. Due to the limits of the noble metal resources, the low-cost, abundant and environment-friendly metals are expected to replace noble metal catalysts and have been widely investigated with focus on improving their activity comparable to that of noble metal catalysts. Nanocatalysts, particularly, catalysts with single-metal atom, display highly enhanced activity, and have become the frontier of the catalysis in recent years. The metal-free catalysts including organo-catalyst, carbons and ionic liquids without metals have emerged as green alternatives for various kinds of reactions, especially for the production of pharmaceuticals and biologic active molecules.

The bio- and photo-catalysis are considered to be green catalysis, which can be performed in green way under ambient conditions. Electro catalysis is also a green catalysis, which can adopt green and renewable electricity from wind, tide, etc. However, the efficiency of these kinds of green catalysis is generally very low compared to that of thermo-catalysis. Therefore, exploring catalysts with high efficiency for bio-, photo- and electro-catalysis is of significance for sustainable development. The reduction of CO$_2$ into fuels and chemicals via bio-, photo- and electro- catalysis provides green routes for CO$_2$ fixation and transformation, which have been paid much attention in recent years. In addition, the catalysis associated with the use of green solvents is also a green catalytic process.

2.3 Green solvents

As known, over 70% chemical processes require solvents, especially organic solvents that are generally toxic, flammable, and/or corrosive. Therefore, study on green solvents is the most active area of green chemistry research [2], which represents an important challenge because the utilization of green solvents is not a simple replacement to the conventional solvents. The widely investigated green solvents mainly include water, supercritical fluids, ionic liquids and biomass-derived solvents. Besides their green features, the unique properties of green solvents should be investigated to meet the requirements for their applications. Water has been widely applied in inorganic industry, and prevention of water pollution is the main problem in its applications. Recent researches indicate that water is also a good reaction solvent for some organic reactions, showing promising potentials in organic synthesis. Supercritical fluids have temperature- and pressure-controlled properties with liquid- and gas-like performances, which, especially supercritical CO$_2$, have shown promising applications in chemical processes. Ionic liquids that are completely composed of ions can be designed with green features together with unique properties, which are considered as a kind of green solvents and have attracted much attention in green chemistry. In addition, biomass-derived solvents like glycerol also have attracted attention, which may have great potentials.

2.4 Green carbon sciences

Carbon, the fourth most abundant element in the universe, is the key element of life on earth, and offers us organic materials. The efficient utilization of carbon resources and carbon recycling are of great importance for the sustainable development of our society. In the foreseeing future, fossil resources (raw oil, coal, natural gas and minerals) will still be the main resources of energy and chemicals, thus exploring
green technologies for efficient utilization of fossil carbon resources will still be important task of chemists and engineers. With gradual consumption of fossil carbon resources, biomass as the largest renewable carbon resources has attracted much attention, and related technology to utilize biomass are being developed. The utilization of fossil resources and biomass emits huge amount of CO$_2$, which results in the CO$_2$ concentration in air to reach up to 415 ppm in 2018, thus causing serious environmental and social problems. Chemically, feasible and effective solutions to this problem are the efficient use of the limited fossil resources and the development of processes to convert biomass and CO$_2$ into fuels and value added chemicals on a large scale. Therefore, Chinese scientists [3] proposed concept of green carbon science with four principles, which focuses on the transformations of carbon-containing compounds in the entire carbon cycle, with the ultimate aim at using carbon resources efficiently and minimizing the net CO$_2$ emission. This holistic view also has ramifications for related fields including petroleum refining and the production of liquid fuels and chemicals from coal, methane, CO$_2$, and biomass.

In addition, the recycling and reuse of organic polymers is also an important aspect of green carbon sciences. The spent polymers provide rich renewable carbon resources, and their degradation into chemicals is of significance for sustainable development, which can not only reduce the pollution to the environment but also save the carbon resources.

2.5 Green products

Green products are necessary for sustainable development, which should have the following features: nontoxicity, environmental-friendliness, long life span for use, available recycling, production from natural and/or renewable feedstocks, fabrication with low energy cost, high biodegradability. The green chemicals for agriculture including fertilizers, pesticides, and insecticides can guarantee safe production of enough foods for us. Green pharmaceuticals and medicines can protect our health and lengthen the life span of our humans. Other green products including natural additives for foods, biomass-derived functional materials, natural clays, green coating materials, and so on, can make our life better.

In addition, the recycling of solid wastes including plastic waste, metal waste, glass, and so on, is also of great significance for sustainable development. Transformation of such solid waste into chemicals or useful materials needs chemistry, which is an aspect of green chemistry.

3. Education

Education is perceived as the master key to achieving a sustainable society. The core role of chemistry and chemical industry for sustainable development in modern societies suggests a central role for chemistry education. Green chemistry education aims at incorporating the concept of green chemistry into chemical education, and a major objective is to foster sustainable scientific literacy and to develop corresponding skills among the present and future generations [4]. More importantly, the intention of green chemistry education is to promote the desired types of awareness in the young generations, keeping in mind the importance of social and environmental sustainability and the role that chemistry can play to promote sustainable development, being to allow them to actively learn how to shape society in a positive, sustainable fashion. Therefore, green chemistry education should be and also has been paid much attention all over the world.

Nowadays, more and more female students are educated at high schools and universities, and they should be have equal rights to be educated with green chemistry. More and more female scientists are working in green chemistry fields, and they should be supported equally. It is believable that women are also able to contribute to sustainable development.
4. Conclusion

Green chemistry provides important solutions to sustainable development, which will give us a beautiful and sustainable world. Women working in green chemistry is an important power to contribute to sustainable development of our society. Let’s work together, and make our life better and better.

REFERENCES

Green Chemistry Promotes Sustainable Development

Prof. Dr. Zhimin Liu
Institute of Chemistry, Chinese Academy of Sciences (ICCAS), Beijing 100190, China. Homepage: Liuzm.iccas.ac.cn

CAS is the largest scientific research organization of China, which has >100 research institutes and 3 universities.

ICCAS is a multi-disciplinary research institute dedicated to basic research of chemistry, and is one leading chemistry research organization in China.

110 professors, 15 women professors.

**CURRICULUM VITAE**

**Professor Dr. of Chemistry**

**Education and Employment History**
- 1999 Postdoctoral fellow of ICCAS
- 1999 Associate Professor of ICCAS
- 2000 Visiting scholar, Nottingham University, UK
- 2002 Visiting scholar, Tohoku university, Japan
- 2007 Group leader
- 2008 Full professor of ICCAS

**Research Interests**
- **Green chemistry**
  - Study on the properties of green solvents including supercritical fluids and ionic liquids;
  - Chemical conversion of CO₂ and biomass;
  - Green solvent-induced fabrication of functional materials;
  - Green catalysis.

**Membership**
- Fellow of Royal Society of chemistry
- Vice Chairman of Committee on Supercritical Fluid Technology of Chemical Industry and Engineering Society of China
- Member of Committee on Ionic Liquids of Chemical Industry and Engineering Society of China
- Member of Committee on Green Chemistry of Chinese Chemical Society
- Member of Committee on Chemical Thermodynamics and Thermal Analysis of Chinese Chemical Society
- General Secretary of Supercritical Fluids Association of Asia

**Editorial Board member**
- Editor-in-chief for Current Opinion in Green and Sustainable Chemistry
- Editorial board member for Sustainable Chemistry and Pharmacy
- Editorial Advisory Board for Industrial & Engineering Chemistry Research
- Editorial board member for Acta Physico-Chimica Sinica

**Awards**
- Selected as Leading Talent of "National High-Level Personnel of Special Support Program", 2018
- A Second Class Prize of National Natural Science Award of China, 2011.
- China National Fund for Distinguished Young Scientists, 2011.
- A Second Class Prize of Science and Technology Award of Beijing, 2007

**Green Chemistry Promotes Sustainable Development**

- **Green chemistry**
- **Green carbon sciences**
- **Atom-economic reactions**
- **Green solvents**
- **Green products**
- **Education**
- **My research interest**

**Sustainability?**

- "Sustainability" is a concept that is used to distinguish methods and processes that can ensure the long-term productivity of the environment, so that new generations of humans can live on this planet.
- Sustainability has environmental, economic, and social dimensions.
We live in a chemically-dependent society

Over 97% of man-made goods are produced using at least one chemical process. Chemistry plays a crucial role in modern civilization.

- Fertilizers afford us with enough food
- Synthetic polymers give us colorful clothing.
- Modern construction materials offer us comfortable housing.
- Medicine protects our health and prolongs the lives of our humans.

Chemistry makes our life better.

Great Challenges for Sustainable Development

Old Chemical Processes

- Small portion (~10%) of resources we take from earth is converted into products. Most of them is transformed into waste.
- Huge amount of harmful wastes are generated annually, and serious pollution is caused.
- It is not sustainable in products, process and resources.

Green chemistry is highly desirable

New and green chemistry is highly desirable for sustainable development, but challenging!

Green Chemistry ?

- A new approach to designing chemicals and chemical transformations that are beneficial for human health and the environment.
- Aiming to save resources and energy, and completely convert feedstocks into target products and eliminate pollution from the beginning.

12 Principles of Green Chemistry

1. Prevention rather than remediation
2. Atom Economy
3. Less Hazardous Chemical Syntheses
4. Designing Safer Chemicals
5. Safer Solvents and Auxiliaries
6. Design for Energy Efficiency
7. Use of Renewable Feedstocks
8. Reduce Derivatives
9. Catalysis
10. Design for Degradation
11. Real-time analysis for Pollution Prevention
12. Inherently Safer Chemistry for Accident Prevention


Green Chemistry Attracts Worldwide Attention

- Green Chemistry Centers/networks all over the world
- IUPAC subcommittee on Green Chemistry (2001)
- USA Presidential Green Chemistry Challenge Award (1995)
  - Greener Synthetic Pathways; Greener Reaction Conditions; The Design of Greener Chemicals; Small Business; Academic
- International conferences on Green Chemistry
We live in the age of carbon

Most of the articles of society are carbon-based. Carbon resource is indispensable for us.

There would be no modern civilization without carbon, but carbon is also threatening the survival of our humans due to our own problems.

Fossil resources
- Currently, we are heavily reliant on fossil resources, which offer us energy and chemicals.
  - Oil affords >90% of organic chemicals. But only 10% of petroleum is used to make chemicals.
  - Natural gas, with predominant component of methane, is mainly used to produce energy.
- Coal is the largest carbon resource, and it provides the major energy via combustion, meanwhile it emits huge amount of CO₂ together with S-, N-containing compounds, resulting in pollution to environment.
- Fossil resource is the base of chemical industry, but they are finite and increasingly difficult to access. Time is running out for petrochemical feedstocks and for other traditional resources.

Renewable resources
- Nature provides us with plentiful biomass. ~200 Billion tons of lignocellulose is produced every year. But only 4% is utilized as carbon resource. Especially, their transformation to desired products is challenging.
- ~40 Billion tons of CO₂ is emitted from fossil utilization annually, and its concentration in air has reached >400 ppm (in 2018). Only 0.4% is used for chemicals production due to both thermodynamic and kinetic problems.

Efficient utilization of renewable carbon resources is crucial to sustainable development of our society

Green Carbon Science (GCS)?

- Energy generation
  \[ C + O_2 = CO_2 \]
  \[-393.5KJ/mol \]
- Natural Photosynthesis
  \[ CO_2+H_2O \rightarrow \text{Biomass} \]

GCS Definition
Study and optimization of transformation of carbon-containing compounds, processes involved in the entire carbon cycle from carbon resource processing, carbon energy utilization, CO₂ fixation, and carbon recycling to minimize the carbon unbalance caused by over-consumption of fossil resources.

Main research areas
- Highly efficient utilization of fossil resources
- Economic processes to use biomass and CO₂

Modern chemical industry emits huge amount of CO₂.

Transformation of CO₂
- Modern chemical industry emits huge amount of CO₂.
- Natural photosynthesis provides us with plentiful biomass.
- Conversion and utilization of CO₂.
- Fuel 이용
- Chemicals
Commercial production of urea, salicylic acid, carbonates

- Both thermodynamic and kinetic limitations.
- Photocatalysis and electrocatalysis can overcome the thermodynamic limitation.
- Cheap and renewable H₂ is important.

Challenges:

- Reducing to fuels, e.g., CO₂, CH₃OH, HCOOH, CH₂OH, etc.
- Involving the synthesis of various chemicals, e.g., cyclocarbonates, benzimidazoles, N-formylamides, etc.

Transformation of biomass

Nature provides us with plentiful renewable carbon resources—biomass.

Edible
Non-edible
Biomass

Challenges:

- Reduction to fuels, e.g., CO₂, CH₃OH, HCOOH, CH₂OH, etc.
- Involving the synthesis of various chemicals, e.g., cyclocarbonates, benzimidazoles, N-formylamides, etc.

Biomass-derived green and renewable feedstocks

Non-edible biomass includes cellulose, lignin, chitosan and their platform compounds.

- Cellulose is the largest biopolymer with unit structure of glucose.
- Lignin is the second largest biopolymer with aromatic structures, which provides the possibility to afford aromatics from biomass.

Lignin is the second largest biopolymer with aromatic structures, which provides the possibility to afford aromatics from biomass.

Paper industry produces about 50 million tons of lignin waste annually.

Aromatics produced from lignin

Challenges for biomass transformation

- Use of lignocelluloses is extremely important, but selective conversion and separation is challenging.
- Utilization of starch and triglyceride is easier, but their sources are very limited.
- More attention should be paid to explore processes using the special structure of biomass.
- Transformation of renewable carbon resource is of great importance, which is a long-term task.

Green solvents—Environment-friendly solvents

Around 70% of chemical processes require for solvents.

**SOLVENT GUIDE**

<table>
<thead>
<tr>
<th>Ranking</th>
<th>Solvents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preferred</td>
<td>Water, ethanol, propanol, n-butyl alcohol, AcOEt, AcOH, AcOEt, MAN, PDMF, toluene, hexane, NMP</td>
</tr>
<tr>
<td>Preferred or Problematic</td>
<td>MeOH, iBuOH, BiOH, ethylene glycol, acetone, MEK, MIBK, cyclohexane, AcONMe, AcOEt</td>
</tr>
<tr>
<td>Problematic</td>
<td>MeTHF, heptane, Me-cyclohexane, toluene, xylene, chlorobenzene, acetonitrile, DMPU, DMSO</td>
</tr>
<tr>
<td>Problematic or Hazardous</td>
<td>THF, MTBE, cyclohexane, DCM, formic acid, pyridine</td>
</tr>
<tr>
<td>Hazardous</td>
<td>Py, O, dioxane, DME, pentane, hexane, DMP, DMA, NMP, 1,4-dioxane, nitromethane</td>
</tr>
<tr>
<td>Highly hazardous</td>
<td>ELO, benzene, CO₂, phosgene, DCE, trifluoromethane</td>
</tr>
</tbody>
</table>

- ~20 Million tons of harmful solvents are emitted annually, resulting in harm to people and pollution to the environment.
**Green solvents:**

- Water/supercritical water
- Supercritical CO$_2$
- Ionic liquids
- Polyethylene glycol
- Biomass-derived solvents

The replacement of harmful solvents with green ones needs to reconsider many new issues due to the unique features of green solvents.

**Water (H$_2$O)**

Water is the most accessible green resource in the earth, which has wide applications in industry.

As a chemical feedstock, it can serve as a reductant to provide H, and also as an oxidant to provide O. As a green solvent, it shows unique performance due to the strong ability to form H-bonding.

Exploring its efficient utilization in chemical processes is of significance for sustainable development.

**Supercritical CO$_2$**

Critical Point: 31.1 °C, 7.38 MPa

- **Properties**
  - Gas-like viscosity and diffusion
  - Liquid-like density
  - Near zero surface tension
  - Tunable properties...

- **Applications**
  - Extraction
  - Dyeing
  - Drying
  - Cleaning
  - Chemical reactions
  - Material processing or preparation...

For example, >80% of hops for beer is produced by CO$_2$ extraction.

**Ionic Liquids (ILs)**

A kind of organic molten salts composed of organic cations and inorganic/organic anions.

- **Unique properties**
  - Ionic microstructure
  - Multiple interactions
  - Wide applications
  - Solvent
  - Catalyst
  - Microwave absorber
  - Surfactant

ILs can be designed with green features.

**Biomass-derived solvents**

- Glycerol
- Furfural
- Furfuryl alcohol
- Ethyl levulinate
- Butyl levulinate
- 2,2,5,5-tetramethyloxolane

These solvents will replace some traditional solvents.

**Degradable polymers**

- We live in a world where synthetic plastics are everywhere. From clothing to crisp packages and from bottles to buckets, plastics make our lives more convenient.
- But >80% plastics we consume ends up as waste, which causes serious problems to us and to our environment. It was reported...
- Degradable polymers are highly required.
- Natural polymers such as cellulose, chitosan, wool, silk, spidersilk and mussel byssus fibres, and biopolymer-based nanocomposites, present an attractive alternative for synthetic polymers derived from petrochemicals.
**Green pesticides**

Nowadays, pesticides have been widely applied in agriculture, which improves the crop yields, but are harmful to human beings and to soil.

**Green pesticides** that are low-toxic, high efficient, and degradable are of great significance for sustainable development.

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**Circular economy**

By recovering resources from the waste materials, we can reduce our reliance on virgin feedstocks that are not sustainable as well as reducing the quantity of materials going to landfill sites.

**Recycling is essential for environmental sustainability.**

**Rubber recycling.** Rubber is used in a vast number of products, and the volume of rubber waste produced globally makes it difficult to manage because accumulated waste rubber, especially in the form of tyres, can pose a significant fire risk. Recycling rubber not only prevents this problem but can produce new materials with desirable properties that virgin rubbers lack.

**Element Recovery.** Increased consumption of electronic equipment has brought with it a greater demand for rare earth elements and metals. It is predicted that the global supply of rare earth elements could soon be exhausted. A sustainable approach to the use and recovery of rare earth elements is highly needed.

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**Green chemistry education**

- Green Chemistry education has been paid worldwide attention.
- A wide range of new approaches, courses, tools, and materials related to green chemistry have been introduced and demonstrated in the chemistry curriculum in colleges and universities around the world.
- Green chemistry education must be integrated into the way we teach scientists from the earliest ages, e.g., from high school students.

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**My research interest**

- **Chemical Fuels**
- **Renewable Carbon Resources**
- **New Materials**
- **Biomass**
- **Reaction Mechanism**
- **Carbon Transformation**
- **Thermo-catalytic Transformation**
- **Electrocatalytic Transformation**
- **Photocatalytic Transformation**

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**Transformation of carbon dioxide**

- Ionic liquid catalysts
- Polymer catalysts
- Solvent-mediated catalytic systems

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**Atom-economic reactions**


**No byproducts**
Artificial photosynthesis

Summary and outlook

Green chemistry provides a concrete path to solving environmental problems.

Green chemistry is the way for sustainable development, and it is the future of chemical industry.

Our woman scientists can play key role in development of green and sustainable chemistry.

Thank you for your attention!
The 9th Japan Korea China Women Leaders Forum for Science & Technology
第9回日中韓女性科学技術指導者フォーラム

Poster Session
Eiko NAKAYAMA  
Professor, Faculty of Life and Environmental Science and Graduate School of Life Sciences, Showa Women’s University

**Education**
Degree: BA, Description: in Agricultural Science, Kyoto Univ., Japan, 1982  
Degree: PhD, Description: in Agricultural Science, Kyoto Univ. Grad. Sch., Japan, 1995

**Research Field**
Wood Science and Technology  
Environmental Science

**Career History**
**Showa Women’s University, Tokyo, Japan**  
Professor, Faculty of Life and Environmental Science and Graduate School of Life Sciences (2007-)  
Associate Professor, Faculty of Life and Environmental Science and Graduate School of Life Sciences (1997-2007)  
Lecturer, Faculty of Life and Environmental Science (1989-1997)  
Research Associate, Faculty of Life and Environmental Science (1985-1989)  
**RIKEN: Institute of Physical and Chemical Research, Wako, Japan**  
Guest Researcher, Polymer Chemistry Laboratory (2005-2006)  
Collaborative Researcher, Polymer Chemistry Laboratory (1996-2005)  
**LUKE: Natural Resources Institute Finland, Helsinki, Finland**

**Civic, Political, and Philanthropic Activities**
The Japan Wood Research Society, Director (2011-)  
The Society of Japanese Women Scientists, Director (2005-)
Yoshihito MORI
Professor, Ochanomizu University
Principal, Ochanomizu University Kindergarten

Education
Degree: BParm in Pharmaceutical Sciences, Tokushihma Univ., Japan, 1983
Degree: PharmD in Pharmaceutical Sciences, Hokkaido Univ. Grad. Sch., Japan, 1988

Research Field
Nonlinear Phenomena in physico-chemical system and microwave technology application for botanical essential oil extraction.

Career History
Pharmacist, Toyama Medical and Pharmaceutical University Hospital, 1988-1989; Researcher, Molecular Institute of Sciences, 1989-1995; Research associate, Nagoya Institute of Technology, 1995-1998; Associate Professor, Ochanomizu University; 1998-2014, Professor, Ochanomizu University, 2014 up to now. Ochanomizu University Izumi Nursery Principal, 2014-2016.

Achievements
The nonlinear phenomena research revealed surface tension-driven oil-droplet movement was directed in an asymmetrical boundary and surfactant foam production in space was bifurcated on gravity and the collaboration with Afghan women scientists was made on microwave-assisted essential oil extraction.

Civic, Political, and Philanthropic Activities
Member of Japan Inte-Society Liaison Association Committee for Promoting Equal Participation of Men and Women in Science and Engineering, 2005 up to now; Chair, Science Summer School for Girls at National Women's Education Center, Japan, 2007; Member of Gender-equality Promoting Committee of The Chemical Society of Japan, 2004 up to now. Member of Tokyo Bunkyo-ward equality committee, 2008 up to now. Host professor of Japan governmental aim for Afghan women promotion, 2003 up now

Current Memberships
Member of The Chemical Society of Japan: Member of Japan Electromagnetic Energy Application: Member of The Japan Society of Microgravity Application.
Poster Session Coordinator (Japan)

Maki IWAKUMA
Vice President, The Institution of Professional Engineers, Japan
Fellow of The Institution of Professional Engineers, Japan
Fellow of Japan Society of Civil Engineers

Education

Degree: Bachelor of Agriculture, Faculty of Horticulture, Chiba University
Registered Professional Engineer, Japan (Applied Science, No.15111)

Research Field

Environmental Study and Research

Employment Record:

1972-: Engineer, CTI Engineering Co., Ltd.
1989-1994: General Manager, R&D Division, Environmental and Biotechnology CTI Engineering Co., Ltd
1994-2005: Director, CTI Science Systems Co., Ltd.,
2006-2009: Executive Vice President, CTI Science Systems Co., Ltd
2010-Present: Chief Engineer, Institute for Environmental Monitoring TOKEN C.C.E. Consultants Co., Ltd.

Professional Memberships:

As the Institution of Professional Engineers, Japan (IPEJ)
2005-2009: Board of Directors Member
2005-2007: Vice-Chair, Policy and Planning Committee
2007-2009: Vice President/Chair, Publicity Committee
2011-2015: Chair, Gender Equality Committee
2017-Present: Board of Directors Member /Vice President/Chair, Corporate Planning Committee

As Women Engineers Society
1985-1991: Committee Member, the Society of Women Civil Engineers
1991-1997: Secretary-General, the Society of Women Civil Engineers
1998-1999: Vice-Chair, 11th International Conference of Women Engineers and Scientists (ICWES-11)
2004-Present: Committee Member, International Network of Women Engineers and Scientists, Japan
2009-2011: Director, the Woman Professional Engineers Society of Japan (Non-Profit Organization)
2015-Present: Committee Member, Steering Committee of National Women's Education Center

Awards

1996: Award of the Institution of Professional Engineers, Japan
Poster Session

(1) SJWS:
Recent Activities of the Society of Japanese Women Scientists

(2) JWEF:
History, Objectives and Activities of Japan Women Engineers Forum

(3) Girls’ STEM Career Path Project (GSTEM-CPP):
Junko Kogure / Megumi Furuichi
Encouraging Teenage Girls to Choose Career in STEM Field
– Report from Natsugaku (Girls’ Science Summer Camp)

(4) Dilinigeer Dilixiati, Maya Ueda, and Toshihiro Kondo
(Graduate School of Humanities and Sciences, Ochanomizu University)
High Electrocatalytic Activity for Oxygen Reduction Reaction of Ni and Co
Core-Pt Shell Nanoparticles

(5) Jafari Samira
(Department of Chemistry and Biochemistry, Division of Advanced Science,
Graduate School of Humanities and Sciences, Ochanomizu University)
Afghan Achillea santolina L. essential oil extraction by conventional and
microwave heating

(6) ESCO (Environmental Science Club of Ochanomizu University)
https://ochakan.1net.jp
Nanako KAWANO and Shoko TANAKA
Outreach Activity in Science
Establishment, purpose, membership of SJWS

The Society of Japanese Women Scientists (SJWS) was established in April, 1958 to foster friendship among female scientists, facilitate knowledge exchange among them in various fields of research and provide support during their career with the ultimate goal of advancing world peace. Since April, 2014, SJWS has become the general incorporated association.

Now in 2019, the number of members is about 350, and there are a wide range of members, including researchers in science, engineering, medicine, pharmacy, and agriculture, belonging to universities, research institutions, as well as researchers and engineers from companies. It is a collaborative organization of the Science Council of Japan, and is active in Hokkaido/Tohoku Block, Kanto Block, Tokai/Chubu/Hokuriku Block, Kansai Block, Chugoku/Shikoku/Kyushu/Okinawa Block.

SJWS supports female researchers and scientists

Activities I

- Seminars for SJWS members and non-members who are active in the natural science field, including famous foreign researchers.
- Symposions and social gatherings of female scientists.
- Science classes for small children and experimental guidance at summer school for high school girls.
- Academic journals published by Japanese women scientists (once a year). NEWS published (twice a year).
- Member of the Japan Inter-Society Liaison Association Committee for Promoting Equal Participation of Men and Women in Science and Engineering (EPMEWSE).
- Launched SJWS Science Communicator Certification System (2007-).

Recent Activities

- The 12th Academic Conference & 60th Anniversary Lecture was held in November 3, 2018 (Sat / Holiday) at Showa Women’s University Cosmos Hall & Sofia
  ◊ Commemorative lecture 1
  RIKEN Center for Developmental Biology (CDB)
  Masayo Takahashi, M.D., Ph.D., Project leader
  ◊ Commemorative lecture 2
  Okinawa Institute of Science and Technology Graduate University (OIST) Machi Dilworth, Vice President for Gender Equality and Human Resources Development

Activities II

- SJWS Early Career Investigator Award; award will be given for members of the Society who have made research achievements in the field of natural sciences and can expect future prospects, agree to the purpose of the Society, and strive to achieve it. Since 1996, 49 people have been awarded.
- SJWS Distinguished Service Award; award certificates and anniversary gifts will be presented to those who have contributed to the promotion and research of Japanese female scientists (non-members are allowed) or who have made significant contributions to the association. Since June 1996, 44 people (including two men) have been awarded.

Recent Activities

The 25th Early Career Investigator Award and Distinguished Service Award to be recruited

SJWS office

in Kondoh laboratory, Tokyo Institute of Technology
B-60, 4259 Nagatsuta-cho, Midori-ku, Yokohama, Kanagawa, 226-8501 JAPAN
E-mail: sjws-office@sjws.info Tel & Fax: 045-924-5800 URL: http://www.sjws.info/
What JWEF is:

JWEF was established in 1992 for women engineers to achieve the objectives by networking and exchanging information. The objectives are to improve each engineer’s skill, to create the comfortable working environment where women engineers can demonstrate own abilities, and to contribute to society in increasing the number of women engineers.

History:

Japan experiences the industrial restructuring driven by specialization and advancement in science and technology. Accordingly, the mobility of engineering population and the diversity of career paths and responsibilities in the profession have been increasing.

Most of all, there has been a growing demand for engineers. Meanwhile, many women engineers have made significant contribution to the profession.

However, the absolute number of women engineers is still small. Also, the individual expertise is not always reflected on current human resources for engineering.

JWEF promotes networking among women engineers who often leave to be isolated in their workplaces, such as enterprises, educational and research institutes.

We hold various training courses across sectors and fields. These activities provide opportunities for women to achieve the self-development as well as to be empowered to play an active role in the profession.

Furthermore, JWEF conducts various researches and studies, and develops socially influential recommendations based on the findings.

JWEF Objectives:

➢ Networking and Friendship
  We promote
  ❖ Networking among women engineers across specialties
  ❖ Networking with female students aspiring to an engineering career
  ❖ Networking with other Japanese as well as overseas organizations including INWES (International Network of Women Engineers & Scientist)
  ❖ Friendship through regular meetings and interest groups

➢ Exchanging Information
  We promote
  ❖ Exchanging information across sectors and fields
  ❖ Research and Study on women engineers

➢ Increasing and Empowering Women Engineers
  We provide
  ❖ Career information and role models for female students including junior/senior high school and university students
  ❖ Recommendations and messages to build gender-equal society

➢ Career and Leadership Development
  We encourage
  ❖ Career and leadership development through lectures and training courses
  ❖ Enhancing knowledge and skills through study tours and workshops

URL: www.jwef.jp , Email: info@jwef.jp
Activities:
➢ Symposium, Regular meeting, and sight visit
   Recent Events and topics
   ❖ What is “Unconscious Bias” and how to engage
   ❖ Food loss - Way and which women engineers can contribute for future - from view point of SDGs,
   ❖ Sight visits
      • The Latest and largest logistics terminal in Japan,
      • The changes in gigantic Steel industry, work flow and labor force
      • Future of space industry – Japan Aerospace Exploration Agency
➢ JWEF AWARD - Incentive Award to young woman engineer
   To acknowledge and promote the importance and contribution of women engineers in the industry, JWEF awards a young woman, every year, as an excellent role model, who presents her leadership both in the work place and society.
➢ Study group
   ❖ Technology Study group - To grasp the latest industry trends, its challenges, policies, and technologies, the developers, and/or, the policy maker, or industry specialists give lectures.
      Topics are;
      • The relation between Primary Industry and Disaster prevention
      • How industries engage SDGs (sustainable Developments goals).
      • Manufacturing technologies of hardware and components
      • Image Processing Technologies and creation of future value
      • Robotics,
      • Space Industry and more
   ❖ Mentoring Skills Training Group – Improving mentoring skills through actual/real mentoring exercises, and mutual training for mentoring across the different age group.
   ❖ Targeting next generations, JWEF provides High School and Uni-Students with practical advice and guidance for career.
   ❖ Run the trial class for fabrication laboratories, and let children experience the joy of creation/productions. Target - teens under 15 years old.
➢ JWEF News Letter, and periodical information provision via Mail system
➢ Networking
   ❖ Regional/section meeting to energize and promote mutual exchanges between the member who are away from capital and big cities.
   ❖ Cross cultural exchanges between different communities, such as, international bodies, scientist-communities, and delegation to the overseas conference and events.
   ❖ Information exchange between corporate member companies.
   ❖ Information exchange between senior member
   ❖ Social gathering, meeting up with various communities both domestic and overseas. JNWES(Japan Network of Women Engineers and Scientists), JSPEW(Japan Society of Professional Engineers of Women) JSWS(Japan Society of Women Scientists) and other.

Composition of JWEF member:
JWEF is constructed by 3 categories, one is individual member, from various industries, different generations and positions, next category is the student member, and the third group is the corporate member, which are increased proved by the importance and promotion of diversity and inclusion related activities. ‘As of 2018 Individual member (adults and students) 100, Corporate member (companies) 19.
Encouraging Teenage Girls to Choose Career in STEM Field – Report from Natsugaku (Girls’ Science Summer Camp)

Oct 11, 2019
Girls’ STEM Career Path Project (GSTEM-CPP)
Junko Kogure / Megumi Furuichi

Gender Gap Index: Our common subject

Source: Global Gender Gap Report 2018

Female’s low rate in Japanese STEM fields

What makes girls hesitate?

Hard to get jobs?
Difficult Entrance Examination
Hard to get married?
Lacking role models
Hard work in STEM career

Our approach in Natsugaku

Teamwork beyond generation

Source: School Basic Survey 2016 (Ministry of Education)

Our approach in Natsugaku

Choose Careers in STEM with Confidence
Explore STEM Fields
Diversity
Connect with People
Deep Communication
New Models & Mentors

Bringing Over Future Life
Sharing Dreams

Programs Run by Professionals in STEM-Fields
Programs Run by STEM Major College Students

Teamwork beyond generation

National Women’s Education Center (NWEC)
Girls’ STEM-Career Path Project (GSTEM-CPP)
Graduate & Undergraduate students (TA)
Scientists Engineers (Professionals)

Source: EPMEWSE Japan Inter-Society Liaison Association Committee for Promoting Equal Participation of Men and Women in Science and Engineering

Our approach in Natsugaku

Programs Run by Professionals in STEM-Fields
Programs Run by STEM Major College Students

Teamwork beyond generation

National Women’s Education Center (NWEC)
Girls’ STEM-Career Path Project (GSTEM-CPP)
Graduate & Undergraduate students (TA)
Scientists Engineers (Professionals)

Source: EPMEWSE Japan Inter-Society Liaison Association Committee for Promoting Equal Participation of Men and Women in Science and Engineering
Natsugaku (Science summer camp)

Unique Points
- Teaching assistants
  - Programs they voluntarily organized
  - Detailed and customized support for girls
- Many organizations & staff
  Girls can:
  - explore various STEM fields
  - meet various “Real” role models

Point (1) – Teaching assistants (TA)
- 30 Female grad & undergrad students in STEM major
- Support girls’ activities during camp
- Organize & run programs

Original Point (2) - Many organizations & staff
- Over 50 organizations & 250 staff
- Experiments & poster presentations
- “Real” role models for girls

Programs for girls (Organized by TA)
- Meet role models in person
- Image own future in STEM career
- Tell own dream in STEM career
- Share their thoughts

High satisfaction answered
- Girls: Extremely Satisfied 87%, Satisfied 12%, Others 1%
- N=101

Girls’ reports with experiences after Natsugaku
- Presentation as a research project
- Application for overseas training program
- English speech contest

Acknowledgement
National Women’s Education Center
Students’ Natsugaku Planning Committee
- Over 200 delegates from member organization of the Japan Inter-Society Liaison Association Committee for Promoting Equal Participation of Men and Women in Science and Engineering

Grant
- Noevir Green Foundation

Other support
- Roche Ltd.
- PLUS Corp.
- Chugai Pharmaceutical Co., Ltd.
- Other support: Mitsubishi Heavy Industries Co., Ltd.
- Kowa Co.
- KIOJA Corporation.
- Other support: Nissan Holdings Co., Ltd.
- JPL Corp.
- Shionogi Corporation.
- Pacific Enzymes Co., Ltd.
- Other support: Sumitomo Dainippon Pharma Co., Ltd.
- Hitachi Chemical Co., Ltd.
- Other support: The Molecular Biology Society of Japan
- Japan Women’s Science and Engineering Forum.
- Other support: The Japan Society of Applied Physics
- Japan Women Engineers Forum.
- Other support: The Iron and Steel Institute of Japan
- Japan Society for Industrial and Applied Mathematics.
High Electrocatalytic Activity for Oxygen Reduction Reaction of Ni and Co Core-Pt Shell Nanoparticles

Dilinigeer Dilixiati, Maya Ueda, and Toshihiro Kondo
Graduate School of Humanities and Sciences, Ochanomizu University

Introduction

Polymer electrolyte fuel cell (PEFC) has been receiving intense attention as an efficient and clean power source for stationary and automotive applications. Platinum (Pt) is the most stable and active catalyst for the oxygen reduction reaction (ORR) at the cathode (Eqs. (a)) of the PEFC. However, Pt is an expensive precious metal, and moreover, Pt electrocatalytic activity for ORR is not enough to actual operation of PEFC. In order to achieve higher performance and lower cost, the core-shell typed nanoparticles with non-noble metal as a core and noble metal as a shell have been expected. In the Kondo laboratory, we have succeeded to electrochemically construct Ni and Co core - Pt shell nanoparticles on the glassy carbon electrode surfaces and to obtain the higher electrocatalytic activity for the ORR than that of the polycrystalline Pt. In this study, it is aimed to construct the core - shell nanoparticles with higher electrocatalytic activity for the ORR by reviewing how to construct nanoparticles. Here, the particle size was controlled by the potential step method to construct fine Ni core - Pt shell nanoparticles, and their electrocatalytic activity was evaluated using the rotating disk electrode (RDE) system.

\[
O_2 + 4H^+ + 4e^- \rightarrow 2H_2O \quad E^0 = 1.23 \text{ V (vs. NHE)} \quad (a)
\]

Experimental

1. Ni nanoparticle preparation

After the pre-treatment of the glassy carbon electrode (GCE) substrates, the potential of the GCE in the deaerated 0.1 M Na_2SO_4 + 0.1 M NiSO_4 electrolyte solution was stepped to several potentials and determined the stepped potential to be -1.67 V (vs. MSE), where the nuclear formation and growth simultaneously take place.

2. Ni core - Pt shell nanoparticles preparation

Ni nuclear formation takes place just after the potential is stepped. In such instantaneous mode, the size of the Ni nanoparticles can be controlled only by the stepped periods, which were 2 s, 5 s, 10 s, and 20 s. Just after the potential stepped period passed, the potential control was off and the electrode potential was back to an open circuit state. Then, a few drops of concentrated K_2PtCl_4 solution was added into the electrolyte solution and kept for overnight during monitoring DPV.

3. ORR measurements

After ultrasonic washing with ultrapure water for 5 min, the surface area of Pt covered nanoparticles was evaluated by CV, measured in the deaerated 50 mM H_2SO_4 and the electrocatalytic activity for ORR was evaluated by measuring linear sweep voltammogram (LSV) in the oxygen saturated 0.1 M HClO_4.

Results and Discussion

![Ni nanoparticle preparation](image1)

![RDE measurements](image2)

![LSVs of the Ni core - Pt shell nanoparticles with polycrystalline Pt electrode](image3)

Conclusion

- As clearly shown in Fig. 2, when the potential of the GCE was stepped to -1.67 V, Ni nanoparticles can be deposited on the GCE surface with an instantaneous mode.
- From Fig. 3 and Table 1, the electrocatalytic activities of Ni core - Pt shell nanoparticles prepared for the 10 sec deposition period was 3.5 times higher than that of polycrystalline Pt and was highest among Ni core - Pt shell nanoparticles prepared in this study. This result suggests that the size of core - shell nanoparticle is not important, but the thickness of Pt film on Ni is the key factor for the ORR.

Future work

1. Control the thickness of the Pt shell.
2. Preparation of Co core-Pt shell nanoparticles.
Abstract

Afghan Achillea santolina L. essential oil extraction by conventional and microwave heating

Jafari Samira

Department of Chemistry and Biochemistry, Division of Advanced Science, Graduate School of Humanities and Sciences, Ochanomizu University

Microwave technology has attracted attention in recent years. Microwave technology was applied in communication for the first time, but it is used in many fields now. In particular, it is employed in medicinal plant researches for the extraction of essential oils due to its specific heating mechanism, cost, and applicability in atmospheric condition.

Afghanistan is a mountainous country with a high continental climate. The climate and geographical location of Afghanistan have contributed to the diversity and richness of the plant flora in this country. Moreover, most of these plants contain essential oils, however, these essential oils were not extracted and used before. Therefore, the aim of this study is the extraction of essential oil from medicinal plants of Afghanistan by hydrodistillation and microwave-assisted hydrodistillation methods, as well as analysis of the obtained essential oil.

Afghanistan flora comprises about 5000 species and 30% of them are endemic. Traditional medicine in Afghanistan has a long history. For example, people of Wakhan Corridor and Pamir have used medicinal plants to cure their illnesses such as infectious disease, fever, and pain. Additionally, Pamiri people in Afghanistan and Tajikistan, prepare the medical herbs as decoction or tea as well as they use fresh or dried different parts of medicinal plants. Asteraceae is the largest vascular plant family which comprises 1600 genera and 24000 species. Furthermore, four important and famous genera of this family are Artemisia (500 species), Centaurea (500-600 species), helichrysum (600 species), and Achillea (140 species). There are 705 species of Asteraceae family in Afghanistan that 192 of them are endemic. Together with, 17 species of Asteraceae have medicinal value and 15 species contain essential oils. Achillea santolina L. is one of the members of genus Achillea (Asteraceae family) that can be found in Afghanistan, Jordan, Algeria, and Egypt and it contains essential oil. There are conventional and nonconventional methods for extraction of essential oils. Microwave-assisted extraction is one of the modern techniques for the extraction of essential oils from plants that has some advantages over conventional methods such as short extraction time, low solvent consumption, eco-friendly and efficiency. In this study, Achillea santolina L. is used for the extraction of essential oil by hydrodistillation and microwave-assisted hydrodistillation extraction methods.

The dried flowering aerial parts of Achillea santolina L. collected from Mazar-e-sharif was subjected to HD and MAHD extraction. For the MAHD extraction, a single-mode microwave extractor was used that the volume of its flask is 50 mL. Additionally, different power, time and amount of plant materials were examined in the microwave-assisted extraction.
The maximum used power was 210 W and the minimum used power was 180 W for 15-30 min. The yield of extracted essential oil by HD extraction method was 0.75%. Whereas, the essential oil could not be extracted from A. santolina L. using the MAHD extraction method because this plant has less amount of essential oil and it is needed to use more amount of plant materials for the extraction.

High performance thin layer chromatography (HPTLC) with the support of an image processing software was used for the qualitative and quantitative analysis of the obtained essential oil by HD extraction method. The HPTLC analysis was performed using a silica gel 60 sheet and the mixture of toluene-acetone (95:5 v/v) in the twin trough glass chamber. As well as, visualization of the HPTLC sheet was carried out using the anisaldehyde derivatizing reagent. For the image analysis of HPTLC chromatogram, the scanned HPTLC chromatogram was converted to a densitogram using ImageJ software for further analysis. The Rf values of visualized zones were calculated using ImageJ. Then, the qualitative analysis was performed by comparison of the colors and Rf values of visualized zones. Therefore, the three contents of the obtained essential oil were identified that were (+)-limonene, (-)-β-pinene and (-)borneol. In quantitative analysis, the concentration of β-pinene and borneol were determined. The ImageJ software was used to illustrate the calibration curves of β-pinene and borneol and the amount of these two contents were calculated by the obtained regression equation from the calibration curves of β-pinene and borneol. The concentration of β-pinene and borneol were determined 5% and 2.25% respectively in the essential oil of A. santolina L. As well as, the reproducibility of chromatographic method and image analyzing method was assured by calculating the Rf values and concentration of β-pinene and borneol using ImageJ.

In conclusion, A. santolina L. essential oil was extracted by MAHD and HD methods, as well as the obtained essential oil was analyzed qualitatively and quantitatively in this study. The yield of extracted oil by HD extraction was 0.75%, but the extraction of the essential oil by MAHD was not succeeded and the amount of the essential oil was very small and not recoverable. In addition, the qualitative and quantitative analysis was performed by HPTLC with the support of an image processing software. In qualitative analysis, three contents of the essential oil were identified which were (+)-limonene, (-)-β-pinene and (-)borneol. In quantitative analysis, the concentrations of β-pinene and borneol were determined that were 5% and 2.25% respectively. Furthermore, this study can contribute to future studies on this plant from different parts of Afghanistan, as well as extraction by single-mood microwave extractor can be applied on other plants of Afghanistan that are rich in essential oils. on the other hand, the antioxidant and antimicrobial properties of Afghan A. santolina L. can be examined in future studies.
Afghan *Achillea santolina* L. essential oil extraction by conventional and microwave heating

Samira JAFARI
Chemistry and Biochemistry department / Advanced Sciences
Ochanimizu University

2019/10/11

1. Introduction

- Afghanistan is a mountainous country which is rich in plant flora. Most of these plants contain essential oils.
- Essential oils are secondary metabolites which are naturally produced by plants. Almost 3000 essential oils are known which 300 of them are used in pharmaceutical, food, cosmetic and perfume industries. (1)

2. Experimental

1. Plant Material: *Achillea santolina L.* was collected in May 2017 in Balkh city and dried in the shape at room temperature.

2. Conventional Hydrodistillation Extraction Method: 100 g dried powdered aerial parts of *Achillea santolina* L. was subjected to hydrodistillation extraction using a Clevenger type apparatus for 5 h.

3. Microwave Assisted Hydrodistillation Extraction Method: Microwave extraction was performed by using 7g of dried aerial parts of plant in a single mode microwave irradiator at 210 W power for 30 min.
2. Experimental

IV. Analysis Method: HPTLC with support of an image processing software was used for analysis of the essential oil. Chromatography was carried out on a 10*10 cm HPTLC 60 F\textsubscript{254} aluminum sheet (Merck, Darmstadt, Germany). Mixture of toluene and acetone (95:5) was used as mobile phase. The spots were visualized by using anisaldehyde reagent.

3. Results

I. Essential oil yield:
The essential oil yield extracted by hydrodistillation was 0.75%. The essential oil yield in microwave was very small amount and not measurable.

II. Qualitative analysis:
To determine compositions of the essential oil, the color and \(R_f\)s of spots was observed. The \(R_f\)s of sample and standards was calculate by a software after converting the scanned photos of HPTLC sheet to a plot profile.

<table>
<thead>
<tr>
<th>No.</th>
<th>Composition</th>
<th>Standard (R_f)</th>
<th>Sample (R_f)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Borneol</td>
<td>0.49</td>
<td>0.49</td>
</tr>
<tr>
<td>2</td>
<td>D-limonene</td>
<td>0.84</td>
<td>0.84</td>
</tr>
<tr>
<td>3</td>
<td>(\beta)-pinene</td>
<td>0.67</td>
<td>0.68</td>
</tr>
</tbody>
</table>

III. Quantitative analysis:
Quantitative analysis of compositions is performed by illustration of calibration curves of standards.

\[
y = 7745.8x + 1716.8 \quad R^2 = 0.9993
\]

\[
y = 255994x + 1926.7 \quad R^2 = 0.9937
\]

Table 1: \(R_f\) values of standards and sample
4. Discussion

The yield of obtained essential oil by HD was 0.75% (v/w) while the yields of *A. santolina* L. essential oil from Egypt, Algeria and Iran were reported 0.49%, 0.99%, and 0.60% respectively. It was found that this plant has less amount of essential oil.

- borneol: Egypt (1.7%), Algeria (0.22%) and Iran (3.93%)
- β-pinene: Egypt (0.2%), Iran (0.31%), Algeria (1.00%) and Jordan (0.35%)
Outreach Activity in Science
Nanako KAWANO and Shoko TANAKA
ESCO
(Environmental Science Club of Ochanomizu University)
https://ochakan.1net.jp

We talk today about paperchromatographics art and a scientific toy for early childhood education.

Paperchromatographics Art
KAWANO Nanako

ABSTRACT
The science-based art production has been performed and the products are exhibited on a SNS, Instagram. The searching function of the SNS, hash-tag, is used for artists to attract much attention.

Typical patterns in the nature of striped and dotted with periodicity

Periodic patterns in a laboratory are produced based on a scientific principle

Another is staining in the nature or a laboratory

Paperchromatographics produces staining patterns with ink-pens, a paper and water
Pieces of the stained paper are used for making an image

The Instagram hash-tag function is used for artists to attract much attention on it.

A Scientific Toy for Early Childhood Education
Shoko Tanaka

ABSTRACT
Flight models made of aluminum foil were examined in a flight tube. The tube was made of a PVC sheet and raising flow was prepared with a room circulator. Flight behavior was depend on form and size of the models.

I made models having various form and size!

Flight tube  Flight models

Each shape has own value about time and number of rotation, but they have similar trend on a ratio of weight to bottom area.

Let’s go search with #paperchromatographics
Closing Remarks
Session Chair Closing Remarks (Japan)

Yumiko NAGOH
Project Manager, Institute for Open Innovation, The University of Tokyo
Vice President of 3 NPOs (JNWES, GSTEM-CPP, ReSDA)

Education
Degree: BE, Description: Chemical Engineering, The University of Tokyo, Location: Japan, Year: 1984
Degree: ME, Description: Chemical Engineering, The University of Tokyo, Location: Japan, Year: 1986

Research Field
Environmental pollution, Surfactant, Washing mechanism

Career History
Since joining Lion Corp. in 1986, she worked as a researcher of process engineering and detergent development for 18 years. She was awarded President award with the theme of development of new life proposal detergent “Heyaboshi-TOP”. After she worked in market research and product planning department for 6 years, she started her new career for public relations division in The University of Tokyo. Recently, she supports Chance Discovery Labs. as a project manager in Institute for Open Innovation. Also she is dedicating to NPO or volunteer activities for next generation, science education, revitalization of senior generation and regional activation.

Civic, Political, and Philanthropic Activities
She has been a leader of mentoring subcommittee at Japan Womens Engineers Forum (JWEF), a 20-year member. Various kinds of career support activities are reported on JWEF website (http://jwef.jp/) for a wide range of age groups, from elementary school students to seniors. She serves as vice president at three NPOs, JNWES, STEM Career Path Project for Girls (GSTEM-CPP) and Relife Social Design Association (ReSDA). Since 2018 she is also involved in a regional revitalization project for the Takatsu River basin in Shimane Prefecture.
Closing Remarks (Japan)

Fusako UTSUMI
President of National Women’s Education Center (NWEC)

Education
1971 graduated from the Department of Mathematics, Tsuda University

Career History
Since joining NEC in 1971, she worked as a Software Development Engineer and was appointed a manager of the Engineering departments. In 1989 she had begun to engage in development of female workers of the company when she was transferred to the Personnel Department. Since then she had undertaken the management of personnel, labor and human resources. In 2001 she was appointed Managing Officer of the Personnel Department of NEC Soft, Ltd. and assumed a presidency of NEC Learning Ltd. in 2005. In 2011, she was appointed as a president of National Women’s Education Center (NWEC). As a first president from private sector assuming the position, she has been expanding the boundaries of the organization including promotion of gender equality and diversity in the workplace and launching new programs for young women.

Achievements
She is the author of “Watashi wa Jinji Kacho Ichinensei” (I’m a First Year HR Manager), Keidanren Publications 1990 and “Motto Suteki ni Working Life” (How to Better Enjoy your Working Life), Daiwa Shuppan 1993.

Civic, Political, and Philanthropic Activities
Auditor, Ochanomizu University (2016 –)
Administrative Council Member, Saitama University (2014 –)
Advisor, The Tokyo Organising Committee of the Olympic and Paralympic Games (2014 –)

Current Memberships
Japanese Society for Engineering Education (Chair of Diversity Working Group, 2008 – )
Japan Society of Educational Information (Board Member 2011 – )
Haneda Airport

Welcome Dinner @ Sunshine Prince Hotel

20191010 Tokyo JAPAN
The 9th JCK-WLF Photos

Opening

Session 1

YOSHIDA-NORO
KUSUME
NOJIRI
KIMURA
M-H YU
SASAKI
YOSHIDA-NORO
S Y KIM
R LI

Session 2

YAMAGUCHI
S K LEE
E JU
H LEE

Forum@ Ochanomizu Univ.
20191011 Tokyo JAPAN
The 9th JCK-WLF Photos

Tea Break

Lunch

Banquet @ Ochanomizu Univ.
20191011 Tokyo JAPAN
Gender Equality for Sustainable Development Goals
持続可能な開発目標がめざすジェンダー平等

9:00-17:00, Friday, October 11, 2019  Ochanomizu University
2019年10月11日（金）9:00-17:00  お茶の水女子大学 国際交流留学生ブラザ

Opening Ceremony
Session Chair: Hitomi Kumagai, CBS, Nihon Univ. Next President of EPMEWSE
Message from MEXT Akira Kusume
Chair of EPMEWSE Mihoko Nojiri, KEK
President of JNWES Ryo Kimura, Sakae Design
President of KOFWST Myeong-Hee Yu, KIST
Head of CWAST Delegation Jihong Yu Prof. Jilin University, CAS
President of Ochanomizu Univ. Kimiko Murofushi

Session 1: Evaluation Systems for Gender Equality Activities
ジェンダー平等度評価システム
Session Chair: Mei Tian, Prof. Deputy Director, Zhejiang Univ. Medical Center
Japan Chikako Yoshida-Noro, CIT, Nihon Univ. & Yasuko Sasaki, Ochanomizu Univ.
Korea So Young Kim, Grad. Sch. of Science & Technology Policy at KAIST
China Ruomei Li, Former Secretary-General, CSEE

Session 2: Career Development Programs for Next Generations
次世代キャリア開発プログラム
Session Chair: Heisook Lee, GISTeR, KOFWST, Ewha Womans Univ.
Japan Rie Yamaguchi, JWEF
Korea Suk Kyeong Lee, The Catholic Univ. of Korea, School of Medicine.
China Erfan Ju, Senior Engineer, Director, GE Toshiba Silicons, Great China

Session 3: Role of Chemistry for SDGs
持続社会のための化学の役割
Session Chair: Akiko Itakura, Group Leader, NIMS
Korea Heesun Chung, Dean, Prof. GRAST, Chungnam National Univ.
China Zhimin Liu, Prof. The Institute of Chemistry, CAS

Poster Session Coordinators: Eiko Nakayama, Showa Women’s Univ.,
Yoshihito Mori, Ochanomizu Univ., Maki Iwakuma, P.E. Jp

Closing Remarks Session Chair: Yumiko Nagoh, Univ. Tokyo
President of NWEC Fusako Utsumi

Banquet at Ochanomizu University