Specialization: Know More!

NUS Chemistry Week 2013

FOC 2013: IGNITE!

Overseas Experiences

Chemistry Apps
In this age of widespread information sharing facilitated by technology and social media, one might question the necessity of printing hundreds of copies of student magazines, some of which would be left as unopened as the later pages of our textbooks. Indeed, the printing of annual issues of Chemiscope is both time and financially demanding for the Chemical Sciences Society (CSS). Why do we still do it?

We believe that Chemiscope reinforces the identity of being a Chemistry student at NUS. The magazine records and shares the many experiences of the staff and students of NUS Chemistry. These experiences have enriched the learning journeys of our fellow students by forging relationships and learning beyond textbooks. In the ennui of overwhelming work, Chemiscope serves as a reminder that being a Chemistry undergraduate is more than churning out laboratory reports and studying incessantly. The articles in Chemiscope show that learning chemistry at NUS need not be dreary, but can be enjoyable. We hope that you will enjoy reading the meaningful and exciting experiences of fellow students and that some of these articles, such as those on UROPS and SEP, would be helpful to you. As you spend each passing year in NUS Chemistry, we hope that you would have a growing collection of Chemiscope issues and fond memories to look back on.

With each new issue of Chemiscope, we endeavour to bring to you more interesting and relevant articles. The 16th issue of Chemiscope has a wide range of articles to aid you along the path you wish to take towards completion of your B.Sc degree. A good example would be the interview with A/P Lai Yee Hing on the new Chemistry Specialisation options. We also aim to connect members of NUS Chemistry together, as evidenced by our interview with a new lecturer, Dr Stephen Chui.

We would like to convey our heartfelt appreciation to the many staff and student writers who have contributed to the successful publication of this issue of Chemiscope. We are also thankful to you, our readers, for taking the time to read the articles. We welcome any feedback and strive to improve our magazine each year to better serve the NUS Chemistry community.

Cheers

Choo Hui En
Tan Yong Quan
Timothy Kwok Xiongwei
It is my pleasure to invite you to read *Chemiscope* 2014.

In 2013, we have attained several milestones which highlight our commitment to the continuous improvement of chemical education in Singapore. We have renovated the physical, general, organic and inorganic teaching laboratories to a very high standard. The laboratories are brightly lit, spacious, fully air-conditioned, and equipped with the latest instruments. Our chemistry Olympiad team continues to bring home medals year after year.

In addition, the teaching committee and our teaching professionals have worked very hard to revamp the chemistry teaching curriculum in order to align it with the trends and shifting interests. Specialisations are now being developed to deliver the most up-to-date course content in modern chemistry.

NUS Chemistry professors continue to make headlines in research. In 2013, we have published as many as 7 *Nature/Nature* series journals, which go in no small way to raise the international rankings of the university (especially the *Nature* index). Our publication outputs in top notch chemistry journals like the *Journal of the American Chemical Society* and *Angenwandte Chemie* have scaled new heights. All these achievements are unmatched in the history of the department. It speaks volumes about the changing mindsets among our researchers with regard to the selection and execution of research topics. We will continue to fly the chemistry flag high.

Yours sincerely

Loh Kian Ping
Professor and Head
Department of Chemistry
Message from CSS Advisor and President

To the 26th CSS Management Committee,

Thank you for your time and effort in planning and executing the many activities for your fellow Chemistry major students – time which you could have spent studying or writing lab reports. The department acknowledges your sacrifices in building links between the department and the current students, outreach (pre-students) and alumni (post-students). This year, we would especially like to thank you for being willing and cheerful facilitators and helpers to participants during the NUS Chemistry Week 2013 in June. It would have been dull without your presence. As always, we are grateful to CSS for organizing Industrial Visits, Student Bonding Events, Graduation Night and Freshmen Orientation Camp. Keep up the traditions!

Let me also congratulate you on the publication of this year’s Chemiscope. It is a well consolidated and comprehensive magazine that covers most aspects of student and staff life, be it academic, experiential learning, outreach and social aspects. Good job!

To the Chemistry students: CSS is by default YOUR club. What they do is for you, so make the most of it. Have a fulfilled and vibrant year ahead in 2014.

Thank you
Dr Emelyn Tan
Advisor to the Chemical Sciences Society (CSS)

Dear esteemed NUS Science Faculty members and fellow students,

I am delighted to present to you Chemiscope, the magazine of the Chemical Sciences Society (CSS). The club has come a long way and the baton is now passed to the 26th Management Committee. CSS has continued to work with the NUS Department of Chemistry to cater to the welfare of the NUS Chemistry students, doing our very best to organize events that are both educational and enjoyable. The direction for the 26th Management Committee is to raise the awareness of CSS to the NUS Chemistry population, and we hope to achieve this through coming up with more exciting and beneficial activities that are relevant to the interest of the NUS Chemistry majors and also to create a better channel for feedback. Therefore, I sincerely hope that, as students, you would give us your very full support in our upcoming activities in the next semester, as well as in future academic years in our efforts to serve the NUS Chemistry community.

I would like to acknowledge the Science Dean’s Office, Prof. Loh Kian Ping, A/P Fan Wai Yip, Dr. Emelyn Tan, Ms. Chia Siew Ing, as well as all the faculty staff for their continuous support towards CSS. I would also like to extend my utmost gratitude to all the Chemistry undergraduates who have shared their enriching overseas program experiences in their articles, as well as the 26th Management Committee. All in all, I would like to urge everyone to live your lives to the fullest. Seize the opportunities that come your way and may your NUS life be filled with vibrancy!

Warmest Regards
Neo Hui Lin Perlin
President, 26th Management Committee, NUS CSS
We conducted an interview with Dr Stephen Chui, a lecturer of inorganic chemistry who recently joined NUS Chemistry, to learn more about him.

Can you tell us more about yourself?
I was born in Hong Kong and am now 40 years old – though I certainly don’t look like it. I always think that I am still young, much like you guys. I received my Bachelor and PhD degrees from the University of Hong Kong of Science and Technology (HKUST). After that, I moved to University of Hong Kong (HKU) to do my postdoctoral research. I spent ten years there, starting from a postdoctoral fellow, then senior research associate and became a research assistant professor for three years.

What are some of your research interests and past experiences in research?
My research interests are the application of X-ray diffraction analysis of functional inorganic polymers and structure-property relationship. I have had 60 accepted publications since 1998. In particular, one of them was from my PhD work, which was published in Science in 1999. It has had over 1900 citations since then. This work describes a serendipitous discovery of a robust polymeric porous compound (well-known generic name HKUST-1). This compound has an unusual open framework structure that can effectively and selectively separate oxygen and nitrogen from air, as well as being as heterogeneous catalysts for some organic transformations. This compound is now industrially produced by a German company BASF, and is now commercially available (as a trade name Basolite C300) as found in webpage of Sigma-Aldrich Chemical Company. This is what I have achieved and this may be useful to others and also important in my life as a chemist.

Why did you decide to come to teach at NUS?
I realize that NUS has a great international reputation and the faculty is strong in teaching and research. Because of the expiry of my previous contract, I had to leave there. As such, I had to think about where my career was going. Before I joined NUS, luckily, I did have a one-year teaching opportunity. At the time, I taught two modules, bioinorganic chemistry and medicinal chemistry. I felt a sense of satisfaction after delivering lectures to the students, and had a strong feeling that I definitely preferred teaching in the lecture theatre over the X-ray laboratory. As a teacher, I can interact with more students and inspire them. It’s certainly a meaningful and respectable job. Luckily, I was hired by NUS and am very pleased about that. Frankly speaking, I hadn’t been in Singapore before my employment by NUS. I actually wasn’t even aware of NUS’s high university ranking. However, Singapore is a very nice place for my family. As it is quite similar to Hong Kong, I think it won’t be difficult for my family to adapt the lifestyle here. I arrived here on 14th December 2012 and I am quite enjoying the lifestyle here. It’s much more green and peaceful, and I find that people around me are all very friendly.
Interview with Dr Stephen Chui

What are your teaching and administrative duties?
I teach CM2111 Inorganic Chemistry II and CM4214 Structural Methods in Inorganic Chemistry. As for administrative work, I have been newly assigned as the UROPS coordinator. Together with my colleagues, I will be one of the trainers for Singaporean and International Chemistry Olympiads 2014. I do want to thank all those who have helped me to successfully organize the Chemistry Day Camp event during the NUS Chemistry Week 2013. I have learnt many things from this event.

What do you think are some of the similarities and differences in the education between Hong Kong and Singapore?
I can’t say too much about the similarity and difference in the education between two places, since I am still a newcomer here. In general, Singaporean students are relatively kinder and more respectful to others (teacher as well). For myself, I certainly try to be respectful to them as well. I think that this is a result of my being a foreigner here. When I was teaching at HKU, most of the students were obviously from Hong Kong, so they didn’t really treat me as anything special. But here, I’m a “foreigner”. I may have quite different living experiences, background, culture, interests, which might invite Singaporean students to talk to me about. Maybe that’s why we can nicely get along to each other. In general, I feel that Singaporean students are more focused on academic achievements, and are extremely driven and hardworking. However, they have to be careful to not be overly obsessed with their studies and lose track of everything else. Modules offered by the university only make up a very small portion of one’s life. And sometimes, being too preoccupied with work can produce the opposite effect and actively harm rather than help you. “Be in the middle way and never go to extremes”.

What advice would you give to the Science student who is considering between research and teaching?
I think that the student should seriously consider his or her own interests first. Does the student want to be a good teacher? Does the student want to be a good researcher? Teachers and scientists are very different in nature. So it’s very important if you can find out the career direction before you graduate. If you’re still undecided, my advice would be to discuss it with a senior, mentor or teacher. Most of them would have faced these kinds of questions before, after all, and would thus be in a great position to help. Finally, time is limited; don’t waste it, regardless of what you are going to do.

Class of CM2111
AY13/14 Sem 1
Interview with A/P Lai on Chemistry Specialisations

Kwan Yee Ching, Choo Hui En, Tan Yong Quan

The Department of Chemistry has recently introduced specialisation options for students graduating with B.Sc (Hons). These specialisation areas, in Materials Chemistry, Medicinal Chemistry and Energy and Environment, are offered in response to current job market and research trends. We speak to A/P Lai, one of the project’s directors, to learn more about the specialisation options.

What was the motivation behind the creation of specialisation options for Chemistry undergraduates?

It is mainly due to two reasons. Firstly, in the last 10 years the educational or the curricular landscape has changed in NUS. In particular, the key change is to build up experiential learning component, which includes UROPS, SEP and professional placement. All these are different practices for experiential learning and students have a choice of taking one or a combination of these components depending on how they plan their curriculum. This is to offer optimum flexibility in terms of students’ designed curriculum. In line with this, the second reason behind why we would like to introduce specialisation is that currently we have the Applied Chemistry, which is more or less a specialised program. This is program-driven and thus offers relatively less flexibility outside the program. Students enter the Applied Chemistry course after their first year, and in some cases they may not have covered sufficient chemistry fundamentals to allow choice of different specialisation in higher years. We believe that with the broadening of the education or subject education, a lot of barriers are coming down between chemistry and biology, chemistry and physics, with a lot of these so called combined specialisation areas. We need a more common platform for students to move into in higher years. We believe that students should have 2 years of basic training in general chemistry before entering specialisation, rather than entering a specialised program after one year.

Applied Chemistry is a structured program where students need to fulfil specific requirements and this may lead to a compromise in certain areas of chemistry fundamentals. Some Applied Chemistry students may find they may have insufficient knowledge of fundamental chemistry as they move up to higher years, particularly in their final year projects. The compulsory Professional Placement in Applied Chemistry has been invaluable, but the program structure may restrict students’ choice in another experiential learning like SEP, or in doing both. With the specialisation program, we are trying to retain the good features of Applied Chemistry and yet opening up the doors to everyone, with greater flexibility. Thus all students can start from a general platform for 2 years and if you would like to specialise, you plan or design your curriculum accordingly, but do it as early as possible for optimum flexibility. Take note that whether your intention is entering the job market directly or doing graduate studies, specialisation may or may not be the right choice. You may still consider focusing on the more classical chemistry areas. Offering an honours degree with specialisation is not to say that this is a better program, we are just opening more doors for students to plan or design your very own
Interview with A/P Lai on Chemistry Specialisations

curriculum. To some, specialisation works wonders; to some it may be a hindrance. The key message is we want to offer greater flexibility and more opportunities for all chemistry students in terms of curriculum choices and experiential learning on a similar platform. We don’t have to end up with internal competition between the Pure Chemistry and the Applied Chemistry, as both programs want to attract the best students.

What are some of the difficulties that the department has faced during implementation of this specialisation program?

I think we still have quite a bit to go in terms of full flexibility. We are just streamlining our curriculum to a more generic platform that offers more flexibility. From our past records, there is not much difference between Applied Chemistry and Pure Chemistry graduates in terms of career prospects. We are offering 3 specialisation options at the moment and we are still thinking about offering specialisation in Analytics and Forensics in the future. Maybe we have yet to optimise the possibilities of specialisation. On the other hand, this scheme gives us the flexibility to alter the program in response to future changes. As an example, maybe 5 years later area X of chemistry is no longer in great demand and another area Y of chemistry is emerging. Hence, we may condense X and introduce specialisation Y. If our first 2 years of foundational chemistry are good, then students would still do well even if we change the specialisation options in the future.

For the fundamentals (Physical, Organic, Inorganic and Analytical Chemistry), we do not claim them as specialisations at the undergraduate level. But you can prepare yourself in different combinations to different depths to better prepare yourself for a graduate program in these areas, local or overseas. We are going to condense some of the Applied Chemistry modules into elective Chemical Technology modules at a later date. For example, students who are going into Materials Chemistry specialisation and think that they are going straight into the industry can take the Chemical Technology modules at their own initiative. Our main problem is to optimise the number of modules available for the specialisation. At this point we have enough modules in-house. So our big challenge is to look at some of the other departments’ modules or even other faculties’ modules like Engineering, which would complement our specialisation options. Immediately, you might realise that the big challenge is that a lot of those modules have pre-requisites, which means that the students would have to plan way early ahead.

Currently our main effort is to get enough in-house modules for students for each specialisation. Another challenge is to match the final year project with the student’s specialisation area. That is difficult to control in terms of exact match in supply and demand. Although there is a channel now that if you cannot get a final year project (FYP) in the specialisation, you can still file for specialisation by reading more courses. Of course, every student would like to do a final year project that is based on their specialisation. But if you are really keen on a specialisation, you should view it as equipping yourself with the relevant knowledge as much as possible and plan to take more modules from the specialisation area. There is no reason to say that if I do a research project in that specialisation, then I don’t have to do the rest of the specialisation modules since the final year project can account for 8 Modular Credits (MCs) (equivalent to 2 modules) towards specialisation. Students should not have the idea of wanting to do a specialisation but still choosing the easiest way out. If I were the student I would take those 2 extra modules as well as after all I am aiming for a specialisation. We hope students can look at specialisation in a more open-minded way rather than as a prescribed recipe for them to
follow till graduation. The bottom line is: we are close to world-class in terms of curriculum design. We have the resources, we have the people to teach and train students but we still lack student initiative in terms of planning their own curriculum. I think some of our students are still a little bit too dependent on program-design curriculum in the sense that you don’t design your own curriculum based on your needs, but you simply fit into the programs that are offered. There are many decisions you have to make, like when do you do SEP, whether you can couple it with UROPS, or Professional Placement, and whether you have time to fit these things in and what are the available combinations. We are not offering a fixed recipe for you, so students have to come with their own initiative to bring the best out of the specialisation program to meet their interest and needs, and to plan from year 1.

The last challenge is how we link up with the industry well so that we can provide practical advice to students on the job market in each specialisation. I am sure if Analytics and Forensics is offered, many would want to do it, probably because of popularity rather than practicality. But Singapore’s forensics market is small. Thus, we cannot produce 50 forensics graduates a year. This is again, back to students’ wise decision in their choice and planning. This is because by taking up a specialisation related to a small job market, rather than getting yourself a good job, you may end up with no job if there is an oversupply. We are trying to work with the industry to see what the job market is like, and we certainly do not want students to think that specialisation is definitely the best for all of them. We are hoping not to have a flood of students doing a particular specialisation.

**Will there be any quota for each specialisation?**

At this point, we do not want to publish a quota, but when the number of students interested in a specialisation grows too big we are going to talk to them. Medicinal and Materials Chemistry in Singapore are still looking very good, with Environment and Energy coming up. However, it would not be wise to produce too many graduates in any specialisation area.

**Students only file for specialisation towards graduation. How then will the department control this number?**

It is the student’s decision to file for graduation. If you fulfill all the requirements, and towards graduation you are going to apply for a job but do not want to give the wrong impression that you are too specialised, then you do not file for specialisation. The flexibility is there, depending on what your next phase is going to be. For example, you happen to look at the papers and 5 out of 10 jobs available are in your line, then it is fine for you to file for specialisation before you graduate because you know the trend is going to be there for the next couple of years. In this case the specialisation might give you an edge when you go for the interviews. On the other hand, if you see that the field is not in great demand, or from your own planning you are going to go into different areas after 2 years, then you might not want to file for specialisation. Students should be mature enough to make their own decisions. We are, of course, available for advice. Things change, even for research areas. We may have a dialogue session with those who have some idea of doing specialisation to explain to them what the current situation is like.

**But sometimes students are less active in such discussions. What if they do not turn up?**

The following is strictly my own opinion: After thirty years in NUS, probably the only thing I will regret when I retire is that our students do not take the initiative. I think it is about time not to do everything for the students. We will educate them
in that when you are given an opportunity you have to take it, whether it is for clarification or consultation. It is your curriculum, so you have to take ownership and initiative. We are here to help but we are not going to babysit. You can decide during the 2 years whether you should file for specialisation or not. After 1 year, if you find that you do not like what you are doing, or it is not what you expect, then you still have time to take another route. Nevertheless, it is important that these students do not think that those modules that they have done are wasted because they would be equipped with more knowledge and they would be able to talk about it even if they do not have to work on it in the future. The flexibility is there. You have to do your part too if you want to optimise the value of the program.

When might the specialisation in Analytics and Forensics be introduced?
We are looking at it. It is a more practical but specific or “narrow” kind of training. Unless we have a good feel that students understand that it is not CSI, and are not going to enrol themselves in the program just because of its popularity, we may delay mounting it. We also have to work with external institutions and organisations in coming up with good practical training to complement the academic curriculum. If we introduce this specialisation, it will have limited places. This is not to deprive students of the opportunity to study in the field of Forensics, but because you may not get a job in the end if there is an oversupply. That is why we have to design it much more carefully and have put Analytics in. We would like to have a very sound foundation on analytics with specialised training in forensics, so that a small group of students can go into specialised forensics training while some might go into Analytical Chemistry as a career.

You mentioned that for students who wish to go into graduate programs, specialisation may tie them down in terms of flexibilities, but will there be advantages as well?
Some universities may ask students to take an aptitude test or an entrance examination for their graduate studies so as to establish what they have learnt and maybe to tie up with scholarship or even teaching assistantship. In this case you cannot tell your department that you can only do materials chemistry, for example, and not be able to do other areas of chemistry. This is an exaggeration but it illustrates my point that you may stand to lose out if a more general platform is required in what you are seeking. We already have this feeling that our students are staying away from the more difficult modules. This is a historical baggage in undesired mentality that we have to carry, but hopefully we can break it at some point. We don’t want specialisation to make it even worse. Like I said, we are going to expand the number of modules available to give students more flexibility for selection. But I don’t want it to happen in the negative fashion. For example, for graduation, you only need to take 10 modules, and there are 10 modules offered in Materials Chemistry, so you take all 10 in Materials Chemistry plus a FYP without exploring other areas of chemistry. Of course, if your aim or plan is to do graduate studies in Materials Chemistry then the specialisation may be suitable. Otherwise such a move may place you at a disadvantage in other scenarios.

Is it possible for students to take modules from other departments or faculties to fulfil the requirements for specialisation?
This is not in place yet but we are looking at it and it is possible in time to come. We will bring in modules from other departments and faculties. For example, there is no reason why students pursuing specialisation in Medicinal Chemistry cannot include some pharmacy or life sciences modules in
their curriculum. For Environment and Energy there is no reason why we cannot look at membrane engineering. Starting next year, anyone who falls within the specialisation areas can file for graduation with specialisation. However, for students who entered NUS 2 years ago, the specialisation programme that they go through may not be fully equipped modules outside of Chemistry since this is a relatively new programme. By AY14/15, there should be modules from their departments that students can read to fulfil the specialisation requirements. But the majority should still be chemistry modules. The specialisation only needs a minimum of 24 MCs, in which case you cannot split half between Chemistry modules and modules from other departments, for example. I have to emphasise that although we have not officially put modules from other departments in, through personal consultations with the academic advisor, students have a lot of room to take what they want to pursue their interests and goals. In principle, naming specific specialisations is redundant; we are just spelling it out for you. You can always go for an interview and give more credit for yourself by saying you have planned this from your first year, and the modules you have done allows you to be specialised in that area. It is not necessary to put it explicitly in your transcript. If our students plan their own curriculum, you define your strength in it, and strictly speaking there is no difference from a spelled specialisation in your transcript. You can even design more appropriate courses for yourself than those prescribed.

**In that case will there be prerequisites of modules from other departments in order to take higher level Chemistry specialisation modules?**

It is now a general trend in the university to treat year 3 and 4 as the same bracket. In the classical way of thinking, level 3 is easier than level 4 and level 4 modules need the knowledge from level 3. But I think the current concept is that year 3 and 4 are advanced modules, and they are the same in terms of difficulty and depth because they are more topical. Hence, we may reduce the pre-requisites to year 2 if not year 1. I understand that there is currently some confusion in the descriptions of some modules after the changes, and some only have a one-sentence description. There has been an ongoing effort in providing a more comprehensive description for each module. There may also be detailed syllabus in the IVLE platform for each module. If there is doubt, by all means come and consult us, since we cannot possibly publish all the possible combinations and scenarios. A standardised format of the syllabus of each module will soon be made available in websites at department, faculty and university level.

**Will there be lab components for the specialisation modules?**

For the next academic year (AY 13/14), CM3291 and CM3292 will still be in a similar format as before. From AY 14/15 onward, lab components related to specialisation will be incorporated into the CM3291 and CM3292 modules. In addition, from next year (AY 13/14) onwards, all practical modules will have a similar format, mode of assessment, expectations, lab report examples and all these aspects will be published online. We have standardised comment codes in the marking of report. For level 1000 and 2000 lab modules, all reports will be marked by faculty members, and we have standard codes for each type of comments. Students should refer to those codes and reflect on their reports. In the future, lab examinations will all be done in a standard format. The next phase is to see how we can build these specialisation trainings into the practical. Our plan is to have a basket of experiments. For example (not finalized), there might be 7 baskets, Organic, Inorganic, Physical, Analytical, Materials, Medicinal and Energy and Environment, and students will choose to do any 5 baskets; or we will condense Organic and Inorganic
Interview with A/P Lai on Chemistry Specialisations

Into synthetic chemistry training, and group Physical and Analytical chemistry into one basket. Again, we are hoping to introduce flexibility but this will be implemented only in AY14/15.

**Will the number of academic staff be a limitation?**
We believe that years 1 and 2 form the foundation and so level 1000 and 2000 practical modules will be mainly handled by faculty members, and teaching assistants will play a minor role at these levels. For Level 3000, we want to introduce open-ended type of experiments. For example, we don’t have different experiments, but a series of synthetic reactions and we couple the spectroscopic application directly into the practical. So you may have to spend 4 weeks in doing 1 experiment but it is a sequential project. Therefore, we will have competent Teaching Assistants (TAs) specifically trained for this purpose. These TA will be trained by faculty members who would design the experiments. We are trying to go for a ratio of 1 TA to 10-12 students. For practical modules, we have reduced the ratio of students to equipment. Limited space is still a challenge to us. Another aspect we are going to introduce into the practical modules is to include writing risk assessments. Starting next year we will have pre-lab component that students have to work on. We are going to make use of IVLE for the assessment, and the assessment has to be done within a certain time period. Probably you will be given 2 attempts online in total. If you fail both attempts then you have to talk to the lecturers-in-charge. If they think that you are really not prepared, then you may be barred from doing that experiment. However, if the lecturer finds that you actually understand enough then you may still be allowed to enter the lab.

**In summary, the new specialisation options open up new doors for students to pursue their interests and goals. A B.Sc(Hons) degree with specialisation is not necessarily better than one without. It is up to the student’s initiative and prudence to decide the best path for him or herself. The specialisation program should grant Chemistry students greater flexibility in designing a curriculum that would portray them as having a specialised set of skills that might be valuable in specific job and research areas. Students who do not graduate with specialisation should not feel disadvantaged as general training in all areas of chemistry is useful, as it has always been. **Do note that students who are not intending to specialise can still take modules under the specialisation program to fulfil their major requirements.**

**For queries and academic advice regarding specialisation, please approach:**
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For CM students, CM326X modules can only be taken as UE but not to fulfil major requirements as they are Applied Chemistry modules. An exception is CM3261 Environmental Chemistry, which can be used to fulfil CM major requirements as it is one of the modules under the Environment and Energy specialisation for CM majors.

The Applied Chemistry program no longer admits new students with effect from AY 13/14.
Interview with a Japanese Exchange Student

Chan Guo Dong

As many Chemistry students go on overseas exchange programs during their second and third years, likewise there are some foreign students who choose to spend 1 or 2 semesters in NUS Chemistry. They bring with them interesting insights that help NUS students gain a better understanding of university education around the world. I speak to Aomori Yuki, a Japanese exchange student, to learn more about university education in Japan.

Could you please introduce yourself?
Hi, my name is Aomori Yuki. I am from the Kyoto Institute of Technology, and I will be in NUS for a year (2 semesters) as an exchange student. I am an Applied Chemistry major, specializing in Materials Chemistry.

Could you briefly tell us what is the system like in Japanese universities?
In the Chemistry Department in my university, all freshmen will study the same modules for organic, inorganic, and physical chemistry. From the second year onwards, we will be separated into Materials, Polymer and Biochemical specializations.

Our modules are such that they are either just lectures or only tutorials. Both types of modules are of 2 modular credits (MCs) each. Hence, a particular topic would take a total of 4 MCs. In the lecture modules, the lecturer would be standing at the front of the hall and give a lecture on the topic; while in the tutorial modules, we would be applying our knowledge from the related lectures to solve questions. However, the tutorial modules are only available for the more important modules. Thus, the more in-depth and less important modules such as “Surface Science” would not have any tutorials.

How do the lecturers teach in Japan?
There are various types of teaching staff in Japan, but most of them have the aura of researchers. Due to the depth of the topics, it is often the case that students do not understand what is being taught. There are lecturers who just write on the blackboards and not say a word. There are also lecturers who read off from the textbooks.

Thus, it would be common to see some students preparing for tutorials, writing lab reports, or even sleeping during lectures. However, 100% of the module grade is dependent on the final exams. Therefore, as long as we score more than the passing mark of 60% in the final exams, we would be safe.

What about the tutorial modules?
We have around 13 tutorial sessions per semester. In each tutorial, there would be a 45 minutes test on the topic, which is followed by the marking and explanation of the answers. Our final grade is dependent on the average of the 13 tests. As long as we are able to score an average above 60%, we would pass the module.

What differences have you observed between lecturers in Japan and in Singapore?
I feel that the lecturers in Singapore have a strong sense of wanting their students to understand what they are teaching. They often ask questions like “Do you understand this?” or “What is the answer to
Interview with a Japanese Exchange Student

this?” They have a very good understanding on how to use the computer software to teach effectively. However, the bad thing would be that there are some lecturers who have very strong accents, and that is something which I am still unable to get used to.

How are the laboratory sessions conducted at your university?
There is a big difference between the things that the laboratory staff in the two countries are strict about. In Japan, there is less focus on the outfit to be worn in the laboratories. As long as you are wearing a lab coat, it would not matter what you are wearing underneath the lab coat. Instead, there is a great deal of emphasis on the clean-up process. We usually wash the glass using acetone only when organic compounds are involved. Other than that, the glassware are washed using deionized water. Japan emphasises on minimizing reagent wastage and environmental issues with regard to chemicals.

There is also a difference in the lab reports between Japan and Singapore. In Japan, our reports are handwritten in Japanese, and depending on the experiment, can be over 20 pages in length. The emphasis of the reports would be more on how experimental yield can be improved, rather than explaining the observations from the experiment itself.

Lastly, do you have any advice for students who are intending to go to Japan for SEP or for further studies?
Based on my experience, I would think that the greatest thing to take note of would be language. Japanese students are a little shy, and there are few who would actively speak in English, so it would be good to be able to speak some Japanese. It would also be better if you have a common topic to talk about with the Japanese students, for example: anime, manga and music. A common topic would be able to bridge the gap between students. There are fundamental differences in culture and practices between Singapore and Japan which cannot be simply stated out. Thus, it would be better to take note of them and learn and adapt during your stay in Japan.

From the academic point of view, both Japanese and Singaporean university students are good at their studies, so there should not be many problems adapting to school work.

Images of Kyoto Institute of Technology from http://www.kit.ac.jp/english/
CSS organized an industrial visit (IV) to GlaxoSmithKline Beecham Pharmaceuticals Ltd (GSK), located at the Jurong Industrial Estate on 27th September 2013. Upon arrival at GSK, the 40 participants were warmly greeted by the staff and Mr George Lam, who is the Director for Operational Excellence and Sustainability for the GSK sites at Pioneer Sector 1 and Quality Road in Singapore. He gave us an overview of the company structure and its different medicines, vaccines and consumer healthcare products.

Afterwards, the participants were divided into two groups and toured the analytics laboratory and amoxicillin plant, with Mr George Lam and his assistant serving as guides. We visited the control centre and observed how the engineers monitor and regulate the manufacturing line. Some engineers took time off their work to interact with the participants and briefly introduced their daily working procedure, manufacturing practices and precaution steps to be taken during emergency. These good manufacturing practices include self-inspection to ensure applicability of the quality assurance system as well as regular evaluations of the quality standards of the products with the objective of continuous improvement. The passion and commitment of the staff were visibly evident in their interactions with the students.

Subsequently, we were brought to the analytics laboratory. Detailed explanations of the instruments were provided by the guides as the participants explored the laboratories, marvelling at the similarities and differences between the NUS laboratories and the laboratories at GSK. As the main product at the Pioneer plant is amoxicillin, we were introduced to equipment for the qualitative and quantitative analysis of the drug. Some instruments, such as gas chromatography, were familiar to us, while some instruments, such as the Karl Fischer titration cell (used to determine trace amounts of water in the product), were not. We thus developed a greater appreciation of the theory learnt in analytical chemistry modules.

The IV to GSK was fruitful as many of us saw the real-world application of our education at NUS. We also gained a better understanding of how scientists and engineers work in a pharmaceutical plant. CSS will be conducting more IVs in the future so keep a look-out for such announcements!
The General and Physical Chemistry Teaching Laboratories were refurbished during the 2013 summer vacation period to better suit the needs of Chemistry students. The laboratories, located at S5 Level 1, are now fully air-conditioned to create a more conducive learning environment. New instruments were also purchased to replace some of the older ones. Do look forward to learning experimental techniques in the new brightly-lit and spacious laboratories!
Taking a UROPS (Undergraduate Research Opportunity Program in Science) module sapped much of my energy and time for two semesters. But in exchange, I gained first-hand experience of completing a research project and rewarding learning relationships well beyond my initial expectations. Under the guidance of Asst. Prof. Jason Yeo, I began my UROPS project on the electrochemical reduction of carbon dioxide into useful hydrocarbon products. Learning the ropes from Dr Chen Chung-Shou and the fourth-year students in the group, I started with conducting supervised experiments. During the hour-long gas chromatography experiments, I was happy to help in the lab with various tasks, such as rinsing NMR tubes and preparing solutions for later use, relishing my time in a research lab watching actual researchers and students doing their work. Working without textbooks, the main source of information was research papers. The novelty of the field meant that much was to be discovered, and the real-time sprouting of new research was particularly exciting, for science as I had always read from books was being written before my eyes.

The semester flew by quickly with me spending most of my free periods in the lab, tagging along with experiments or trying new ways of increasing the hydrocarbon yields from carbon dioxide. One particular flop was when we deposited copper particles onto gold discs in a bid to obtain a higher ratio of ethylene to methane. Our initial excitement over a few experiments with particularly high ethylene selectivity quickly died after finding out that they were only produced by chance. Working with Chung-Shou, it was eventually found that the key to high ethylene selectivity was pre-roughening the copper discs in KCl solution. Even though the material analysis was afterward undertaken by Chung-Shou, he always made sure that I kept up with the findings by patiently explaining what he had found and what he was going to do next.

Weekly meetings with Jason also allowed us to review the progress of the research. I was pleasantly surprised at the high level of involvement Jason had in all his students’ projects and with the support and encouragement provided by everyone.

When it came to writing the report, I faced problems presenting the data in a clear manner, which was mostly helpfully pointed out by Jason after reading my drafts. Writing the report was challenging as a lot of data was collected, but only the right data had to be weaved into a coherent story. Many inadequacies in the data were also sieved out during the writing, for we took a step back from conducting experiments to analyzing all the pieces of information together. I am particularly thankful that Jason gave me multiple opportunities to rehearse my presentation before my presentation with my examiners. The short presentations to A/P Xu Qing Hua and Prof. Lee Hian Kee were daunting, but my examiners provided useful feedback which I conveyed to Chung-Shou about how we could improve.

Every bit of time and energy that I have invested into my UROPS project has brought forth most spectacular returns, for deciding to do it is probably one of the best decisions that I have made in NUS. The experience and relationships which I have gleaned are priceless, and I hope that you will also embark on your UROPS project if you are interested in research, or simply trying to find out if a Final Year Project is for you. If not for UROPS, seeing a research project through is something I would neither have the expertise nor the opportunity to do, and definitely one of key milestones of my life in NUS.
UPIP Experience

Yesika Monditalia Ali

UPIP (Undergraduate Professional Internship Programme) at Nestlé Quality Assurance Department

Daily operation in Nestlé’s Quality Assurance (QA) department includes sensory testing where the lab technicians and QA executives would taste Nestlé products such as Milo, malt and soya sauce powder on a regular basis. Furthermore, the experiments performed during my 12-week internship included the quantitative analysis of vitamin C in Milo products, calibration of halogen moisture analyzer and determination of silica concentration in Nestlé drinking water. These experiments involved mainly analytical chemistry which allowed me to put my knowledge into practice.

How was the UPIP?

The internship at Nestlé was an interesting one as I acquired an overview of how a food industry works and the type of job positions that are available for a science graduate (i.e. higher management position such as QA executives). However, the QA laboratory involved routine work which made it mundane. As a more hands-on individual, the QA executive position did not interest me as their job scope consists of mostly paperwork. Other tasks included writing reports, monitoring the Milo production site and managing the lab technicians.

What have I learnt from UPIP?

This internship has given me a better understanding of the operations in QA laboratories and to experience a working life. I had the opportunity to put my analytical chemistry knowledge into practice as I performed various experiments, such as the calibration of halogen moisture analyzer which required knowledge of statistics to obtain the precision of the data. The silica test on Nestlé drinking water required the use of internal standard calibration that I have learnt in CM2142 Analytical Chemistry I.

In addition, the vitamin C tests made use of potentiometers, which allowed me to put my background knowledge of potentiometry into practice. I have also gained new skills while learning how to operate instruments such as the water activity meter and doing leak tests to check the quality of Milo pouches. Furthermore, I did paperwork and data entry which allowed me to be more skilful in data management.

Moreover, through meeting different people in the working environment, it allowed me to learn how to handle each individual of different personalities. I believe this will help me greatly when I officially enter the workforce.

Any advice for students applying for UPIP?

I strongly encourage students to go for an internship and learn as many things as possible. I believe that UPIP is really beneficial for undergraduates as it gives us an overview of the type of environment that we will be working in in the future. Also, it allows me to understand more of the laboratory operation in working environment which then helps me to make a proper decision on which career path I would like to take.
CSS organized a Years 1 and 2 bonding event on 3 Jan 2014 outside of LT 27. Instead of organizing a barbeque for Year 1 students only as had been done previously, the CSS ordered a buffet lunch for both the Year 1 and 2 students. The main purpose for this change was to provide the Year 1 students with greater interaction time with the teaching staff and also to provide them with a platform to find out more about life as an NUS Chemistry undergraduate from their seniors.

The event started out with the lunch session to allow everyone to fill their stomachs before interaction. At first, it was the professors who were taking the initiative to start conversation with the students, asking them questions about their experiences in school so far. Further into the day, more and more students took the initiative to ask the teaching staff questions such as what to expect next semester for the various Chemistry modules and how they can best go about learning and studying for these modules. The students also got to find out more about exchange and immersion programmes, such as EURIP. Dr Zhao Jin explained to the students what they can expect from such trips and how they can go about applying for them, as well as the different learning opportunities available from such activities. The professors also took the time to share the various research opportunities that they would like students to participate in.

This event allowed NUS Chemistry undergraduates to be able to talk to the teaching staff in a more informal manner which in turn makes it easier for them to be able to approach any of these teaching staff for help in the future. The professors dispensed advice on how to overcome some of the difficulties encountered while learning chemistry. The teaching staff also discussed with the students how they could better deliver their content so that students would have a more enriching learning experience. At the end of the event, CSS gave out goodie bags to all who attended to thank them for taking the time off their schedule to attend the event. The event has helped foster greater communication between the staff and students of NUS Chemistry. The CSS looks forward to organizing another bonding event in 2015!
The NUS CSS Freshmen Orientation Camp is an annual project that has been organized for many years with the goal of bonding the NUS Chemistry Freshmen together as well as to assimilate freshmen into their university life. The theme of the annual CSS Freshmen Orientation Camp 2013 was chosen to be IGNITE! as the committee members hoped that we are able to kick-start a NUS Chemistry freshman’s life on a good note. Held from 5th to 7th August 2013, IGNITE! was truly an unforgettable event for many, particularly the freshmen as they embarked on a new journey of fun and laughter.

The camp started off by allowing the freshmen to warm up to one another and also to introduce the facilities around NUS and within the Faculty of Science to them. Thereafter, the freshmen went through a series of activities to not only know more about the NUS study environment, but also to have fun while expanding their social circles. Several highlights of the camps included the Amazing Race, academic talks, library and lab tours, games leading to the grand finale, and lastly the climax of the camp: Don’t Forget The Lyrics. The camp ended with a bang with a prize presentation to the best Orientation Group.

Thanks to the dedicated and fun-loving seniors, sponsors and the NUS Department of Chemistry, IGNITE! was highly successful! This event would also not be possible without the participants. To all freshmen, we sincerely hope that you have found the academic talks useful and have forged many new friendships for the path ahead as an NUS Chemistry major.

Let us now walk down the memory lane as we look through the compilation of photos on the next page:
Seniors! Gamemasters Recruitment for FOC 2014

Dear Chemistry and FST majors, we are happy to announce that the seniors and Gamemasters recruitment drive will be done in March! Do look out for our email in your NUSmailbox and we hope to see you during our next camp 😊
Organised biennially, NUS Chemistry Week 2013, from the 1st to 7th June, comprised of four major events – Science of Cooking and Molecular Gastronomy; Chem•Comm Challenge; Fact or Fantasy and Chem Day Camp.

**Science of Cooking and Molecular Gastronomy**
This was a family oriented event that explored the science of cooking and molecular gastronomy. Molecular gastronomy is a sub-discipline of food science that makes practical use of the physical and chemical transformations of ingredients that occur while cooking. At this event, participants were introduced to the science behind cooking and put it into practice by creating a new dish.

**Chem•Comm Challenge**
Chemistry•Communication Challenge (also called Chem-dot-Comm) is a biannual scientific communication event. It provides a vital opportunity to expose students to public speaking and scientific oral communication before their peers and teachers, as well as engage them in exploring new ideas and deeper understanding of significant topics in chemistry.

Chemistry•Communication Challenge 2013 was held in two languages: English and Mandarin Chinese, and besides Powerpoint presentations, web-based presentation was implemented. Participating schools were encouraged to use information technology (IT) to demonstrate difficult chemical concepts. The key advantages of IT are the ease of employing multimedia presentations in place of live demonstrations, as well as interactivity.

**Fact or Fantasy**
Fact or Fantasy is a fun quiz that tests not only how much students know about Chemistry but also perhaps how much they don’t! Teams of three participants were given a wireless control unit to answer their questions. The quiz master asked rapid-fire Chemistry-related questions and participants pressed a button to answer “Fact” or “Fantasy” instantaneously.

Prior to the quiz, there was a **Lab Tour** around the teaching labs and the Chemical, Molecular and Materials Analysis Centre (CMMAC) within the Department of Chemistry.

**Chem Day Camp**
The 2-day, non-residential Chem Day Camp brought students to a learning platform on which to experience interesting and exciting Chemistry through hands-on laboratory activities, demonstrations, interactive sessions, guided tours around NUS and the Institute of Materials Research and Engineering (IMRE).

A total of 298 students and family members participated. It was positive to see the participants put their hearts into food chemistry, chemistry communication and fun experiments. The department looks forward to another exciting chemistry filled week in 2015.
Family Cooking Event:
Science of Cooking and Molecular Gastronomy

Chem•Comm Challenge

Chem Day Camp

Lab Tour followed by Fact or Fantasy
Graduation Night 2013

Liew Xi

The Chemistry Graduation Night was held on 14 May 2013 at Rendezvous Hotel. It was a night of unforgettable memories in line with the theme of ‘Secret Garden: Tell me Goodbye But It’s Not Forever’, where graduating students from Years 3 & 4 as well as teaching staff from the Chemistry Department joined in the event to celebrate the completion of their education at NUS and to welcome a new chapter in their lives. Throughout the dinner, guests were entertained by live band performances by students and professors, along with interactive table games. The highlight of the night was the pageant contest, in which three pairs of best dressed couples went around garnering for votes. This was a night that we hope the graduates would look back fondly upon as part of their journey in NUS.
Graduation Night 2013
Introduction
The Europe Immersion Programme (EURIP) commenced on 21st May 2013 and concluded on 18th June 2013. The EURIP was mainly held in Lyon, France and was hosted by the CPE Lyon. There were also short trips organized by the school to areas out of Lyon, which included Paris and Geneva, Switzerland. The EURIP also included various academic and cultural visits in France which formed the highlight of this immersion program. Coupled with the lessons conducted by professors from CPE Lyon, the EURIP experience has been an enriching one way beyond my expectations. It has indefinitely formed a remarkable first-time experience studying overseas for me.

Academic Visits
The various academic visits that we went to as part of the EURIP were an eye-opener to me. As a Food Science & Technology (FST) student, some of the visits were particularly applicable to me and were in my areas of interest. Other visits, though not directly related to FST, were very impressive as the discoveries made by these institutes most certainly opened my eyes to other fascinating areas in Chemistry.

In the visit to L’Oréal, I personally enjoyed the cosmetic lab the most. In this lab, we were briefed on the general process they used to come up with a new formula from the mixing of different pre-prepared solutions. This process involved various complicated steps of trials just to come up with a single formula. Most importantly, the plus point of working in this lab is that the researchers are to take home their concocted trial samples to apply on their skin as part of the concoction process. No wonder they have such vibrant and smooth skin!

The visit to L’Oréal is largely applicable to me as these companies have certain fields of research that revolve around some underlying concepts taught in FST. What intrigued me the most is that those fields of research conducted in these companies were what I was particularly interested in – fragrances and flavours. As such, this allowed me to have a general idea of what the industry I am interested is like in France. As an undergraduate entering year 2, this has inevitably provided me with an insight of what the cosmetics and fragrance industry is like. Perhaps if I were to choose work or intern in this industry (or even in these companies) in the future, I would have a rough idea of how the overseas division functions.

We also visited CERN and a NMR research center. Prior to EURIP, I had no idea what CERN was. It was only during the EURIP that I learnt that CERN uses a mind-blowing technology to, in very simple layman terms, discover new particles by colliding other particles at very high speeds. From what I understood from the CERN visit, this collision is achieved by the large accelerators. Although my interests lie in the biological and chemical sciences, the CERN visit has definitely served as an eye-opener to the wonders of the physical sciences.
Europe Immersion Programme

The NMR research centre was remarkable as well. Despite being familiar with the theory behind NMR, it was my first time seeing a NMR spectrometer in the process of analyzing a sample. What was even more fascinating was that the NMR spectrometer was used to analyze complicated compounds, such as proteins. To me, using the NMR spectrometer to determine how the structure of a protein changes with its interactions with different biomolecules in the human body was extremely novel. As such, this visit most certainly broadened my horizon towards the life sciences as I would never have thought of NMR spectroscopy as a technique used to unravel new proteins, their structures and functions.

Cultural Visits
Besides the academic visits, EURIP also focuses on learning the culture of France. The places that I visited included the Louvre Museum, the Palace of Versailles, the Notre Dame and the Eiffel Tower in Paris. The architecture was majestic and astutely crafted. The culture that could be inferred from these places of interests certainly depicts one that is largely European. However, some similarities could be drawn between the European and Chinese culture, one of which is perhaps the history of France. From what I learnt in the Palace of Versailles, the rulers of France were replaced one after another through war, much like how the rulers in China changed from one dynasty to the next. In the Louvre museum, what I mainly wanted to see was the famous Mona Lisa portrait. It was only upon seeing the portrait that I felt that my trip to France had not been wasted.

As part of our cultural visit in Lyon, we traversed through the Traboules, which are corridors or shortcuts used to transport goods around Old Lyon in the past. Now, from what I observed, the Traboules are mostly corridors of residence areas, much like the shophouses in Singapore. As the primary religion in France is Catholicism, CPE Lyon also organized visits to a number of Roman Catholic churches, which are prevalent in both Paris and Lyon and most likely the rest of France as well.

Another appeal of the EURIP is the Beaujolais winery visit. What made this visit so memorable was the fact that it was the day of the release of our results. As such, we were joking that we could take this opportunity to drown our sorrows or celebrate our victories. Jokes aside, the truly memorable part of this visit is that we were treated by the owners of the vineyard like family. Not only did I have to chance to taste Lyonnaise home-cooked food, I also experienced life in the countryside. It was only through the Beaujolais visit that I could truly experience the countryside culture of Europe that I had read about in story books when I was young but never had the chance to experience it until now.

The final visit that I was looking forward to and left me with the deepest impression was the visit to Paul Bocuse Institute. As someone who likes baking, the
visit to Paul Bocuse Institute was an eye-opener. France prides herself for her culinary scene. As such, the Paul Bocuse Institute is not only well furbished to reflect its grandeur but also had well-detailed lessons for its students. I also learnt a lot from the baking demonstration by a patissière from the Paul Bocuse Institute and the techniques learnt definitely aids in improving my baking skills as well as broadening my perspective towards baking. In all, the Paul Bocuse Institute certainly impressed me.

Lessons
Academic and cultural visits aside, there were lessons conducted by CPE Lyon since EURIP is a summer school. These lessons included both chemistry laboratory sessions as well as French lessons. The chemistry laboratory sessions involved concepts that were both familiar and new to me. The familiar ones were recrystallization and the theory behind chemical processes which I learnt in CM1191 and CM1161 respectively. Concepts that were new to me were the use of the gas chromatography as well as the fractional distillation column. As I would be learning these concepts in later semesters, having an exposure during the EURIP has undoubtedly provided me with a slight head start in terms of being familiar with the equipment.

In addition to the Chemistry lessons were the French lessons, which was what I was looking forward to. As someone who took up French as a third language during the secondary school years, going to France and learning and speaking French has always been my dream. However, as I had not spoken French for 6 years, the French lessons were a very excellent refresher course. Listening to the locals speaking French also proved to help in regaining some of my basic French linguistic skills. As such, after the first week in France, I was better able to ask for directions and grasp what the locals were speaking. Also, I realized that the French I learnt in secondary school was vastly different from speaking French in France as there may be lingo that the French use in their daily communication with each other. As such, the EURIP indeed proved to widen my exposure to French as a language.

Conclusion
Looking back at the EURIP experience, I feel that every single moment in France was precious. The academic and cultural visits helped broaden my horizon on the career prospects on said industries as well as how it feels to work overseas. Last but not the least, the EURIP has allowed me to gain a perspective of France from an undergraduate’s point of view – one which I would not be able to gain if I were to ever go to France as a tourist. Such an experience definitely beats the usual shopping and sightseeing activities that a tourist would normally partake when they are in Europe.
Going on China Immersion Programme (CHIP) organised by the Chemistry Department was an initial struggle for us as the 25 days trip seemed like a long time spent far away from home. It was also our first time away from Singapore for such a long time. Nevertheless, we decided to take up this rare opportunity. On the 9th December 2012, we, along with 20 other Chemistry majors, embarked on a 25-day trip to China, together with Dr Emelyn Tan and Mr Lee Ka Yau (Scientific Officer, SEM Lab).

Our first impression when we reached Shanghai Pudong International Airport was: “It is not that cold after all.” Then the wind blew and we felt the bone-chilling coldness. Taking 15 minutes to put on thick layers of winter clothing daily was something new that we had to include into our morning routine. There was once that I (Xing Hua) jumped off a high step during a garden visit. It was a wrong move. Grace said that I looked like an acrobat, with me sliding on the icy pavement, running a few steps and then finally flying towards the solid rock pavement. Thankfully, due to the thick layers of tops and pants, the injuries were minimised to just bruises on one side of the body.

We first went to one of the most renowned institutions in China, Fudan University, to visit their chemistry department. It was quite an eye opener as this was our first time visiting an overseas university. It was a great chance for us to find out what the chemistry curriculum is like outside of NUS. The fact that chemistry was to be taught in Mandarin sounded daunting. In addition, the trip to Fudan University made us realize fortunate we were to have great facilities back at NUS as compared to those limited ones in Fudan University.

Our cultural exploration in Shanghai began later in the evening. The journey to the Shanghai Bund was long, but the scenery was magnificent and not like anything that we had ever seen before. As we walked along the Bund, we could see the heart of Shanghai’s trade and business, Lu Jia Zui, across the Huangpu River. Opposite the Bund, we could see the beautiful city line of Shanghai. What struck us the most was that there was an intricate balance between modernized times and history, separated by a mere river bend. It was modern architecture at one side with historical ones at the other. The Bund depicted the remnants of European style architecture that were part of Shanghai’s history. These two extremes were perfectly matched in Shanghai. It is truly a modernized city comparable to Singapore. Yet, the historical and cultural aspects remain strongly evident. This is what made Shanghai unique.

Our next stop was Hangzhou. We visited the Nong Fu factory, which produces the best-selling bottled
China Immersion Programme

mineral water in China. The factory does not make use of chemicals in its water purification process. Instead, the water purification process is based on physical concepts. In addition, the water sources are also carefully tested before use. For the Hangzhou factory, the water source is the thousand-island river. All machines in the factory are specially calibrated such that once any part of the water purification exceeds the standard, the power source would automatically get switched off and the whole factory would cease operation. Such a strict quality standard guarantees the purity of the drinking water. Understanding the manufacturing process of Nong Fu mineral water totally changed our impressions of the China food industry. After the visit, we realized it was not true that most food in China is ‘poisonous’, as is commonly perceived by Singaporeans. There have been efforts put in to ensure high standards of hygiene and safety. The high quality control standards in the factory made us think that the tainted food incidents were just exceptions.

Xi Hu (西湖, lit: West Lake) is a must-go scenic spot in Hangzhou. There, we took a boat on the freshwater lake. The tranquility felt on the boat ride was something that we had never experienced before and the ride felt like a brief escape from reality. The place had an aura of peace and serenity. At night, we watched Yin Xiang Xi Hu (印象西湖, lit: West Lake Impressions), a water-lights show directed by acclaimed film director, Zhang Yi Mou.

It was both magnificent and touching; the lightings were perfect and the ambience was breathtaking.

We visited many universities during the trip. Of all the warm welcomes given by the prestigious universities, China Pharmaceutical University in Nanjing impressed us the most. Even though we were late due to the bus driver being lost, the university, together with their principal and the board directors, gave the NUS students a very warm welcome. They also placed a lot of thought into making us feel appreciated by making a long banner to welcome our visit. Thereafter, a scrumptious lunch was provided before we visited the school facilities.

We next proceeded to Yangzhou, where we visited another lake called Shou Xi Hu (瘦西湖, lit: Skinny West Lake). The Shou Xi Hu used to be a playground for Qianlong emperor from the Qing Dynasty. We saw an interesting sight as an old man was using a mop as a writing brush, doing calligraphy on the ground. We were impressed by his calligraphy skills, stamina and patience as the words were all equally spaced out and of the same size.
Our last and most memorable stop was Suzhou, where we stayed for 11 days. One positive note about the area that we stayed at was that all the buildings around us were capped at 6 stories high as part of the cultural preservation efforts of the Chinese government. The law prohibits the construction of any high-rise buildings in the inner circle of Suzhou. In addition, it was only at Suzhou where we saw and touched real snow for the first time in our lives! Suzhou is said to be the birthplace of all meticulously designed gardens. Appreciating the view of a meticulously designed garden is paralleled to the action of unrolling a Chinese painting scroll. The exquisite scenery has to be appreciated slowly, and then finally taking in the entire painting. Mere words alone cannot describe the entire scene of the garden. Only, by going there physically and understanding how the entire garden came about, would one be able to understand how magnificent the gardens are.

The Master of Nets Garden (网师园) is one garden that we would fully ascribe the above description to. The day before our group visited the garden, there was a rather heavy snow fall. We made an effort to wake up early so as to reach the garden before the thin layer of snow melted. The snow scenes were spectacular. We all had to agree that it was the most worthy visit in Suzhou.

We had a blast sampling Chinese cuisine. We tried almost all the recommended dishes of each place or restaurant visited. Everyone in the group somehow made it a point to take a picture for every single dish we ate. There were many great restaurants we visited, but I would say the trips to 山外山 (Shan Wai Shan) and 外婆家 (Wai Po Jia) had given us the fondest memories of great food.

It was an extremely enriching trip as not only did we catch a brief glance of education in China, we also sharpened some life skills. It was our first time leaving home for so long and experiencing harsh winter conditions. The trip gave us a new sense of appreciation for China as we saw China in deeper aspects. It was indefinitely an enriching and fruitful trip. We strongly recommend Chemistry students to take up this great opportunity to meet new friends and have a greater encounter with China. In all, we would also like to take up this opportunity to thank Dr Emelyn Tan and Mr Lee for their care, concern, fun and laughter together on this trip.
Choo Hui En

Before going on the Student Exchange Programme (SEP), I was really looking forward to it, yet was worried at the same time. As I had never been away from home from such a long time, I wondered if I could survive in a foreign land by myself. Looking back now, these 4 months of exchange in Hong Kong have been a memorable chapter of my life.

I remember during the orientation talk for exchange students at University of Hong Kong (HKU), the counsellor told us about the different stages of adaption that most students go through. First is the initial excitement of being in a new environment where everything seems so interesting. Next comes the “depression mode” of missing home, and adjusting to a new lifestyle. Then as you slowly fit into the new environment, things start to settle down. Lastly is when it reaches the counting down period to going back home, and you cannot get enough of Hong Kong. Personally, I felt that this cycle describes my exchange experience quite well.

Although HKU is regarded as the NUS-equivalent in Hong Kong, the two universities felt very different to me. Chemistry courses in HKU have much smaller class sizes as compared to in NUS, with the smallest course having only 8 students. The administrative procedures were also very different, as the lecturers and tutors just slot in extra lessons and lab sessions outside of the official timetable. This made it very difficult to find a suitable timing that could accommodate the whole class. Perhaps in this aspect NUS has a better system. For coursework, I felt that the modules in HKU were even more challenging; probably because HKU offers a more compact 3-year curriculum (with honours). Student life is also as vibrant as that in NUS, with many student clubs and societies. From joining some of the student activities, I felt that students take great pride in being in a society and spend much effort in the events. To experience the full vibrancy of the student life at HKU, one should always opt to stay in the student halls.

Many may think that Hong Kong is very similar to Singapore, both being small cities with a fast pace of life. However, from this exchange I realised that Hong Kong can be very different from Singapore. A very attractive part of Hong Kong is that it offers both urban and rural lifestyles. In the numerous outlying islands, nature is still preserved with many mountains, and activities such as farming and fishing are still carried out. City dwellers can easily take a ferry for a getaway, and enjoy what nature has to offer in Hong Kong.

Although most locals can understand Mandarin and English, being able to speak Cantonese allowed me to assimilate into the Hong Kong culture quickly. Staying overseas by myself also gave me the chance to enjoy the kind of freedom where I must be responsible for myself. This enabled me to have the courage to try out new things which I would not have done in Singapore. At the end of this exchange, I am confident to say that I have made use of this opportunity wisely, be it travelling, forging international friendships, cultural exchange, or self-exploration and personal growth. What I will miss most about this exchange is the daily life that I had in my residence and studying in HKU which made up my true Hong Kong experience.
Rayston Leong

I am sure everyone would go on a student exchange programme (SEP) if they were given the opportunity to do so. The Department of Chemistry gives its students this chance to study abroad, experience life in a different cultural setting, and additionally come home with a joint minor in Environmental Chemistry. Annually, the Department of Chemistry reserves places for up to 10 students to embark on the Joint Minor Programme (JMP) in Environmental Chemistry to the University of Toronto (UofT). More often than not, the places are never fully filled and I urge those who are interested in going on exchange to Toronto to really consider this option.

Before I share on my experience at UofT as well as travelling in Canada and USA, I would like to highlight the many aspects that make the JMP different from a generic SEP. For one, application and approval is done directly with A/P Simon Watts and requires no access to the Science intranet. Secondly, you will not be fighting with everyone in the Faculty of Science else for a spot in UofT because the JMP quota is separate from the SEP quota. Third, module mapping for three modules are guaranteed! (Courses ENV237, CHM310, and CHM415 are mapped back to unrestricted elective modules in NUS.) Oh, and your module mapping forms are directly submitted via email to the department for approval and once again do not require you to access the Science intranet.

When people ask me about my experience and exchange to UofT, there can only be one word to sum up the whole of my JMP – AWESOME! If you love the winter like me, Toronto gladly welcomes you with open arms for four months from January to April. In fact, students going in winter have the option of extending into summer as well. If only I had known of this earlier, I would certainly have delayed my travel plans and actually stayed for an extra term in summer before travelling in the later months.

The learning environment in Toronto is different as well. Due to the nature of the courses read there, class sizes are generally smaller and there will be more interaction amongst students and the lecturers. As such, I find that this method of teaching facilitates and improves the learning experience as there is better retention of the subject matter. And although there were fewer contact hours in class (as a Chemistry major, I had an 11-hour timetable for the first time while reading five courses.), we had to spend more time out of class on readings and assignments, compared to the modules taken in NUS. This however offered more flexibility in planning our day and gave us the opportunity to be involved with student life at UofT.

The content covered for Environmental Chemistry as a whole may seem new and somewhat daunting at first but Professor Jon Abbatt, who teaches both CHM310, Environmental Chemistry, and CHM415, Atmospheric Chemistry, is very knowledgeable and effective at relaying the subject content over to us. He is equally dedicated to both research and teaching and uses a wide variety of pedagogical
methods for teaching and assessment. For my cohort, we were reading ENV235, Physics and the Environments, which has since been replaced by ENV237, Physics of the Changing Environment; the thing about ENV235 was that the past year papers were readily accessible online and provided good practice and preparation for the test and exam. I managed to map CHM325, Introduction to Polymer and Solid State back to a dummy NUS module. The notes were detailed and scoring was a breeze. The last module that I mapped there was CHM416, Separation Science, back to NUS CM4242, Advanced Analytical Techniques. Even though Professor Thompson does not give out any notes per se, he manages to capture the attention of the class and learning from the blackboard and an overhead projector was just as effective as compared to other teaching methods.

Some people would go on exchange and find that they are the only ones in the host university representing NUS but that is not the case for those going to UofT. In semester 2 of AY2013/2013, there were 22 of us from NUS on exchange at UofT, we practically saw one another every day even though most of us came from different majors. Especially so for those who were doing the JMP; we saw each other in three of the courses and four for those of us whom had mapped another Chemistry module together. I definitely got better acquainted with my other Chemistry course mates who did the JMP with me by the time we were ready to head back home. This probably stemmed from the fact that four of us rented a house together to split the rent. This made housing very affordable and it was undeniably to our advantage that the house was located in Chinatown, where groceries were cheaper and food suited our palates better. To make things better, our house was located only a kilometre away from our classes and as such, we enjoyed leisurely walks to school on the days we had lessons.

Student life is heavily emphasized in UofT and it is close to impossible to find a full-time student there who is not involved in any form of co-curricular activity at all. Being an exchange student, I had to be as "local" as I could get and I ended up joining Hart House Singers, one of the many choirs in UofT. I even got the chance to perform in a concert with them!

No exchange programme is complete without having toured the country. Even though I was on exchange in Toronto, Ontario, Canada, I travelled all around Canada and the United States as well. Mini trips began during the semester itself when the group of us from NUS took advantage of the weekends to travel to Niagara Falls and Buffalo. A handful of us had a two-week break in the midst of our exams and we decided to travel down to Washington DC to see the cherry blossoms, Philadelphia, New York City and Boston before
heading back to Toronto for our remaining exams (note that those of us on JMP have both credits and grades transferred back and this is discouraged if you are falling behind in your studies). And within five days of returning to Toronto, I was all packed and ready to embark on my grand plan of circling around both Canada and the United States, which I had envisioned myself doing even before leaving for exchange. My trip started off with intercepting a few other NUS students who were en route to Quebec City from Ottawa before heading back down to Montreal. From there, I began my solo trip and flew across the country to Vancouver to meet friends who were either on exchange or resided there. Thereafter, I went down the west coast of the USA, covering Seattle, Portland, San Francisco and Los Angeles. From there, I flew across the country to Miami and spent a week relaxing at Miami Beach and meeting many people from around the world. Key West, the southernmost point of continental USA was my next stop and from there, I proceeded back up the east coast to New York again, before seeing how different Niagara Falls looks in summer, and finishing my trip back in Toronto.

Looking back at the experience and journey I had on exchange in winter 2013, would I go on exchange ever again if I could? Definitely!
Appsolutely Chemistry has set up a consolidation of reviews on 120 Chemical Mobile Apps from both the Apple App Store and Google Play Store. These apps are able to enhance interactive learning and facilitate research efforts in chemistry. Hence, we were motivated to introduce these handy educational tools to our students. After ten weeks of hard work, we had characterised 120 apps based on 19 NUS modules and 12 app types (functionalities).

Furthermore, the apps were rated, out of 5 stars, based on their applicability, relevance, aesthetics and user-friendliness. We then arranged the apps based on this unique ranking system. Next, we listed the pros and cons for every app, to give the students a gist of why the app is good, or not suitable. To join in the “hashtag-ing” trend, we have our own tags which were based on NUS modules and app types. Thus, students are able to view similar apps under that particular category - or tag.

We hope that students are able to make full use of this website as these apps enable students to adopt multiple learning modes with the use of audio and visual representations. We are in the process of creating more apps for our Chemistry undergraduates so do look out for them!

URL:
http://nuschemistry.wix.com/appsolutelychemistry
Chia Siew Ing

The Dialogue on Chemistry Education is organized by NUS Department of Chemistry, in partnership with MOE and NIE. The event aims to create a platform for communication and the exchange of ideas between educators in schools and institutions of higher learning, so as to improve on the teaching and learning of Chemistry in Singapore. The inaugural dialogue was held on 18 November 2013 from 8.30am to 2.00pm at NUS University Town-Plaza auditorium with the theme, “Partnership in Chemistry Education”. The event was well-received and brought together over 130 teachers and educators from Secondary Schools and Junior Colleges for active engagement in all manner of discussions concerning pedagogy in Chemistry.

The morning saw the arrival of the panel speakers, Distinguished Prof. David Treagust (Curtin University), A/P Daniel Tan Kim Chwee (Deputy Head, Teaching and Curriculum Matters, NSSE), Mrs Irene Tan (Master Teacher, Academy of Singapore Teachers) and Dr Chia Fu Siong (Lecturer, Singapore Polytechnic). The event was supported by the Ang Kok Peng Memorial Fund and the Royal Society of Chemistry. The Guest of Honor, Mrs Ang Kok Peng (see photo 2), was also cordially invited to grace this event.

After a brief session of breakfast and mingling, Prof. Loh Kian Ping (Head, NUS, Department of Chemistry) delivered a warm welcome address to start the dialogue proper. In his address, he gave an overview of the development of NUS Chemistry programs over the years since 1996, as well as outlined the new curriculum development for the 13/14 academic year. This was followed by a memorial lecture delivered by Prof. Treagust, a distinguished Professor of Science Education from Curtin University. His topic on “Conceptual Change in the Learning of Chemistry” was inspiring and provided piercing insights on conceptual change ideas in science teaching and teacher education.

The panel discussion was then opened by Dr Adrian Lee (Moderator and Senior Lecturer, NUS, Department of Chemistry) to explore the topic “Chemistry Education from Secondary to Tertiary to Life”. The plenary speakers shared their professional views and valuable experiences in leading our new generation of digital natives to appropriate learning and development outcomes. Tokens of appreciation were later presented to the panel speakers and Guest of Honor to round up the session before the morning break.

After the tea-break, the dialogue attendees were split into nine groups to participate in the breakout session (see photo 3), with a facilitator in each group chairing the session. Valuable information was gathered during the one-hour interactive session as participants shared their ideas and thoughts. Many illuminating learning points were shared, which no doubt would be useful and constructive for forward planning. Through this year’s dialogue and the many more that will follow it, partnership with schools and MOE is expected to get stronger. Dr Adrian Lee gave a closing speech and expressed his thanks to the audience for their active and productive participation during the breakout session.

Although Dr Lee’s speech signalled the conclusion of the dialogue, there remained one last item on the day’s agenda. After the dialogue’s end, some 25 participants proceeded to attend a three-hour teaching workshop conducted by Professor Treagust. The workshop was focused on pedagogy and the use of diagnostic instruments to assess students’ understanding; it provided an instructional design on different types of resources that teachers could draw from when conducting their Chemistry lessons.
Through the workshop, participants were equipped with a deeper understanding of various teaching strategies, allowing them to further refine their teaching methodologies.

Teachers and educators have expressed their enthusiasm towards the dialogue, and look forward to more of such sharing sessions with experts and peers. Perhaps A/P Johan Geertsema’s comments (Deputy Director, NUS, Centre for the Development of Teaching and Learning) sums up the dialogue’s favourable reception best: “I found both of the sessions I did manage to attend very interesting, even if some of it was over my head since I am not a Chemistry specialist. But what struck me was the attention to detail of the speakers to pedagogical matters, in particular the genuine desire to show the relevance of the subject to learners so they can be encouraged to think for themselves.”

Photo 1: Panel Discussion on “Chemistry Education from Secondary to Tertiary to Life”
(from left: Dr Adrian Lee, A/P Daniel Tan, Mrs Irene Tan, Prof. David Treagust and Dr Chia Fu Siong)

Photo 2: Guest of Honor, Mrs Ang Kok Peng, receiving a bouquet of flowers as token of appreciation from Dr. Adrian Lee, Chairperson of the Dialogue Organizing Committee

Photo 3: Dr Leong Lai Peng (standing) facilitating the breakout session for one of the groups
As comprehensive as college-level courses in science are, there is value, too, in learning beyond the textbook and outside the classroom. The three popular science books below provide one such learning avenue, and may help reignite your passion for science. These books may be found at NUS and National libraries.

**Galileo’s Finger: The Ten Great Ideas of Science**
by Peter Atkins

The author of the widely-used *Atkins’ Physical Chemistry* textbook is also a prolific popular science writer. In *Galileo’s Finger: The Ten Great Ideas of Science*, Atkins brings the reader on an exciting journey to rediscover ten of the most important ideas in science. These ten ideas – Evolution, DNA, Energy, Entropy, Atoms, Symmetry, Quanta, Cosmology, Spacetime and Arithmetic – may already be familiar to most readers in varying degrees. However, *Galileo’s Finger* goes into great depth and explains how these ideas came to be and how they are relevant to the world in which we live. Although biological concepts are introduced first, followed by chemical, physical and finally mathematical ideas, the author has stated that the chapters may be read in any order. Though the use of mathematical equations is kept to a minimum, the book is still difficult for the general reader who is untrained in science. However, it is appropriate for pre-university students and undergraduates with a passion for learning the wide-reaching implications of these ten ideas. The chapter on symmetry, starting from introduction to simple symmetry operations, to the necessity of symmetry in understanding molecules, then to particle physics and finally to the mathematical formulation of conservation laws, is especially mind-blowing.

**The Disappearing Spoon**
by Sam Kean

In *The Disappearing Spoon*, Sam Kean takes his readers through a rich narrative spanning 150 years and 100 elements. The book is very much rooted in history as it is in chemistry, for Kean undertakes the ambitious task of presenting the stories of all periodic table elements page by page and period by period. However, *The Disappearing Spoon* is by no means some dull, dry hybrid of a chemistry and history textbook, in which the author systematically but blandly ploughs through the table from hydrogen and helium all the way up to the synthetic elements, as if tediously ticking items off...
The elements are organised thematically into chapters, rather than according to conventional systems of arrangement like periodicity and group. In so doing, *The Disappearing Spoon* exposes to readers new relationships and connections between seemingly separate, disparate elements, offering both layman and chemist plenty of refreshing insight. But if the stitching between elements and chapters is good, the individual narratives themselves are simply superb. Kean adopts a casual, breezy writing style, and touches upon quirky topics such as Gandhi’s inexplicable hatred towards iodized salt, Glenn T. Seaborg’s comically egotistical attempts to have an element named after him, and aluminium’s descent from precious metal to kitchen foil when better, cheaper separation methods for the metal were discovered. As the reader gets through the book’s first few elemental anecdotes, one thing soon becomes apparent: *The Disappearing Spoon* is a celebration of all things chemistry, and is guaranteed to entertain and to educate despite its heavy subject matter.

Dawkins has written many science books, most notably *The Extended Phenotype*. However, in *The Oxford Book of Modern Science Writing*, Dawkins takes a step back from his usual authorial role, and instead compiles excerpts from the writings of other scientists and mathematicians. The excerpts cover a wide range of topics from physics to philosophy, and some are written by famous scientists such as Richard Feynman, James Watson and Albert Einstein. The introductions written by Dawkins are a key selling point of the book. These introductions give the reader quick insights into the scientists’ lives and the motivations behind their writings. The rich context provided by the introductions point out subtle aspects of the excerpts that might otherwise be missed by the reader, thus aiding in the appreciation of these works. The compilation is divided into four sections: *What Scientists Study*, *Who Scientists Are*, *What Scientists Think* and *What Scientists Delight In*. This manner of organization helps readers better understand the thinking process of accomplished scientists and grants them an appreciation of scientific research. The excerpts and introductions are just of the right length to reignite interest in science in the reader and leave him/her with a sense of wonder. Ultimately, this book shows that scientists can be passionate creatures capable of writing enthralling prose and poetry.

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Source:
*The Disappearing Spoon* – [www.samkean.com](http://www.samkean.com)


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**The Oxford Book of Modern Science Writing** by Richard Dawkins

As one of the world’s most prominent evolutionary biologist and science communicator, Richard
When people think of chemistry, images of people in lab coats swirling test tubes would naturally surface. However, there is a field in chemistry that is nowhere near this stereotypical image but rather involves "virtual experiments" i.e. simulations done on a computer. We refer to the field of computational chemistry, which began over 40 years ago when computers became much more accessible to the scientific community.

**Roots in Quantum Chemistry**
In order to perform "virtual experiments" on a computer, we need to reproduce the laws of nature to simulate the behavior of molecules in reality. This theoretical background has its early beginnings in quantum mechanics in 1925. The first thing that comes to our minds after mentioning “quantum mechanics” would probably be the Schrödinger equation. By solving the Schrödinger equation, one obtains the wave function of the system, which contains all the information about the system. What is perhaps less known is the equivalent matrix formulation of quantum mechanics. This formulation is commonly used in computational work today due to the ease of manipulation of matrices by computers. In a few decades, quantum mechanics has evolved from solving simple systems such as “Particle in a Box” to being able to handle large chemical systems, giving rise to the entirely separate field of quantum chemistry. Many theories have emerged, with Hatree-Fock Theory perhaps being the most well-known. In Hatree-Fock Theory, the motion of each electron is considered to be independent of other electrons and the interactions between electrons are accounted for in an average fashion. However, electron motions are not independent but are instead correlated in reality. Thus, many electron correlation methods have been developed, such as the popular Density Functional Theory and Coupled Cluster Theory.

**Rise of Computers**
The emergence of a plethora of theories has been accompanied by rapid advancements in computer technology. With the prevalence of computers, non-experts in computational chemistry can also perform calculations to elucidate the reaction mechanisms behind their synthesis pathways or calculate thermodynamic properties in catalytic cycles. In fact, the growth of computational chemistry has been greatly intertwined with the growth of computer technology. As long as the usage of computers and its development continues, computers will only become faster and more accessible, and computational chemistry will continue to flourish. Furthermore, the increased development of computers for gaming and graphics design means that computers today can produce stunning graphics unlike their yesteryears’ counterpart, which only produced monotonous text outputs. This means that results can now be delivered in graphical form rather than strings of numbers that may be hard to interpret.

**Electrostatic Potential Map of a Water Molecule**

**Power of Prediction**
Outside of laboratories, computational chemistry is seeing increased presence in the industry. One is hard-pressed to find a pharmaceutical company that has not dedicated some resources to computer-aided drug design. Similarly, computational chemistry is incorporated into the design of materials and chemical energy storage. Computational chemistry
A Brief Outlook on Computational Chemistry

offers the ability to predict the outcomes of reactions without performing them. This can result in tremendous savings in materials and manpower. By using computational chemistry, reactions that look promising *in silico* can be selected and conducted in the laboratory, leading to quicker development of pharmaceutical drugs and better materials. With an increasing emphasis on nanoscience, the chemical systems of interest are also decreasing in size. The convergence of smaller systems and increasing computer power further justifies the necessity of computational chemistry at the frontiers of chemistry.

**Challenging Experiments**

With improving computing capabilities and more accurate theories, calculated predictions from simulations are approaching experimental accuracy, sometimes even outclassing the best of experimental results. Professor Sven Lidin, Chairman of the Nobel Committee for Chemistry summarizes the current status succinctly: “What has happened over the past few years is a really fascinating development. When I was a young chemist, theoreticians would come to us with ideas about how a system would behave. And if their predictions would agree with our experiments, they would be happy. And if the two did not agree, we are always sure that the theoreticians are wrong again. Today, when the theoreticians come with a prediction that we cannot prove or disprove, normally we as experimentalists go back and check our experiments again. Because it may just as likely be we who are in the wrong today. This is how far theoretical chemistry has come to become one of the tools of experimental science.” Indeed, The Nobel Prize in Chemistry 2013 was awarded jointly to Martin Karplus, Michael Levitt and Arieh Warshel for their efforts in computational chemistry. The laureates pioneered methods that use both classical and quantum mechanics to model large, complex chemical systems such as enzymes. Quantum mechanics, which is more accurate, is used to describe the central parts of the system such as the active site of an enzyme while the computationally less expensive classical mechanics is used to describe the rest of the system. The key accomplishment of the laureates was to show how these two inherently incompatible regions can be made to work together to better elucidate protein form and function, as well as to better model complex chemical systems without the need for unrealistic amounts of computing power.

**Taking Stock**

As computers become faster with development, computational chemistry is becoming an increasingly attractive alternative to experiments by pushing the frontiers of chemistry and increasing the productivity of the industry. That said, chemistry is ultimately an experimental science. People who believe that simulations will completely replace experiment are as equally misguided as those who do not embrace simulations as a tool to accelerate their research. Computational chemistry has gone a long way, forging a fruitful cooperation between theory and experiment that has made many previously unsolvable problems solvable today.
Upcoming Events

Dates and events are subject to change. Keep yourself updated with the latest NUS CSS events by liking our Facebook page: https://www.facebook.com/NUSCSS

AY 13/14 Semester 2

12th – 14th Feb  Bazaar and Graduation night ticket ordering outside LT 27
25th Feb  Industrial Visit to Solvay Singapore @ Biopolis
Week 7  CSS Freshmen Orientation Camp 2014 seniors recruitment
Week 8  Past year paper solutions ordering
Week 10  Past year paper solutions collection
Graduation night ticket payment and collection
14th May  Graduation Night 2014 – Royal Blood
Jun-July  Preparation for CSS Freshmen Orientation Camp 2014
Early Aug  CSS Freshmen Orientation Camp – Chemical Sciences Investigators

AY 14/15 Semester 1

Week 2  CSS 26th Annual General Meeting
Main and standing committee interview and recruitment
Recess week  Industrial Visit (TBC)
Week 8  Past year paper solutions ordering
Week 10  Past year paper solutions collection
Early Jan  Years 1 and 2 bonding event

We would like to extend our gratitude and appreciation to the following people for their contributions:

Prof. Loh Kian Ping  A/P Lai Yee Hing  Dr Emelyn Tan
Dr Stephen Chui  Ms Chia Siew Ing  Mr Ouyang Fengcong John
Ms Kwan Yee Ching  Mr Rayston Leong  Ms Wan Jane Hui
Ms Beryl Thum  Ms Guan Xing Hua  Ms Grace Lee Yuan Ping
Ms Yesika Monditalia Ali  Mr Liew Yong Yew, Tony  Mr Tan Jia Sheng, Benny
Ms Aomori Yuki

and those who have helped to make Chemiscope better in one way or another!

Do contact us if you would like to contribute articles or suggestions for the next issue of Chemiscope.

Cover and layout design: Eugene Chow Zhi Hao, Heng Yong Ler, Eunice Leow Min Ru, Tan Yong Quan