（学校用）

様式 A-1
(FY2024)

2024年5月14日

サイエンス・ダイアログ　実施報告書

1. 学校名・実施責任者氏名：千葉県立佐倉高等学校 ・ 浅野 裕史

2. 講師氏名：Dr. Katarzyna Joanna Malawska

3. 講義補助者氏名：入江 優

4. 実施日時：2024年5月14日（火） 14:00～15:40

5. 参加生徒：　2年生 40 人、 1年生 40 人、 　年生 　人（合計 80 人）
   備考：理数科の生徒

6. 講義題目：Bioconjugation of Au25 Nanocluster to Monoclonal Antibody

7. 講義概要：

Life on Earth is built of proteins. By studying protein structure we can understand it better.Cryogenic Electron Microscopy (Cryo-EM) is an advanced type of electron microscopy that is widely used to study proteins and other organic material. Contrary to conventional electron microscopy, the advantages of this method include use of mild conditions – analysis at low temperatures and use of low power electron beam for irradiation. Importantly, protein samples can be prepared by freezing in water. The use of frozen, hydrated samples allows protein to retain its structure during analysis. However, the use of mild conditions results in low signalto-noise ratio of Cryo-EM images. This problem can be solved by applying gold nanoparticle labelling.

The interaction between antibody and antigen is very important for our immune system. Because antibodies can recognize antigens, we can also use them as markers for Cryo-EM samples. Antibodies modified (decorated) with gold nanoparticles help us see more details in Cryo-EM images and thus increase the signal to noise ratio. The conventional gold nanoparticles (> 5 nm in size) are sometimes difficult to handle, can disconnect from protein and lead to false result in Cryo-EM.

To improve the signal to noise ratio, we decided to attach smaller, atomically precise nanoparticles to antibody, to create a new type of marker for CryoEM. As a result of collaboration between Kanai-laboratory (UTokyo, Graduate School of Pharmaceutical Sciences) and Tsukuda Laboratory (UTokyo, Graduate School of Science) we developed a method of antibody modification (bioconjugation at tryptophan and lysine) that can be used to attach a special type of gold nanoparticle – called gold nanocluster (Au25) to antibody trastuzumab. We then analyzed this protein-cluster conjugate under Cryo-EM with the help of Kikkawa Laboratory (UTokyo, Graduate School of Medicine).

In this presentation I would like to tell you the story of how we succeded in producing the first ever conjugate of Au25 cluster and antibody.

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 45 分

2) 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）

プロジェクター使用による講義

3) 事前学習

㊒ ・ 無 （どちらかに〇をしてください。）

使用教材 講師から事前送付いただいた講演要旨やキーワードリスト

9. その他特筆すべき事項:

Form B-2
(FY2024)
Must be typed

Date（日付）
16.05.2024 （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）MALAWSKA KATARZYNA JOANNA（ID No P 23408）

- Name and title of the lecture assistant（講義補助者の職・氏名）
Ms. Irie Yu

- Participating school（学校名）: Chiba Prefectural Sakura High School
- Date （実施日時）: 14.05.2024 （Date/Month/Year:日/月/年）

- Lecture title（講義題目）:
Bioconjugation of Au_{25} nanocluster to antibody

- Lecture format（講義形式）:
◆☒Onsite ・ ☐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） 40 min（分）, Q&A time（質疑応答時間） 55 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））
I used a projector, laser pointer and slides prepared in MS Power Point.

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

Life on Earth is built of proteins. By studying protein structure we can understand it better. Cryogenic Electron Microscopy (Cryo-EM) is an advanced type of electron microscopy that is widely used to study proteins and other organic material. Contrary to conventional electron microscopy, the advantages of this method include use of mild conditions – analysis at low temperatures and use of low power electron beam for irradiation. Importantly, protein samples can be prepared by freezing in water. The use of frozen, hydrated samples allows protein to retain its structure during analysis. However, the use of mild conditions results in low signal- to-noise ratio of Cryo-EM images. This problem can be solved by applying gold nanoparticle labelling.

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In this presentation I explained students about of how we succeded in producing the first ever conjugate of Au_{25} cluster and antibody. The first part of the lecture also contained basic information about Poland (geography, language and cultural customs, plus photos from my hometown, Kraków) and myself, that hopefully encouraged students to visit my country in the future. By mentioning several famous polish scientists and artists (Maria Skłodowska-Curie, Mikołaj Kopernik and Fryderyk Chopin) and introducing our Group and the cutting-edge research at Kanai Laboratory, I hoped to instill the passion for science in these young students attending my lecture.

[1]Malawska, K.J.; Takano, S.; Oisaki, K.; Yanagisawa, H.; Kikkawa, M.; Tsukuda, T.; Kanai M.: *Bioconjugate Chem.*, **2023**, 34, *4*, 781.

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

We (the Lecture Assistant and I) were greeted at Keisei Sakura Stn. by Asano-sensei from Sakura HS, with whom I exchanged many emails prior to the event. We traveled to school by car, even though it is located close to the station, which is very, extremely kind of the Organizers. The meeting was organized in an older part of the School, where lectures are held, but the room was well equipped and I had no technical problems with my presentation. I met several teachers before my talk. About 40 students attended the lecture. The group mostly consisted of male students. The students were very kind, attentive and did not interrupt me during my talk. After the talk they were given about 10 min to think about their questions. I received a total of about 10 questions, 90% of which were absolutely excellent questions, very relevant to the scientiffic part of the presentation. I am truly impressed because I felt my lecture could be too difficult to HS students. The questions were asked in perfect English which made me happy, there was no need for translation from Japanese by the Lecture Assistant. One thing that bothers me though, is that there was no single question from the female students in audience, I even tried to encourage them a little bit but sadly it was not succesful. Overall I think the students enjoyed my presentation and the materials such as keyword list which I provided prior to the lecture were very helpful in understanding the content. To sum up, I am very happy about my experience.

- 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。）:

質疑応答も含め、高校生の方々が英語でスムーズにやり取りできており、大変優秀だと感じました。外国人研究者と最先端の研究に関して交流を行う、非常に貴重な経験になったと思います。