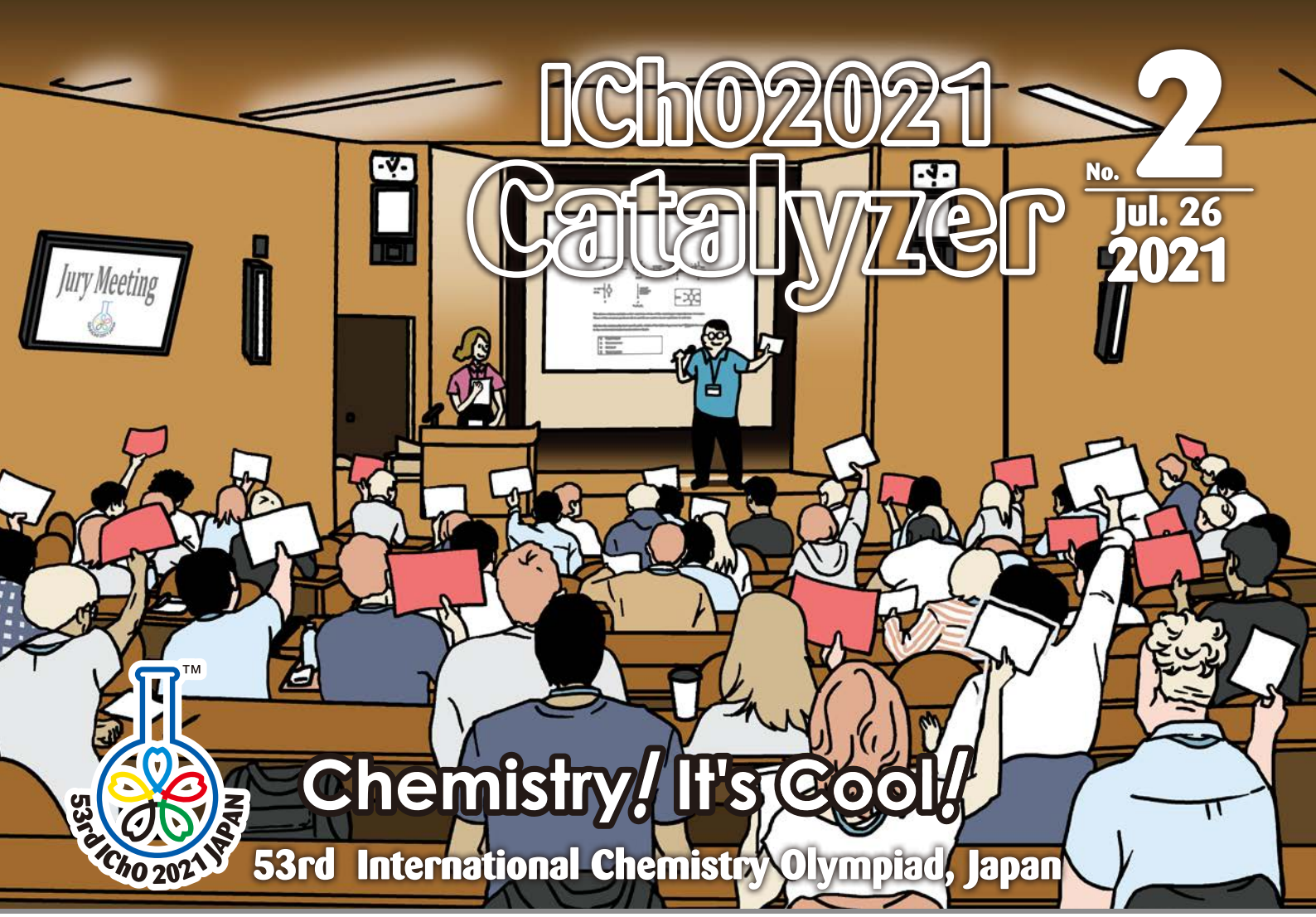
IChO2021
Catalyzer
No. 2
Jul. 26 2021



Cover illustration : Jury Meeting

Nobel Prize Research from Japan 02

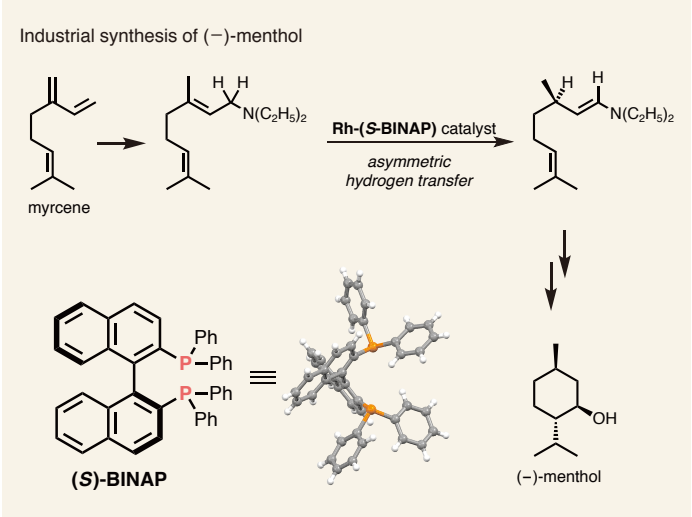
Asymmetric Reactions

Ryoji Noyori

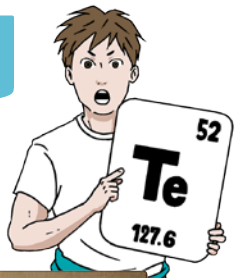
Photo by Kagaku-Dojin

Dr. Ryoji Noyori (1938–)

Some organic compounds exist as two stereoisomers that are mirror images of each other (chiral molecules); the relationship resembles that of a person's right hand and left hand. Many chiral molecules are found in nature, typical examples of which are the amino acids that make up proteins in living organisms. Interestingly, proteins in living organisms are composed of only one of the mirror-image isomers (L-type amino acids). Since living organisms distinguish chiral molecules, asymmetric synthesis is extremely important in the development of pharmaceuticals, flavors, and food additives. Ryoji Noyori developed unique chiral phosphorus ligand BINAP as a source of chirality essential for the synthesis of chiral compounds. BINAP has a beautiful structure with C_2 symmetry, and its metal complexes enable various catalytic asymmetric reactions. One of the best known applications of BINAP is the Rh-BINAP-catalyzed asymmetric hydrogen transfer reaction, a key step in the synthesis of (−)-menthol used in flavors and pharmaceuticals. This technology has been commercialized by Takasago International Corporation (Japan), a world leader in the fragrance and flavor industry. For developing such a truly practical method for catalytic asymmetric synthesis, Ryoji Noyori was awarded the Nobel Prize in Chemistry in 2001, together with William S. Knowles and Karl Barry Sharpless.



The Opening Ceremony held at the Virtual Reality Venue



Program of Opening Ceremony

- Opening Movie
- Introduction of Sponsors
- Opening Address by Dr. Kohei Tamao
  President, IChO2021 Japan Committee
- Welcome Message from HAGIUDA Koichi
  the Minister of Education, Culture, Sports, Science and Technology
- Message from Dr. Akira Yoshino
- Introduction of Participating Teams

Dr. Kohei Tamao
President, IChO2021 Japan Committee
Chairman, Organizing Committee for the 53rd IChO2021, Japan

HAGIUDA Koichi
the Minister of Education, Culture, Sports, Science and Technology

Dr. Akira Yoshino
Honorary Fellow, Asahi Kasei Corp. 2019 Nobel Laureate in Chemistry

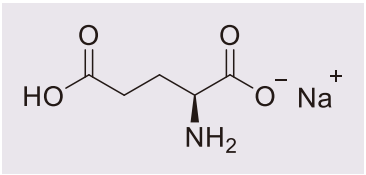
Chemistry! It's Japan!

The Discovery of Umami Component

••• Kikunae Ikeda

Our sense of taste includes sweetness, sourness, saltiness, and bitterness as well as umami. The umami component was discovered by Kikunae Ikeda. Back then, the taste was thought to consist of a combination of four tastes: sweet, sour, salty, and bitter. Ikeda believed that dashi or broth made of dried bonito flakes and kelp, contained ingredients that made people feel that a food was delicious. Motivated by this somewhat unique Japanese sensibility, he attempted to identify the source of umami from kelp, and in 1908, determined that monosodium glutamate was indeed the umami component. Although glutamate itself had already been described as a chemical compound, Ikeda was the first to formulate the concept of glutamate as a component of umami. Based on this discovery, the company Ajinomoto was established, which has grown to become one of Japan's leading food companies. Ikeda also discovered the umami component of bonito, and together with his student Shintaro Kodama, discovered inosinic acid as the second umami component. Whether umami is a taste or not has been debated for a long time, but the discovery that the taste buds on the tongue contain sensors (glutamate receptors) that sense umami as well as the other four tastes has scientifically proven that humans can actually sense umami as a taste. The Japanese word umami has now gained currency in English and has become internationally recognized.

Dr. Kikunae Ikeda
(1864–1936)



Structure of monosodium glutamate

Kansai Scenes 2

Tenjin Festival and Gion Festival

Held throughout the country, many of Japan's festivals are religious events. The Tenjin Festival in Osaka, the Gion Festival in Kyoto, and the Kanda Festival in Tokyo are known as Japan's three top festivals; two of them in the Kansai region of western Japan. The Tenjin Festival is held at the Osaka Tenmangu Shrine, which enshrines Sugawara no Michizane, a 9th century scholar and politician. On the night of July 25, the anniversary of Michizane's death, a boat procession is held on the Okawa River, accompanied by a fireworks display. It is known as the festival of fire and water because of the splendid sight of bonfires, lanterns, and fireworks reflected on the Okawa River. Aside from the festival, the Osaka Tenmangu Shrine also attracts students who come to pray for success in their entrance exams, as Michizane is worshipped as the god of learning. The Gion Festival has been held at Yasaka Shrine since the 9th century. Thirty-two large floats called *Yamahoko* are paraded through the center of Kyoto on July 17 each year.

Tenjin Festival

Gion Festival

Tale related to Preparatory Problem

••• Practical Task 4 •••

Hinokitin : Let a Deep-red Natural Pigment Inspire Your Curiosity

Practical Task 4 of the preparatory problems deals with nonbenzenoid aromatic compounds, a collection of which is designated in Japan as Certified Chemical Heritage No. 036. Reading the related literature, we found an article containing a comment by Tetsuo Nozoe*, looking back on his research into a seven-membered ring compound named hinokitiol, which reads: "I was attracted by the red pigment hinokitin in the wood of the Formosan Hinoki Cypress tree (*Chamaecyparis obtuse var. formosana*) derived by Nenokichi Hirao". Hirao had published a paper on hinokitin in 1926 (*Nihon Kagakukaishi*, vol. 47, pp. 666–671). Nozoe unexpectedly discovered that hinokitin contained iron, and obtained hinokitiol by removing the iron content, leading to the discovery of a new family of chemical compounds, the nonbenzenoid aromatic compounds. Hinokitin is an iron trivalent complex with hinokitiol as a ligand. In Practical Task 4, you are to synthesize hinokitin from hinokitiol and iron (III) nitrate nonahydrate. Watch in awe as the reaction produces a compound with an impressively deep-red color (see photo). I hope that the red color of hinokitin will catalyze the curiosity and passionate spirit of inquiry of young people who will create the future of chemistry.

*Tetsuo Nozoe (1902–1996) : Japanese Chemist, Professor of National Taiwan University (1936–1948) and Tohoku University (1948–1966)

Today's schedule Jul. 26

Student

- VR Closed

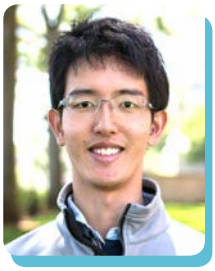
Mentor

- **Deadline of The Problem Feedback** (Oly-Exam)
  J 09:00 C 02:00 E 20:00 (Jul. 25)
- **1st Jury meeting** (zoom) J 21:00 C 14:00 E 08:00

J : JST = UTC + 9 C : CET = UTC + 2 (summer time) E : EST = UTC - 4 (summer time)

CHEER UP! Participants!

Welcome to IChO! I hope you are enjoying your virtual stay in Japan and getting ready for the exam. More than anything, however, enjoy your time with participants from other countries. I made many lasting friendships in IChO and I am sure you will too! When you hesitate to talk with someone because they speak a different language or come from a different culture, remember your passion for chemistry will be the bond that connects you together. Have fun!



from **Tomohiro Soejima** (Japan)
University of California, Berkeley
Department of Physics
PhD student

IChO 43rd in Ankara, Turkey Gold medal
IChO 44th in Washington D.C., USA Gold medal

ELEMENT QUIZ Q2

Stainless steel is an alloy made by adding two metals to iron. Which of the following is the correct combination of the two non-iron metal elements?

1 (Co, Mn) 2 (Zn, Ni)
3 (Ca, Mn) 4 (Cr, Ni)

Short short from Kansai

Illumination of Tsutenkaku Tower

As the COVID-19 pandemic continues to rage around the world, Japan too is battling waves of cases and new variants, and has started vaccinating its population in stages. Tsutenkaku Tower, the symbolic tower of Osaka, lights up in different colors to call on the local citizens to help prevent the spread of the disease. In accordance with the model adopted by the Osaka prefectural government in its countermeasures against COVID-19, the color is red during a state of emergency, yellow when an alert is issued, and green when the alert is lifted. The tower has also been illuminated with blue lights to express gratitude to the medical personnel who are struggling on the front lines.

Answer for Q1

4 (Nd, Fe, B)

A neodymium magnet contains iron and boron in addition to neodymium, as shown by the chemical formula $Nd_2Fe_{14}B$.

The iron generates magnetization and the neodymium directs the magnetization in one direction.

The boron keeps the distance between the iron and the neodymium atoms at an optimum level.

Chemistry! It's Cool!

53rd IChO 2021 JAPAN™

IChO2021 Catalyzer No. 2

Official Website
https://www.icho2021.org/

icho2021

Jul. 26
1885
Got married!
Marie & Pierre Curie

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