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More CO₂ leads to less nutritious food?!

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On the Origin of the ACD-song
Interview with dr. Ivana Drienovská
Summer Puzzle

Try your hand at our chemistry crossword puzzle!
Summer vibe of ACD'ers

Volume 53
Edition 4



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From the Editor

Dear reader,

A warm welcome to all the new students!

To start this edition of the BLAD off, we have a tribute to the best season of the year. Here, Siebe and Stijn have put together a poll on "summer vibes" to give us some insight into what ACD members think in regards to summer. Then, Michelle and Tim give an interview with the esteemed Ivana Drienovská, an expert in artificial enzyme design and professor at the VU. Siebe takes a deep dive into the relationship between plants and the concentration of CO₂ and Stijn departs from the world of chemistry, enters the world of sociology, and comes back to tell us about it. Also, in this edition we have a crossword puzzle to test your knowledge on well-known and not so-well known names in chemistry.

We hope you enjoy reading this edition half as much as we enjoyed making it for you, because we had a ball.

On behalf of our entire editing team,

Anna May Inzenhofer

Content

| | |
|----|--|
| 4 | From the Chair |
| 5 | Het Wel en Wee van de OC 4 |
| 6 | More CO ₂ leads to less nutritious food?! |
| 10 | Summer vibe of ACD'ers |
| 14 | Recipe: Salmon Pasta Salad |
| 16 | Crossword puzzle |
| 18 | Interview with dr. Ivana Drienovská |
| 22 | On the origin of the ACD-song |
| 24 | Chemistry Undercover |

From the Chair

Dear members,

Here we are, at the end of the year with the holiday season upon us, some time off from studying, time for hobbies, going on trips, or hanging out with friends. I've been enjoying the beautiful weather here in the Netherlands, hanging out in the different parks, going for a swim and enjoying long warm evenings with a barbecue. I hope everyone has finished their academic year splendidly and is also enjoying the summer and the surplus of free time.

Of course, I want to thank all our members for the unforgettable year I have had. With help of all our committee members we have been able to organise all sorts of activities ranging from lectures to parties, to excursions, even one across the border and finally of course the ACiD :).

But what happened within the ACD the last couple of months. The first big thing I want to talk about is the election ALV, where our new board was elected. This means my work is nearly done and it's time for a new generation to stand up to organise activities and (hopefully) enjoy the year to come.

Besides choosing the next board, there were also numerous activities which have to be mentioned. Starting with the annual sporting event, this year in Utrecht, the ONCS (in ascension weekend). Starting of with a Wednesday evening party, everyone really got into the mood for the upcoming two days of sporting, and the next morning tired (and maybe a little hungover), the sporting commenced, ranging from football, to handball, to frisbee, blind badminton and even more relaxed games such as board games and kubbs. Then in the evening there was another party which



meant starting sports on Friday even more tired. In the afternoon the sports were over and it was time for the award ceremony and the trip home.

The final event I want to talk about is FLUX. With the first normal ending of an academic year in 3 years time, it was finally possible again to organise the FLUX festival, and what an afternoon of fun have I had. Enjoying Sangria in the sun, enjoying free popcorn and cotton candy and running wild on the assault course. And after tiring myself out on the assault course, which took shorter than I expected, I was able to enjoy the barbecue to refill my energy for the rest of the evening. Of course when the party was over, the afterparty just got started in the Oerknal, where the party went on until the sun start rising again, or so I have heard.

I hope everyone has enjoyed the last year and is relaxing this summer and recharging for the upcoming academic year!

From your chairman,
Martijn ten Brink

Het Wel en Wee van de OC Part 4

Sverre Overdijk

Dear reader,

This is quite the interesting Wel en Wee to write, as it is both the last edition of the past academic year, as well as the first one that gets read by the new first year students.

Since this is the first Wel en Wee many people will read, I will start off with a quick introduction on what the OC is, its functions, and its members. First, what does 'OC' even mean? The OC is the abbreviation of programme committee, or 'opleidingscommissie' in Dutch. The function of the OC is to make sure the quality of the education programme is up to par. The OC does this by providing the programme with solicited and unsolicited advice and by having a veto on the OER (Teaching and Examination Regulations or 'onderwijs en examenregeling'). To evaluate the OER, we use the information supplied by you as a student to the committee in the form of penal evaluations and the course evaluations. It is therefore of the utmost importance for you, your fellow students, and the students yet to come, that you fill in these evaluations. You will get these evaluations via an email from UvA-Q after the course is finished. Furthermore, the OC is a listening ear apart from the course evaluations, for all suggestions and more pressing matters. So, if any issues arise during your study, and you cannot resolve it with your lecturer, please contact us.

To ensure everyone feels heard in these matters, the OC consists half of student members and half of lecturers. This year's bachelor members are Casper van Eijden and a spot that is vacant at the moment of writing. For the masters, it is Anniek Versteegen, and me, Sverre Overdijk. The teaching members for the VU are Klaas Giesbertz and Tom

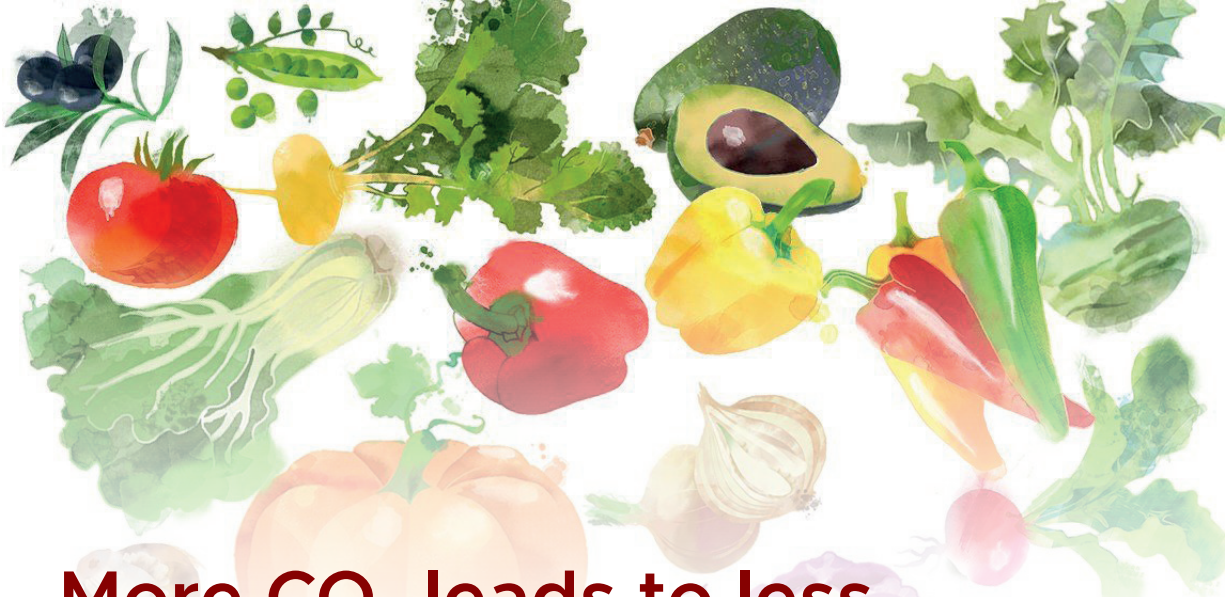
Grossman, who is also the chair of the committee, and for the UvA Hong Zhang, and Tati Fernández Ibáñez. If you contact us via email you will get in contact first with our secretary, Melanie Messih. You can also find the members of the committee on the dedicated DataNose page of the OC, which is also available via the UvA website. Also, if you want to share something in a less formal way, please feel free to approach any of the members in person.

So, after this introduction, what have we been up to since last Wel en Wee? Last time I mentioned the UvA-Q system being broken. This is luckily fixed by now, and the course evaluations we missed because of this are being sent to us. This means we can now clear the backlog that resulted from the system breaking down. Luckily, everything does still come in, which means we can now act on the feedback that you supplied us with.

For now, this rounds up this year's activities of the Programme Committee. For the upcoming ACiD's, I will give further updates on matters discussed here, as well as everything else that the OC has been up to in the meantime.

OC mail: ocs-science@uva.nl

OC page: student.uva.nl/sck/content/az/opleidingscommissie/opleidingscommissie



More CO₂ leads to less nutritious food?!

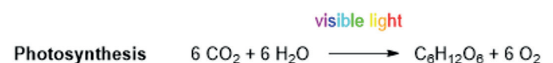
Siebe Lekanne Deprez

Occasionally, you come across a scientific article or a (reliable) news outlet that can completely change your mind about a certain topic. Such realisations can impact people to a large degree, and they might even change their behaviour as a result. Recent examples for me were 1) academic studies have found that the COVID-19 virus is much less likely to spread via surfaces than through the air, but the guidelines still emphasise cleaning and washing your hands,¹ and 2) the sleep problem people can get by looking at screens during the evening/night is not because they expose themselves more to blue light, but because they keep their brain occupied by all kinds of activities like streaming, chatting, scrolling reddit etc which happens to involve a screen.²

Last month, I made a 180 degree turn regarding the following statement: more CO₂ in the atmosphere would lead to more active photosynthesis processes and thus more food production. However, it turns out that the opposite is true wherein more CO₂ results in less food production in the long-term. Moreover, higher CO₂ concentrations will also result in food becoming

less nutritious as the increase in a plant's sugar production overthrows the uptake of nutrients. In this piece, I will elaborate on these claims by giving you more insight in how plants deal with higher CO₂ concentrations and which secondary effects come into play.

First, let us introduce the old concept which I believed for a long time. The CO₂ concentration has increased significantly compared to the pre-industrial era. Now, consider the general reaction scheme for photosynthesis that is essential for plant growth (below). It can be seen that CO₂ is one of the reactants, and by increasing the CO₂ fraction, the reaction is expected to shift to the right according to Le Chatelier's Principle. As a result, the plant grows faster as more photosynthesis takes place. Therefore, higher CO₂ concentrations in the atmosphere would enhance plant growth and the capability to increase food production.



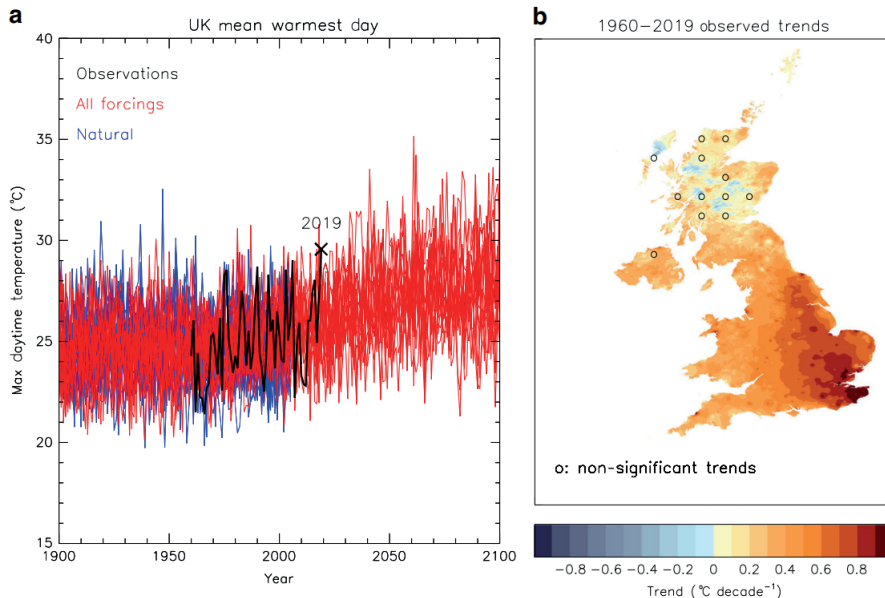


Figure 1. a) Maximum daytime temperatures (in °C) in the UK, b) temperature trends in the UK. “Observations” (in black) are the measurements made while “All forcings” and “Natural” are climate models that include only non-human activity (belonging to natural) or all forcings (natural + human activities).⁴

Higher temperatures in combination with drier conditions will decrease food production

The tricky part is that though this statement is true, there are also more important factors that come into play. To discover what these factors are, a geographic point of view must be taken; while more CO₂ may result in more food production, it also increases the global temperatures which makes farming increasingly more difficult or even impossible. Two connected factors are of importance: 1) higher temperatures causes farmers to relocate to regions closer to the poles that are less suitable for farming, and 2) higher temperatures lead to more droughts in the current farming regions.

To elaborate on the first aspect, regions closer to the poles are yet too cold to be favourable lands to farm and currently, much of the farming is performed in Middle-Europe, North America, India, and China. But, as the temperature increases, it makes sense to move the farms closer to

the poles. So, relocate farms closer to the poles, maintain the food production and the problem is solved, right? This is correct for the short-term of a few decades when the current regions are still viable, but for the long-term, a thorough study has found that food production will decrease significantly as the places near the poles are much less fertile, have worse infrastructure and are less accessible.⁵ Luckily, the study shows that prospects for wheat production are on the optimistic side, but the prospects for maize, rice and soybeans are very pessimistic. Overall, higher CO₂ concentrations result in higher temperatures that are unfavourable for food production.

In addition, higher temperatures not only cause farming regions to shift towards the poles, but it also makes farming in the current regions increasingly more difficult. Namely, the elevated temperatures lead to more extreme weather, *i.e.* larger temperature fluctuations and higher changes for extreme weather. A study by Chris-

tidis *et al.* predicts the temperature trends in the UK for the upcoming century based on measurements and the results are shown in Figure 1.⁴ It depicts that the days will become hotter and more frequent. While the study only focuses on the UK, the effects for Europe and especially for countries around the Mediterranean Sea are expected to show similar trends. All over Europe, the summers have become drier and warmer with more forest fires and droughts consequently. These changing conditions do certainly not favour crop production and plant growth. Moreover, the enzymes associated with photosynthesis (e.g. chlorophyll) denature at temperatures higher than 42°C.⁵ Thus, returning to the photosynthesis scheme, you can add as much CO₂ gas as you want to obtain a higher yield, but if there is a deficit of water and the enzymes that absorb visible light break down, then it might be hard to achieve your goal...

Higher CO₂ concentrations reduce the nutrient contents in plants such as Fe, Zn and proteins

Besides the temperature dependence of CO₂ and the drop in food productivity in the years

to come, there is an even nastier consequence of elevated CO₂ concentrations, which is that the sugar contents in plants increase at the cost of important nutrients. A study by Davis *et al.* from 2004 found that the nutrient content of 43 different crops was lower in 1999 compared to 1950. The authors looked at the nutrients Fe, Zn, Ca, vitamins B, and C and found a reduction of 15 to 20%. At the time, the observation was explained through “changes in cultivated varieties between 1950 and 1999” and the connection was not yet made between higher CO₂ levels. However, later articles show a strong relation and were able to verify it experimentally by growing a selection of crops at ambient and elevated CO₂ levels.⁷ A part of the results is shown in Figure 2. Here, the percentage nutrient change (Zn, Fe, protein and phytate) is depicted on the y axis for different crops.

The results clearly show that there is a negative percentage change for most of the nutrients for almost all crops.⁸ Note that the nutrients play important roles in biological processes and a lack of them can be dangerous. Thus, growing crops at

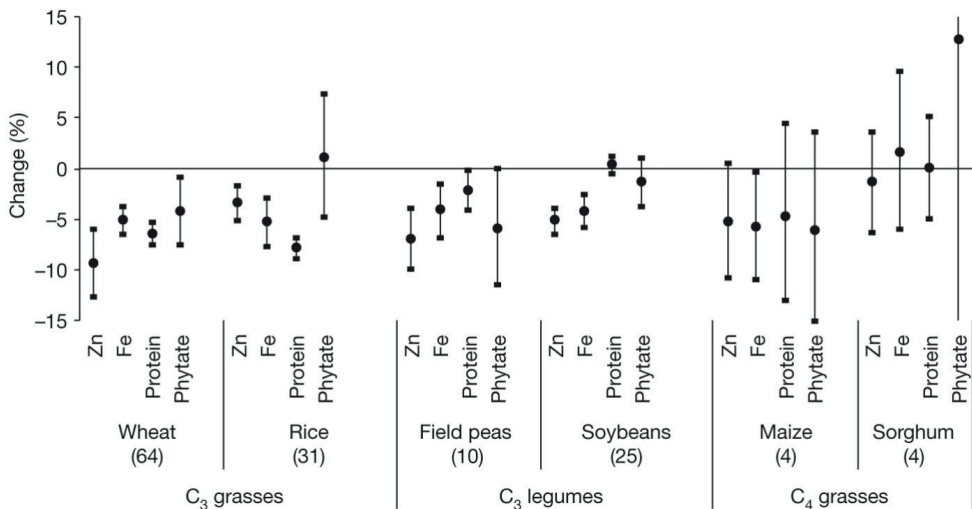


Figure 2. Percentage change in nutrients (Zn, Fe, protein and phytate) for different crops at elevated CO₂ concentrations (546–586 ppm) relative to ambient concentrations (≈417 ppm). The numbers in parenthesis represent the size of the dataset for each crop and the C₃/C₄ specification depicts which photosynthesis pathway the plants take.^{7b}

higher CO₂ levels decreases the nutrient content and makes the crops more “junkfood-like”. The resulting impact is best described by one of the researchers Irakli Loladze^{7b}: “Every leaf and every grass blade on earth makes more and more sugars as CO₂ levels keep rising. We are witnessing the greatest injection of carbohydrates into the biosphere in human history - [an] injection that dilutes other nutrients in our food supply. It is thus expected that nutrition problems will arise for humans in the upcoming decades if the CO₂ level keeps rising. Since this article is already depressing enough, the reader may want to look-up the consequences themselves as an exercise.

To conclude, we started with the claim that elevated CO₂ concentrations lead to more food production as higher levels aid photosynthesis and enhance plant growth. This is indeed the case but is negated by secondary effects such as elevated temperatures and drier conditions that will cause an overall decrease in food production. Moreover, the increasing CO₂ concentrations also lead to higher sugar contents in crops at the costs of essential minerals and proteins. What may we think about these distressing conclusions? Well,

for one, I hope nobody hijacks these claims to argue that we should eat less plants and more meat (which is nonsense of course). Personally, the unfavourable prospects actually motivate me more to reduce my own CO₂ emissions, support organisations that care about the environment, and vote for political parties that address the importance of reducing CO₂ emissions. But, enough about me, what will your response be?

Disclaimer: this article was heavily inspired by Simon Clark's YouTube video entitled “No, more CO₂ won't help us grow more food” (https://www.youtube.com/watch?v=qFA7Sui8w_g&ab_channel=SimonClark)

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8. There is a debate going about the role of phytate. On one hand, it is considered an “antinutrient” since it binds to minerals (Na, Ca, Fe etc.), inhibiting the uptake. On the other hand, phytate may reduce the risk for cardiovascular diseases.

Summer vibe of ACD'ers

Siebe Lekanne Deprez & Stijn Engelaar

Last year, we investigated the phenomenon “the ACD'er” by means of a poll (N = 19), which led to more insights about this creature and how to recognize it if you came across it at Science Park or at the VU.¹ However, the poll focused on ACD'ers behaviour during the winter period; we still did not have any clue about the summer period. Now with the current (amazing & low effort) poll it is examined how the ACD'ers vibe in the summer.

Vacation plans and means of travel

First, the poll reveals that the ACD'ers do have a variety of preferences regarding their ideal travel location in the summer if money is not important, ranging from America (Florida, Hawaii, St. Lucia, road trip through the United States) to the Scandinavian islands to Asia (Japan, roadtrip through Asia) and Oceania (Australia and Fiji) (Figure 1). Although these are clear preferences, sometimes the ACD'er just likes to travel to a tropical island with a nice beach, albeit with an all-inclusive experience so don't talk about being picky. On the other hand, some prefer to visit as many locations as possible and would like to travel all around the world. Finally, one ACD'er remains indecisive and continues dreaming about a dream location to visit.

We also looked into the ways we travelled compared to the National average! A poll by the CBS from 2019 showed that 49 percent went on vacation by airplane, 44 percent by car and the remaining 7 percent by train/bus/boat. However, the poll among the ACD'ers looks quite different! The biggest difference is the number of ACD'ers that travelled by airplane, being just 12 percent. The only way of transportation that looked

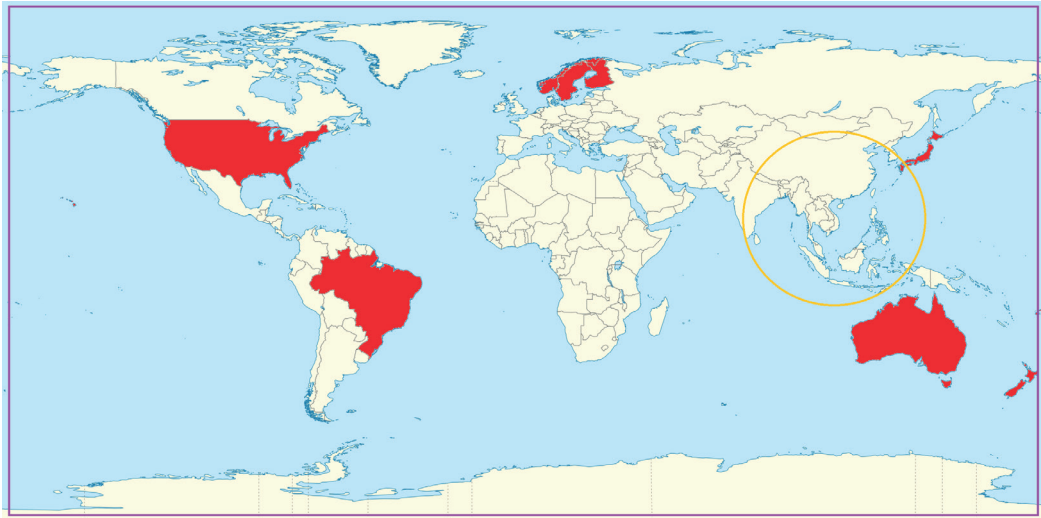
similar was the car with 52 percent in our poll. Lastly, 24 percent went by train, of course this is something that got more popular in recent years and the CBS poll is from 2019!

To summarise our holidays in songs: Some ACD'ers are interrailing and listening to Kendeng Kendeng either from the rails or from our own Guus Meeuwis while living the Best Life or Die Guten Zeit (Hardy Caprio, Wincent Weis) while others Fly Away (Tones and I) with the airplane. The people with a less fortunate time will have to Work 9 to 5 (Rihanna, Dolly Parton), to earn the money to be the Dancing Queen (ABBA) during the long nights (Langste nacht/ Gold Band) drinking Tequila (The Champs) while singing 'uit m'n bol' (André Hazes). Finally, a couple of ACD'ers might have quite venturous plans and try to get the most out of this summer, but It is a long way to the top (AC/DC) and you might get rickrolled in the meantime by Never gonna give you up (Rick Rastly). Let's hope it is not Running in the Family (Level 42).

Summer preferences and favourites

What is a good summer without enjoying a nice drink or dish? The ACD'ers certainly know what they want which results in a neat collection. Regarding the drinks, it basically comes down to cocktails and beer with a wide variety within them including Corona, Desperados, Ratler and Ijwit Zatte for the beers, and Sangria, Aperol spritz, Pina colada, Blue Lagoon, Aqua di Valencia for the cocktails. On the other hand, non-alcoholic drinks (fortunately) also come into the picture being Fanta Lemon and water. The choices for the favourite summer dishes reveal that the ACD'ers

¹ BLAD 2 of the year 2020-2021 (Volume 52, edition 2)



▼
Figure 1. Locations of the ACD'ers' dream locations. In **red**, concrete locations are highlighted while in **orange** and **purple**, a trip through Asia and the world are shown, respectively.

have a preference for Mediterranean and Italian dishes. It seems like we crave for pasta-, noodle- and 'regular' salads in the summer with a few exceptions such as Sushi, cheese, nachos and ice (cream). One ACD'er goes full in and chooses the most experimental dish on the menu, who knows what that might bring.

What do the ACD'ers actually prefer to do in the vacation? This question showed why organising the BEC is a hell of a job as we are very divided on this topic. If we are asked a Would You Rather question with three options: either a City trip, hiking or relaxing, the distribution is almost equal at 32 percent, 32 percent and 37 percent, respectively. A movie night is also not easy to organise as we have very different tastes for summer movies. Some people would rather watch musicals such as LalaLand, Grease or Mama Mia, while others rather watch a cartoon such as Moana or the Minions on the warm summer nights. Timeless classics such as Harry Potter, The Gladiator, or Forrest Gump are of course also appreciated! Movies that are also very summer related are

Zomerhitte and Death on the Nile.

To stay busy we visited lots of festivals/concerts, a lot of them rock(ish)bands such as: The Rolling Stones, Red Hot Chili Peppers, Nothing but Thieves and Hatari. Dutch artists are also not unnoticed by us as the ACD'ers were also present at Goldband, Joost Klein and Davina Michelle. We should not forget about Briston Maroney, Cory Henry, and Harry Styles also got our attention. Even though we mostly go to music shows, we also have theatre lovers who went to Margreet heeft de Groep Verlaten.

Summer experiences

Besides the summer plans and preferences regarding dishes and drinks, the BLAD committee was also interested in how the ACD'ers actually experience their summer. In recent years, the summers in the Netherlands have become increasingly hotter, and the ACD'ers cope with this differently. As in the typical Dutch style, some of them just like to complain about the heat, while others simply don't care or go to the beach



to cool down. One ACD'er takes extreme measures and plans to sit in the fridge all day. Finally, there is one poor soul among us that has to spend the holidays in the E-building. At least the building contains air conditioning. Furthermore, the ACD'ers have different favourite summer activities, which results in an interesting spectrum. On one hand, one prefers to enjoy the summer by relaxing, drinking cocktails, reading books, and/or enjoying the presence of friends, while others prefer sports activities such as swimming, hiking, and climbing. A couple of ACD'ers try to do both actually by going to the beach and going for some swimming. An excellent idea!

Future perspectives and resolutions

Even in the middle of the vacation, we reminded you that this will not last forever and that there will be a time that the classes start again, sorry for this. We found three different groups of people in the poll. Some people instantly thought about EC. On the one hand obtaining as much EC as possible and avoiding resits. On the other hand, some did not want to worry too much because their BSA was already obtained. The second group is looking to find a better balance between obligations that are not study related, work/relax, and chemistry. Lastly, we have the relaxed group who could not bother to think about EC or other obligations but want to become more active in the ACD, attending more Borrels and activities.

Sports

The two remaining questions were about your favourite stickers/memes and if you prefer watching the national Dutch women's soccer team, the male soccer team, or neither of both. Tackling the second question first, women's soccer has developed immensely in the last decade, and this year, another European Championship was organized in the UK. Now, we were wondering if more people would watch the women's team with respect to last year. The poll reveals that it has become a little bit more popular (3 vs 2 last year), but the ACD'ers like the male team more, and some ACD'ers like both teams. Although, most of the ACD'ers do not like watching soccer at all.



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| ELEMENTS | MATTER | PERIODIC | STABLE |
| GRAM | METALLOID | PERIODS | UNSTABLE |
| GROUPS | MOLE | POLYATOMIC | VALANCE |

Salmon Pasta Salad

by Tim Lugtenburg

With the high temperatures we are seeing this summer I searched my recipe books for one that is suitable on a hot summer afternoon. This salmon pasta salad contains warm salmon the first time you prepare it, but the next day, it tastes just as good directly from the fridge. Since I will soon be graduating, this will be my final recipe for ACiD magazine; it has been a pleasure writing them for you and I hope you enjoy it!



Ingredients:

- 240 g salmon fillets
- 150 g wholewheat pasta
- 100 g chopped bell pepper (or asparagus)
- 1 tbsp olive oil
- 2 tbsp balsamic vinegar
- 1 tbsp Dijon mustard
- 50 g chopped spinach
- 40 g chopped romaine lettuce
- 2 diced tomatoes
- 50 g chopped sun dried tomatoes
- 2 tbsp chopped fresh basil
- 1 lemon (juice and zest)

Preparation:

1. Cook the salmon in the oven at 180 °C for 12 min.
2. Boil the pasta according to instructions and chop the vegetables.
3. Cook the bell pepper at high heat for tasty browning.
4. In a large salad bowl (to allow for proper salad tossing) add all the ingredients together with the seasonings.
5. Enjoy! Stays good in the fridge for about two days.

Chemical detail:

While preparing the salmon in the oven, the biochemical detail oozed out of the fish. It turned out that the white semi-liquid stuff covering the surface of the salmon was a protein called albumin which gets denatured and solidifies at the temperatures we are baking it at. Albumin is completely harmless, but in case you do not like the look of it on your piece of salmon, you can always try cooking it at lower temperatures.

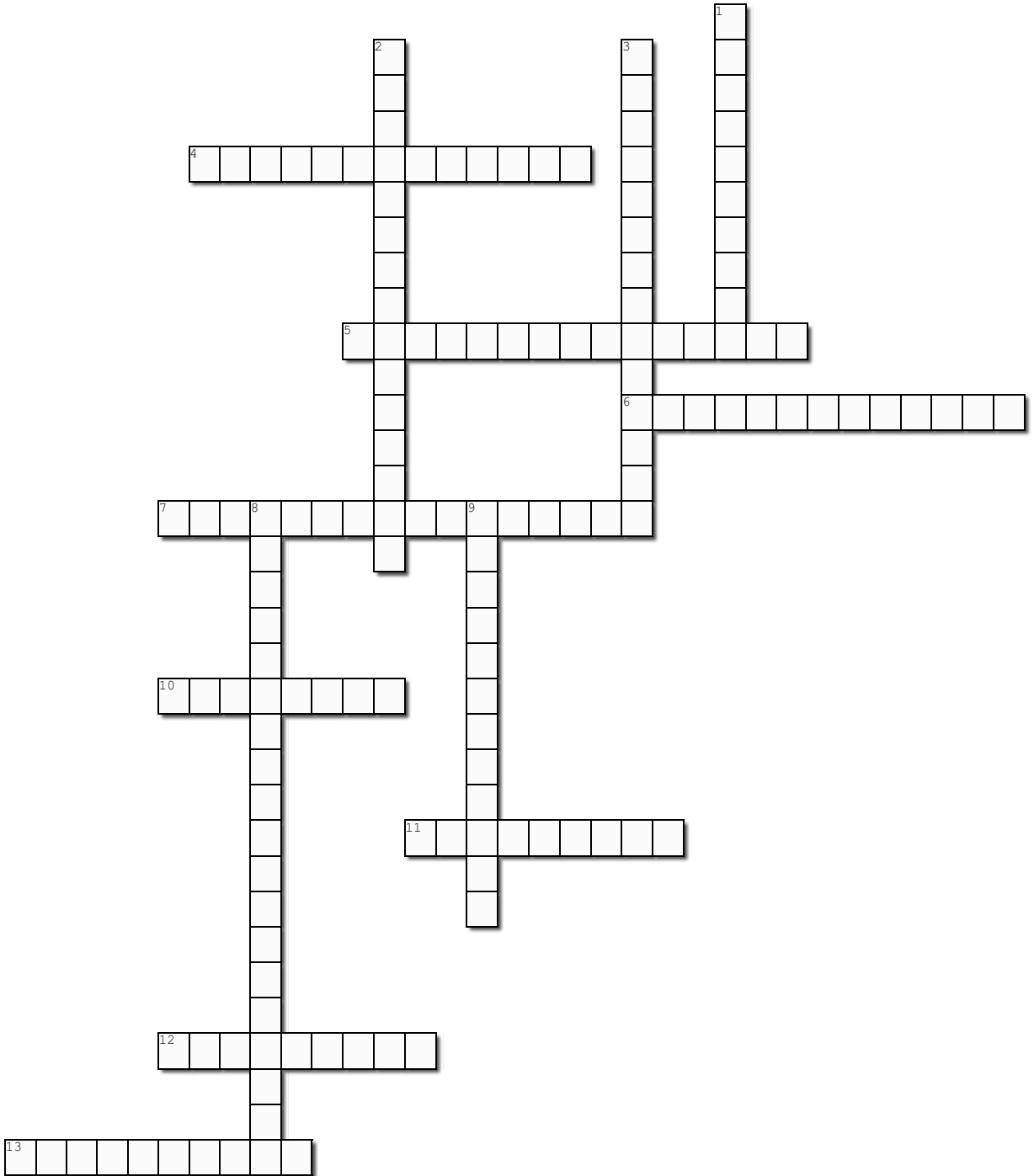
In this case we simply put the salmon in the oven and after the set time it turns out perfectly tender.

In other cases, however, you may prefer to get a nice brown crust on your salmon. For that I recommend using a piece with the skin still on it and to cook it on that side for the most part and only flip it for the last bit. The skin prevents the meat from becoming too hot to quickly and allows for the heat to pass all the way through to the core. Another tip that helps with this is to always let it reach room temperature before cooking (this holds for meat in general).

1. <https://hungryhealthyhappy.com/salmon-pasta-salad/>
2. <https://www.bonappetit.com/story/white-stuff-on-salmon>



Complete the crossword puzzle below



Across

4. Considered the first alchemist of the Western World, lived between the 1st and 3rd centuries in Alexandria.

5. A 1965 Nobel prize winner known for their poetic, expressive writing style. I quote, "Our investigation now entered a phase which was tinged with melancholy."

6. Graduated from Iowa State University. Developed over 400 products using biomass starting materials, the majority from peanuts and sweet potato.

7. Famous for their X-ray diffraction studies of DNA and surmising its helical structure. Unfortunately not cited for their contributions by Watson and Crick.

10. In 1874, developed the idea that optical rotation was based on 3D arrangements in space. Professor at the UvA for 2 years.

11. Siberian chemist. Predicted the outlay of the periodic table in 1869, leaving gaps for the elements that had not yet been discovered.

12. Won the 2001 Nobel prize for chirally catalysed oxidations (hint: titanium). Famously said "there's simply never an adequate excuse for not wearing safety glasses in the laboratory at all times."

13. Discovery of polonium and radium. Went on international tours to raise money to purchase radium for cancer therapy.

Down

1. Work has led to the first monodirectional light-driven molecular rotary motor being created in the 1990s. Awarded the Nobel Prize in 2016. A Dutch national hero.

2. First woman admitted to MIT in 1870. Began a private practice in sanitary chemistry, which included testing household items for arsenic.

3. Awarded the 1964 Nobel Prize for their elucidation of natural products using X-ray analysis

8. Hungarian biochemist who won the 1937 Nobel Prize for his discovery of vitamin C and discovering components of the citric acid cycle.

9. First inorganic chemist to win a Nobel Prize in 1913. Proposed the concept of a 'coordination number' and the existence of octahedral complexes.

1. benferinga
2. ellenh.richards
3. dorothyhodgkin
4. marythelweess
5. richardwoodward
6. georgewarner
7. rosahindanklin
8. albertszent-györgyi
9. alfredwerner
10. vanthoff
11. mendeleev
12. sharpless
13. mariecurie



Welcoming Assistant Professor dr. Ivana Drienovská at the Grossmann lab

Michelle van Dongen & Tim Lugtenburg

Dr. Ivana Drienovská came to the VU in 2020 and has been working as assistant professor at the Grossmann lab for over two years now, conducting research in the area of biocatalysis. Originally from Slovakia, she moved to the Czech Republic for her Bachelor's and Master's degree in Biochemistry after which she started her PhD at the University of Groningen in the Roelfes group. After a 6-month postdoc and a research associate position at the more industrially oriented Technische Universität Graz in Austria, she moved back to the Netherlands to start at the VU. Despite being part of our chemistry community for quite some time now, the bladcommittee realized she had yet to receive a proper introduction and decided to invite her for an introductory interview. Fortunately, she said yes, and we had the opportunity to partake in a very 'gezellig' interview in which she told us all about her time as a student, her career and her research; all so

full of passion that we can't wait to see what kind of research she will bring to our university.

Career path

We kicked off the interview by asking where her passion for biochemistry started and why she had wanted to study it. She answered that already from the age of 10 she had liked and been involved in both biology as well as chemistry by partaking in biology and chemistry competitions (Olympiads). During high school, she even entered the international Olympiads. These competitions included tests on different areas of Chemistry, encompassing both a theoretical and experimental part. For example, in elementary school one had to be able to conduct analytical tests and due to the international competitions, Ivana could already in high school solve NMR spectra. From an early age she had therefore developed a passion for as well as a close relation

to biology and chemistry, so when the time came for her to choose a study programme, it was only natural to choose for these subjects. She said she liked chemistry a bit more than biology which drew her to biochemistry. In this way, she could combine both subjects while remaining a bit more on the chemistry side.

Asking about her time as a student, she told us that she decided to work in the lab from the first year of her Bachelor's degree, since she had already taken some 1st and 2nd year lectures as preparation for the competitions. Working in the lab besides her lectures would hence be more interesting to her and she thought she would learn more in this way, since the lectures weren't that fascinating in her opinion due to the old-style non-interactive way they were taught. During her studies, she lived in a student dorm which she really enjoyed. We asked whether she joined any clubs/student associations while in university upon which she told us that clubs were not really a thing in the Czech Republic. This is actually one of the aspects she loves about our country; clubs form a driving force to meet new people and are in her view great for networking. While at university, she mostly met people from her lectures, the lab and her student dorm. She also believed that she might have followed more of her other passions if there was a club/association that she could have joined.

The next aspect we were curious about were the differences she had noticed between studying in the Czech Republic and the Netherlands. Besides the lack of associations in the Czech Republic, Ivana told us that the main difference can possibly be found in the whole university's structure. Whereas in the Netherlands you focus on a subject for 5-6 weeks, you follow a range of subjects for 3-4 months in the Czech Republic followed by an exam. From her experience at the University of Groningen, she got the feeling

that a course is more oriented on smaller/shorter aspects due to the shorter term. Additionally, Dutch students are more independent in their study with more additional poster/PowerPoint presentations. In the Czech Republic, she only had lectures followed by an exam, but she expects that the usage of posters and presentations might also move to the Czech Republic. She moreover noticed that oral exams are not common in the Netherlands, whereas they were in the Czech Republic. Dutch students seem to be a bit afraid of these oral exams.

We then asked about her career path after her studies and if she has ever been in two minds about staying in academia or moving to industry. She mentioned that she never really thought about a career in industry and that her mind has mostly been set on academia. However, she did want to learn more about the application aspect of biocatalysis. During her PhD and 1 year postdoc in Groningen she conducted fundamental, not really applied research in which the enzymes exhibited relatively low activities. As a next step, during her second postdoc, she wanted to witness where this fundamental research leads to. In other words, she wanted to partake in research that mattered more in a direct manner, was directly applicable. To this end, she took on a postdoc in Graz, Austria which is a university largely focussed on applications and industrial collaborations. During her time there, she was a project manager of a big project in collaboration with Chinese and German companies which was focussed on enzymes that can reuse wood material left-over from wood processing. She really loved this academia-industry combination but prefers to stay more in academia due to her curiosity and drive for puzzle/problem solving. In industry, you always have to take the work costs into account and cannot follow up on everything you would like to find out in more detail and/or solve the problems for. However, she does see the

value in the direct applicability of industry and tries to set up academia-industry collaborations herself as well during her time as assistant professor. The seed for her eventual path to become a professor was already planted during her graduate studies where she enjoyed mentoring other students as well as conveying her passion for the subject through teaching. This combined with the freedom found in academia led her to consider the position here at the VU. Which she liked especially due to the welcoming environment she had experienced in the Netherlands where the Dutch often automatically switch to speaking English to include everyone.

Transitioning from performing research herself to leading a group was difficult at times and is an ongoing process for her. Especially the fact that, as a group leader, you no longer work directly with what you are excited about means that it is all the more important to have a wonderful team with lots of enthusiasm that can update her on the results. She also loves the teaching she now gets to do as you surely have noticed during one of her many courses in both the bachelor and master.

Research highlights

Looking at her previous publications, we see two Nature papers that most of us can only dream of.^{1,2} She attributes a lot of this success to being in the right place at the right time, and it seems her early start in research also gave her an excellent head start. But what does her current research actually revolve around? Overall, she wants her group to focus on the biocatalysis of new-to-nature organic reactions. Meaning the development of artificial enzymes that perform reactions that are not yet easy to do with natural enzymes by implementation of unnatural metal cofactors or unnatural amino acids. Currently this means bringing secondary amines into biocatalysts and seeing how well they perform. An example



is the challenging fluorination reaction, five or six enzymes have been identified that can do this, even though many medicinal compounds contain fluorine. Having a protein scaffold with a secondary amine that can perform the fluorination reaction is her holy grail.

The project she feels the most sense of pride of is some of what she did during her PhD. She had to combine computational as well as experimental work in order to develop an artificial enzyme at the time. The reason she is proud of this one in particular is that she did all the aspects of the project on her own, and in the end it worked exactly as predicted computationally.³ Interestingly, this is also the first ever example of a metal-binding unnatural amino acid for enantioselective catalysis.

Of course, not everything in science is perfect yet, so we asked her what she would like to see different within the research field. This brought us to the topic of publishing negative results, something she thinks would be very valuable as it saves time working on things that have already

been attempted and people can learn from it. Whereas currently it is often attempted to frame the story towards a positive result even when that wasn't the initial intention. A possible solution to this is the archival type of publishing of negative results, so that it is still possible to index them and find it as a researcher in the field.

On a more personal note

Since there is more to a professor than just their academic achievements we asked her about some of her personal interests and hobbies. She loves swimming which she used to do semi competitively, and even was a swimming teacher at some point. She likes to remain active in general, as she has run a half marathon, tries new gym classes and went to a Rocalypse class for example. During her postdoc, she loved to travel all the time as well, but since she now has a young child this became a bit less.

One of her idols in science is Nobel laureate Frances Arnold, who is the founder of directed evolution. Ivana's work also involves directed evolution and she was offered to do her postdoc in her group. This was two weeks after she had gotten the position at the VU, however, and even though the VU did allow her to visit for a couple of months at Caltech, this was also when Covid struck. She still hopes she can experience working with her at some point.

Future of artificial enzymes

We were also curious about her view on the future of her field; what would a crystal ball show? Looking into her crystal ball for the future

of the field of artificial enzymes, she hopes that in ten years artificial enzymes will have acquired the efficiency of natural enzymes and that these can be industrially applied for important reactions. But perhaps the unnatural amino acids will see different applications that would bring new adventures and allow her to branch out towards that as well. She hopes her personal goals will remain aligned with artificial enzymes at the VU, to continue having a great lab group and have some new adventures alongside artificial enzymes. Hopefully she will have enough lab space, but that is not that bad of a problem to have.

Some final advice

Finally, we inquired whether she had some advice for all of you ACD'ers. Her final words of advice to you: Enjoy your time while studying! Cum laude is always appreciated but not essential for most employer's decision to hire you. You will never be in the same position as you are right now, so explore the different options you have. When you go on to do a PhD or other work you will become more focused at one spot, so right now you will have the most freedom to build your life, make mistakes or have negative results because you can learn the most from these.

We wish Ivana all the best at the VU!

If you are interested in doing your master project in her group (like the authors of this interview), you can always send her a message at: i.drienovska@vu.nl

Further reading:

1. Drienovská, I., & Roelfes, G. (2020). Expanding the enzyme universe with genetically encoded unnatural amino acids. *Nature Catalysis*, 3 (3), 193-202. <https://doi.org/10.1038/s41929-019-0410-8>
2. Drienovská, I., Mayer, C., Dulson, C., & Roelfes, G. (2018). A designer enzyme for hydrazone and oxime formation featuring an unnatural catalytic aniline residue. *Nature Chemistry*, 10 (9), 946-952. <https://doi.org/10.1038/s41557-018-0082-z>
3. Drienovská, I., Alonso-Cotchico, L., Vidossich, P., Lledós, A., Maréchal, J. D., & Roelfes, G. (2017). Design of an enantioselective artificial metallo-hydratase enzyme containing an unnatural metal-binding amino acid. *Chemical Science*, 8 (10), 7228-7235. <https://doi.org/10.1039/c7sc03477f>

On the origin of the ACD song

Michelle van Dongen

“We zijn de allerbeste...”

I got you there, didn't I? With the word 'ACD' already on the tip of your tongue? For most ACD'ers, this first sentence probably has become a trigger for our beloved association song, or more commonly called in Dutch '*Het ACD-lied*'. I remember from when I was a first-year student that I was amazed by how most ACD'ers would stop half-conversation to suddenly burst out in song together, but now after almost 5 years of studying (yes, I am getting old in the ACD-world), I couldn't picture myself doing otherwise. It got me wondering where our song came from and if there might be a nice origin story in there. To this end, the bladcommittee contacted past treasurer (2006–2007) and chairman (2007–2008) Jan-Hein Hooijschuur who was part of the brain behind this '*lied*' and could share some wonderful anecdotes, text, and audio fragments.

So, let's first of all start with what an association song is for the ones unfamiliar with the concept. 😊 An association song is a song written for and about an association, which can be a student-, sports-, study association etc., and this song is often sung together at the association's events. You can find '*Het ACD-lied*' on the next page (or on the wall of the UvA association room if you are reading the blad there). For the ACD at least, it is tradition that the chair sings or more like yells the words in **bold** and the rest of the members the words in *italics*. The chair should start the song, or if the chair is not there the next one in the constitutional order of the board. Especially on events together with other associations, this leads to a fun competition of “which association can out shout the others”. I do have to say that since we have a more interactive song than most that we are often the loudest of them all. 😊

The '*ACD-lied*' all started from the year 2006 and on, when the 61st and 62nd board of the ACD were in charge and the 61st ACD-board wanted to be more in contact with the other brother and sister associations. During joint events, the sister associations would sing their association songs and up to then the ACD only had its '*Roeterstoeterlied*', the song of the board of the RoeterToeter foundation (the bar of ACD). At the time, there was a healthy competition between the ACD-board and the RoeterToeter-board, so the 61st board found there also had to be an ACD-song. At first, the song '*Aan de Amsterdamse Grachten*' was partly rewritten to '*Aan de Nieuwe Achtergrachten*' by Jan-Hein Hooijschuur, but this did not quite catch on and became slightly out-dated due to the move from Roeterseiland to Science Park.

Fortunately, Jan-Hein had also made an easier, more yell-along song which is now the second part of our beloved '*lied*'. This part was based on the song '*Alle Remmen Los*' from the band '*Band Zonder Banaan*' in which you can hear the “oeh oeh jaja” as well as the A! A! C! C! D! D! The first part of the ACD-song was written a bit later by the 62nd board of the ACD (Jan-Hein and his fellow board member Carien van Aubel) to provide our song with a bit more text and also to convey the “greatness” of our association. This part was based on '*In Alles Zit Meziek In*' from '*Vastenavond in het Krabbegat*' and already from the start of this song you can hear our own '*We zijn de allerbeste*', albeit at a bit slower pace.

Based on the audio-fragments of that time, there have been a few changes compared to our current '*lied*'. The words have mostly remained the same except for the changes highlighted in the text. The biggest difference can possibly be found in the melody or the tune itself. Originally, the black

text was sung, resembling the melody of the song it was derived from, whereas now this part is also more like a yell, screamed as loud as possible. The second part of the ACD-lied was more chaotic, more innate to 'Alle remmen los', making our *oeh oeh ja ja* pretty modest in my opinion. If you want to hear the difference yourselves, make sure to watch out for the radio-fragment in which old ACD'ers sing their song during an excursion. Due to some problems with the website, this fragment

will be sent to you later.

Overall, our association song turns out not to be that old (only 16 years) as probably many of you thought. It has evolved quite a bit over the time, and this definitely has made me curious to what it will further evolve to over the years as well as what other stories there are there in the ACD-history. Who knows what more we will discover? I for sure can't wait to find out.

Het ACD-lied

We zijn de allerbeste

-ACD!

We drinken graag een lekker

-Biertje mee!

We komen uit de hoofdstad

-Amsterdam!

En elke vrijdagavond (Original: en in de Roeter-Toeter)

-Gaan we lam!

Wist je dat we heten

-ACD!

En dat we daarom schreeuwen (Original: en dat we dat graag schreeuwen)

-ACD!

We zingen nog een keertje (Original: we zijn hier met zijn allen)

-ACD!

We zijn de allerbeste (Original: we schreeuwen nog één keertje)

-ACD!

Bij het ACD! (Originally a bit more chaos than we are used to for this second part)

-Bij het ACD!

Oeh oeh ja ja!

-Oeh oeh ja ja!

Oh oh ja ja!

-Oh oh ja ja!

Bij het ACD!

-Bij het ACD!

Ja bij het ACD

-Bij het ACD!

Bij het A!

-A!

C!

-C!

D!

-D! (Originally the song ends here)

Bij het ACD!

-Bij het ACD!

ACD HOOG!

Aan de Nieuwe Achtergrachten

Aan de Nieuwe Achtergrachten

Heb ik heel mijn hart voor altijd verpand

ACD vult mijn gedachten

Met een biertje in mijn hand

Al die Amsterdamse mensen

Al die lichtjes 's avonds laat op het lab

Niemand kan zich beter wensen

Dan met ACD-ers op stap

Er staat een lab aan de gracht in oud Amsterdam

Waar ACD-ers hun chemie opleiding nam

De Roettertoetter die huist in een kamertje hier

Daar stroomt die heerlijk drank, daar stroomt al ons bier.

Aleen de bomen, de bomen, hoog boven het verkeer

En over het water gaat er een bootje net als weleer

Aan de Nieuwe Achtergrachten

Heb ik heel mijn hart voor altijd verpand

ACD vult mijn gedachten

Met een biertje in mijn hand

Al die Amsterdamse mensen

Al die lichtjes 's avonds laat op het lab

Niemand kan zich beter wensen

Dan met ACD-ers op stap

Mmmmmmmmmmm

Al die Amsterdamse mensen

Al die lichtjes 's avonds laat op het lab

Niemand kan zich beter wensen

Dan met ACD-ers op stap

Chemistry Undercover

Stijn Engelaar

In the last edition, Anna-May went undercover at two dissertations and gave us insight into what other disciplines of our universities were up to that are - for a change - not interested in HOMO-LUMO gaps, the Schrödinger equation or orbitals. As there is a lot of research being conducted by no less than 2700 PhD students divided over the UvA and the VU, we will highlight two more dissertations in this edition of the ACiD.

Disrupting looming violence

The first defence was the work of Phie van Rompu, a sociologist at the UvA. She studied how social control is maintained by nightlife and event security in the Netherlands.

While you are at a party or an event, sometimes you can recognize that the laid-back vibe is changing to a more hostile one. Van Rompu studies how security recognizes these potential hostile situations, and foremost how they can respond in an appropriate way to retain the social order. The term social order is something that keeps coming back in her defence, as this term is broader than solely violence. For her thesis, she interviewed and observed guards during a vast range of events. She concludes that there are four sets of bodily techniques used by security; the more experience a guard has, the better he can assess which technique should be used.

Dancing is an important part of events, of course. However, a person occasionally gets too passionate and thereby annoys other visitors in their proximity. This could disturb the social order. Most of the time, gazing from the security to this person, so the person gets the feeling of being watched is enough to calm the person down. And retain the social order.

The second technique is talking with people who

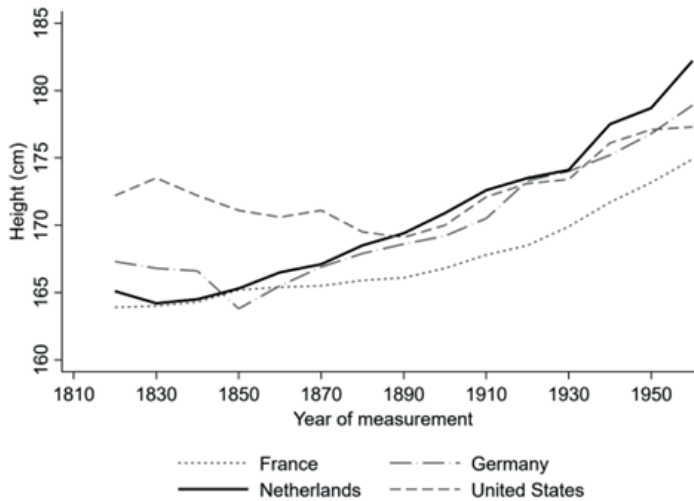
seem annoyed. In this way, the security can better assess the situation and the trajectory needed in the specific situation. She states that it is essential that the guards do not react to the provocations of the antagonist.

In the case that actual violence is looming, the security has to physically reposition groups from each other. In this way, the interest between the groups fades away and thereby the social order can be retained.

Lastly, it could be necessary to end a fight physically. The most crucial point for this disruption is hurting a person and thereby disrupting their violent actions. The violence of the side of the security is sometimes seen as excessive, disproportionate, or inappropriate. However, Van Rompu instead defines this as directionless as it stays closer to the interaction instead of applying normative norms. With normative norms, it is meant that a certain norm or a type of behaviour is 'normal'.

Does size matter?

The second thesis was from Kristina Marie Thompson, from the faculty of science at the VU. She studied how the Dutch have reached the title of tallest nation of the world and how body height influences the later-life outcomes in the nineteenth- and twentieth century.



In the graph above the average height of Dutchmen is shown between 1810 and 1960. A tremendous increase in these 150 years is observed that can most commonly be attributed to better living standards and wellbeing of the people. However, might there be a second reason for this sharp increase? The reason proposed by Thompson is that taller men might have economical, martial and health benefits compared to smaller men. As a result, they may have healthier, and more, offspring resulting in an even steeper increase in the height of the Dutch. For this study complicated analysis methods were necessary for compensating for genetics and early-life opportunities.

Thompson first studied the labour market and social mobility. Especially for men, there is a positive relationship between how tall a man is and the likelihood that the person has a job or a better earning one. Even for brothers this is the case, which shows that persons with a similar socio-economic background are affected.

The study of the marital and the number of offspring showed that taller men did have a higher chance of being married. Even though the taller men were more likely to be married, smaller men were more likely to have a family of more than five children.

Being tall also had a downside, as both taller women and men were more prone in times of nutritional stress, which was very relevant in the studied period. As a result of the malnutrition, they were more prone to diseases and death.

To loop back to the central question: Did male height and later-life outcomes form a virtuous circle, enhancing the growth of Dutch men? No. For this to have been true the person should have been healthier, have more children. For now, the prime explanation for the tallness of the Dutch is the

The dissertation also stated a very interesting fact: The Dutch, are shrinking! In 1980 men and women were on average 183.9 cm and 170.7 cm, respectively. This is 1 cm and 1.4 cm taller than the averages in 2001. This is not solely due to immigration as this is also the case for people with solely Dutch parents and grandparents.

1. van Rompu, M. F. S. (2022). Disrupting looming violence: Practices of social control by nightlife and event security.
2. Thompson, K. M. (2022). Does size matter? Body height and later-life outcomes in the nineteenth- and twentieth-century Netherlands.

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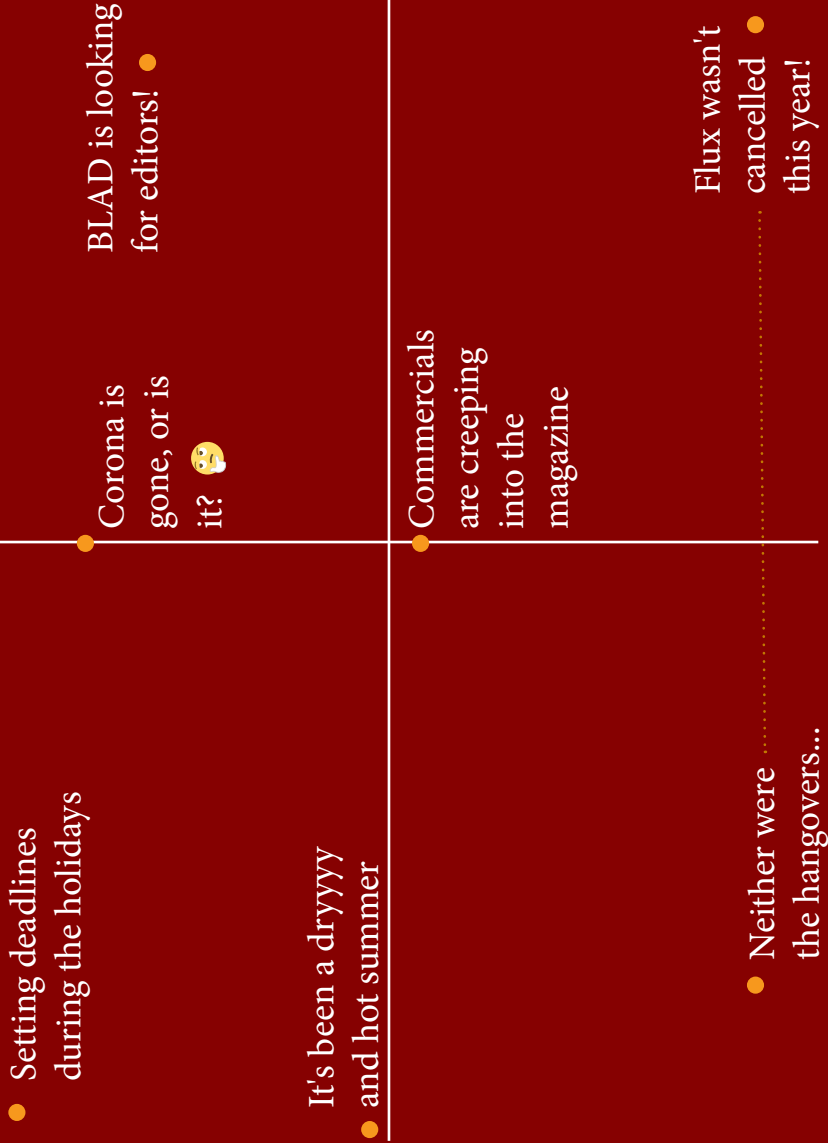
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