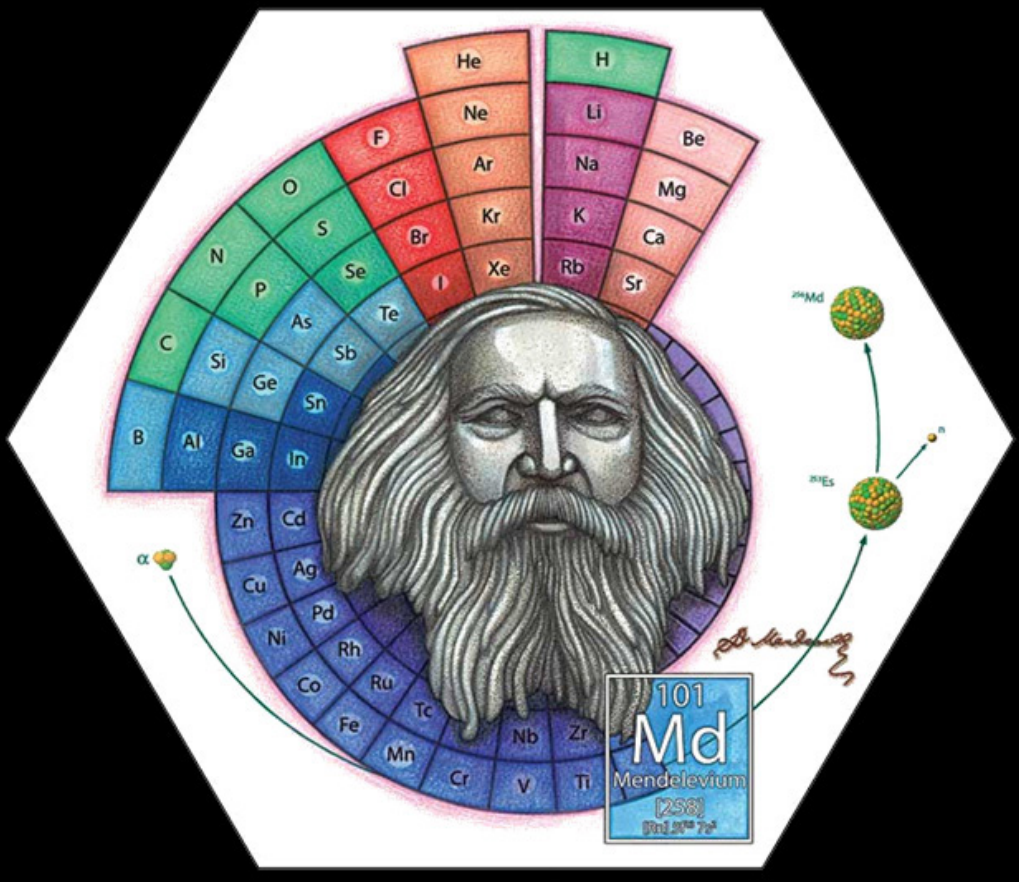
ACiD

Amsterdams Chemisch Dispuut Volume 51 | Edition 2



Amsterdams Chemisch Dispuut

The Periodic Table
The Extraordinary Discovery of Dmitri Mendeleev

PhD Research: Pascal Vermeeren
Understanding Chemistry Using the Activation Strain Model

Interview with Célia Fonseca Guerra
From Student to Teacher and Researcher

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Questa BV
Kennemerstraatweg 11
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072-582 23 92 - questa.app

Colophon

Editorial office
Nadav Joosten
Myrthe Zwart
Maarten van Dorp
Michelle van Dongen
Charlie Smit

Contact
Amsterdams Chemisch Dispuut
(Kamer A0.09)
Postbus 94214
1090 GE Amsterdam
Phone: 020 – 525 7861
Mail: blad@acdweb.nl
Website: www.acdweb.nl

Circulation
550

Next Edition
April 2020

Current Periodical
Volume 51, edition 2
February 2020

Electronic Magazine
The electronic version of ACiD can be found on the website under Association - ACiD.

ACiD is the current periodical of the Amsterdams Chemisch Dispuut, the study association of Chemistry in Amsterdam. ACiD is home delivered to ACD's members and donators and distributed around the department of Chemistry.

From the Editor

Dear reader,

Another year has passed, and we are already halfway through the academic year too. Hopefully you are all well rested after two weeks of hard earned vacation. In this edition we take a look back at 2019, the year of the periodic table, of course by learning more about the periodic table. We also take a more personal look at the last year and see some of your new years resolutions. It will be interesting to see who can actually stick with them. You can learn more about our Master Coordinator Célia Fonseca Guerra, and read about the work of one of her students, Pascal Vermeeren.

We will look forward to another year filled with borrels, excursions and lots of fun. Enjoy reading this edition of ACiD!

On behalf of our entire editing team.

Kind regards,
Myrthe Zwart

Content

From the Chair

Dear ACD'ers,

Here it is again: the second edition of our beloved ACiD. The Christmas Holidays and New Year's Eve have gone by with a bang (of fireworks) and have made way for a new year: 2020. It promises to be an amazing year with so many different events and something for everyone. I hope that 2020 will be everyone's best year yet. Whether you are trying to complete your first year or hope to complete your master's internship; whether you are finally going to pass thermodynamics this year or you are taking a huge step in your PhD project, the ACD will try to help you with all of this, both in the educational or relaxation aspect, whatever is needed for you.

A lot has happened in the recent months. It all started with the most important birthday of the year: our beloved association's birthday on the 7th of November. It was celebrated one day later by our Party Committee, throwing their first party of the year. With the theme 'Hakkers & Kakkers' at an equally 'kakker' location, it was once again a memorable party. The Party Committee did not sit still afterwards and spent most of their free time setting up another 'knalfuif'. I am, of course, talking about the Gala. Everyone who has been to this party will probably agree with me that it has been a night never to forget. As a side note: I couldn't talk very well for a few days after both parties due to a hoarse voice, as a result of our beloved ACD-song. However, it was worth it!

Of course, we didn't only dance and sing. There were plenty of options to mentally enrich yourself as well. The first annual orientation market was held in collaboration with the educational programme. With more than forty projects presented I hope everyone has a more complete picture of what to do in your upcoming projects. Besides the orientation for the educational programme, there also was an orientation for what to do after your study. The LEC has organized two excursions in the recent months. First, they organized an excursion to the conservation and restoration department of the Rijksmuseum and the UvA. During this excursion art and chemistry enthusiasts came together to learn more about the chemistry behind art. The other excursion was at a further location, in Sassenheim, where we visited AkzoNobel. Here our knowledge about paint grew even more. For the rest of the year a large number of lectures and excursions are coming up and I hope to see you all there.

The ACD also travelled to the beautiful Aachen. I wasn't there, but I've heard that the AJW had set up a wonderful weekend with an exciting scavenger hunt and a visit to Aachen's Christmas market. I am already looking forward to the AJW weekend of next year.
Wow, looking back, a lot has happened. Next to all of the above, the MAC and EJC organized some fun activities and the swimming event of the Sport Committee was a great success. Of course, the ABC organized their delicious drinks of which I want to highlight some of them. Firstly, the annual 'Kabouterborrel' with the NSA was again an incredible success. I didn't know the Brainwave could be that full of gnomes. Secondly, the Sinterklaas drink, where the SinterCWAL was present again this year and thanked all active members with a refined poem and a delicious chocolate letter.
For the upcoming period I wish everyone a lot of success in what you are going to do, in what you are going to organize with your committee, and with the course you will finally pass. Enjoy reading the rest of the articles in this magazine.

With kind regards,
Your chairman
Sam Hulscher

ACiD Announces: Het Wel en Wee van de OC Part 2 – Electric Boogaloo

Maarten van Dorp

It has been a while since the last 'Wel en Wee', and since then a single period of the academic year has passed. Of course, you have all filled in the course evaluation forms for the courses you have followed, but for those of you who have not done that yet, we would like to urge you to do so anyway. If everyone fills in their forms this isn't just beneficial for the programme committee (OC), but also for you, the student, yourself. Say the course you followed had horrible lectures, and you want the respective professor to change this. Not only will it become clearer how good or bad the lectures were since more responses yield more statically accurate results, it will also be harder for professors to argue that the responses are outliers and should not be taken into account. To add to this last point, it's also important to note that you should fill in the forms even when you liked the course, so the lecturers know what works and shouldn't be changed. Our part of the deal is then to fight as hard as we can to implement your feedback.

If you have anything besides the course evaluations you want us to talk about or evaluate, you could always send us a mail. To this end, I accidentally gave you my personal mail last edition, but naturally the right mail is the special OC mail. You can find this at the end of the article. Oh, and another thing I forgot to mention, the OC has its own page with extra information on the UvA site. It can be found on the A-Z list of the Chemistry page.

By the time you will be reading this the committee will just have had a meeting and I will probably give you an update on that in the next edition. Aside from the programme committee the curriculum committee has also been keeping itself busy. Although I cannot divulge too much about the possible contents of the new curriculum, most of it is very likely subject to change, I can tell you about the way we are taking the feedback of students into account.

Some weeks back, Davita and I invited some interested students to have a look at a couple preliminary curricula and discuss them. Overall some remarks were made in regard to courses that combine different disciplines, like Chemische reactiviteit en biomoleculen, and the number of electives in the curriculum. If you are interested to see, provide some suggestions for the next curriculum, or are interested in maybe having another meeting, feel free to mail Davita and/or me. These email addresses can be found at the end of the article as well.

Davita and I then took the comments, summarized them, and presented them to the committee. Now, as some of you who have participated in student politics might know, it is easy to get a tad cynical about how well you are actually being listened to as a student. In this case, however, the committee was very open to our feedback, listened intently, and immediately made some simple changes to the curriculum to address the comments made by students. So once again, if you have some issues with the current curriculum and don't want us to repeat history, then please, please, mail us.

Hopefully until next edition, when I will present the topics discussed in the latest OC meeting.

OC mail: ocs-science@uva.nl
OC page: student.uva.nl/sck/content/az/opleidingscommissie/opleidingscommissie
Curriculum committee feedback mail:
davita.vanraamsdonk@student.uva.nl
maarten.vandorp@student.uva.nl

Some Words From the Party Committee

Dear ACD'ers,

We are already almost halfway the academic year, time sure goes fast. We, the party committee, sure have enjoyed your dance moves this past year, of course starting with the 'hakkers en kakkers' party, where the room was filled with the 'lijpste lullo's', the 'hitsigste hockeymeiden' and the biggest 'gabbers en gabberinnen'. In addition, we have had an amazing gala together with our math and physics brothers from the NSA, with moulin rouge as this year's theme. Beautifully decorated ladies and sharp looking gentlemen came beautifully dressed to this dazzling gala and brought a sensational atmosphere. They have been two marvellous parties.

As the party committee we don't only look back, but we also have to look forward to the next semester, with the spring party. Even though the days are still short and we are still in the midst of winter, we already have to start the preparations. Naturally we will end the year with the incredible flux festival. In short, enough to look forward to in the next semester!

Kisses,
Martijn ten Brink, on behalf of the party committee

New Year's Reflection within the ACD

Charlie Smit

Joost Koning

What is your chemistry related highlight of 2019?
With the subject 'Practicum Molecuul en Leven' we did several experiments and I basically liked all of them, but I think the most stunning one would be the one where we made Nylon. I was amazed by how it is so easy to make and how we made a solid out of two different liquids.
What is the best thing the ACD did last year?
Well, because I live quite far from Science Park, I didn't witness too much things the ACD organised. However, I really liked the 'Kabouterborrel'! I really like specialty beers, especially after my first exam week.
What do you hope to learn this year?
I cannot think of a particular thing. I just like to increase my knowledge about chemistry, so I'm quite exited for almost every subject.
Anything you are looking forward to in 2020?
I'm really looking forward to getting my 'propedeuse', but obviously I need to do some work for it first.
What is your new year's wish?
That's a hard question. I just hope that I'll be doing fine this year not only considering my study, but off course I also want to have a lot of joy this year.
What are your new year's resolutions, if any?
I don't really believe in new year's resolutions to be honest. I think that if you really want something to succeed you can do it any time and not just because some number on a calendar changes. But if I had to choose one, I think it will be 'getting my propedeuse'.

Rens van Roosmalen

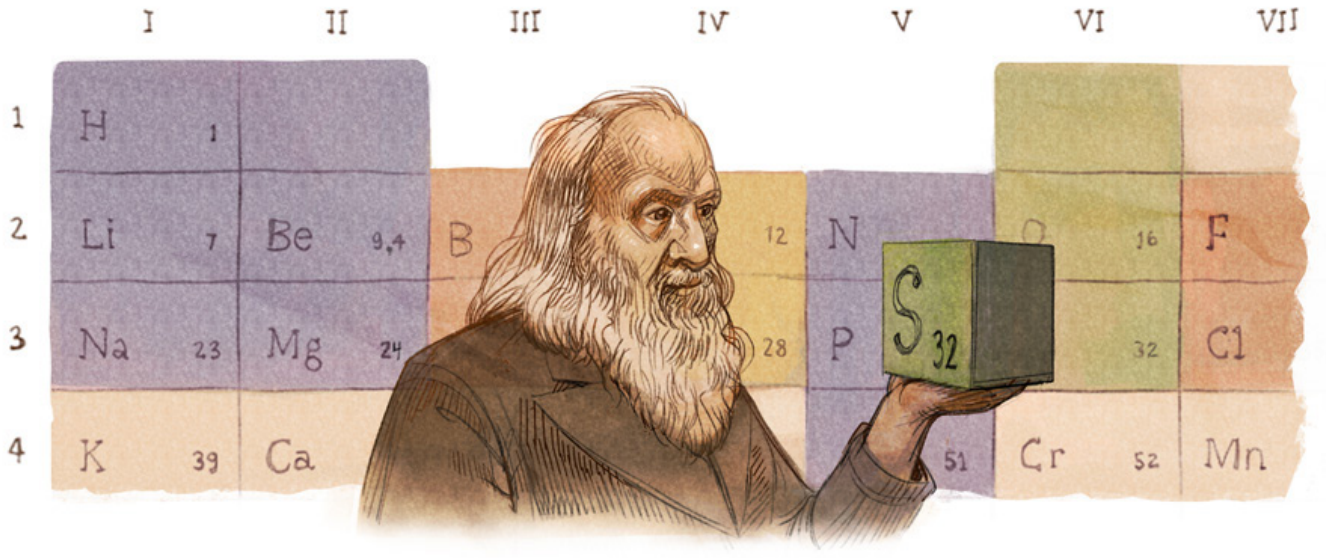
What is your chemistry related highlight of 2019?
Working in the lab for three months to finish my bachelor's degree, you learn a lot more in practice compared to lectures.
What is the best thing the ACD did last year?
For me it was hosting the weekly 'borrels'. There were a lot of awesome bigger events like the BEC and EJW, but all the borrels combined will always win for me.
What was your favourite day of 2019?
March the 29th, I finished my project on this date and started my early summer holiday.
What do you hope to learn this year?
I would like to figure out what to do with my life (tips are welcome).
Anything you are looking forward to in 2020?
I am looking forward to the study trip to Seville this year! It's going to be a lot of fun and I love Spanish food. As I'm growing older, I'm also starting to enjoy some of the educational aspects of the study trips we take.
What is your new year's wish?
I wish to have a lot of fun again this year and to make some good progress on my Master's degree
What are your new year's resolutions, if any?
Drinking a bit less than the past couple of years, shouldn't be too hard.

Tijmen Menist

What is your chemistry related highlight of 2019?
Synthesizing latex
What is the best thing the ACD did last year?
Probably the ACD wintersport but that might also be because I'm hyped right now.
What was your favourite day of 2019?
The day after me and two friends arrived at the Mediterranean by bike (alcohol was definitely involved).
Anything you are looking forward to in 2020?
Climbing outside
What is your new year's wish?
I wished my jaw would stop hurting so I could eat an oliebol.
What are your new year's resolutions, if any?
Get my OVM license (for the non-climbers: climbing multiple lengths of rope on a big wall).

Bibi van Poelgeest

What's your chemistry related highlight of 2019?
Isolating ovalbumin from a chicken egg in the lab at the O|2 building at the VU. It took a while before I got the experiment going, but after a while we were on a roll and then it was very fun and everything went well. Until we went to the nanodrop to synthesize our sample, when we found a small scooter, you know, one out of those surprise eggs. Of course, we had to put the Eppendorf with our sample on it and it stood surprisingly stable. This is how the running gag 'epje op een stepje' came to be.
What is the best thing the ACD did/that happened at the ACD last year?
It's hard to make a choice between all the borrels I went to, the Moulin rouge gala together with the NSA, the Hakkers en Kakkers party honouring the ACD's birthday, and the first year's weekend, which we also held together with the NSA. I really loved all these activities and I hope there will be a lot of chaotic nights and weekends to come.
What was your favourite day of 2019?
My favourite day had to be 17 September, when I turned 18. Even though it was a just a normal weekday I had lots of fun, just chilling with my friends. And being a legal adult is great, because, ethanol.
What do you hope to learn this year?
This year, I mostly just hope to learn enough so I can pass my classes and get my BSA, and to get a better image of what chemistry exactly is and to find out which parts of chemistry I like best.
Anything you are looking forward to in 2020?
The only thing I am really looking forward to is the summer. Not even really the holiday, I just really want warm weather with long days and short nights... Not that my nights aren't short now, but it is about the idea of more sun.
What is your new year's wish?
If I tell you, it definitely won't happen right?
And last but not least, what are your new year's resolutions, if any?
My new year's resolutions this year are: less drinking, less procrastinating and better planning. I haven't succeeded yet, I think I'll start in February, or march, or next year... or next decade...



The Periodic Table: An Extraordinary Story of a Teacher and the Discovery that Immortalized Him

Maarten van Dorp

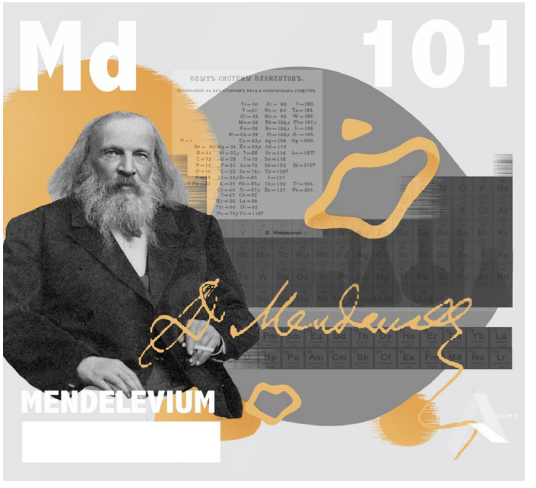
As we roll into 2020, the tens are making place for the twenties and although everything to say about 2019 has been said, there is still one thing left to look back on. That is, last year was the international year of the, so very familiar, periodic table of chemical elements. Most chemists have a vague notion that the table was designed, or discovered even, by Dmitri Ivanovich Mendeleev, but few know any details about his life. Who was Mendeleev? What is the story of the periodic table?

If you knew who Dmitri Mendeleev is, which I honestly hope you did, it is highly likely that you imagine him to be the gray old man he is in the picture in this symbol for the element named after him. Distinguished, yes, but adventurous and exciting? Maybe not quite. In reality, Mendeleev's life was every bit as exciting as it could be in 19th century Russia.

Let's start at the beginning. Mendeleev was born in 1834 to Ivan Mendeleev and Maria Mendeleeva (maiden name Kornilieva) in the Tobolsk governate in Siberia. Mind you, he was born near Tobolsk, a city that to this day only houses 100.000, so it must have been quite near wilderness two centuries ago. As an aside, Tobolsk also is the city Tsar Nicolas II and his family were moved to during the February revolution, before being moved to, and executed in, Yekaterinburg during the October revolution. Back from the Romanovs to the Mendeleevs, during Dmitri's youth his father was blinded by cataracts and his mother, a remarkably strong woman, was left to support the household by reopening the glassworks owned by her family. The success of the factory wouldn't last, as it burned down several years after it opened. By then Dmitri had graduated from the local Gymnasium, and his mother, now out of financial options to support the family in Tobolsk, moved the family to Saint Petersburg.

In St. Petersburg Mendeleev started his academic career in 1850 at the Main Pedagogical Institute, where he was educated to become a teacher. Currently the building Dmitri studied in is the main building of the Saint Petersburg State University, and amusingly contains the longest corridor of any academic building in the word. The institute being highly prestigious, a large portion of his fellow students went on to become professors at different universities. Mendeleev graduated without problems with a degree in teaching, which was held in higher regard than it is now. This might seems like an inconspicuous steppingstone in the life of a great academic, but his degree would later prove vital for the discovery of the periodic table. His luck was once again quick to run out, and Mendeleev was diagnosed with tuberculosis, a death sentence before the advent of antibiotics, shortly after graduation. Because of his tuberculosis Mendeleev left for Crimea in 1855, back then Crimea wasn't the glamourous peninsula the Russians of today perceive it to be, expecting to die. During his time there he taught science at the 1st Simferopol Gymnasium. To Dmitri's great annoyance there were little students to teach, because, while he was comfortable lecturing, most of the young men in the region were out fighting the Crimean war against the Ottomans, French and Brits from 1853 to 1856. With the youth already doing the dying for him, Mendeleev sought out a second opinion on his tuberculosis diagnosis, and it turned out that he was healthy as a horse (if not a bit hypochondric). Once again having a bright future ahead of him, he moved back to St. Petersburg in 1857 and in 1859 he started studying abroad in Heidelberg.

While in Heidelberg he met an array of influential chemists of the time. One of these chemists was Alexander Borodin, who was famous for discovering, among many other discoveries, aldol reactions. The name Borodin might also ring a bell among the more cultured of the readers, as the composer of the critically acclaimed opera Prince Igor. But, back to Mendeleev. The study abroad only lasted for a year, and he returned to St. Petersburg in 1860, and in 1861 he once again leaned on his education as a teacher to make his living and wrote his first textbook called Organic Chemistry. Although not quite Clayden, the book was received very well and won the Demidov Prize of the Imperial Academy of Sciences. It won't be surprising then that he was a Privatdozent (somewhat equivalent to an associate professor today, were it not that Mendeleev had yet to acquire his doctorates degree) before long, and he took this position at the St. Petersburg Technological Institute. This is where the periodic table comes back into the picture.



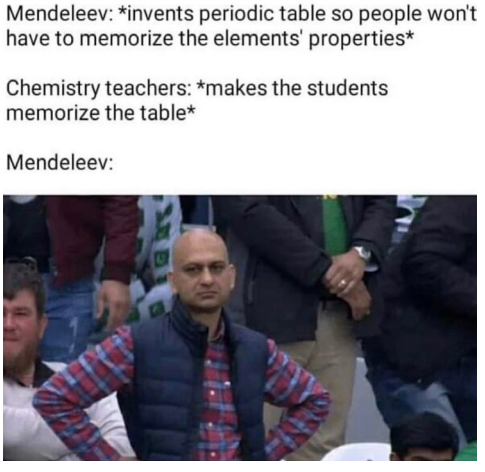
Students at the Technological Institute were there to get a degree in engineering or other technical disciplines and most were not interested in chemistry. Just like the students of today they performed horribly at the mandatory subject they hated and their teacher set out to simplify ways to teach them. For the elementary chemistry he begun to devise a system that might make it easier to remember specific reactivity, and devised the rudimentary system for what would later become the periodic table. Because of his excellent teaching he soon made promotion and became a professor at the St. Petersburg State University in 1865. Once again making good use of his education as teacher, he wrote a textbook, Principles of Chemistry (the titles of textbooks really haven't changed in the past centuries), for one of his classes in 1868. Seeing the utility of the study help he made for his engineering students he included it in his textbook, while at the same time critically reflecting on it. This would set him on the path to making arguably the single most important discovery in the field of chemistry after the atom. But before we actually talk about the periodic system, I am going to fast forward a bit to 1882, to talk about the most remarkable anecdote of Mendeleev's life.

It was in 1876 that his sister introduced him to one of her friends, Anna Popova. By then, he was already married to his wife for 14 years, and over that time he had grown disenchanted with her. The new miss Popova, however, seemed quite wonderful and he fell deeply in love with her. He wanted to propose to her, but unsure whether she would accept, he, in good Dostoyevskian fashion, threatened to commit suicide if she wouldn't marry him. She, smitten (or more likely, absolutely horrified) by the romantic gesture, consented. However, there was a hurdle to be taken first. 19th century Russian matrimonial law, and the church, forbade men to remarry within seven months after their last divorce. Mendeleev, still madly in love, of course couldn't wait seven months, and so he wrote to the Tsar to ask for an exception. Already rather famous, he got his exception, and so it was that in March 1882 he divorced his first wife and in February 1882 married his second wife. March... February... For a whole month Mendeleev was a bigamist regardless of seven month waiting periods; being a bigamist was highly illegal. Tsar Nicholas II caught wind of this crime, and when asked whether he was going to do persecute Mendeleev for it, he simply and incredibly replied: "We admit that Mendeleev has two wives, but we have only one Mendeleev."

Stepping back to 1868, Dmitri was busy at work, noticing periodic trends in reactivity of the elements, and in 1869 he finished his famous periodic table with only four missing elements in the main group. The very same year he presented his findings in a very short paper to the Russian Chemical Society for it to be published in the very first volume of their paper under the title The Dependence between the Properties of the Atomic Weights of the Elements. By the way, the paper was written both in French and Russian, as most upper-class Russians spoke and wrote the former language, so if you are proficient in French, you could try to read the original version of the paper yourself.

But why was it that the table of this once tuberculosis diagnosed schoolteacher is the one we still use today? After all, back in 1817 Johann Döbereiner proposed a table of triads, effectively laying the groundwork for the later works on periodicity. In 1865 John Newlands already proposed the law of octaves, with the repeating of chemical properties every 8 elements. Or Lothar Meyer, who published almost the exact same results as Mendeleev in the same year, but in a German paper.

Of all those scientists, it was Mendeleev who dared to explicitly predict the existence and properties of 3 elements, which turned out to be Scandium, Gallium and Germanium. It was the schoolteacher, with his table designed to help his unwilling engineering students learn, who dared to push his discoveries to the limits. Despite his relatively humble beginnings, and his tumultuous life, he played to his own strengths, he dared, and changed and entire academic field forever. And for that, we remembered Mendeleev almost two centuries later.



Filled peppers with spinach and cheese

Michelle van Dongen

With the temperatures slightly dropping and our short days consisting out of grey skies and drizzle we are often in need of some colour. And what screams colour more than the famous red, orange and yellow pepper? Even better, they taste delicious too, especially filled with spinach and topped with cheese. Add some small potatoes and some chicken and you got yourself a hot, colourful and most importantly yummy dinner.

Ingredients:

- **2 peppers (pick the colour)**
- **75 g spinach**
- **2 tablespoons herb cream cheese**
- **Pinch of pepper (the herb)**
- **Grated cheese (as much as you think to be necessary)**

Preparation:

Pre-heat the oven to 180 °C. Remove the top of the peppers and possibly some seeds. Mix the herb cream cheese and spinach in a bowl and stuff your mixture in your peppers. Sprinkle grated cheese on the top and heat the filled peppers in the oven for 30 minutes. Enjoy!


FeestCie
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Stef Stuntpiloot




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Understanding Chemistry Using the Activation Strain Model of Reactivity

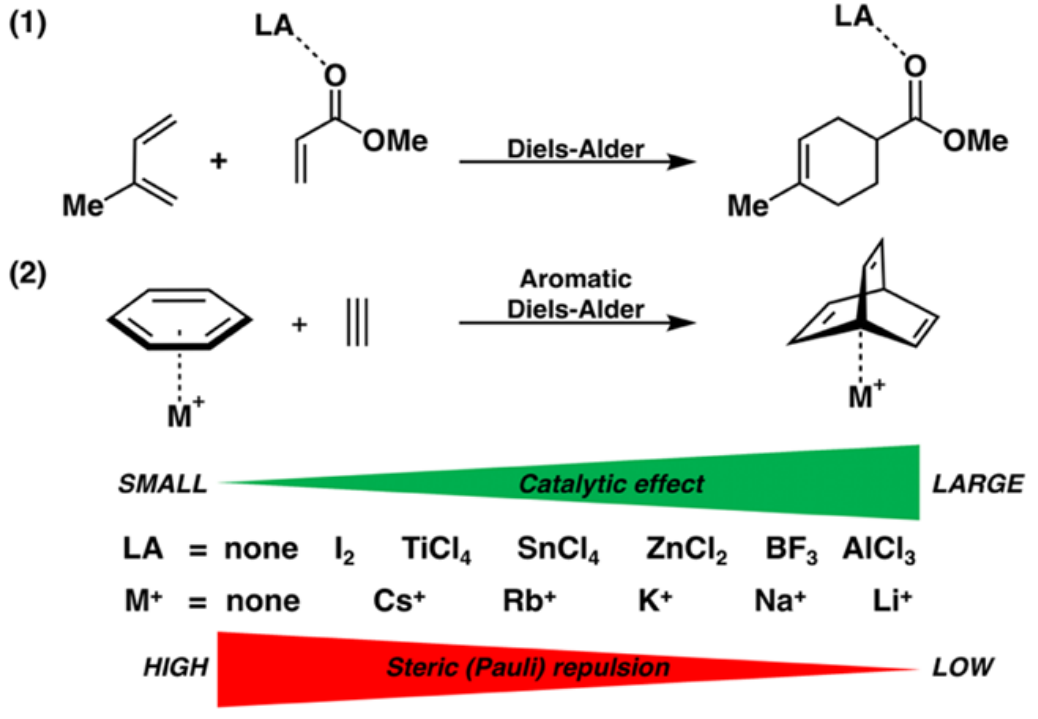
Pascal Vermeeren

With the aid of computational techniques, chemists of all disciplines now have the ability to accurately compute the molecular structures as well as the energies of a wide-range of chemical reactions. This development equips chemists with the necessary tools to understand chemical reactivity, which, in turn, enables them to both predict and rationally design new reactions. One of these tools is the activation strain model (ASM) of reactivity, which is developed in the theoretical chemistry group at the Vrije Universiteit in Amsterdam. This model relates the relative energy of any chemical reaction along the reaction energy profile, to two distinct factors, namely, the strain energy and the interaction energy. The strain energy is the energy needed to deform the reactants, that undergo a chemical reaction, from their equilibrium geometry into the geometries they acquire to react. The interaction energy is the actual chemical interaction between the two deformed reactants. To get a more complete understanding of this chemical interaction, the model can be extended with a matching energy decomposition analysis (EDA) scheme, in which the interaction energy is split into the classical electrostatic interaction, steric (Pauli) repulsion between the occupied orbitals of both reactants, and the stabilizing orbital interactions. Recently, we wrote a protocol, which serves as a step-by-step guide, explaining how to perform these analyses on any chemical reaction or interaction of interest.[1]

During my PhD, in the group of Dr. T. A. Hamlin and Prof. Dr. F.M. Bickelhaupt, we routinely use the methodology described above to understand and rationally design organic and inorganic reactions. One class of the reactions we have recently studied are Lewis acid (LA)-catalyzed Diels-Alder reactions. The Diels-Alder reaction takes place between a diene and dienophile and was discovered over a century ago, but are up to this day still one the most relevant processes in chemistry, because this reaction is able to produce six-membered rings, generating up to four stereocenters, and, therefore, significantly increasing the molecular complexity in a single step. Coordination of a LA results in not only a faster reaction, but also one with a higher regio- and stereoselectivity. According to general organic chemistry textbooks, the catalytic effect of LAs originate from the strong donor-acceptor interaction between the LA and one of the reactants, which, in turn, results in a significant stabilization of the LUMO of that reactant and, therefore, a smaller HOMO–LUMO energy gap. In our recent studies, however, we came to the unexpected conclusion that, in contrast to the textbook explanation, LAs do not catalyze Diels-Alder reaction via a lowering of the HOMO–LUMO energy gap, but instead by reducing the steric (Pauli) repulsion between the occupied orbitals of the diene and

dienophile.[2,3] Coordination of a LA to the reactant, either to the dienophile (Reaction 1) or diene (Reaction 2), polarizes the occupied orbitals of that reactant away from the other incoming reactant and leads to less repulsion between the occupied orbitals of both reactants. We argue that this unexpected electronic mechanism behind LA-catalysis is actually a more general phenomenon and in order to support this claim, we are actively expanding the scope to a wide-range of LA-catalyzed organic reactions.

Furthermore, as second project, we are expanding the use of the activation strain model to understand the physics of the adsorption of molecules on surfaces. As a model system, we study the adsorption of pentacene onto an iron oxide (Fe3O4) surface. Our theoretical results are to be validated using scanning tunneling (STM) and atomic force microscopy (AFM) experiments. This experimental work will be performed in the group of Dr. Ingmar Swart at Utrecht University. With these experimental techniques, we will be able to quantify the adsorption geometry of a single molecule as well as the shape of its molecular orbitals. These observations can, in turn, be directly linked to our theoretical results and will help us to optimize our computational techniques.



1. P. Vermeeren, S. C. C. van der Lubbe, C. Fonseca Guerra, F. M. Bickelhaupt, T. A. Hamlin *Nat Protoc.* **2020**, DOI: 0.1038/s41596-019-0265-0.
2. P. Vermeeren, T. A. Hamlin, I. Fernández, F. M. Bickelhaupt Angew. Chem. Int. Ed. **2020**, *accepted*.
3. P. Vermeeren, F. Brinkhuis, T. A. Hamlin, F. M. Bickelhaupt *Submitted Manuscript*.

Chemistry Highlights of 2019

Michelle van Dongen

The year 2019 was another exciting year for researchers in the different fields of chemistry. Of course, we've had the yearly Nobel Prize, which this year went to the lithium ion battery, but in every field there are small breakthroughs every day. It is hard to keep track of all the important trends in the chemistry department, so how do we determine the highlights of an entire year? For some insight I peeked at C&EN, short for chemical and engineering news. C&EN is a trade magazine weekly brought out by the American Chemical Society (ACS) which often reflects on the previous year and predicts trends for the upcoming one.

The first trend they highlighted follows society's growing concern for the effects of climate change.[1] In the year 1990 first evidence was brought forward that fine particulate matter such as $PM_{2.5}$ could enhance respiratory and cardiovascular diseases. This result was initially strongly doubted, even by the researchers themselves. However, ever since that year study after study has been done underlining the results and 2019 saw an even further increase in air quality studies. In **Nature Communications** a group discovered that black carbon, a combustion-related PM, was able to traverse from the mother's lungs to the placenta, where it could cross the barrier to the foetus' side even during the early, vulnerable pregnancy stages.[2] Detrimental health effects could therefore be initiated from the very first life stage. Another research article in **Environ. Health. Perspect.** , published in May, also showed a link between exposure to air pollution from an early age and reduced fundamental cognitive abilities.[3] The researchers tested children in Barcelona on their cognitive development from the prenatal period until the age of 7, meanwhile measuring the children's exposure to $PM_{2.5}$.

With climate change still in mind, other chemists further developed electrochemical organic synthesis to enhance the greenness of industrial processes with lower energy consumption and emissions.1 In this method, organic synthesis is carried out in an electrochemical cell. The oxidation reactions take place at the anode and the reductions at the cathode. The research group of Blanco et al.[4] focussed on the electro hydrodimerization of acrylonitrile (AN) to adiponitrile (ADN), one of the largest organic electrochemical processes in industry (Figure 1 and 2). AN is reduced to ADN at the cathode, while the produced hydroxide is oxidized back to water at the anode in an electrochemical cell under a certain voltage (Figure 1). ADN is the main precursor to Nylon 6,6, often used in the textile and plastic industry. Organic electrochemical synthesis is favoured environmentally due to its benign reaction media (often water-based electrolytes) and mild reaction conditions. However, there are still certain drawbacks: reactants are often poorly soluble in the electrolyte and it is difficult to control the product selectivity. One of the undesired by products in the synthesis of ADN was 2-methylglutaronitrile from propionitrile. The group tried to increase the product selectivity through use of voltage pulses between 5 and 150 ms and discovered an 20% ADN production increase and a 250% increase in relative selectivity in comparison to the widely used constant-voltage processes. Something even more exciting about this research is that they later on combined their experimental work with an artificial intelligence (AI) program to further optimize the electrochemical synthesis conditions. This resulted in a 30% ADN production enhancement and a 325% increase in selectivity.

Lastly, there are sensational developments in the organic synthesis department that we could talk about. Researchers at the University of Oxford found a way to ambiently cleave the C-C bond of famous benzene5, the aromatic six-membered ring known for its hardiness and stubbornness to react. Previously, this cleavage was only known to occur using transient, highly

highly reactive species in situ, such as carbenes. Now the group developed a complex with a single aluminium centre which can perform the oxidative addition of the C-C bond at room temperature and reversibly. The complex is formally described as [(NON)Al]– with NON = 4,5-bis(2,6-diisopropylanilido)-2,7-di-tert-butyl-9,9-dimethylxanthene and is stable at room temperature under inert conditions. The reaction is shown in figure 3 and this process might be promising for the synthesis of functionalized acyclic compounds derived from benzene.

These articles were obviously only a few of the many highlights we were presented with this year, but I hope they've inspired you to dive into the breakthroughs of past year yourself and perhaps fantasize over what 2020 would bring our wonderful chemistry society.

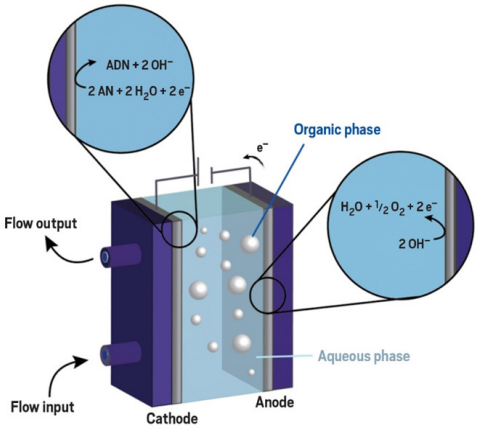


Figure 1. Schematic representation of an electrochemical cell for the reaction of AN to ADN.[4]

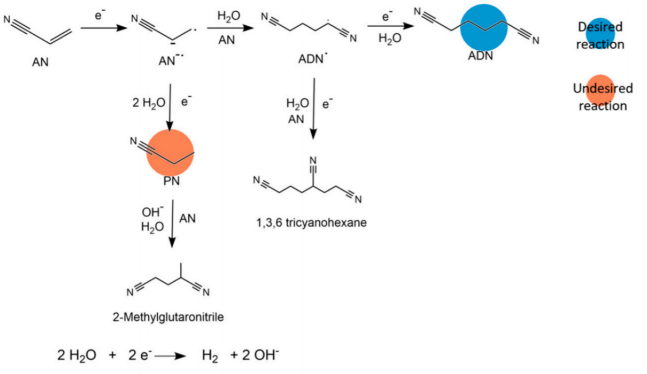


Figure 2. Reaction of AN to ADN and one of the main undesired reaction pathways. [4]

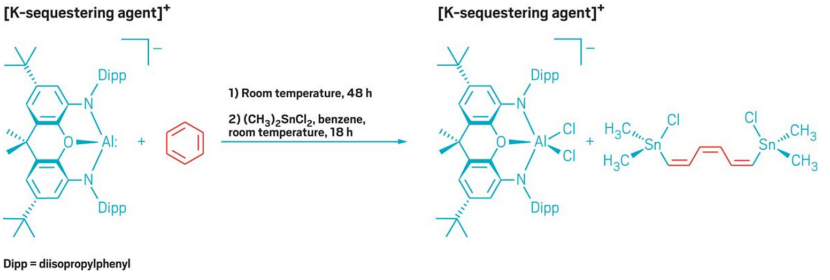


Figure 3. The reaction of the C-C bond cleaving of benzene using the aluminium complex

1. Bourzac, K.; Krietsch Boerner, L.; Halford, B.; Torrice, M. *C&EN* **2019**, *97* (48).
2. Bové, H., Bongaerts, E.; Slenders, E.; Bijnens, E. M.; Saenen, N. D.; Gyselaers, W.; Van Eyken, P.; Plusquin, M.; Roeffaers, M. B. J.; Ameloot, M.; Nawrto, T. S. *Nature Communications* **2019**, *10*, 3866.
3. Rivas, I.; Basagana, X.; Cirach, M.; López-Vicente, M.; Suades-González, E. ; Garcia-Esteban, R. ; Álva rez-Pedrerol; M.; Dadvand, P., Sunyer, J. *Environ. Health. Perspect.* **2019**, *127*, 1-11.
4. Blanco, D. E.; Lee, B. ; Modestino, M. A. *Proc. Natl. ACAD. Sci.* **2019**, *116*, 17683-17689.
5. Hicks, J. ; Vasko, P. ; Goicoechea, J. M.; Alridge, S. *J. Am. Chem. Soc.* **2019**, *141*, 11000-11003.

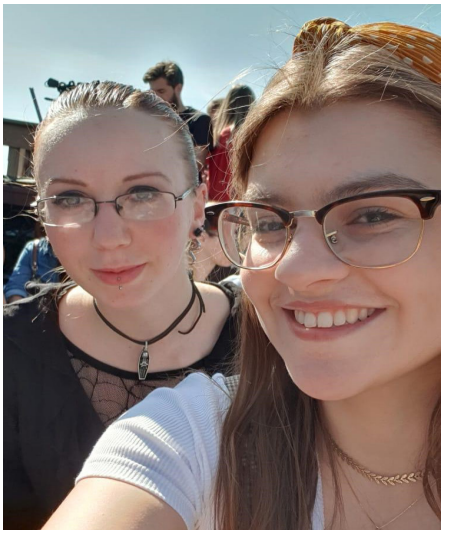
International Chemistry Students at the UvA and VU

Maria Azevedo and Helena Sieber

Each year the UvA and VU welcome 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. This time Maria and Helena share their experience of studying at these Dutch universities.

Maria is 24 years old and from Brazil. She decided to do her chemistry master's degree at the University of Amsterdam, because this university is part of a multicultural environment and is amongst the best research universities in the world.

Helena is 22 years old and from Germany. She wanted to acquire experience abroad whilst studying an interesting subject, so she started the joint degree of the Master of Chemistry in Amsterdam.



Both met at VU during the introduction day for the Chemistry MSc Programme and cycled to UvA together. That's when their new friendship started. They met again after the Christmas break and got into a conversation about their experiences in Amsterdam so far:

M: 'Hey Helena! Happy New Year! Are you enjoying your master so far?'

H: 'Hey Maria! Yes, I am. In my opinion, studying at two distinct universities really enlarges our experience of Amsterdam. There are so many extracurricular activities like talks, seminars, meetings with research groups and so on. We can go to so many things! Do you remember the trip to Aachen, organized by the ACD?'

M: 'Yes, that was my first ever visit to a Christmas Market. I also really like the way our curriculum is structured. In comparison to Brazil, the length of the courses is quite different. In Brazil each course takes at least 6 months with more than one exam throughout it. I think it is a great experience to get to know different education systems, and UvA and VU have a lot to offer in addition to their courses.'

H: 'I agree! The content of the courses are interesting, demanding and well presented. Also, I think the professors here are more accessible. All in all, I feel very at home in the diverse city of Amsterdam, where I can meet people from all over the world.'

M: 'The cultural activities in Amsterdam are also exceptional! I truly enjoy going to museums and getting to know more about the Netherlands. On top of that, I can bike everywhere and get to see the beautiful places around the city.'

All in all, studying abroad is an exciting way of meeting new cultures and gaining different knowledge inside the classroom and outside. We believe that this experience will help us grow on a personal and professional level.

From student to teacher and researcher

an interview with Prof. Dr. Célia Fonseca Guerra

Michelle van Dongen and Nadav Joosten

It was 1987 when prof. dr. Célia Fonseca Guerra started her study chemistry at the VU. This was before our bachelor-master structure and the joint degree between UvA/VU. The study was an ensemble of chemistry and pharmaceutical science students and after two years you had the option to dive further into chemistry or go off in the pharmaceutical direction. Célia chose chemistry. Her first love for chemistry was particularly in organic chemistry, but mainly because of the fundamental theories behind it. When she first encountered Hückel theory, a new love was found: theoretical chemistry. The choice for theoretical research came as no surprise. Even before starting her study at the VU she had always loved both chemistry and mathematics. As a non-theoretical chemistry student, you might think by yourself 'What is the importance of theoretical chemistry?' As said by Célia: to prove how things really work on a molecular level both calculations and experiments are needed. When calculations and experiments are put together in the right way the amount of knowledge won't be 1+1= 2, but 3 or more. Working together is crucial in that regard.

Most of us know that being a student is not only about studying but it encompasses a whole range of activities. So, what type of student was Célia?
As a student Célia always aimed to get the highest grades of the class without neglecting her social life. She could still vividly remember the ambiance at her study, as everyone was so tolerant towards each other.

It didn't matter who you were, where you were from or what clothes you would wear. It was quite the same as our ambiance today, maybe it's a quality owned by most chemists. During her time at the VU she also undertook an activity which we nowadays could not go without: a foreign excursion. No foreign excursion had been organized for a long time, so Célia and her fellow students planned an excursion to London. Here she found out how privileged we are in the Netherlands regarding our lab facilities, which are very good compared to the English ones. She also was the student member of the board of the division of theoretical and physical, because it was obligated to give students a voice in matters concerning them. Célia was never a committee member of the study association, but when help was needed, she would be there.

With the busy student life of studying and social activities, a calm space was needed from time to time. Back in the day she often went to Portugal where here parents owned an apartment to study for a few weeks. It was quite easy for her to be in Portugal, as her two Portuguese parents brought her up with the Portuguese language during the first years of her life. Besides having family where she could stay, the trips to this country were easily made due to student discount and having a father who worked at KLM. These days she doesn't fly to Portugal anymore when she needs a quiet place, but she just locks herself up in her study at home. However, Portugal will always be her favourite country for a holiday.

Near the end of her study, she met her (now) husband and colleague prof. dr. Matthias Bickelhaupt. The two met when she was doing her end project, comparable to our master project, and when he was a PhD student who came by her department once a week. At the moment we asked her about how it is to work together with her husband, Célia reacted quite surprised that we were aware of their relationship, but still answered our question. Working together doesn't create problems at all in their relation as partners and colleagues. Both are good at separating work and private life. Finding the right balance was quite easy because they have similar ideas about how to deal with people and how research should be done. Having the same mindset makes most 'challenges' simple.

After graduating, Célia did a PhD and travelled to different universities worldwide. She became a doctor in the year 2000 and from 2000 to 2005 she was a postdoctoral associate. During this time, she gave birth to her two sons. She continued doing research at the VU and from 2010 to 2012 she was a consultant at Wacker Chemie and visited even more different universities.

After this intermezzo she came back to the VU in 2012 to finally become a professor in 2018. This information can all be found in her Curriculum Vitae at the website of her research group. Maybe, you all are wondering why she would write the birth of her sons on her cv. This had everything to do with grants. During the application you need to show your cv and they check the frequency of your work. When a scientist has a lower frequency of publishing in their career than others at that time, some organisations will want to know the reason. To prevent having to answer these questions repeatedly, Célia has put the birth of her sons on her cv. At this point you may wonder whether she has ever encountered any other difficulties associated with being a female in a world mostly dominated by men. Luckily, her answer was no. She has never been aware of any kind of discrimination. Despite being the only female PhD student during her time she never had the feeling that she was treated differently than her male colleagues. She felt quite comfortable in this 'man's world'. As a reason for this she proposed that she was already used to this situation from early on in her life. In classes like mathematics in high school she would mostly be surrounded by men and the same was the case for her study. However, she can imagine it would be hard to adapt to this situation when coming from a background with a more balanced male/female distribution.

Coming back to the present, Célia is now a professor, director of the Master of Chemistry and teacher. In an era of increasing workload, it must be difficult sometimes to get everything done. When asking her about it, she admitted that some periods are really busy and challenging to manage. Nonetheless, the key is to set out days explicitly for reading and writing and other days for appointments. Management tasks are performed besides these scheduled tasks. She acknowledged that even with a planning it is still hard work, but

mostly due to big bureaucracy. Back in the day the professor was only responsible for making an exam and grading the students. Nowadays, professors have to take responsibility for all small steps leading up to the final grade: they have to upload exams, make a test blueprint, an answer key, a study guide and more. Additionally, the increased yearly information sessions to encourage adolescents in studying chemistry has added to the workload, as these are also Célia's responsibility. Some of the changes are improvements like the study guides, but the 5-yearly visitation by the NVAO to check the quality of our study might actually not be that beneficial. This visitation demands much effort and time of everyone and with the 5-year time span you can start the preparations for the next visitation the day after the last one. Célia believes it would be better to have these less frequently, more like every 10 years. When asked if some of these changes have improved the level of education, Célia said that in the end good education can only come from good teachers which arise from good scientists. Luckily, we have good scientists here in Amsterdam who, with their knowledge, are able to be good teachers.

Another thing which changed a few years ago is the start of the joint degree between UvA and VU. When asked about her perspective on this collaboration, she mentioned that, in her opinion, the two different universities have grown towards each other concerning their education programme. Most differences have already disappeared or will disappear in the near future. She is an advocate of the different VU and UvA days and she hopes that they are working well. Important for Célia is that most students feel at home at both universities. Concerning their research departments, the UvA and VU are still two separate universities due to a failed merger. Nevertheless, she doesn't experience much difference between the universities, because they are still Dutch universities with nearly the same culture.

Having heard about her great academic career we were also wondering about the activities she would undertake in her spare time. During her free time Célia likes to go on a walk, grab a movie or something to eat and most importantly, go on a holiday. She has always worked hard, but has also learned that to be successful you need to be flexible and see where things go. Her role model in chemistry was and is Nel Velthorst, her professor in analytical chemistry at the VU and the only female professor there at the time. Her professor showed her that it was possible to have an academic career as a woman. Outside of the academic world Célia looks up to Angela Merkel, because who cannot be a fan of 'a quantum chemist who is a world leader?' Célia admitted that finding your career path can be hard and is not a straight line, but that the most important thing is to always follow your heart and be a little stubborn: it will get you where you want to be. If you don't know where you want to go in life, the advice from Célia was to **follow your heart, because that's where your best qualities are.**

Chemistry vs. (Psycho)Bio(Medical Sciences)

Maarten van Dorp

Once again, two students of anther discipline will be asked about their views on chemistry students, and vice-versa. This edition we will stay closer to home and we will talk to a psychobiology and a biomedical sciences student.

The (psycho)bio(medical sciences) student on chemistry

First of all, what is your name and why do you study (psycho)bio(medical sciences)?
B: My name is Bowine, and I chose psychobiology in the 6th year of high school when I didn't know what I wanted to study. However, when I visited one of the psybio promotion evenings, I simply told my friend: "This is it." She told me not to rush my choice, so naturally, I rushed my choice.
M: Hi, I'm Maaike, I study biomedical sciences, not because I like the study overall, but because I want to conduct research into cancer, or to be more specific, immunotherapeutic treatments of cancer.

What do you think chemistry entails?
B: A course I had to follow in high school I sucked at. To me, it's throwing together 'stuff' and hoping it doesn't explode.
M: The first thing I think of is exploding things in the lab. Aside from that, it's the study of the bond between molecules. Oh, and of course all cellular structures we discuss with biomedical sciences have a chemical component.

Who is 'the' chemistry student?
B: Well, of course, my view is a bit skewed, but they are tall, wear glasses, come to the CONGO drinks a lot, and they think they are amazing. Nonetheless, they are very 'gezellig'. Overall, they aren't the purebred nerds people expect them to be, as the cutest boys on my school were chemists.
M: Someone with super poofy hair that they just exploded.

How do chemistry students overestimate themselves?
B: People skills. Just like the rest of the STEM studies they, tend to overestimate how good they would be at studying the humanities.
M: How well they can handle their drinks.

What are (psycho)bio(medical science) students better at than chemistry students?
B: We tend to have a more interdisciplinary frame of mind and can switch to the real world outside of academia with that. It's because we have more respect for the humanities.
M: Handling their drinks. On a more serious note, they are very driven people. I think this is because biomedical sciences present the students with the clear societal role of helping people, and that really motivates you.

What chemistry students better at?
B: Having a good time on New Year's Eve.
M: I could imagine that they are better at studying and not focussing on the 'being a student' part.

What do chemists do all day?
B: Fangirling about molecules and shitting around on the lab.
M: Fucking in the lab.

The chemistry student on (psycho)bio(medical sciences)

What is your name and why do you study chemistry?
S: I'm Stijn, and I have always wanted to do work in chemistry.
A: My name's Akshay. I study chemistry simply because I enjoy looking into things at a micro-scale.

What do you think (psycho)bio(medical sciences) entail?
S: I assume it's looking into brain activity for psybi and that biomed looks at the application of the drugs that are developed by biologists and chemists.
A: The way cells and the human body works, and the interactions between those cells. Eventually, they use this knowledge to create tech to influence those interactions.

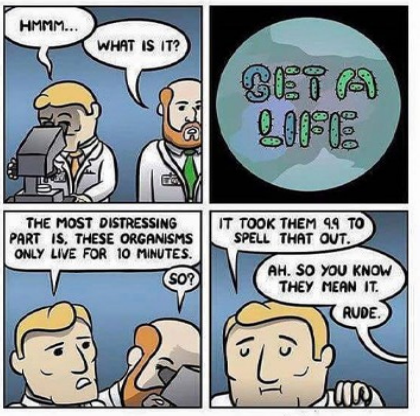
Who is 'the' (psycho)bio(medical science) student?
S: I don't know that many of them, but to me, they seem to all be 'not-quite chemists'.
A: Well, I know one dude on science park who studies psybi and he is incredibly smart and has a photographic memory, so to me that is what psybi students are like.

How do (psycho)bio(medical science) students overestimate themselves?
S: Biomedical students think that they'd sail through chemistry courses, but it usually turns out they know nothing about the subject. Psybi students don't overestimate themselves as much, but they do think that they are good at programming, which they suck at. Someone told me she programmed in MATLAB...
A: That is a tough one...
Siza enters the room: They think they are great at labwork, whereas the work they do doesn't even qualify for that.

What are they better at than chemistry students?
S: I guess they are better at unravelling the highly complex biological systems of the human body. To be honest I also think they have better career prospects because their discipline seems to be a bit more diffuse than chemistry.
Akshay and Nadav agree: There are more women. Akshay also thinks that they are better at memorizing complex biochemical pathways.

What are chemistry students better at?
S: The way we analytically approach problems. Chemistry too.
A: Translating the micro and chemical world to the macro scale.

What do (psycho)bio(medical science) students do all day?
S: They collect plants.
A: Pipetting and growing yeast.



Smaakmatrix

Inspired by the Parool

Scientific

The lovely dutch weather

The website has a fresh new look (which probably stresses out a lot of people)

Horrible

The point this page is trying to make

Brilliant

Bente is back again!

All other people in the board

People saying 20 - 20 or 2k20 instead of 2020

The ACD room has a new layout

Beer-related