ACiD

Amsterdams Chemisch Dispuut Volume 51 | Edition 1

Amsterdams Chemisch Dispuut

The Nobel Prize in Chemistry
A Rechargeable World
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[Pd2L4][X4] and [PdL][X2] Cages as Molecular Binders
Environmental Chemistry
The Chemistry Behind Climate Change

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From the Editor

Dear reader,

Thank you for opening the first ACiD of this academic year. This is for some of you the first ACiD you've ever read and for everyone of you the first edition which is entirely in English. In this edition our incredibly creative committee has written many beautiful and interesting articles for you. You can for example meet the new chair, board and of course the youngster of ACD, our beloved freshmen. Of course you can also improve your cooking skills with our recipe. Last months many things also happened in the world of chemistry, for example the Nobel prize which was very Lit(hium) and some of our members became Bachelor of Science by finishing their bachelor projects. Hopefully you'll enjoy it.

On behalf of our entire editing team.

Kind regards,
Nadav Joosten

Content

The Old Chair Says Goodbye

Dear ACD'ers,

Even though my chairmanship ended about a month ago, the ACiD committee is still letting me write a final piece for this beautiful column. Over the past three years, I have always enjoyed reading the words from the chairman or chairwoman, however last year I somehow stopped reading them. Perhaps it was because every time I read them, I had a feeling I'd seen those words before. Which is why I look forward to once again read unfamiliar words from the chair, as I will do in this edition.

After a year of governing the association, which mainly consists of cleaning the room, it was about time for us to step down. Our hands started to look old and wrinkly, probably because of all the buckets of cleaning water we had to use, our faces started to become a little pale because of the dried-up sweat from cleaning the table. Now that we can rest and sit on our behinds for a bit, we start to become the actual nice people we always used to be. It was a tough year, but in the end, we pulled each other through and are now allowed to look back on an awesome year.

And I want to thank everyone that was part of last year, donors, members, committee members and the people I could have not done without: me, myself, and I (yes, I do have trouble sleeping at night). I mean of course my fellow board members. I think I speak for all of them when I write that we hope to see you guys again on the ACD activities this year. We had a great year and are very confident that the current board will make this year a success.

That only leaves me to wish you all a great year. Make the most of your time studying and enjoy life! And to the new board: you guys are awesome, go on and push your ideas through, have a great time, laugh and do have some stress, it will only make it more satisfying to look back on. For the last time, best wishes, kindest of regards, "houdoe",

Your former chairman,
Rens Ham

The New Chair Says Hello

Dear ACD'ers,

First of all, I want to thank Rens for his kind words. We are going to have a great time and hopefully a good year. Also, I want to thank the whole 73th board for all their work and effort last year. Thanks for all the educational, fun and cultural activities, and way more. You guys did a great job! For now, go and relax, and good luck with your study, projects and other pursuits.

All righty, now it is my turn to write the words from the chairman. I'm not going to lie; I am a bit nervous about this piece. That is because writing is not my biggest talent and it is my first time writing a piece like this. So be kind for me guys. :)

Where should I start? Since last ACiD, a lot has changed. First of all, we've welcomed a whole new generation of ACD members. The freshmen had a great time in the Intreeweek and the 'Facultaire Introductie', where they got to know the UvA and also the ACD. With our annual Meet the Freshman, the whole association got to know the new and enthusiastic members. The Freshmen also had their 'eerstejaars'-weekend, which was, as always, a big success. In a month, many first-year students got to know our committees and a lot have found a committee which they like and joined.

Beside the first-year Bachelor-students, also a whole new generation of (pre-) Master-students joined the ACD. I enjoyed the BBQ at the introduction, and I hope everybody did. Also, we had a nice activity organized by the MAC;

Pub quiz, Games and Pancakes. Here, the new masters got to know each other, and we had a great time with amazing Dutch food.

Beside all the new members, the board switched too. The General Assembly was well visited and the transmission to a new board went smoothly. Now, we were, after months of preparation, the new board of Amsterdams Chemisch Dispuut! The next day, we had our constitution reception in Café Hotshots. The board had a great time and we'd like to thank everybody for congratulating us and for being there.

Another change is the new fridge in the ACD-room. As voted on the General Meeting, the ACD got a new refrigerator, with more room for all our drinks. Also, for those wondering, one of the old fridges now continues to contribute to the ACD in the VU-room. Speaking of the VU-room: things are going to change there. We are doing our best to make this room a place to stay and relax, just like the room at the UvA.

We also had some fun activities, a Games night and a football tournament, where I saw that we as a board are not as good as Barcelona. Also, we had an interesting Company day, with start-ups and valorization as the theme. I am looking forward to all the coming activities this year, even as all the lectures, the excursions, the parties, the BEC, the ONCS, the All-years weekend and way more.

Speaking for the new board, I can say that we are very excited for this year and we are eager to make this a year to remember for every ACD-member. I hope to see all of you at the activities and make it an amazing year together!

The kindest of regards,

Your new chairman,
Sam Hulscher

Some words from the SLA

SLA,

Most of you will probably think: SLA, what is that? Some of you (hopefully) know that it's something you can eat, that it's something healthy. Others will recognize that within the environment of ACD it means something completely different. In that environment SLA means a year of celebrations and amazing parties: The Lustrum of ACD! Next year, in the year 2020, the ACD will celebrate its 75th birthday. The SLA (Stichting Lustrum ACD) has already been working hard on a whole spectrum of different activities, all fitting in the Lustrum's theme that we want to keep secret for now ;).

We want to organise a symposium, with hopefully the most amazing speakers (don't tell anyone that we want to ask Clayden himself to come). We are also planning a sports day, a world breaking record event, special Lustrum Beer, a bring-your-parent-to-science-park-day, a reunion for all the 'old' chemistry students and of course an amazing party, with cake, because it's still a birthday. And that is just the tip of the tongue!

To make it even more unforgettable, we want your speculations as well; for instance, about an amazing foreign excursion to Japan and many more... It will be a year to remember, both as an ACD member, alumnus, a donator or a VOLA-member. We hope you are just as excited for it as we are, and we look forward to seeing you all during all the events next year!

Kisses,

SLA (Tori, Rens, Myrthe, Lars, Lesley, Maxime and Marit)

Meet the 74rd Board

Hi, I'm **Sam**, the Chairman for this year. Many may know me as the unofficial bouncer on the drinks on Friday or the biggest HamKaas-lover of the ACD. You may not know me as coin collector or as milk-lover. I'm very excited for the upcoming year and you can always have a conversation with me to know more.

Hey guys, my name is **Jari** and I am the new Secretary of the ACD. I hope to see you all at one of our borrels and I would like to challenge you to a game of tafelvoetbal there! I'll buy you a beer if you manage to actually beat me.

Hi ACD'ers. I'm **Bart** and will be the Treasurer of the ACD. Please hit me up to get to know me during one of our activities or drinks to talk and drink a beer together (but don't throw it all over my shirt!!!).

Hi, I'm **Nadav** Commissioner of Education. I've many responsibilities like organizing the orientation markets, writing the ACiD, organizing the foreign excursion and drinking beer. Beside doing this not so important, but still very important board stuff I like to talk with as many members as possible and play some games which is the reason for my stock of cards. So, if you're bored, you can ask me for a nice game.

Hi, I am **Floris**, Commissioner Activities and Bar (ABC) of 2019-2020. Also known as the grandpa of the board, since I'll be turning 23 this year. With a totally fresh Activity and Bar Committee we're trying to implement some new ideas. I'll also take place in multiple other committees to make this a fun year for everyone.

My name is **Bente**, Commissioner of External Affairs, and I'm a second year student. I like to travel, a good read and I definitely can't resist the Oerknal's snack platter. At least, the vegetarian version. I'll be walking around the university soon and I hope to see you there, or at one of the lectures and excursions!

Meet the Freshmen

Kirsten

What was your best experience this summer? Decibel
How are you going to survive this winter? Lots of chocomel
Which chemicals would you like to put together just out of curiosity? H2O2 and KI
What do you expect to learn this year? Skills that will come in handy during lab days
What was the most exciting thing about the first few weeks of study? You get to know a lot of people in a short period of time. Everybody is very nice and ent husiastic. I'm very curious about all the other activities.
Do you have a quote from your first few weeks of study? 'Het is geen realiteit dat ik paprika-poeder over Maarten heen heb gegooid' ~ Bibi van Poelgeest
What is your favourite drink? Malibu cola. Cocos is just the best, end of discussion
Which course are you looking forward to? Organic chemistry and structure clarification

Hajo

What was your best experience this summer? Well, the first question and you've already got me. Outside of a short weekend in Zeeland, I haven't really gone on holiday. I did go to the beach a couple of times, went boating around town with a friend, played a few games, almost died in a heat wave, you know, typical summer stuff. I don't think there is anything specific I would call the best experience, but I was overall quite pleased with how my summer turned out.
How are you going to survive this winter? I usually just wrap myself up in a blanket and play games all day. I might even leave my house to take a short walk if the weather calls for it. I'm also planning to go to Cologne with some friends to visit the annual Christmas market there, which I promise is a lot more fun than it sounds.
Which chemicals would you like to put together just out of curiosity? I've always wondered what would happen if I poured all cleaning supplies from that cupboard beneath the sink together The actual pouting would probably be more enjoyable than the reactions that take place, but hey, you can't win 'em all.
What do you expect to learn this year? Well, I expect that I will learn a lot, but I don't really have any exact expectations. I'll just wait and see.
What was the most exciting thing about the first few weeks of study? I think the most exciting thing was probably my second time in the lab, doing the first half of the 'Biodiesel from spent coffee grounds' experiment.
Do you have a quote from your first few weeks of study? I say so many dumb things, that I can't really think of anything at the top of my head.
What is your favourite drink? Have you ever imagined what the nectar of the gods tastes like? I haven't, and I don't need to because I already have Lipton Green Ice Tea Mint Lime.
Which course are you looking forward to? I don't really have any course in particular I'm looking forward to. I think everything looks interesting, so I'm just letting myself experience and hopefully enjoy whatever gets thrown in my way, I mean, what could possibly go wrong?

Fay

What was your best experience this summer? I went to see my favourite band SWMRS for the 5th time. Because they are a small band, they take time to hang out with some fans after their shows.

Since it was my 5th time seeing them, they know me by now. And nothing is cooler than being known by your favourite band and talk with them for a little while.

How are you going to survive this winter? Wearing hoodies and beanies at all times.

Which chemicals would you like to put together just out of curiosity? I would like to "throw" all kinds of object and chemicals into a superacid.

What do you expect to learn this year? The basics (and somewhat further) of chemistry.

What was the most exciting thing about the first few weeks of study? Meeting new people! It is quite important to make friends within your year because you will spend the next few years with them. Luckily, I have made some great friends already who make it more fun to go to classes.

Do you have a quote from your first few weeks of study? "Is water soluble in water?"

What is your favourite drink? Vodka soda, with preferably fanta!

Which course are you looking forward to? Organic chemistry, I have always loved that subject.

Perry

What was your best experience this summer? Being on top of the Eiffel tower

How are you going to survive this winter? With a warm coat and a lot of hot chocolate

Which chemicals would you like to put together just out of curiosity? Acetone and hydrogen peroxide.

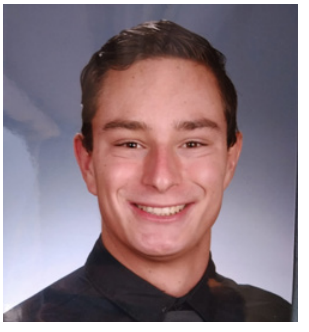
What do you expect to learn this year? A lot of chemistry, I hope.

What was the most exciting thing about the first few weeks of study? Intreeweek

Do you have a quote from your first few weeks of study? 'Ja, ik heb over Bibi haar kleding heen gekotst.' (Translation: Yes, I've thrown up over Bibi's clothes.')

What is your favourite drink? Hertog Jan

Which course are you looking forward to? Organic chemistry



Sverre

What was your best experience this summer? My exam trip to Valencia. I had a great time being with my friends in the lovely sunny climate and eating amazing Spanish food like paella. But above all, not having to worry about school.

How are you going to survive this winter? Loads and loads of tea, sweaters and complaining that it's cold.

Which chemicals would you like to put together just out of curiosity? Francium and water

What do you expect to learn this year? All the basic skills in chemistry and all the theory needed to learn the more complicated stuff in the upcoming years.

What was the most exciting thing about the first few weeks of study? The intreeweek and getting to know all the new people.

Do you have a quote from your first few weeks of study? 'Students can't be alcoholics.'

What is your favourite drink? Mojito: rum is one of the most amazing boozes and lemon flavoured lemonade is the best flavour lemonade. That combined with sugar and mint is just the best cocktail possible.

Which course are you looking forward to? The practical course where you can make up your own experiment, I believe it's 'Chemie en Licht.'

What is the most fun thing about your committee? Going to Sevilla.

Het Wel en Wee van de OC

Maarten van Dorp

Some of you might not know what the programme committee ('opleidingscommissie' (OC) in Dutch) is, so we will start off with a short introduction:

In essence, the OC is a committee that ensures that the quality of the education programme is up to par, and it does so by giving advice and having a veto on the Teaching and Examination Regulations (Onderwijs- en Examenregeling (OER) in Dutch). Additionally, on their own initiative, they provide advice to or make proposals for the programme director and dean, and possibly invite the programme director and dean over for mandatory meetings. In practice this means that the OC evaluates the OER each year, takes the information from the course evaluations and has contact with the lecturers about that info, and that the OC is listening to suggestions from students and lecturers about the programme. Of course, you can find more information on the UvA site, and soon also on the Canvas page of the BSc and MSc chemistry.
To make sure students get to have a say in these matters, there are two bachelor students and two master students in the OC. This year they respectively are, Robin Schatens, me, Anna Butter and Mariyana Savova. The emails of these students can also be found on the dedicated DataNose page, so feel free to send them a mail or approach them in person if something is bothering you about the study.
So, what has the OC been up to during this academic year? As mentioned before, we are trying to make the OC more accessible by making a Canvas page on both the BSc and the MSc chemistry pages. Aside from this, the OC had received some feedback that lecturers did not grade certain courses quickly enough, and this has been communicated to the programme director Sape Kindermans, who will point out to the lecturers to resolve this problem. Of course, the OC has also reflected on the feedback forms they have received and have communicated this information to the lecturers. Professors then reply to the feedback and usually incorporate it into the course. To pick a few, the courses Molecular Spectroscopy, Wiskunde voor Chemici 2 and Practicum Duurzame Chemie have been reflected on.

Aside from the OC, this year an ad-hoc curriculum committee has been formed. This committee consists primarily of professors and aims to restructure the curriculum of the BSc programme. Two student members, Davita van Raamsdonk and me, have been appointed, and the professors and us are very happy to hear your ideas on a new curriculum. Don't get your hopes up that you will experience the new curriculum yourself though, since the deadlines for the finished proposal are still somewhat far in the future, and implementation is still years away.

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[Pd2L4][X4] and [PdL][X2] Cages as Molecular Binders

Xander Schaapkens

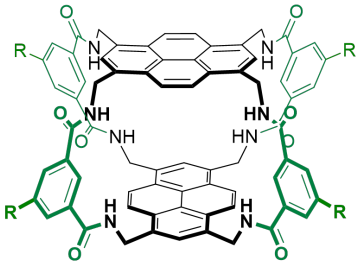
A staple of biology has been the selective recognition of complex molecules. To replicate this recognition synthetically allows chemists to gain insight into biological events, such as diabetes, cancer metastasis and Alzheimer's disease. This has led to the development of cage-like organic macrocycles which have been studied as (fluorescent) glucose sensors in water and as a binder for squaraine derivatives in chloroform. While these macrocycles display excellent binding properties, their preparation requires multiple step synthesis and involves a low-yielding macro-cyclization.

On the contrary, metal-based coordination cages replace the cyclization step and the difficult purification thereof, with a higher yielding self-assembly between the metal-corners and the ligands. This self-assembly approach is used in my PhD research to design and synthesize new cages. My research is split in two major parts: first designing and synthesizing new molecular cages and second the use of these and known cages to bind carbohydrates and/or charged guests.

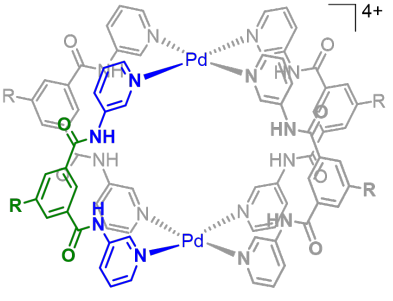
Firstly, we have designed hybrids between the organic macrocycles and self-assembly cages, wherein a macro-ligand coordinates to the metal. This ligand is comprised of three major parts: an aromatic surface (black), isophthalimide pillars (green) and pyridines (blue). As the last step, formation of the cage is performed with coordination chemistry.

Secondly, we study the already known [Pd2L4]4+ cages and our own designed cages as binders for carbohydrates and charged guests. This involves many NMR techniques, circular dichroism (CD), mass spectrometry, UV/vis and if needed isothermal calorimetry (ITC). These techniques allow us to follow what is happening when the concentration of the guest is increased and how well these compounds go inside the cage.

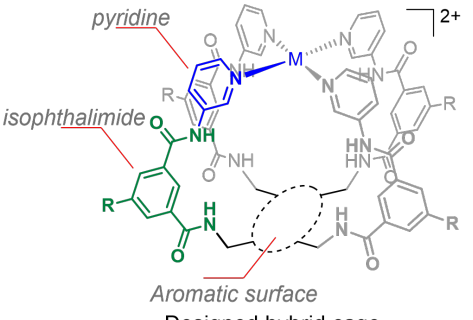
This research is a new topic within the HomKat group and was developed over the past two and a half years. Luckily, thanks to some very motivated students, we have generalized and optimized the synthesis route of the ligands and have some initial results for binding.



Organic Macrocycle



$[Pd_2L_4]^{4+}$ cage



Designed hybrid cage

Honey Mustard Chicken Salad

With an Emulsifier to Keep it crispy

Alexandra Polykova

Ever prepared a fresh crispy salad to-go only to be disappointed to find out it has turned all soggy? That's because salad leaves have a hydrophobic surface to protect themselves. The oil in a vinegar-oil dressing, however, will easily penetrate the hydrophobic surface and ooze in between the leaf's cells, causing the entire leaf to lose its crispiness. In this recipe, surfactant molecules present in mustard will act as emulsifiers and break down the oil into tiny droplets that can dissolve in the vinegar instead of ruining your lettuce.

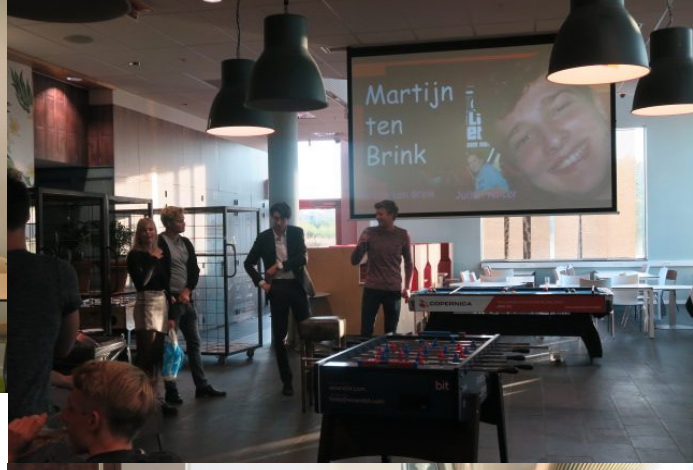
Mustard dressing:

- **5 tablespoons honey**
- **4 tablespoons dijon mustard**
- **2 tablespoons olive oil**
- **2 minced cloves of garlic**
- **2 teaspoons salt**
- **1 teaspoons pepper**

Salad:

- **4 chicken thighs**
- **300 g romaine lettuce**
- **200 g cherry tomatoes**
- **¼red onion**
- **1 avocado**

Mix all the ingredients for the mustard dressing. Use half to cover the chicken thighs and refrigerate for 30 minutes. Fry the chicken thighs, about 5 minutes on each side. Slice the chicken, chop the lettuce and veggies, and mix. Add 3 tablespoons to the rest of the dressing and drizzle over the salad.


Martijn
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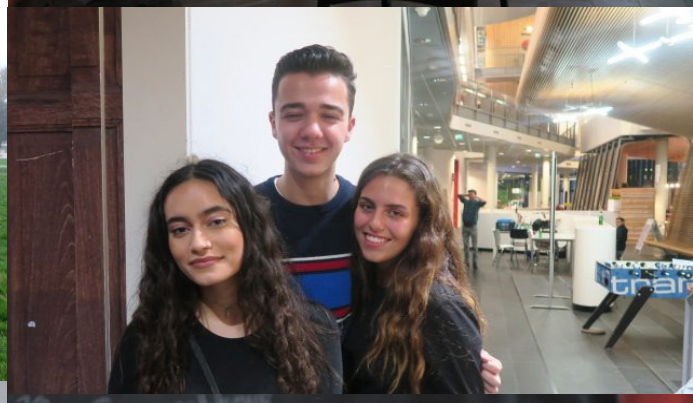


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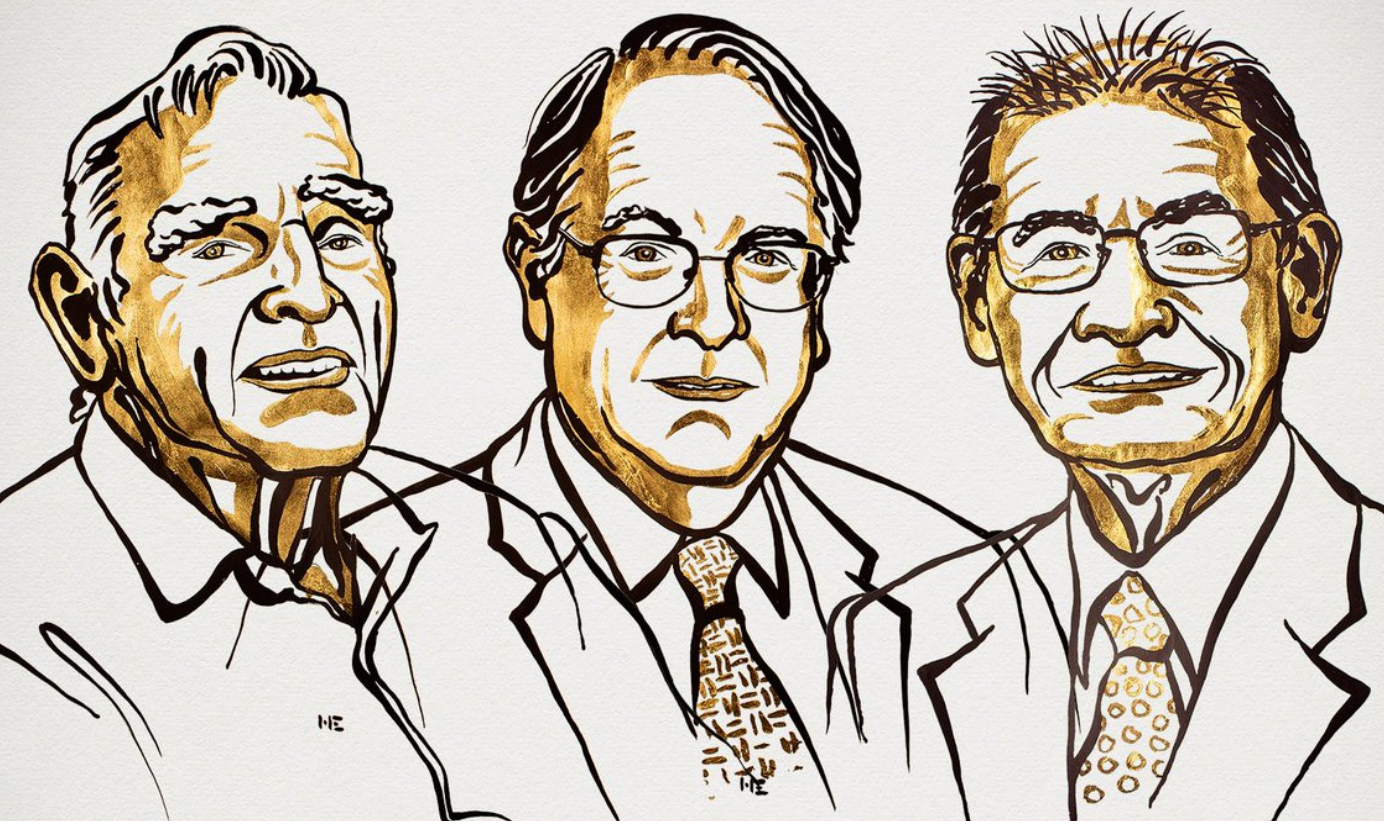


The Nobel Prize in Chemistry for a Rechargeable World

Alexandra Polykova

Have you charged your cell phone today? Most of us are used to always having it at hand to write messages, call someone, listen to music, keep ourselves updated. We also have portable laptops that we can use to work or study wherever we are. Someone might also be concerned with recharging some other portable device, or even their electric car.

None of this would have been possible without batteries, more specifically lithium ion batteries. That is why this year's Nobel Prize in chemistry has been awarded to **John B. Goodenough**, **M. Stanley Whittingham** and **Akira Yoshino** for their contribution to the development of the lithium ion battery.

Lithium is the lightest metal in the periodic table, so you can pack a lot of lithium into a battery without making it heavy. In addition, the low ionization energy of lithium makes it suitable for achieving a high electric potential.

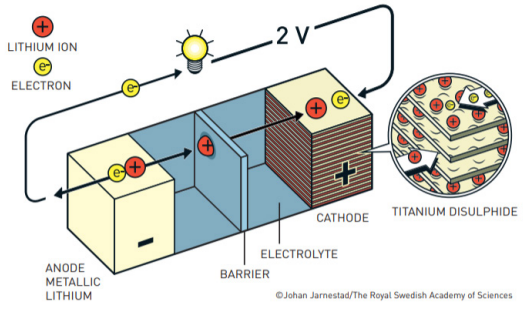
M. Stanley Whittingham was involved in studying intercalation materials – layered structures, similar to graphite, which can accommodate "guest" molecules or ions. It was assumed that a layered material that could intercalate lithium ions from the electrolyte could serve as a cathode against lithium metal. Eventually, Whittingham demonstrated that a battery with a titanium disulphide cathode and lithium metal anode produced a potential of 2 V.

John B. Goodenough tried to develop a similar, but better cathode material. He hypothesized that a

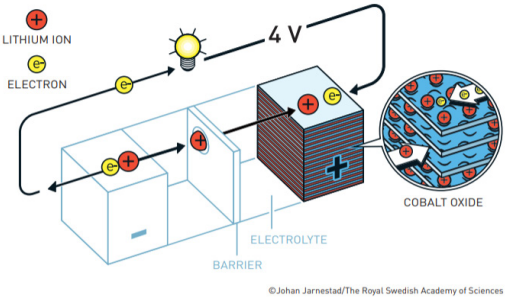
metal oxide would have even better intercalating ability. His theory was confirmed when a battery with cobalt oxide and lithium metal showed an impressive potential of 4 V.

However, the metallic lithium anode had a tendency to form dendrites that broke through the barrier to the cathode and short-circuited the battery. One way to work around the problem was to design an "ion-transfer cell" where lithium is only present in its ionic form, moving between two intercalation materials. Akira Yoshino overcame the challenge of finding a suitable intercalation material that was stable and also maintained a high potential. He demonstrated that petroleum coke, a by-product of the oil industry, together with Goodenough's cobalt oxide produced a potential of 4 V in a stable, rechargeable battery.

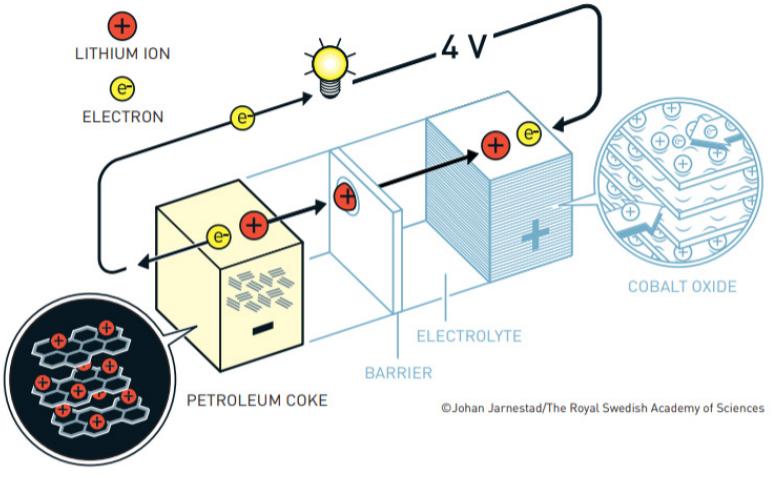
Battery technology has undoubtedly revolutionized our society, but there is still room for improvement. Cobalt is a rare and expensive metal with a troubling supply chain. Lithium mining not a trouble-free process either. And if electric vehicles, solar and wind power really are to compete against fossil fuels, we need even more efficient energy storage. Electrochemistry remains a highly relevant field – we need to continue to push the limits of what battery technology can achieve.



Whittinghams battery with a titanium disulfide cathode and a metallic lithium anode.



Goodenoughs battery with a cobalt oxide cathode and a metallic lithium anode.



Yoshinos battery based on the ion-transfer configuration with a cobalt oxide cathode and a petroleum coke anode, with lithium ions moving between them..

Images by Johan Jarnestad obtained from the Nobel Prize press release

International Chemistry Students at the UvA and VU

Alexandra Polykova

This September, the UvA and VU welcomed a new group of chemistry students, including some internationals. International students do not only start a new study programme but often also face an entirely new culture. Three international students share their first impressions and tell about the contrasts between UvA/VU and their previous studies:

Sarah (not pictured) from China has started the Molecular Sciences track of the MSc Chemistry programme. She says the biggest difference is that the study periods are much shorter than what she's used to. It can be a bit of a challenge, but she feels confident that she will learn how to adjust her studying strategy for future courses. She was also surprised to find that one course can have several teachers, which is a nice opportunity to communicate with and learn from different professors who have different fields of research and different teaching styles.

Anna (upper picture) has come here from Poland, where she previously studied chemical engineering. She has started the Analytical Sciences track of the MSc programme and says that the courses here are more practical-oriented and more closely related to real-life applications and that there are more interesting subjects to choose from. Another contrast is that the relationship between students and teachers is more informal.

Alexandra (the author, lower picture) came here from Sweden and was happy to find that the MSc chemistry programme seems to be quite popular and has many interested students, compared to the much smaller groups at her home university.

In summary, we all face different culture-shocks, surprises, and challenges, but in any case, our experience here at UvA and VU will certainly be very rewarding!

Adventures of a Chemist Abroad

Hello everyone!

My name is Maxime, I'm a 3rd year Bachelor student, currently on an Erasmus Exchange for one semester at the Sorbonne University in Paris! I've chosen this wonderful city for its beautiful history and atmosphere, but also to improve my French. At the university, I am following several 3rd year Bachelor courses of Chemistry IN FRENCH! To be honest, there were some struggles in the beginning. France is a very difficult country with regard to administrative issues and lots of paperwork, so that was a little frustrating. Also, since I am studying in French, there are not many international students and the French students weren't very open to interacting with me. After a few weeks, I had my first lab days and luckily groups were formed for a poster presentation. I now finally could get in touch with some students. What's very different here compared to studying in Amsterdam, is that they don't have their semester split up in several terms. All courses start in September and the final exam week is the first week after the Christmas holiday. Most courses have one or two tests during the semester and a final exam at the end. Due to this schedule, the work ethic is a lot slower here. Next to this, the general planning of a university day is from 08:30 until 18:00, with one hour of lunch break, so the days are long. Also, the 3rd year bachelor courses are not at the same level as the courses in Amsterdam. The good side of the lower level of courses and the low pressure, is that this does really enable me to improve my French and I also have enough free time to really enjoy the experience of living in this exciting city!

As I have lived here for 6 months now, I am so grateful for the way this city has welcomed me. I was here as a tourist before I came here to study, so during my stay here I have not visited all of the most famous spots. However, since I have been interested in photography for a while, I am trying to capture Paris the way tourists don't get to know it. For instant, the beautiful small streets with street art and the neighborhood I live in (the 20th Arrondisement), but I visited the Grand Mosque as well. In the meantime, I found a very big group of international students, with events and meet-ups planned every day! Even though Paris is an expensive city, we always seem to have fun and keep the spending reasonable. Finally, I would like to mention that in general I feel that the abroad experience is really good for me as a person. I have had a lot of time to reflect on my own feelings and thoughts and I have come to lots of personal realizations. Therefore, I would recommend an Erasmus Exchange to anyone open for an adventure that will not always be easy but will be something to look back to for the rest of your life.

The Chemistry of Climate Change

Michelle van Dongen

'I want you to act as if the house is on fire, because it is.'

- Greta Thunberg at the World Economic Forum, Davos

With the mindset of one of Greta Thunberg's famous quotes and other slogans like **'There is no planet B'** did millions of people across the globe participate in the Global Climate Strike from the 20th until the 27th of September. They were marching for the preservation of Earth as we know it and demanding more severe action against climate change. During the 20th century the Earth's average temperature has already increased 1 °C and according to the reports of the **Intergovernmental Panel on Climate Change (IPCC)** the temperature will either increase a further 1.5 °C or 2,4-4,3 °C depending on our reduction of the greenhouse gasses, such as CO_2, NO_2 and CH_4. Consequences of climate change are already visible and will continue to increase, if the rise in temperature will exceed this 1.5 °C.

If no severe action is taken, ice caps and glaciers will continue to melt during the 21st century, thereby disrupting the polar megafauna.[2] Sea temperatures will further increase, leading to thermal expansion, once the water reaches temperatures above 4 °C. Together with the added melted ice this would result in a sea level rise of 0.8-2 m. The increased temperature will also result in more acidic waters with less dissolved oxygen, disrupting ecosystems even more. We will encounter more heavy weather, such as heat waves and storms, maybe even hurricanes. The wet areas will experience more rain, while the dryer areas of the Earth will become even drier, leading to more floods and more ruined crops. Beside the increase in temperature, air pollution is also still a problem, because of its detrimental health effects. A good question one could ask themselves thus, is how we as humans are related to these problems and what causes them.

The increased temperature over the century can mainly be ascribed to the enhanced greenhouse effect.[2–3] Our Earth is a so-called warm body, absorbing and re-emitting radiation it receives from the Sun, our main source in keeping our temperature decent. Of all the wavelengths the Sun emits and the Earth absorbs, the Earth mainly emits its own radiation in the thermal infrared region of 5-100 µm, a form of heat (Figure 1).

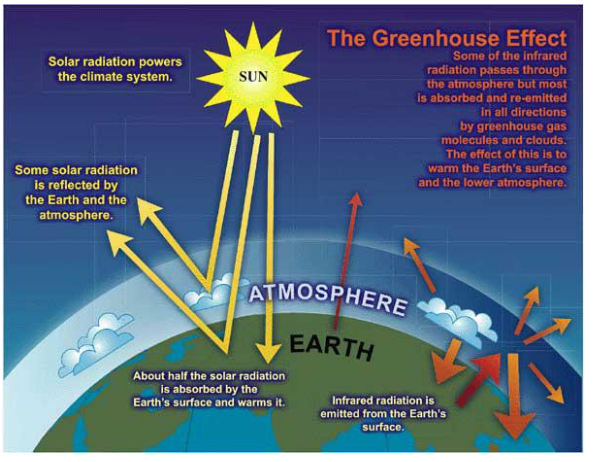


Figure 1. The greenhouse effect.[3]

Subsequently, the famous greenhouse gasses, such as CO_2, NO_2, CH_4 and even water vapour, can absorb this radiation, which prevents its escape directly into space. The molecules can re-emit this radiation towards the surface, which is then again absorbed. It might also be redistributed to heat in the near surroundings, warming the air (Figure 2). Water vapour is responsible for about two third of the greenhouse effect, CO2 a quarter.[2] The greenhouse effect itself is actually a natural phenomenon and promotes that we can live in a comfortable 15 °C at and near the

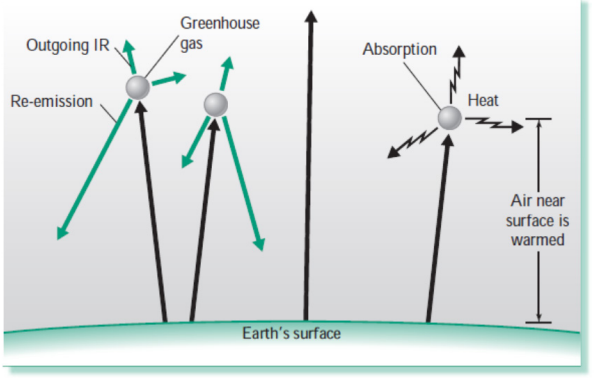


Figure 2. The effect of Greenhouse gasses.

Earth's surface. Without the greenhouse gasses the surface's temperature would be around -18 °C. Metaphorically, the greenhouse gases are our personal blanket. During the past century we just have created extra layers by increasing the concentrations of CO_2, NO_2 and CH_4 due to our combustion of fossil fuels, deforestation for agricultural use and increased meat production.[2] The increased concentrations lead to more reflection of the thermal infrared light back to our atmosphere, thereby heating the Earth. The increased temperatures also result in more water vapour, the best of all greenhouse gasses, which increases the temperature even more. In conclusion, we're stuck in a positive feedback loop.

Air pollution has also become more prominent in societies, mostly visible in the form of (photochemical) smog over the city. Important components of air pollution, not visible themselves, are particulate matter (e.g. $PM_{2.5}$, particles with a diameter less than 2.5 µm) and ozone. These components are thought to lead to several health risks such as asthma, cancer, brain damage and cardiovascular problems.[2] The particulate matter is mainly a result from incomplete combustion processes or from further reactions of O_2 and NOx with the so-called Volatile Organic Compounds, VOCs. Recent research has indicated that ammonia might even be a big contributor to forming these small particles through its reaction with surrounding NOx or SOx. Ozone production has mainly increased due to the enlarged amounts of VOCs and NOx. Its catalytic cycle, with the OH radical, can be seen in Figure 32, where NO is an incomplete combustion product.

These were, in a nutshell, only a few of the problems which made people march the street, and their background chemistry. Our house has actually been on fire for some time now and hopefully the time has come where we will try to put it out. The polar bears would be really happy with us, if we did.

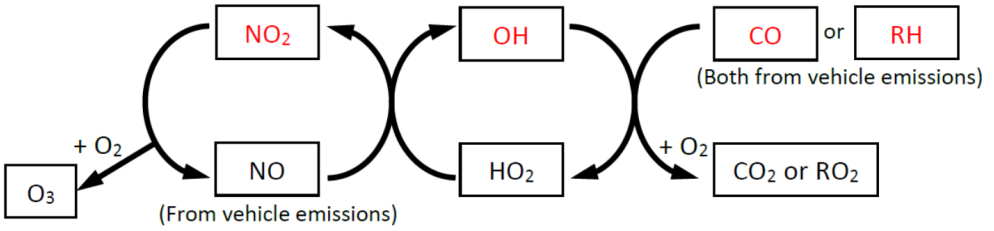


Figure 3. Simplistic view of the catalytic cycle in tropospheric ozone.

1. IPCC, 2018: Summary for Policymakers. In: Global Warming of 1.5°C. An IPCC Special Report on the impacts of global war ming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthe ning the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty [Mas son-Delmotte, V., P. Zhai, H.-O. Pörtner, D. Roberts, J. Skea, P.R. Shukla, A. Pirani, W. Moufouma-Okia, C. Péan, R. Pidcock, S. Connors, J.B.R. Matthews, Y. Chen, X. Zhou, M.I. Gomis, E. Lonnoy, T. Maycock, M. Tignor, and T. Waterfield (eds.)]. World Meteorological Organization, Geneva, Switzerland, 32 pp.
2. Baird, C.; Cann, M. Environmental Chemistry, edition 5; 978-1-4292-7704-4; W.H. Freeman and Company: New York, 2012.
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The Fickle Use of the ECTS

Maarten van Dorp

"Hey, do you know how many lectures there are for this course? Wow, two lectures and a seminar every week? That seems a bit excessive for 6 EC."

As I was unpacking my bag for a lecture Theoretical Philosophy, I had this exchange with a fellow student. To my surprise she was actually rather peeved with the prospect of having to follow two lectures and be present at a seminar every week. Later I found out that there are philosophy courses, one of which I was to follow, that only have one lecture and one seminar per week. Most STEM (Science, Technology, Engineering and Mathematics) students would probably be dismayed to hear that this course, which spans two months, is worth 6 EC. Understandably so, once compared to the 6 EC course Organic Chemistry, which featured weeks that included two lectures, a seminar, and a 9-to-5 day on the lab.

One often jokes that you should never complain to a STEM student how swamped you are with work, because they're always more swamped than you are. And yet, their BSc degrees also feature 180 EC... Something seems awry with the ECTS, but why and what exactly?

First, we need to clarify what the abbreviations I've been throwing around are about: ECTS and EC. The ECTS is the European Credit Transfer and Accumulation System, a system that was instituted by the European Higher Education Area (EHEA) in 1989, together with the Erasmus programme, to facilitate the transfer of study credit between institutions when studying abroad. The unit of a study credit in this system is the European Credit, EC.

The 'European' in the EHEA and ECTS does not limit the cooperation to the European Union, but extends itself to 48 member states, which comprise the members of the Council of Europe [not to be confused with the European Council, a political body in the EU, red.], excluding San Marino and Monaco, but including Belarus, the Holy See of the Vatican and Kazakhstan (see figure 1). Do you still follow? The reason I am overloading you with this information is because the ECTS has easily found its way into EU legislation, and by virtue of that also into Dutch legislation, because the European Commission, the executive body of the EU, also has a seat in the EHEA. Under the bottom line this means that the ECTS is supported by international declarations [which are not legally binding, red.], Dutch national law and EU law.

Figure 1. Member states of the EHEA.

So how does the ECTS facilitate the reliable transferral of study credit between institutions? As mentioned before, it uses EC. These then are made equivalent to a certain volume of learning hours. The user manual of the ECTS made by the European Commission specifies that a full-time academic year of 60 EC should range from 1500 to 1800 hours, meaning that one EC corresponds to 25 to 30 hours of work. So far there seems to be no problem with the differing workloads between chemistry and philosophy. However, the manual also states that the exact workload associated with an academic year is usually formalised in national legal provisions. The Dutch government has done exactly that, and in article 7.4 of the 'Wet op het hoger onderwijs en wetenschappelijk onderzoek' (WHW) it defines 60 EC to be worth 1680 workhours. That equates 1 EC to 28 hours.

Using these ECs, the ECTS also provides a way to discern different qualities of education by pinning down first, second and third cycles of education and allotting specific amounts of credit to them. Although most students are unaware of these terms, they are quite familiar with the principle; our BSc., MSc. and

PhD structure derives from it, making it easy for students to follow up their degree abroad.
Of course, there are many more intricacies to the ECTS that promote the transfer of study credit, but the problem I am concerned with lies in the definition of the EC and its use in practice.

As I have pointed out repeatedly, there seems to be a very big discrepancy in the required amount of work for 6 EC between courses and programmes. A student of philosophy will receive 6 EC for a course that requires a lecture and a seminar a week, whereas a chemistry student will have to work almost 4 times as hard for the same amount of EC in some cases.
Now, the more astute of you would point out that the workload the ECs represent, does not only include contact hours, but also the time the student undertakes self-study. Self-study hours are in many cases the piece that makes the workload puzzle fit 6 EC for a course. However, the problem lies in the way these hours are recorded. At the UvA it is done by use of the course evaluation forms that students fill in after the course has finished. Since very few students actively record the amount of work they put in, simple surveys like the course evaluations bring with them the fundamental uncertainty of self-reporting. On top of this, the number of students that reply to these surveys is shockingly low, meaning that the results they offer can at times statistically be completely irrelevant. Take both the aforementioned effects into account and it becomes clear that self-reported self-study is not a good basis to grant EC on. I speak from personal experience when I say that a 6 EC philosophy course simply requires less work than a 6 EC chemistry course.

Funnily enough, the university itself also seems to have noticed that workhours are an unreliable measure for assigning EC. The Onderwijs- en examenregeling (OER), that has passed through several levels of internal (student)government, of the faculty of law states the following in article B-1.2.3.: "For the calculation of the workload we take 120 pages per EC." Quite different from the prescribed 28 hours of study. The current definition of the EC seems to be somewhat unworkable and vacuous.

At this point some of you might defend the current system by saying: "Well, what does it matter that STEM students have to work harder for their ECs? STEM diplomas are worth more, not only because they learn more valuable skills, but precisely because they have learned to work harder."

To this I would agree, it is indeed the case that STEM diplomas, including the chemistry diplomas most of us will acquire, are seen to be more valuable than a diploma in philosophy. However, this makes my point that the EC is not trusted as a measure of workload painfully clear: all employers assume that, even though a bachelors in philosophy and chemistry both feature 180 EC, the chemistry bachelor requires more work. Amounts of credits seem irrelevant.
If anything, the defense given above argues for the allocation of more study credit to STEM bachelors, something that cannot be done in the current system of ECTS-prescribed cycles of education. It highlights the dysfunctionality of the system.

So then, what does it matter? First of all, it is remarkable that the government would legislate both nationally and internationally on study credits that are linked to work hours, only for the students and universities to not follow them, as seen in the different workloads of chemistry and philosophy. Should we abide by the law? Yes, we should.
Secondly, a weak definition of study credit and workload could cheat students out of the opportunity to complain about to much work. The course coordinator could artificially cut the load by simply giving less seminars and increasing the amount of self-study hours, while not changing the actual content of the course, giving a false impression of a lighter load. In the same context arguments that the diploma will be more valuable and thus that they should just suck it up, become more defendable.
Thirdly, it becomes exceedingly hard for course coordinators to plan their courses based on EC rooted in workhours. This is clearly illustrated by the fact that the faculty of law takes the number of pages to read as a lead for study credit.
So, what is the conclusion to this article? Obviously, that the current EC deserves to be redefined for the reasons above. Do I have a better alternative ready at hand? No, but maybe the pages approach is not that bad.
Naturally, I understand that this Europe-wide change is not simply going to happen because I have written a piece in the ACiD. At best, I hope that this becomes a topic of discussion at the faculty and I hope at the very least that I have given you some insight in the way our current academic system works.

Chemistry vs. philosophy

Maarten van Dorp

The old but not quite forgotten series 'Chemistry vs. ...' is making its long-awaited comeback. We will look at chemistry through the eyes of people in other disciplines and walks of life. Of course, we will also return the favor and have a chemistry student speak too. This edition: the philosophy student.

The philosophy student on chemistry

First of all, what is your name and why do you study philosophy?
T: My name's Taylor and I started philosophy simply because it interests me most, I read the books they read for the courses and in the future, I hope to combine it with some form of art, like literature or film.
N: My name is Niels and I'm doing philosophy because my study in economics didn't make me feel, to a certain extent, like a student anymore. I wanted some less practically relevant knowledge that I liked learning.

What does chemistry entail exactly?
T: Haha, well, back in secondary school it was already my hardest subject, so I'm having a tough time defining it exactly. When I think of chemistry I think of those figures of molecules. To me they look a bit like the floorplan of a room and a tad incomprehensible.
N: To try and describe the chemical ingredients of the world, I guess. The physicists try to understand movement and the chemists try to understand matter.

Who is the chemistry student?
T: That depends I recon, there is no 'the chemistry student'. But if I'd have to name a characteristic I would think of my old teacher and of people who have a very abstract way of thinking.
N: Haha, compared to the students of economy they are a bit nerdier, but not in a positive 'dedication to the study' way. They are students who find fun in their discipline, their passion for chemistry. They are also stubborn and autonomous because they might think they are cleverer than the rest.

In what do chemistry students overestimate themselves?
T: Oof, I wouldn't know. I don't really have a judgement on that. I don't have a judgment on that for any STEM (Science, Technology, Engineering en Mathematics) student.
N: Uuuuuhm, that's a good question. I'd say their own intelligence and that they're always right of course. Their stubbornness comes from being the smart kids in secondary school and thinking: "We are the clever STEM students and the rest are losers." Not necessarily wrong, but they sometimes do overestimate themselves in thinking that there or no other clever people at the university.

What are philosophy students better at than chemistry students?
T: That's also hard for me to say without me thinking it sounds stupid. It might sound a bit stupid, but maybe they appreciate philosophic literature better.
N: Ethics and politics. Philosophy students are better at having nuanced views of things and looking at things from different points of view. Chemistry students only tend to look at things from one side and view that as the objective way of looking at it.

What are chemistry students better at?
T: Well, I recon that they look at the world in another way, like they can see through things in a chemical way and say: "Ah that's what this is made up of." In the same way other studies can do that for their discipline.
N: Focusing on a subject and looking at a concrete thing objectively. Not doubting absolutely everything.

What do chemists do all day?
T: Making chemical jokes.
N: I heard that they throw explosive pieces of sodium in the canal during their drinks, so I recon that after studying hard they also do some crazy stuff for fun.

The chemistry student on philosophy

What is your name and why do you study chemistry?
R: I'm Robin and to be honest I study chemistry simply because that is what I am signed up for in Studielink.

What does philosophy entail exactly?
R: What is philosophy? Can you ever really philosophize? One of my friends once got kicked out of a philosophy party and he was told to take his coat and go outside. He then started to argue that you could never really be outside and know what a coat is. I recon that such a thing comes close.

Who is the philosophy student?
R: I know two philosophy students, Job and Maarten. In my eyes the philosophy student is somewhat of a hipster.

In what do philosophy students overestimate themselves?
R: They don't really seem to overestimate themselves, although I wouldn't exactly say that they are down to earth. Philosophy students seem a bit pretentious to me, since they tend to try and overcomplicate things with philosophical jargon. The very 'out-there' clothes from the thrift shop don't help either.

What are chemistry students better at than philosophy students?
R: Absolutely everything. STEM life forever.

What are philosophy students better at?
R: Navigating sentences like: "You cannot will some things more than you will other things, but some willed things are of a higher will than others." Absolutely impenetrable if you ask me.

What do philosophers do all day?
R: Reading a paper or book that, for instance, Kant wrote, then reading one that, as another example, Nietzsche wrote, and then explaining them in such a way that it seems like they have fundamentally different ways of viewing things. In reality the differences are minute of course. [Neither Kant nor Nietzsche would be very happy with that analysis, red.]

Smaakmatrix

Inspired by the Parool

Scientific

Horrible

Brilliant

Beer-related

- Climate Change
- The BladCommissie only has 4 members
- Brinkies in the ACD room!!!
- BEC (foreign excursion) is going to Sevilla this year
- Floris received 20 casks of La Chouffe on his foot, ouch!
- Despo is removed from the assortment for the winter
- The (UvA) ACD room has a new fridge