國立交通大學
National Chiao Tung University

出國報告（出國類別：學術訪問與商討合作事宜）

題目：出訪東京大學、筑波大學

服務機關：應化系
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一、摘要（200-300 字）

In this trip, I visited the Hamaguchi group at the University of Tokyo and the Nomura group at the University of Tsukuba. The primary objective of the visit to the University of Tokyo was to discuss with Professor Hiro-o Hamaguchi the transfer of the major instruments at Tokyo toward his retirement in March, 2012. During my visit to the University of Tsukuba, I stayed for several hours in the laboratory of Prof. 野村暢彥. I had a discussion with his students about our collaborative projects on Raman imaging of bacterial biofilms (生物膜) and was invited to see a unique instrument that they have developed recently to analyze biofilm metabolites.

這次的訪問行程，我訪問東京大學濱口宏夫教授實驗室，及筑波大學野村實驗室。最主要的目的在於：1、在濱口教授於 2012 年 3 月退休後，將搬運主要實驗設備至交大，故就此事進行討論。2、同時，我也至筑波大學訪問，和野村教授的學生討論目前我們正在進行的合作計畫：細胞生物膜的拉曼光譜分析。同時，我也有機會參觀野村實驗室最新自製設備，其設備可用來分析生物代謝產物。

二、目次

三、本文

（一）目的

The primary object of the visit to the University of Tokyo is to discuss how and where the instruments in the Hamaguchi group should be transferred toward Prof. Hamaguchi's retirement in March, 2012. It is confirmed that a femtosecond Ti:sapphire laser system for electronic hyper-Raman scattering and a 400 foci confocal Raman microspectrometer will be transferred to NCTU sometime next March. I also plan to have a detailed discussion with Prof. Hamaguchi about management of USIL after he becomes full-time at NCTU next year. Besides the discussions, I look around the Hamaguchi laboratory to find small instruments that might be useful for our research at NCTU.

The visit to the University of Tsukuba is meant to have a discussion with students of Prof. Nobuhiko Nomura about our ongoing collaborative projects and future plans. I would like to have a closer look at the AFGAS system that they developed recently for metabolite analysis of bacterial biofilms.

出訪的最主要目的是討論濱口宏夫教授實驗室設備，在濱口教授於2012 年 3 月退休時搬運至交大的事項。目前可確定明年三月搬運至交大的系統有：（1）femtosecond Ti:sapphire laser system：爲支援受激電子拉曼散射系統。（2）400 foci 共軛焦拉曼顯微分光計。同時，因爲明年濱口教授將要來交大任職，故對於交大「尖端光譜及成像實驗室」未來的管理事項有更多細節的討論。除此之外，我也找尋可以適合交大實驗室使用的小型設備。

至於到筑波大學訪問一事，我和野村教授及學生討論目前我們實驗室正在執行的計畫，及未來合作一事。同時，我也希望能看他們實驗室最新架設，可以分析細胞代謝物的系統：AFGAS 系統。

（二）過程

The following is the schedule of my visit:

Nov. 7	14:30	Arrival in Tokyo
Nov. 8		**Visit to the University of Tokyo**
	11:00~14:00	Discussion and luncheon meeting on transferring the instruments in the Hamaguchi group
	14:00~15:00	Looking around the lab
	15:00~17:00	Discussion with Prof. Hamaguchi

Nov. 9		**Visit to the University of Tsukuba**
	10:30~12:00	Discussion with Prof. Nomura's students
	12:00~12:30	Lab visit
Nov. 10		**Visit to the University of Tokyo**
Nov. 13	19:10	Leave for Taipei

Nov. 8th and 10th. I paid a routine visit to Prof. Hamaguchi's laboratory at the University of Tokyo. First, we had a meeting in which we discussed how and where many advanced instruments in the Hamaguchi laboratory should be transferred toward Prof. Hamaguchi's retirement in March, 2012. The attendees of this meeting, other than me, were as follows: Profs. 濵口宏夫 and 加納英明, Drs. 島田林太郎, 安藤正浩, and 岡島元 (東京大學), and Prof. 岩田耕一 (學習院大學). It has been agreed that the following two instruments will be transferred to NCTU, most likely in March or April, 2012.

- Femtosecond Ti:sapphire laser system to perform electronic hyper-Raman spectroscopy
- Multifocus (20 × 20 foci) confocal Raman microspectrometer developed at Tokyo under a collaboration with Tokyo Instruments, Inc.

These instruments will probably be kept under the custody of the University of Tokyo from next April and onward, so they will just be relocated to NCTU. Furthermore, it has been confirmed that the instruments already transferred to NCTU, such as a Zeiss-based confocal Raman microspectrometer and nanosecond time-resolved near/mid-infrared spectrometer, can be used continuously in USIL. We continued the discussion during lunch.

After lunch, upon permission of Prof. Hamaguchi, I looked around his laboratory to search for other useful instruments that could be moved to NCTU together with the above-mentioned two major instruments. I found an analog oscilloscope and a pellet mill (plus a vacuum pump) for IR measurements to be useful for us. These instruments will be packed together when the femtosecond laser system and the multifocus Raman microscope are shipped out.

During my stay at the University of Tokyo, I had discussions several times with Prof. Hamaguchi about the following issues:

- His possible stay at NCTU in December
- Management of USIL after his moving to NCTU. In particular, we discussed to what extent my own group will be independent from Prof. Hamaguchi's new group. The tentative conclusion is that we will share some infrastructures as well as man power, but the organization of the two groups should be fully independent.
- Short stay in Tokyo of my Ph.D. student, Chuan-Keng Huang, from December to January. We finalized his study plan.

11 月 8 日、10 日：

我至東京大學濱口教授實驗室參加固定的訪問 meeting 行程，首先，我們先討論在濱口教授退休之後，實驗室的設備分別要送往何處。與會者除了我之外尚有 Profs. 濵口宏夫 and 加納英明, Drs. 島田林太郎, 安藤正浩, and 岡島元 (東京大學), and Prof. 岩田耕一 (學習院大學). 我們已同意搬運於 2012 年 3 月或 4 月搬運這兩項設備至交大：

- Femtosecond Ti:sapphire laser system to perform electronic hyper-Raman spectroscopy（飛秒鈦藍寶石雷射系統）
- Multifocus (20 × 20 foci) confocal Raman microspectrometer：此設備是 Tokyo Instruments, Inc 共同開發

這些設備目前仍在東京大學保管名義，之後將會運送至交大。除此之外，我們同時確認這些已經搬運至交大的設備：Zeiss-based confocal Raman microspectrometer、nanosecond time-resolved near/mid-infrared spectrometer 將可在交大「尖端光譜及成像實驗室」繼續使用。

午餐之後，我同時再尋找可連同上述兩項主要設備搬運至交大的設備。我爲實驗室的紅外光測量儀找到合適的設備：示波器及壓粒器 (加上真空幫浦)。這些設備將會連同上述的主要設備一起運送到台灣。

在訪問東京大學其間，我和濱口教授就以下的議題進行多次討論：

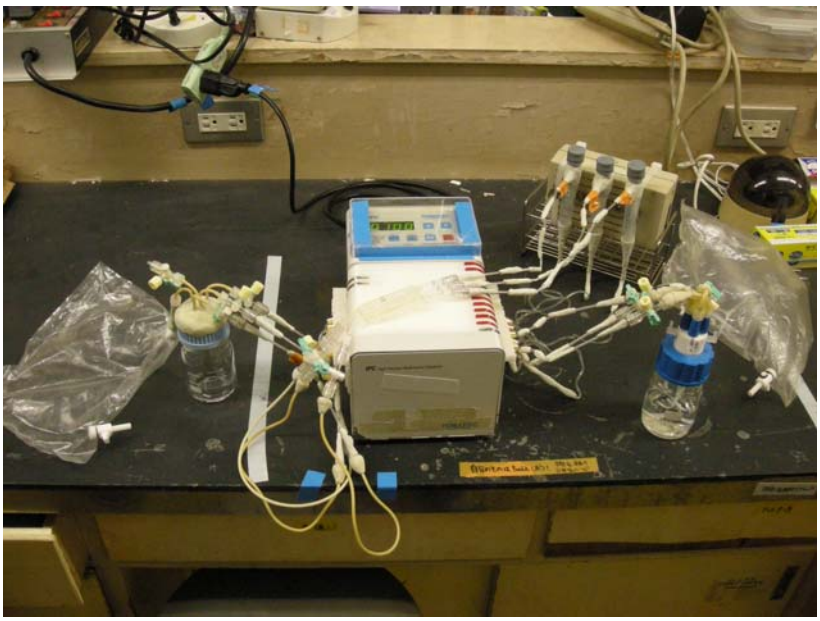
1、12 月份預計出訪交大。

2、在濱口教授至交大之後，如何管理尖端光譜及成像實驗室。特別是，我的團隊從濱口教授團隊獨立出來至何種程度。目前暫訂的結論爲我們兩個團隊會分享基礎設備及人力，但是這兩個團隊的組織是將會完全獨立。

3、12 月份我們會派黃傳耿同學至東大，故我們確定黃傳耿同學的學習計畫。

Nov. 9th. I visited Prof. Nomura's laboratory at the University of Tsukuba. He is one of our collaborators in Japan, who is working on bacterial biofilms. We initiated the collaboration in 2008, and since then, we have been trying to apply Raman microspectroscopy and imaging to gain molecular-level insight into bacterial biofilms. An outcome of the collaboration has recently been published (H. N. Noothalapati Venkata, N. Nomura, and S. Shigeto, *J. Raman Spectrosc.* **42**, 1913 (2011)). Because Prof. Nomura was out of the office for a conference, two students of him took care of me. I gave a follow-up report on the ongoing projects on the biofilms of *Rhodococcus sp.* SD-74 and *Lactobacillus plantarum*. We discussed the biological role of carotenoids, which are commonly detected in the biofilm of *Rhodococcus sp.* SD-74 by Raman microspectroscopy. The students told me that they are particularly interested in the distribution of extracellular DNA (eDNA) in the biofilm of *Burkholderia multivorans*, in which

they found that the degradation of eDNA enhances initial attachment of planktonic populations. I promise to measure this sample as soon as we can.
After the discussion, I was invited to the laboratory, where they showed me the AFGAS (**A**irtight **F**low reactor for nondestructive **G**aseous metabolite **A**nalysis and **S**tructure visualization) system (Y. Yawata, N. Nomura, and H. Uchiyama, *Appl. Environ. Microbiol.* **74**, 5429 (2008)). As can be seen from the picture below, the AFGAS system consists of a peristaltic pump, a container of culture medium, and tubes for collecting the metabolites. We also are interested in having a similar flow reactor system in USIL and already purchased a pump from the same company. It was thus very fruitful for me to see how the system was constructed. Actually, the system looks like really a home-built apparatus.
I also talked about the possibility of inviting Prof. Nomura and his student/postdoc to NCTU next year. Their visit will definitely stimulate my students and also promote the collaboration.



11 月 9 日
我訪問在筑波大學的野村教授實驗室。他是我們實驗室在日本的合作計畫人員，其研究主題在於細胞生物膜。我們是由 2008 年開始進行合作，從那時起，我們即試圖應用拉曼光譜及成像技術取得細胞生物膜中分子層級的內視。目前我們的合作結果已發表：(H. N. Noothalapati Venkata, N. Nomura, and S. Shigeto, *J. Raman Spectrosc.* **42**, 1913 (2011)).。因爲野村教授參加會議，故由實驗室兩位學生負責我的行程。我提出接續報告於目前正在進行

的計畫，其計畫是關於研究 *Rhodococcus sp.* SD-74（紅球菌）及乳酸菌生物膜之研究。我們討論胡蘿蔔素在生物性中的角色，這種元素常被拉曼光譜術於 *Rhodococcus sp.* SD-74 的生物膜中檢測出來。學生們告訴我他們最感興趣的部分是 *Burkholderia multivorans*（鼻疽伯克氏菌）生物膜中的 eDNA（釋放出來的細胞）分佈，在鼻疽伯克氏菌生物膜中，我們發現 eDNA 的衰退提高了浮游群體的初步連結。我允諾將會盡早進行測量此項樣本。在討論之後，學生將新型設備系統展示給我，這特系統是 AFGAS (**A**irtight **F**low reactor for nondestructive **G**aseous metabolite **A**nalysis and **S**tructure visualization) system (Y. Yawata, N. Nomura, and H. Uchiyama, *Appl. Environ. Microbiol.* **74**, 5429 (2008)). 如上圖照片所示，此套設備包含蠕動幫浦、培養基容器，以及收集代謝產物的管子。我們同時希望我們實驗室也能有類似的流式反應系統，目前我們也已購買幫浦。能夠看到這套設備如何架構起來，對我來說是富有意義的，事實上，這套設備看起來像是自行架設的儀器。我同時也提到邀請野村教授及其學生、博士後研究員來訪的事項。他們的到訪將會給我們學生帶來刺激，同時也可促進彼此的交流合作。

（三）心得及建議

All the discussions I had during this visit are of great help for ongoing research in my laboratory. It is a good news that a Ti:sapphire femtosecond laser system will be transferred to USIL next spring. Because we moved a Ti:sapphire regenerative amplifier and optical parametric amplifiers from IAMS last year, it might be possible to combine with these existing amplifier systems the oscillator coming from Tokyo. The discussion with Prof. Nomura brought me an idea to establish a research center (or association) in Taiwan for spectroscopic investigations of biofilms oriented to environmental sciences. As always, I greatly appreciate kind support by the ATU plan.

這次出訪的討論對我們實驗室的規劃有很大的幫助。能夠於明年春季將 Ti:sapphire femtosecond laser system（飛秒鈦藍寶石雷射系統）搬運至交大。因爲我們去年已經搬運鈦藍寶石再生放大器及光纖放大器至交大，也許可能結合目前我們所有的震盪器放大器系統。和野村教授的討論帶給我一些想法，能夠在台灣成立光譜中心以研究生物膜，且以環境科學爲研究方向。同時。我感謝五年五百億經費在這方面的支持。