

様式 A-1
(FY2025)

R7 年 12 月 11 日

サイエンス・ダイアログ 実施報告書

1. 学校名：名古屋市立向陽高等学校
2. 講師氏名： Dr. Alastair HERRON
3. 講義補助者氏名： 大島 佑介 様
4. 実施日時： 2025 年 12 月 8 日（月） 14:15 ～ 15:20
5. 参加生徒： 2 年生 34 人、 年生 人、 年生 人（合計 34 人）
備考：国際科学科の生徒
6. 講義題目： Introduction to deuterium science
7. 講義概要： 重水素についての説明、医療分野での活用、実験
8. 講義形式：
対面 ・ オンライン（どちらか選択ください。）
 - 1) 講義時間 45 分 質疑応答時間 20 分
 - 2) 講義方法 プロジェクター使用による講義、実験・実習の有無など
 - 3) 事前学習
有 ・ 無（どちらか選択ください。）
使用教材： 講義概要とキーワードリストの提示
9. その他特筆すべき事項：

Form B-2
(FY2025)
Must be typed

Date (日付)
2025/12/09 (Date/Month/Year: 日/月/年)

Activity Report -Science Dialogue Program-
(サイエンス・ダイアログ 実施報告書)

- Fellow's name (講師氏名): Alastair Neale HERRON (ID No. P24032)

- Name and title of the lecture assistant (講義補助者の職・氏名)
Yusuke OSHIMA (Graduate Student, Kyoto University)

- Participating school (学校名): Nagoya Koyo Senior High School

- Date (実施日時): 2025/12/08 (Date/Month/Year: 日/月/年)

- Lecture title (講義題目):
Introduction to Deuterium Science

- Lecture format (講義形式):
◆ On-site ・ Online (Please choose one.)(対面 ・ オンライン)((どちらか選択ください。))
◆Lecture time (講義時間) 45 min (分), Q&A time (質疑応答時間) 15 min (分)
◆Lecture style(ex.: used projector, conducted experiments)
(講義方法 (例: プロジェクター使用による講義、実験・実習の有無など))
Used a projector and conducted various demonstrations to illustrate concepts

- Lecture summary (講義概要): Please summarize your lecture within 200-500 words.

I began the lecture by introducing my home country of Northern Ireland and my journey as a scientist, including my experiences as a scientist in academia and in the drug industry. I discussed the contributions that chemists make during the drug development process and how industrial chemistry differs from academic chemistry.

I then provided an introduction to my work on deuterium chemistry: first, I explained the concept of isotopes and why hydrogen isotopes are particularly special compared to the isotopes of other elements. I emphasized that isotopes have identical chemical properties, but differing physical properties and demonstrated this concept by preparing ice from heavy water (N.B. heavy water is not radioactive), which has a higher density than normal ice and so will not float when placed in water. I then briefly explained the concept of drug metabolism and how deuterium is being used to improve the stability of drug molecules in the body. In order to demonstrate why chemical bonds to deuterium or tritium are usually stronger than those to protium (hydrogen), I asked some of students to hold a set of identical springs bearing different weights. As heavier masses are attached, the springs will oscillate at sequentially lower frequencies. I then related

how this lower frequency corresponds to the lower bond energies and thus more stable bonds.

Finally, I discussed the difficulties of synthesizing deuterated molecules in relation to the high strength of carbon-hydrogen bonds and how the design of specialized catalysts can facilitate the introduction of deuterium into molecules. I explained how catalysts afford new reaction pathways with lower activation barriers and so are used widely in industrial processes and in biological settings as enzymes. To demonstrate the dramatic effect of catalysts on chemical reactivity, I performed the decomposition of hydrogen peroxide (commercial Oxydol solution) using the catalase enzyme found naturally in beef liver. Normally, the decomposition of hydrogen peroxide is very slow, but upon the addition of the beef liver, oxygen formation was rapid and led to a lot of bubbling. I ended the lecture with a summary of the various concepts that I had introduced and how it relates to the work of our lab.

◆Other noteworthy information (その他特筆すべき事項):

The students were very engaged and asked many questions. They also seemed to really enjoy the various demonstrations that were performed during the lecture. The teaching staff of Nagoya Koyo Senior High School were very helpful in facilitating the lecture.

- Impressions and comments from the lecture assistant (講義補助者の方から、本プログラムに対する意見・感想等がありましたら、お願いいたします。):

高校生にとって母国語ではない授業で、聞き慣れない内容を学ぶ授業であったにも関わらず、高校生の理解しようとする姿勢、そして高校生のもつ活気に喜ばしく思いました。そのような活気のある姿を見てこちら側も何かモチベートされるような気持ちになりました。

意見としては、JSPS の活動とは異なると思いますが、自分も同行者として同行したので、何か進路のアドバイスになるようなことが少しでもできればいいなと思いました。

Demonstration: Heavy Ice

- 氷の密度は重水の氷の密度も違います。

	H ₂ O (液体)	H ₂ O (氷)	D ₂ O (重水)
密度	1.000 g mL ⁻¹	0.917 g mL ⁻¹	1.105 g mL ⁻¹



氷は水に浮きますか？

