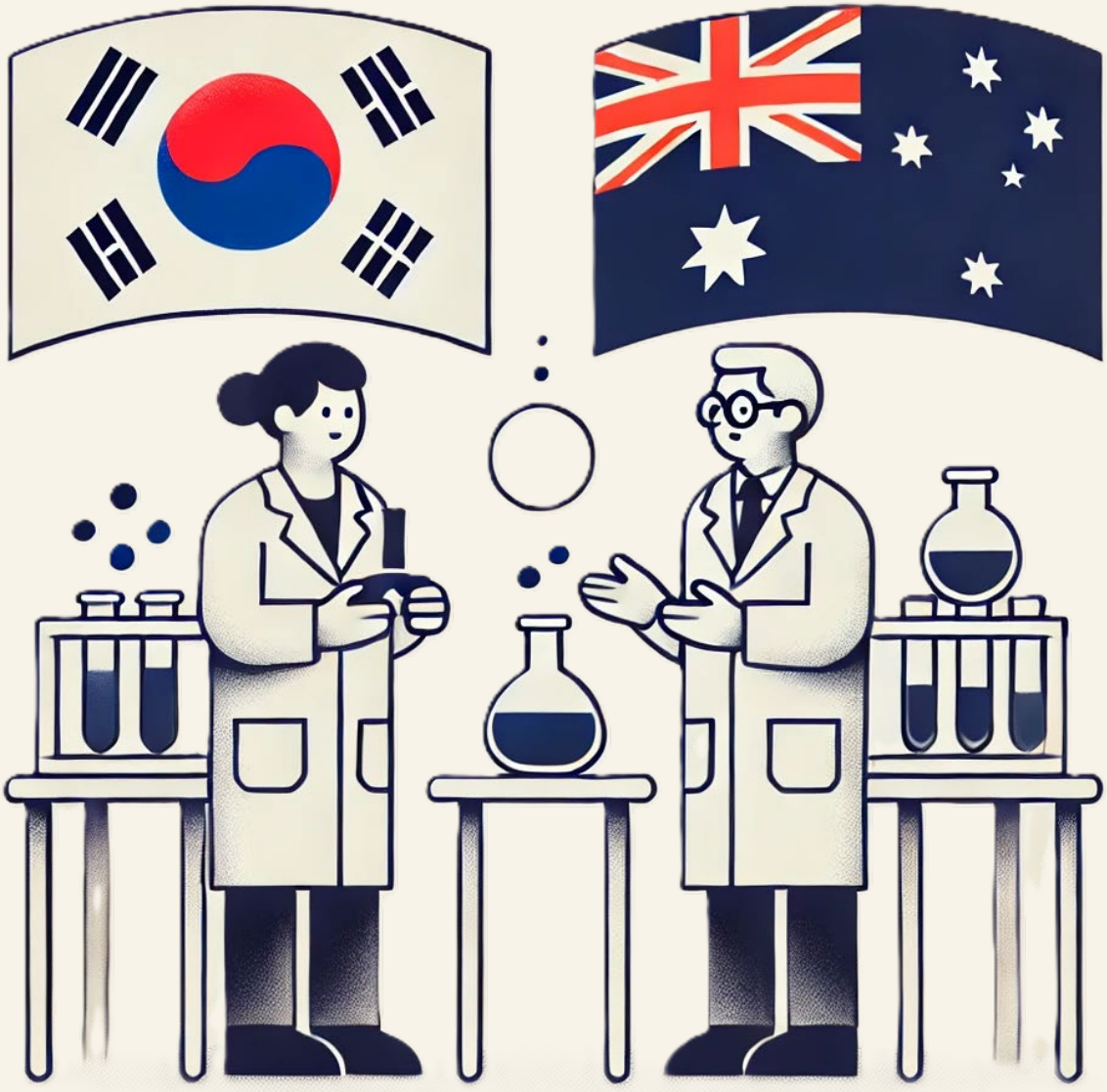
KASEA

Quarterly

Korean Academy of Scientists and Engineers in Australia

Vol 3 Issue 2



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GREETINGS FROM THE AMBASSADOR

안녕하십니까.

호주와 뉴질랜드 곳곳에서 활동하고 계신 재호주한인과학기술인협회(KASEA) 회원 여러분들께 정기 학술지 *KASEA Quarterly*를 통하여 인사드리게 되어 무척 기쁘게 생각합니다. 저는 제24대 주호주대사로서 막중한 책임감을 가지고 이번 8월부터 새로이 업무를 시작하였습니다.

한국과 호주는 한국전쟁에서 함께 싸운 혈맹으로 1961년 수교 이래 자유, 민주주의, 법치라는 핵심 가치를 공유하며 긴밀한 협력 관계를 발전시켜 왔습니다. 양국은 수교 60년인 2021년 양국 관계를 '포괄적 전략 동반자 관계'로 격상하고 인도-태평양 지역의 핵심 파트너로서 과학기술, 기후변화 대응, 사이버안보, 글로벌 공급망, 국방·방산 등 다양한 분야로 협력을 더욱 확대해 나가고 있습니다.

특히 과학기술 부문에서 한국과 호주의 우호와 신뢰 관계는 앞으로 더욱 깊어질 여지가 크다고 봅니다. 코로나 19 팬데믹과 그 여파, 기후변화로 인한 각종 이상현상 등 어려운 도전들이 우리 앞에 놓인 가운데 AI, 퀀텀, 우주, 바이오메디컬 등 다양한 과학기술은 획기적인 문제 해결의 열쇠가 될 뿐 아니라, 미래 산업의 경쟁력과 안보 문제에까지도 중요한 역할을 하고 있습니다. 호주는 한국의 상용화 및 첨단 제조 역량에 큰 관심을 가지고 있으며 핵심기술 국제협력에 적극적인 정책을 펼치고 있는 만큼 양국 간에 의미 있는 과학기술 협력 성과를 기대하고 있습니다.

KASEA로 대표되는 우리 과학자 여러분의 헌신과 뛰어난 연구 성과 덕분에 호주 내에서 대한민국의 존재감이 더욱 빛나고 있음에 진심어린 감사의 말씀을 드립니다. 저 또한 여러분들의 활동을 지원하기 위해 최선을 다하겠습니다. 차세대 회원 분들과의 연결을 더욱 튼튼히 하기 위한 대학 챕터 설립을 비롯한 새로운 시도와 노력들이 성공적으로 이루어져 KASEA가 더욱 발전해 나가기를 소망하며, 새 봄을 맞아 모든 회원분들께 새로운 희망이 가득하시기를 바랍니다.

주호주대사 심승섭

NET-ZERO EMISSION BY GREEN AMMONIA

Woo Jin Lee (Senior Research Scientist, CSIRO)

Ammonia (NH_3) is well known for its noxious odour. Since German chemists Fritz Haber and Carl Bosch developed a chemical synthetic process in 1909 (Nobel Prizes in Chemistry awarded for their invention, so called the Haber-Bosch Process in Figure 1; $N_2 + 3H_2 = 2NH_3$), it has revolutionised agricultural industry by massive production of fertilisers from synthetic ammonia. As of 2020, the global production of ammonia reached around 190 Million tons (equivalent to US$200 billion) with an annual growth rate of 6%. Figure 2 shows the worldwide ammonia shipping infrastructure. Meanwhile, green ammonia has recently been attracting significant interests from the industry, academia and R&D sectors since it is emerging as a powerful decarbonisation agent. The Haber-Bosch process has high carbon emission intensity because most hydrogen is coming from steam methane reforming (SMR), which accounts for 10 kg of CO_2 per kg of hydrogen. For green ammonia, hydrogen is supplied from renewable solar- or wind-powered electrolyser of water ($H_2O = H_2 + O$), which is environmentally sustainable. Australia's renewable energy superpower will play a crucial role in supplying renewable hydrogen to East Asian markets like the Republic of Korea and Japan in the near future. However, shipping and transferring liquified hydrogen from Australia to the point of end-users (8,000 km) is very challenging, primarily due to the huge cost of maintaining it at -253 °C. In this regard, ammonia is considered the most economical hydrogen carrier. For a scenario modelled for 2028, the levelised cost of hydrogen (LCOH) for being transferred from Australia to Korea and Japan in liquid ammonia can be reduced by up to 60%, compared to that of liquefied hydrogen. Therefore, green ammonia will be a game-changing factor for Australian renewable energy market to significantly impact the current transition towards net-zero society.

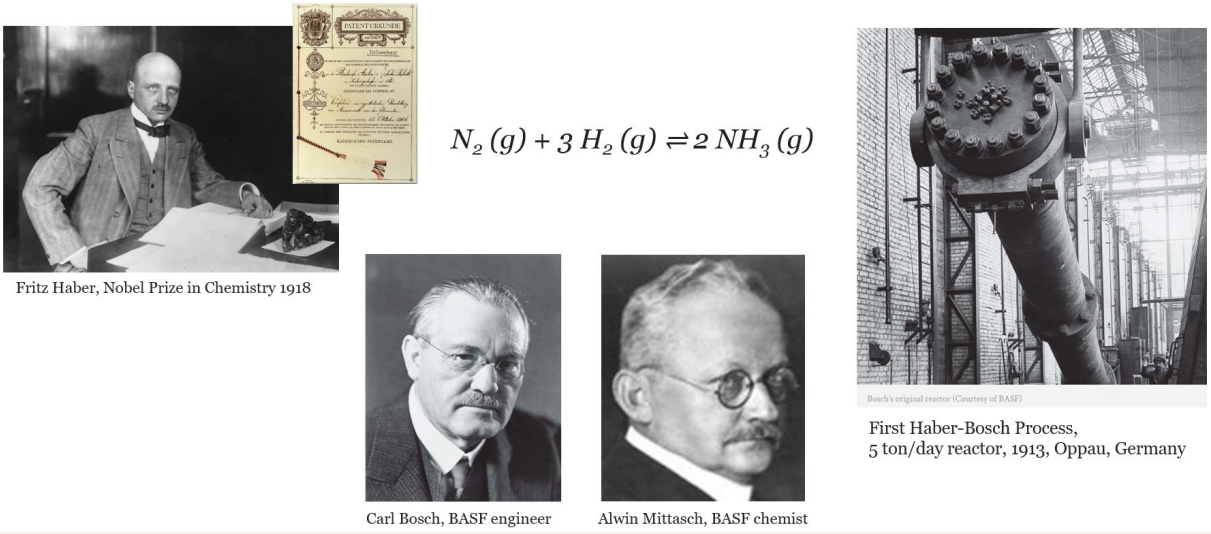


Figure 1. Revolutionary invention to synthesise ammonia by Haber-Bosch process in early 20th century, attributing to dramatical increase in agricultural productivity.

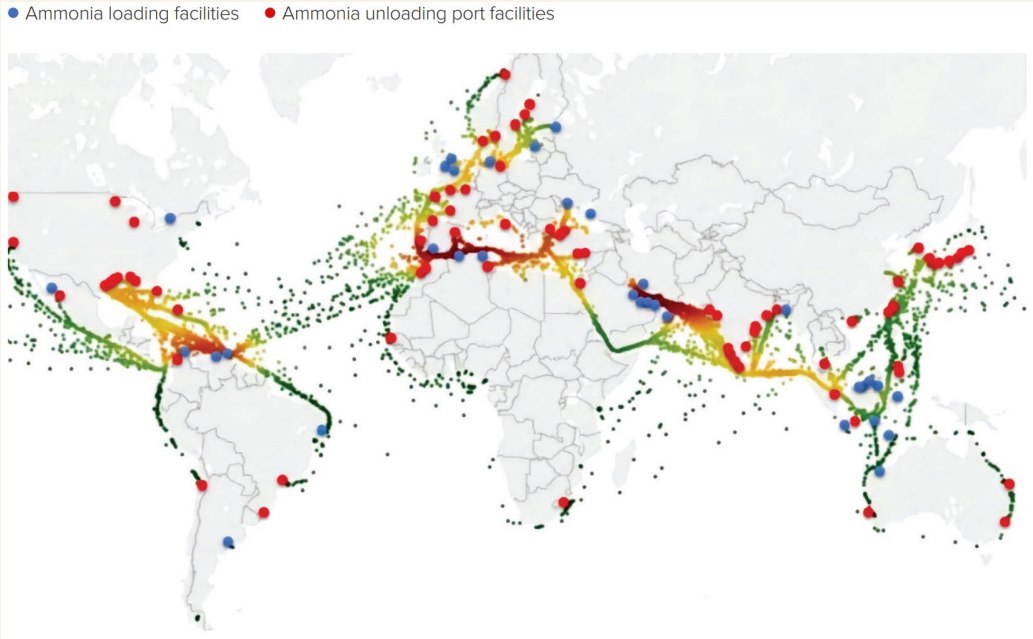


Figure. 2. Worldwide ammonia shipping infrastructure, including a heat map of liquid ammonia shipping vessels and existing ammonia port facilities (*Source: The Royal Society*).

Currently, about 85% of ammonia is being used for fertiliser manufacturing globally. As the ammonia value chain is shown in Figure 3, its extended usage will be rapidly deployed to decarbonise the energy sectors. Green ammonia can play as an energy storage medium because it is easily stored in large quantities in a liquid form at mild conditions (10 bar or -33 °C), representing around 40% energy density of petroleum. It can be also used as a zero-carbon fuel in fuel cells or by combustion in engines, industrial burners and gas turbines. Reflecting the current progress in demonstration, alternative fuel to maritime industry will be the first demanding sector to adopt green ammonia. In addition, direct generation of electricity is one of potential uses for ammonia through fuel cells or gas turbines to provide power to the grid. After ammonia cracking (i.e. decomposition) and gas separation, pure hydrogen can be produced and supplied to existing energy supply chains. There are several landmark works done across the leading countries. In Japan, IHI Corporation has demonstrated the world's first CO_2-free power generation with a gas turbine using liquid ammonia (2,000 kilowatt). The company is also undertaking the demonstration project to replace 20% coal with ammonia in Hekinan thermal power station.

In addition, research has been carried out to establish a technology to combust ammonia-hydrogen fuel blend in gas turbine. In Australia, the federal and state governments have been giving their full support to green ammonia projects, primarily through Australian Renewable Energy Agency (ARENA). One of the recent remarkable projects is Yuri project in the Pilbara of Western Australia, where French electricity giant ENGIE S.A. and Japanese MITSUI Co. are building 18MW scale solar plant to produce renewable electricity and 10 MW electrolyser to produce green hydrogen that will be supplied to the existing ammonia production facility owned by Yara International (total project cost $87 million; See Figure 4). In the meantime, as a huge potential green ammonia importer, more than 30 stakeholders

from government, research institutions and industry in Korea have officially launched ‘Green Ammonia Alliance’ to collaborate in all parts of the ammonia value chain: production, transportation, cracking and utilisation in 2021.

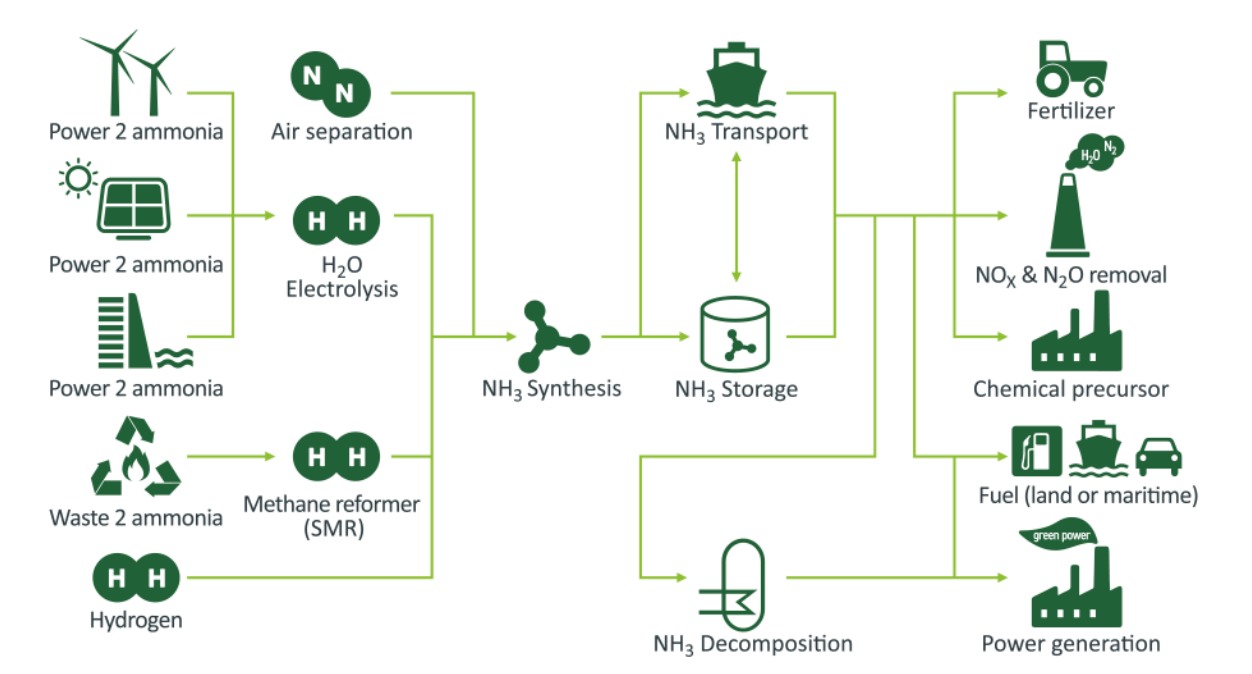


Figure 3. Green ammonia value chain (credit to Proton Venture).

Figure 4. Panoramic view of Yuri project plant in Karratha, Western Australia (credit to ENGIE).

In summary, green ammonia will be a game changer in decarbonisation technology. Apart from conventional use in fertiliser, it will be a powerful medium to supply renewable energy in power generation and transportation sectors. Hence, it will play a critical role in transition

towards net-zero emissions. Given its significant potential in renewable energy, Australia will lead the global market in green ammonia value chain. To build the pathway for deploying green ammonia at scale, international collaboration among the parties of diverse expertise is highly desirable to create the value.

<References>

1. The Royal Society - Ammonia: zero-carbon fertiliser, fuel and energy store (2020).
2. Global Hydrogen Review, IEA Report (2022).
3. Australia’s emerging hydrogen and ammonia industry, Minerals Council of Australia (2022).
4. Ammonia for power, Prog Energy Combust Sci, 69 (2018), 63-102.
5. Ammonia Energy Association - Ammonia Energy APAC Conference 2023.

제 2 회 세계한인과학기술인 대회 후기

Youngil Kim

(The ARC Centre of Excellence for Climate Extremes (CLEX), Climate Change Research Centre (CCRC), University of New South Wales)

이번 제 2 회 세계한인과학기술인 대회에서는 기후변화, 생명공학, 인공지능 등 현재 대두되고 있는 미래 핵심 기술 및 연구 결과들이 발표되었고 많은 관심을 받았습니다. 정부 기관뿐 아니라 여러 기업의 관계자분들이 참석하여 각 분야별 최신 기술과 지식을 공유해주셨고, 이를 통해 학계 뿐아니라 산업에서 적용되는 실제 적용사례들을 많이 접해볼 수 있었습니다.

대회 중 학술분과는 지속가능 미래를 위한 첨단과학기술, 지속가능한 푸른지구, 지속가능 미래를 위한 사회적 준비로 나뉘어 있었는데 첨단과학기술과 함께 지속가능한 지구를 만들고 미래를 준비한다는 큰 틀안에서 짜임새 구성된 것 같아 참석자로서도 흥미롭게 발표를 들을 수 있었습니다. 저는 지속가능한 푸른지구의 소주제인 기후변화 과학 세션에서 발제를 맡았습니다. 이 세션은 다양한 시각에서 기후 위기에 대응하는 연구들을 소개하는 자리였는데 지역별 미래 극한 기후 자료를 생성하는 제 연구가 발제 중 하나로 선정되었습니다. 최신 연구를 하시는 다른 분들이 많이 계셨는데 제가 제출한 내용이 우연히 세션 주제와 맞아 선정된 것 같아 부끄러웠지만 최선을 다해 준비하였습니다. 세션 당일 발제가 끝난 후 여러 연구자 분들 및 교수님들과 연구 및 해외생활에 대한 질의응답 시간이 있었는데 새로운 시각과 교류 가능성을 배우고 연구자로서의 방향성을 정립하는 소중한 시간이었습니다. 세션장을 맡아주신 국가녹색기술연구소 이상협 소장님께서도 발제자들을 배려하며 진행해주셔서 더욱 원할게 발표와 토론을 할 수 있었습니다.

처음 참석한 이번 대회에서는 훌륭한 기조연설이 많이 있었습니다. 짧은 글에 모든 분을 언급할 수는 없지만 플로리다대학교의 이지현 교수님의 리더십 강연에 특히 깊은 인상을 받았습니다. 외국에서 여성이자 이방인으로서 본인의 경력을 어떻게 개발해 왔는지, 연구자로서 어떤 마음가짐을 가져야 하는지, 그리고 우리가 앞으로 나아가야 할 방향은 어디인지 등 도전의식과 삶에 대한 영감을 주셨습니다. 참석하신 많은 분들이 해외 유학생 또는 연구자로서 언어나 문화에 적응하는 것에 어려움이 있는 것을 알기에 서로 공감하고 위로와 격려를 받는 귀한 시간이었습니다.

환영 및 환송 만찬도 매우 인상적이었습니다. 참석자들이 서로 교류할 수 있도록 주최측에서 배려해주셔서 테이블마다 새로운 분들을 만나고 여러 나라의 연구나 생활 환경 등을 들을 수 있어 갚진 시간이었습니다.

끝으로 다시한번 세계 한인 연구자를 초대해주시고 교류할 수 있는 기회를 주신 모든 분들께 감사드립니다. 이번 대회를 통해 얻은 지식과 경험을 바탕으로 앞으로도 연구와 협력을 이어나가며 과학기술 발전에 기여하도록 하겠습니다. 이러한 대회가 지속적으로 개최되어 한인 과학기술인들 간의 교류가 더욱 활발해져 세계의 혁신 연구를 협력 및 선도할 수 있길 바랍니다.

YOUNG PROFESSION FORUMN (YPF) REVIEW

Tammy Lee

I was honoured to be the Australian delegate for Young Professional Forum (YPF), hosted by the Korean Federation of Science and Technology Societies (KOFST). The forum brought together 28 international delegates from nine different countries studying their Masters, PhD or a holding a post-doc position in a science or engineering field. It was an invaluable opportunity to network with fellow like-minded Korean scientists, share ideas, and reconnect with our Korean heritage. As an embryologist and PhD Candidate, I was exposed to various industries and perspectives from those outside of my usual field. Delegates were from diverse industries including evolutionary biology, semi-conductors, astrophysics, and neuroscience.

We were allocated into groups to discuss various topics on science and technology. Our group discussed the topic “Enhancing Korea’s image through science and technology”. We shared that Korea’s image already is a positive one – hardworking, a place with high technology, fast internet speeds and of course, the dominating Hallyu wave. We shared that Korea could leverage their gaming industry and further incorporate science and technology with K-culture (e.g. G-dragon’s recent appointment as a visiting professor at KAIST). Further enhancing Korea’s image will enable Korea to share their innovative science/technology sectors with the world and in turn increase collaboration with other countries.

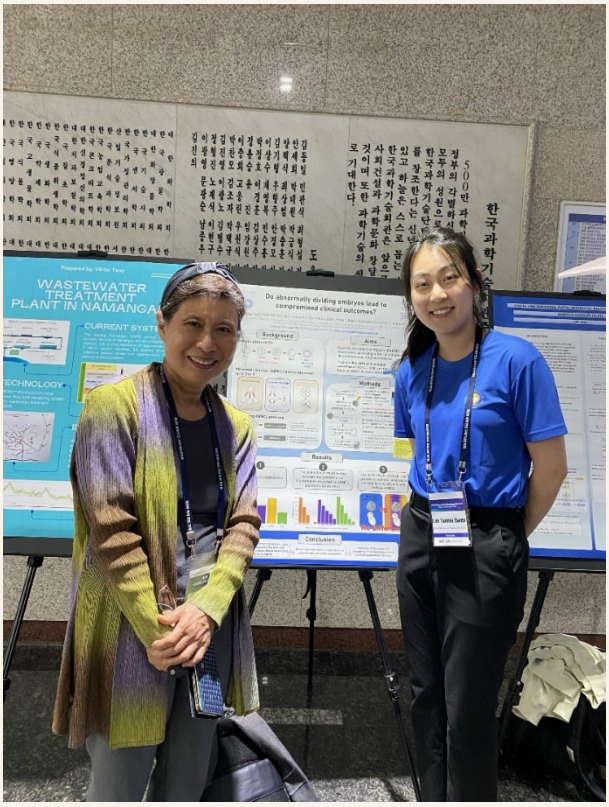
YPF delegates were also privileged to attend the 2nd World Congress of Korean Scientists and Engineers. We heard from distinguished international speakers on space exploration, medicine, and climate change. We also had opportunities to share our research with local Korean academics and industry professionals by poster presentation. The forum also held a FameLab competition in which we had three minutes to present our research using props instead of a PowerPoint presentation. As I work in IVF and my research is on atypical embryo development, I brought along a sperm stress ball and play doh to show abnormal divisions of the embryo.

Throughout the week we also took part in excursions. We reconnected with our cultural roots by visiting the National Museum of Korea. The YPF program also included two corporate site visits – the Korea Railroad Research institute, where we explored their R&D initiatives, and LG Science Park, where we witnessed cutting-edge Korean technology.

I would like to give my sincere thanks to KASEA and KOFST for this unforgettable opportunity to attend YPF. The experiences, knowledge, and friendships I gained were truly invaluable. I strongly encourage those who are eligible to apply in the future.

2024
YOUNG PROFESSIONAL FORUM

2024
YOUNG PROFESSIONAL FORUM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PLANT IN NAMANGA

YOUNG GENERATION FORUMN (YGF) REVIEW

Yejin Han

During our time at YGF, we had the chance to explore a wide variety of fields in science, including space, neurology, and technology. This experience opened our eyes to different areas we might be interested in and gave us a glimpse of the possibilities in these fields. We also learned how to make the most of the opportunities given to us, gaining insights on how to better navigate our academic and career pathways. Listening to personal experiences and stories from the professors was particularly inspiring. Their journeys showed us how we can find our passion in life and the dedication needed to pursue it.

The event featured both large lectures and smaller, more intimate settings where we could have one-on-one Q&A sessions with the professors. These smaller sessions allowed for deeper discussions. Even if a professor's field was not directly related to our interests, there was always something valuable to learn from their experiences and journey. This made us appreciate the diversity of scientific fields and the unique paths each scientist takes.

Participating in YGF also provided me with an opportunity to reflect on my goals and what I want to achieve in my career. Meeting esteemed professors and fellow students from around the world helped me gain a better understanding of my own aspirations and the steps I need to take to reach them.

One of the most enjoyable aspects was meeting science students from all over the world. I made many new friends and connections with people who share similar interests and passions. Everyone was friendly and welcoming, making the experience very enjoyable. We also visited various museums, such as the Museum of Technology and the War Memorial of Korea, which increased our understanding of Korean culture and history. These visits were not only educational but also a nice break from the academic sessions.

We took part in various fun activities within our groups, which were based on our specific fields of study. This was particularly helpful because it allowed us to meet and compare our studies with students studying similar subjects in different countries. One memorable activity involved creating a YouTube Shorts video about the present and future of science. This collaborative project helped strengthen our bonds and allowed us to creatively express our ideas. Another enjoyable activity was making a personalised traditional stamp, which was another fun way to immerse ourselves in and learn about Korean culture.

Overall, the event was a great mix of learning, cultural exchange, and personal reflection. The diverse range of topics and the different formats of interaction made it a memorable experience. It was not just about gaining knowledge but also about connecting with others, reflecting on our own paths, and enjoying the journey together. I am grateful for the opportunity and look forward to applying what I have learned in my future endeavours.

YOUNG GENERATION FORUMN (YGF) REVIEW

Angie Park

I was a participant in the Young Generation Forum in July of 2024. I was the only participant from New Zealand, so I didn't know anyone else that was going, and while I am quite fluent in Korean, I was not as confident in Korean as English. While I was definitely looking forward to the event, these things definitely made me a bit apprehensive as well. However, from the first day, everyone was made to feel very welcome, and our days were kept full and exciting.

From an academic viewpoint, the YGF was an amazing, once in a lifetime opportunity. We were given the chance to meet Korean scientists and academics based all around the world, and were able to listen to these people talk about their work and their passions. Translators were provided for those that didn't understand Korean, so the event was very inclusive, and we learnt a lot about these scientists' lives and their passions. From a networking point of view, this was a unique and invaluable experience.

The YGF was also invaluable in terms of cultural experiences. We were able to do unique activities like making a traditional Korean seal, visit museums to learn more about Korea and its history, and we were also able to explore Seoul after all of our scheduled activities were finished. As we were mostly students based outside of Korea, this was really an exciting opportunity to learn more about Korea and to experience the country for ourselves.

The activity I enjoyed most from YGF was probably the country booth. This was where students from different countries came together to showcase unique foods and items from their countries. It was a very fun event and was an amazing opportunity to experience a small part of life in different countries around the world.

As much as I was grateful for the academic and cultural opportunities presented to us during this event, the part I will be most grateful for from YGF is the people I met. While we were all strangers at the beginning of the week, by the end of the week, it felt like we had been friends for much longer. We were able to meet peers from countries all over the world - America, Canada, Russia, France, and more - and as we spent a week together, we were able to learn so much about each other's lives. During this week, it felt as though we had become good, lifelong friends.

The Young Generation Forum was an incredible opportunity in all aspects. It expanded my horizons so much, opening a window to the rest of the world, and helped me realise much more about what I personally wanted to do in the future. This is definitely a week that I will treasure for the rest of my life.

YOUNG GENERATION FORUMN (YGF) REVIEW

Sumin Choi

지난 7 월 8 일부터 13 일까지 5 일간 서울에서 개최된 한민족 청년 과학도 포럼 (Young Generation Forum, 이하 'YGF')은 나에게 매우 특별한 시간이었다. 세계를 강타했던 코로나 바이러스로 인해 대학시절, 대부분의 외부 행사들이 제한되었던 내게 처음으로 주어진 대외활동의 기회였기 때문이다. 그것도 국내 참가자들로만 이루어진 행사가 아닌, 세계 각국에서 온 다양한 한국계 학생들을 만날 수 있었기에 더욱 기대가 컸다.

포럼 첫날은 80 명에 달하는 인원이 강남구에 위치한 한국과학기술회관으로 함께 이동한 후 어색한 공기를 해소하기 위해 서로를 알아가고 얼굴을 익히는 시간으로 채워졌다. 후반부에는 대학교 전공별로 5~7 명씩 조를 나누어 자유롭게 토론을 할 수 있는 기회가 주어졌는데, 현재 자신의 세부 전공과 관심사, 앞으로 이루고 싶은 목표 등 다양한 의견들을 교환할 수 있었다. 더불어 자신이 살고 있는 나라의 과학 교육과 학교 생활에 관한 이야기도 들을 수 있었다. 각자의 공부 분야와 꿈에 대해 자신있게 말하는 그들을 통해서 불확실한 미래 계획 때문에 고민이 많았던 나에게도 울림을 주는 것 같았다.

한편, YGF 기간 동안에는 국립중앙박물관, 국립과천과학관, 용산 전쟁기념관 같은 장소들을 탐방하는 시간도 주어졌다. 그 중 인상에 남았던 곳은 국립과천과학관인데, 오래 전 초등학교 시절에 방문했을 때의 기억과 많이 달랐다. 그 당시에는 전시 내용들이 단순히 과학 사실들을 나열하는 것에 그쳤을 뿐더러 어렸던 탓에 설명들을 제대로 이해하지 못해서 지루함을 느꼈었는데, 다시 방문한 과학관은 호주 캔버라의 Questacon 이나 멜버른의 Scienceworks 처럼 과학에 문외한인 이들도 즐길 수 있는 공간으로 탈바꿈되어 있었다. 전시 내용도 알차게 구성되었고 무엇보다 관람객들이 전시물을 만져보거나 체험을 할 수 있도록 마련한 점이 마음에 들었다. 비록 어린 아이가 아니라 성인이 되어서 다시 왔음에도 불구하고 과학관은 충분히 둘러볼 가치가 있었다.

본격적으로 세계 한인 과학기술인대회가 개최되는 둘째날부터는 이태식 한국과학기술단체총연합회 회장님과 여러 정치계 인사들의 축사를 시작으로, 국내 및 해외에서 활동하고 있는 한인 과학자들의 강연들이 넷째 날까지 이어졌다. 강연 내용은 대부분 자신의 연구 분야와 그 연구가 앞으로 미래에 어떤 공헌이 될 수 있을지에 관한 것이었다. 타국에서 오신 분들의 경우, 여기에 덧붙여 자신들이 어떻게 타지에서 적응하고 살아남을 수 있었는지에 대한 이야기들도 들려주었는데, 어린 나이에 한국을 떠나 호주에서 살고 있는 나에게도 공감가는 부분들이 있었고 도움이 되는 내용들도 많았다. 또한 단순히 석학들의 발표만으로 이루어진 것이 아니라, 학생들에게 질문 기회를 주고 그에 맞춰서 피드백과 답변이 이루어지는 시간이 주어져 쌍방향 소통이 가능했던 점도 인상적이었다. 해외석학들은 대부분 미국 또는

캐나다에서 오신 분들이었는데, 북미에서는 대학교에 재학 중인 학생들과 한인석학들이 서로 교류할 기회가 많다고 전해주었다. 이 점에서는 호주와 뉴질랜드에서도 한국계 학생들과 과학계 전문가들이 네트워크를 강화할 수 있는 만남의 장이 앞으로 생기면 좋겠다고 기대한다.

비록 2024 년 YGF 의 일정이 공식적으로 마무리되었지만, 지난 5 일간의 일정은 오래도록 기억 한편에 자리잡을 것이다. 이번 세계 한인 과학기술인대회 및 YGF 에 초청된 인사들은 행사 기간 동안 전 세계에 흩어져 있는 과학자들의 협력과 교류의 중요성을 내내 강조하였고. 이 말을 들으면서 과학에는 국경이 없다는 사실을 실감했다. 또, 언어도 다르고, 문화나 가치관도 상이한 전 세계인들을 하나로 묶을 수 있는 수단 중 하나는 바로 과학이라는 생각이 들었다. 동시에 과학기술을 둘러싼 지속적인 전략적 협력과 연대의 중요성을 현장에서 직접 느낄 수 있는 소중한 기회였다.

KASEA PARTNERSHIP

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