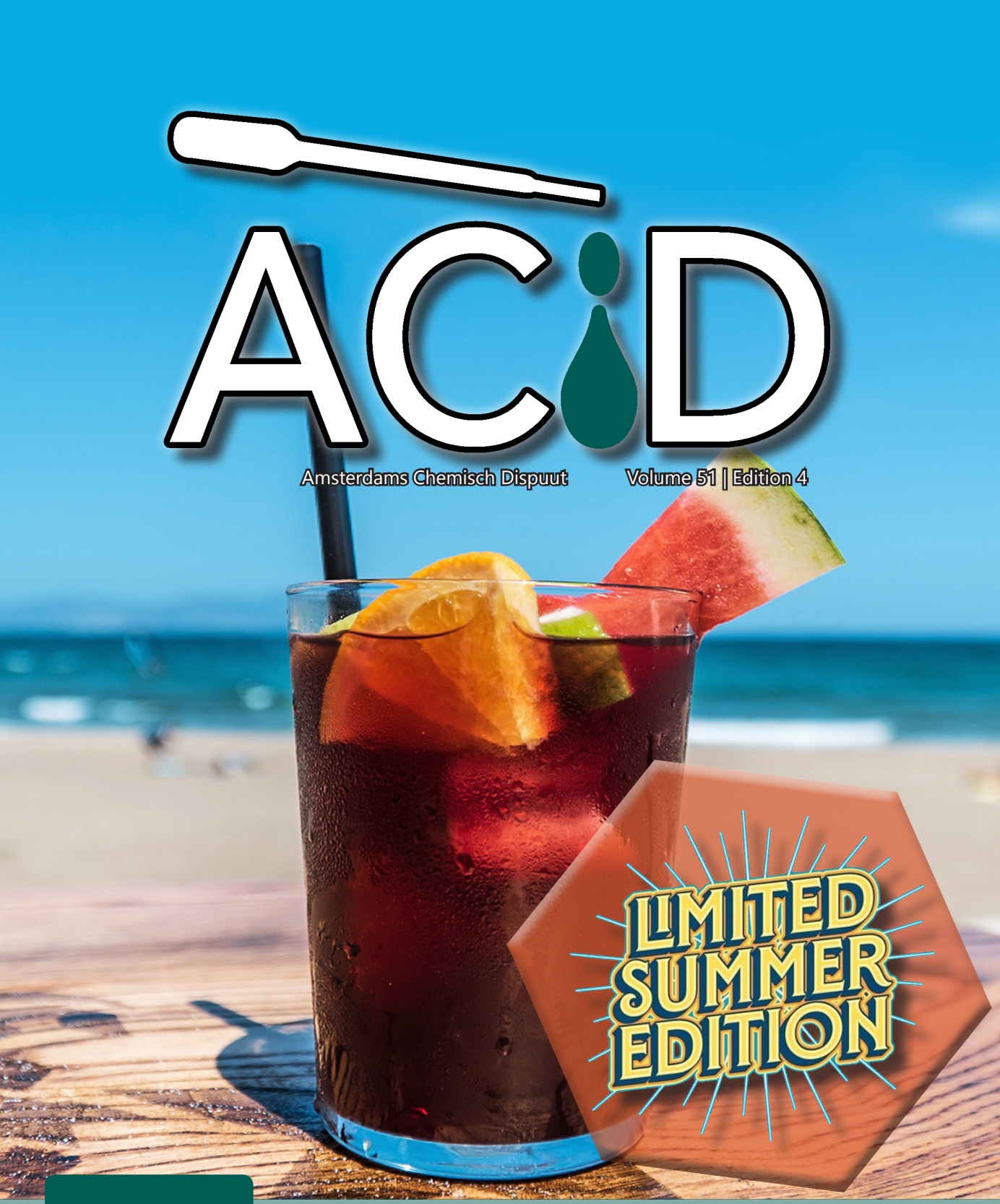

Amsterdams Chemisch Dispuut

From Cowpox to Covid
A Short History of Vaccinations
Bachelor Thesis Project: Anissa Haim
A Design Principle to Influence the Hydrogen Bonds in Hydrogen-Bonded Systems
Read, Watch and Vacation Tips!

Colophon

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From the Editor

Dear reader,

I hope when this edition reaches you, you and those closest to you are still in good health. Perhaps, you are holding this edition in your hands while enjoying the rays of the sun, after having finished your last exams and/or final projects. Or, you are finally conducting experiments again on your well-missed lab and have gotten back on track with the exciting work you so suddenly had to leave behind. Since most people are probably spending their holiday this summer in our own 'kikkerlandje', the Bladcommittee did its best to provide you with extra ideas to prevent holiday boredom. Beside our classic pieces, you will find in this edition recommendations for series, books, 1.5 meter games and fun activities to do close to home. To keep the chemistry spark alive over summer, we have also looked into the working mechanism of vaccines and a way to transform toilet paper (we know you have lots) into alcohol. Hopefully, this will keep you entertained over the weeks, so we can see you well-rested in September!

On behalf of our entire editing team,

Stay safe and have a wondeful summer.
Michelle van Dongen

Content

From the Chair

Lovely ACD-members,

How the world can change in a couple of months. Before March, we all did our thing with little to worry about and enjoyed going to lectures, relaxing in the ACD rooms and joining physical ACD activities. But now, we have a 'new normal'. We are getting used to the online lectures, digital events and the 'one-and-a-half-meter society'. In the last couple of months, we had a big variety of activities, from a dance workshop to drinks, from lectures to movie nights. All of these were online happenings. At first, it was awkward to just sit behind your laptop and enjoy it just like a normal activity. Now, however, I'm getting kind of used to it and I hope all of you guys too!

I'm impressed with how everyone has been able to adapt so quickly. Switching to a completely different way of life from one day to another is a big deal. With everyone, I really mean everyone. I express my appreciation not only to you students, but also to the entire educational board and all the professors and teaching assistants. It must have been extremely difficult to change your course to an almost completely different one. The lack of real personal contact between teacher and student also remains really difficult, because, let's be honest, the contact is worse than usual. For me, contact with other students and teachers is one of the best parts of our study and I really hope it will go back to normal soon. I would also like to say that all committees are doing a good job. It is heart-breaking if you are busy organizing something and then it is cancelled. However, your work has certainly not been for nothing. The preparations that you have already done can be continued next year and all ACD members are looking forward to what you are going to organize. So, to conclude, a big compliment to everyone.

I am really looking forward to the moment when we can be together again: sitting together in a lecture hall, having a drink together, making jokes in the ACD rooms or, for example, playing beach volleyball in the sun. How wonderful would that be again. It certainly is something to look forward to. Very carefully, we are going to organize some physical activities. Still not ideal, because traveling by train is only allowed when it is really necessary and many people have to come by train for an ACD activity. Yet, it is a step forward. For September, it is unclear how it will be. With the knowledge that the majority of education will still be digital, many activities shall also be organized in this way. I hope that we will have enough freedom to do more physical activities, because we all want to see and greet each other, get to know the first year's students and welcome them and start the lustrum year well.

But for now, you can all enjoy the summer. I hope that the exams, resits and projects went well for everyone and that you get some rest for a while. Read a book, meet your friends and enjoy the sun. Then we will all meet again in September, physically or digitally, and we can enjoy a new academic year, with many exciting ACD activities in store.

With kind regards,
Your chairman
Sam Hulscher

Het wel en wee van de OC part 4 – Does someone have a pun? I don't have any more

Maarten van Dorp

Once again, we will start the edition off with UvAQ questionnaires. Don't worry, I won't ask for any more feedback; I just want to share something that made me laugh and cry at the same time. As most of you are probably aware, the UvAQ response rates are dismal. Naturally, the university wanted to improve on the UvAQ feedback forms, and wanted to know why people are not filling them in. So they inquired with the students... By means of a digital questionnaire... Which students ended up not filling in... You may not like it, but this is what peak performance looks like.
Back to business. We are slowly creeping towards the end of the academic year, and it is possible that some of the student members of the committee will have to divert their attention elsewhere in 20|21. So keep your eyes peeled for any vacancies, or, if you want to be proactive, you could send a mail to the committee in advance. We'll make sure to keep you in mind and will keep you updated on any empty seats by mail.

The committee is also coming up to steam with our new chair, professor Grossmann, and the minutes and meetings are becoming more streamlined and quicker. All in all, this makes the committee more productive.

We have been busy with the extra time students didn't get during online exams. We asked the exam bureau (tentamineringsbureau) about this, and they have conferred internally and have passed it on to the study advisor and the programme director. Steps on how to deal with this are currently underway, and as usual you can stay posted about this in the next edition. As a baseline, the exam bureau has made clear that not giving extra time should be an exception, that when it happens the students are owed a motivation for the exception, and that the exam committee should be informed.

The OC has also received a letter signed by some students about a course that they felt had a time burden that was too high. Because this required more acute action, we have urged the students to pass the letter on to the programme director. On the long track we have also asked the students to evaluate the course, so we could discuss structural flaws with the professor in question.

There also was a second course that took up vastly too much time. We have discussed this with the relevant course coordinator, and it seems that there has been a misunderstanding. It seems to be the case that the 6 EC were taken to represent 36 hours of work a week, whereas they only represent roughly 21 hours/week in actuality. As of the writing of this article, it is still unclear what the follow-up will be, as the contact with the professor is still ongoing.

Professor Fonseca Guerra and Joris Peters also stopped by the meeting to update us on how the programme is handling the corona situation. They were very receptive to some feedback when we gave it, so that was much appreciated.

Stay healthy, you will hear from us next edition!

OC mail: ocs-science@uva.nl
OC page: student.uva.nl/sck/content/az/opleidingscommissie/opleidingscommissie

Summer Horoscope

Aries (March 21 – Apr 20)

Finally after a hard period a spark of joy will get to you and will grow during summer. There are some bad days, but good days shall outnumber them this year. Especially because of that cute libra who has an eye on you.

Taurus (Apr 21 – May 21)

The moment has finally come, Red Bull will approach you for a challenge this summer. An opportunity of a lifetime, don't waste it otherwise the aliens will get you first.

Gemini (May 22 – June 21)

Summer is your time to reflect on the past academic year. Luckily this is getting easier due to your new sunglasses. Also, you will be outside a lot, so don't forget the sunscreen.

Cancer (June 22 – July 22)

This summer will be wonderful. Nobody can use a vacation as an excuse to skip your birthday this year. Nevertheless people still keep a distance from you. Maybe it is your breath, so be wise and brush your teeth twice a day.

Leo (July 23 – Aug 22)

This summer will be wonderful. Nobody can use a vacation as excuse to skip your birthday this year. Also you'll get a closer connection with Cancer, you have a lot in common, especially shiny lonely birthdays.

Virgo (Aug 23 – Sept 22)

After a time with a lot of distance it is time to get social (distance). No not online anymore, but out in the open. Go outside, meet people and distance yourself from problems you can't solve.

Libra (Sept 23 – Oct 22)

Summer will make you a better person, especially if you keep a distance from Aries. They will ruin your day at a glance. Speaking of keeping a distance, that will be a big theme for you this summer.

Scorpio (Oct 23 – Nov 21)

Stop reading horoscopes, you're too clever for this bullshit. Just go enjoy your summer!

Sagittarius (Nov 22 – Dec 21)

We all know you prefer winter, but this is gonna change due to the surprise from a person you haven't seen in a while. Enjoy it. You deserve some good things after being distanced from them.

Capricorn (Dec 22 – Jan 20)

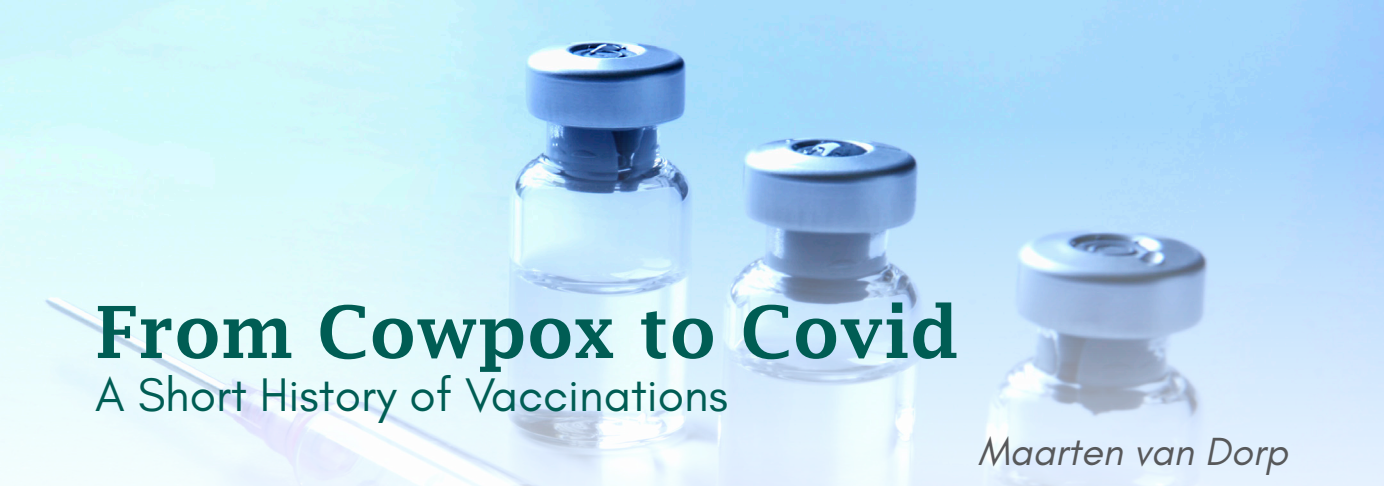
Amazing people like you will also get an amazing summer. You will have long days in the park with a lot of friends, drinks and of course a true summer love. Enjoy it, cause summer gonna end, but luckily your amazingness isn't.

Aquarius (Jan 21 – Feb 19)

Your favorite artist will release a new song and you won't get a sunburn this summer. Can life get any better? Yes, of course you also win the lottery!!!!

Pisces (Feb 20 – March 20)

Your magic number this summer is 1.5 not sure what it means, but with this knowledge you keep yourself and you love onced safe. Oh and you don't win the lottery so spend money on other things.



From Cowpox to Covid

A Short History of Vaccinations

Maarten van Dorp

Human bodies are not isolated from their environment and from time to time this puts stress on our body's capability to maintain homeostasis. In other words: we get sick. Naturally, there are many causes of sickness both from within the body, like genetic defects, and without, like cancer inducing radiation. Among these disease causing factors, or pathogens, there are the germs, infectious bits and pieces of life that multiply in our body and bring it out of balance. Bacteria, fungi, viruses, and the lesser known prions, self-propagating misfolded proteins, all are pathogens.

Except for the latter, we have found ways to deal with them during the advent of modern medicine. Coming from completely different taxonomic kingdoms, we combat fungi and bacteria with chemicals that disrupt their biological processes, while causing little damage to our own cells and organs. For instance, antibiotics like penicillin destroy the cell walls of bacteria, while leaving our own eukaryotic bodies alone.

Viruses, however, require a different approach. Funnily, the word antibiotic hints at this, as viruses are just that: not biotic. By most common definitions of life they are not really alive, and they usually lack any significant internal processes to interrupt. To make matters worse, they hijack the cellular machinery of a host, which makes it exceedingly hard to stop them in their tracks after infection has taken place.

And yet, we can recover from viral diseases due to the wonder of our immune system. So that is what we focus our defense on: prevention by priming our immune response to the unliving invader. Everyone knows that this is achieved with vaccines, but some might not know how they were invented. We will take a quick peek at the anti-vax movement, and of course I will also recap how vaccines work. To top it all of I will shortly touch on a possible COVID vaccine.

The story of vaccination starts further back than you might have thought. It starts with the practice of inoculation, or variolation, which involves taking infectious material from a sick person, like scabs or pus, drying it, and then infecting someone using that debris, introducing the person to a weakened strain of the pathogen. This procedure was commonly performed for prevention of the now extinct smallpox virus, and sounds like a pretty shit idea if you ask me. Nonetheless, it was very effective, and only had a mortality rate of roughly 2% compared to the around 14% of letting the virus run its course.

Even though 2% isn't trivial, it was very popular and it has been recorded at least as early as 1000 A.D. in China, and it has been reported that emperor K'ang Hsi had his children inoculated for smallpox some 600 years after that. It would take until 1706 for the first evidence that it was performed in Africa, and only in 1717 Lady Mary Wortley Montagu wrote about it being done in Turkey. She brought the technique back to England and they finally caught up in 1721.

It is from that same country that the most famous passage in the history of vaccines took place. Around 1770 it was common knowledge in England that farmers who had contracted cowpox, a zoonotic pox virus that only caused relatively mild symptoms, could not be infected with smallpox after that. A bright physician called Edward Jenner decided to test this knowledge scientifically by consecutively inoculating an eight year old boy with cowpox and smallpox, and keeping track of the symptoms. When the boy did not show

signs of a smallpox infection, and after repeating the experiment several times, Jenner concluded that inoculation with cowpox successfully protects from the vastly more deadly smallpox. Jenner then coined vaccine inoculation as the name for his new practice, after the Latin for cow: vacca.

Figure 1. *Dr Edward Jenner vaccinating a child.*

After publication of his findings, word quickly spread, and Dr Jenner was famous before the end of the century, and it was already in 1806 that U.S. president Jefferson endorsed it and credited him for the future extermination of smallpox. Knowing that with the advent of vaccination the average life expectancy in France went up with almost 15 years between 1795-1831, this enthusiasm was merited.

It was this huge success that in part inspired a flurry of research into disease, leading the French Academy of Sciences to challenge its members to investigate the generation of life. It was Louis Pasteur who, in 1860, disproved the theory of spontaneous generation, providing vital evidence for the germ theory of disease that would later prove instrumental in the further scientific development of vaccines.

Numerous new vaccines for all kinds of different diseases were developed in the century following Pasteur's discovery, but there are too many to mention them all in this article. Regardless, there is still one monumental achievement of vaccines to be pointed out.

We will jump to more recent history after WWII. It was in 1959 during the twelfth plenary meeting when the WHO accepted Resolution WHA12.54 stating: " (The WHO) Recommends to the health administrations of those countries where the disease is still present that they organize and conduct, as soon as possible, eradication programmes." Even during the late sixties, when the Cold War was nearing its peak, the U.S.S.R. and the U.S. set their differences aside, and cooperated on a vast scale to reach the goal set out in the resolution. In the end, massive vaccination drives in Africa and Asia managed to beat back the virus, and in 1980 smallpox was declared exterminated. An achievement unprecedented in human history.

So in light of these extraordinary accomplishments, it seems rather bizarre that there is an anti-vax movement. Why would people even resist the safe and hugely successful vaccination? Why would that sentiment emerge only now?

Well, in reality, the movement isn't new at all. Just after the invention by Jenner people were already highly sceptical of the idea of being injected with cow illness. Given the scientific development of the time, understandably so. What if the vaccine turned you into a cow? Who knows what could happen? This sentiment is famously illustrated in 1802 by James Gillray with an engraving depicting cows bursting from people's limbs. If you take into account that it was not uncommon the needles to be contaminated with diseases from previous patients, this was not entirely unfounded.

Figure 2. *The print by James Gillray on possible unintended consequences of vaccination.*

Even though the Pope endorsed vaccination in 1814

there still were some religious concerns that it went against the natural order of things and God's plan. But more serious dissent was organized halfway through the century when it was made compulsory to be vaccinated. This stemmed the liberal tradition at the time that advocated passionately for individual freedom. In 1904 this even led to the so-called Revolta da Vacina in Rio de Janeiro, where streetcars were overturned and protests turned violent.

In part, this is where the current anti-vaxxers find their history, but there has been a recent turning point. Nowadays, the activists are most known for their claim that vaccines cause autism, which is completely unfounded. This can be traced back to an article by Andrew Wakefield, a now discredited ex-physician who published (a now disproven) 'scientific' article in The Lancet in 1998. This paper laid no real causal connection between the vaccinations and autism, but the author still made several press statements saying that they did, and called for their immediate suspension. Later it turned out that Wakefield had received roughly half a million pounds from lawyers who were in search of evidence to use in a lawsuit against the manufacturers of the vaccine. To add to that he was setting up a business in the same market and was expecting to make several millions after he discredited the other product. All in all, the myth seems to originate from the fact that one person wanted to make a buck.

So now that we know how they don't work, we can also ask ourselves how vaccines do work. Aside from passive vaccination, which directly injects antibodies, all forms of vaccination inject some form of antigen matter into the patient. Phagocytes consume this matter, and present the antigens on their surface to T-cells. These in turn differentiate into several types of T-cell, which include the helper T-cell. Helper T-cells interact with B-cells that have already consumed and presented antigens and stimulate them to form memory B-cells and plasma cells. The latter produce the antibodies that would eliminate the invader in a situation with an actual infection. It is the memory B-cells that make a person immune to a disease, as they mount a quick antibody based immune reaction if they are presented with the antigen in the future. This is the easy part of vaccination.

The hard part of vaccination is neutralizing the antigens in such a way that they do not cause an actual infection. Many different methods achieve this in different ways, the simplest of which is attenuation. It involves breeding a virus in a host that is different from humans, allowing it to adapt to the new host. When the newly adapted host is reintroduced after several generations, it is less capable of infecting humans, leading to a less severe illness. In essence this is what the cowpox inoculation achieved. The virus could also be grown in a cell culture to the same effect.

Careful heat or chemical treatment is also an effective way of deactivating viruses and it is responsible for the very first vaccine of the influenza virus. Due to its simplicity it has been in use ever since the end of the 19th century and still is used to this day.

When it comes to the more modern methods there is the possibility of reassortment. By co-cultivating several viruses in the same cells it is possible that their RNA merges and in turn makes the virus less potent. If the resultant virus triggers plenty of antibody generation without causing too much damage it is ready to be injected. This means that the immune system encounters an actual live virus and is 'drilled' in a very realistic way.

On the complete contrary it is also possible to simply inject the proteins that trigger a certain immune response in the first place. This is not quite the same as injecting antibodies, as the immune system still has to react and produce those by itself. For instance, injecting the protein hemagglutinin could effectively immunize someone against influenza.

So what is the situation for the possible COVID vaccine? Right now there are promising candidates. One is in a paper by Jingyou Yu *et al.* that describes several DNA injecting vaccines that provided immunity in macaques. The other was mentioned in an Oxford university paper that describes a vaccine involving an attenuated adenovirus that produces and presents COVID proteins. Several governments are making deals with pharmaceutical companies for future vaccines, and everything considered a new vaccine is expected near the end of 2020.

The Social Distance Games

Nadav Joosten

After cancellation of all important sport events like the ONCS and the Olympic games, it would be nice if there are alternative events that can be organised. So, the Blad committee presents the Social Distance Games. It can be played in small groups and is fit for almost all ages.

Frisbee tag

To play this game only a frisbee is necessary, but if you play this with more fanatical friends it could be wise to protect your eyes and use shin pads. This game can be played with at least 3 people. Create a small field, additionally with some obstacles. To start, you choose one player who has the frisbee and needs to throw it to another player. When he hits the other player, this player is the new thrower. If they miss, they stay the thrower. When the frisbee goes outside of the field's boundaries, the thrower needs to step in the field at the place closest to the frisbee's position outside the field. When someone catches the frisbee, they can choose if they want to throw it to another player or throw it back to the thrower. When the former is chosen and another player is hit, this player now becomes the thrower. For the second option, the first thrower remains the thrower (no roles change). The game is really fun if your field is for example a climbing frame and you aren't allowed to touch the ground. Many varieties are possible when playing this game, so enjoy it. Other versions of social distance tag games are archery tag, nerf tag duel or free for all dodgeball.

Cup piling

For this game you need a rubber band, ropes, and multiple cups. The goal is to make a bigger pile of cups than the other teams and you can play with as many teams as you like, desirably around 3-4 players per team. How to play? Take a rubber band and twist a rope for each player on it. Make sure the ropes are long enough to keep at least 1.5m distance. Now by working together you can pull the ropes and stretch the rubber band to try to grab a cup. When you have a cup, you need to pile it onto another cup. Who can make the biggest tower in 15 minutes wins.

Variations of this game can be done by using different goods to make weird towers.

Other ideas

Almost every game can be played at a social distance if the playing field is large enough. Play for example mega Jenga or Mikado. You can also create a big version of other games by yourself, for example a big version of Settlers of Catan or Monopoly.

Staycation

Corona proof vacation ideas for the summer of 2020

Myrthe Zwart

Unfortunately, many people had to cancel their summer plans due to COVID-19. Maybe you are still thinking about vacationing abroad but are scared to get stuck in a foreign country if they have to scale up the rules and regulations due to a new wave of corona cases. Or maybe you simply don't want to deal with the hassle of looking up all the regulations in your chosen vacation spot. Here are some alternatives for the summer of 2020 to ensure your well-deserved vacation days are filled with fun and relaxation.

Camping

Trusty old camping, who hasn't tried it? But, that busy, child-friendly camping from your childhood memories is not the only option nowadays. If you want a more unique and quiet location to set up camp, try camping at the farmer's (kamperen bij de boer). They offer the same amenities as most large scale campings (such as showers, power, and Wi-Fi) but are often not as busy and in less well-known locations. Not a fan of the usual tent or bulky camper? Expand your options and try something cool like a campervan or rooftop tent. And if you're tight on budget and are in need of camping supplies, Quechua offers great camping solutions for even greater prices.

Renting a house

Maybe this is an obvious one, but if you want a change of scenery without having to hand in any luxuries, a vacation park can be a nice getaway. A cheaper option could be to look at Airbnb, but many people with an Airbnb have decided to rent out their house for longer periods of time. Not a fan of the busier vacation parks and can't find a nice Airbnb? Try www.natuurhuisje.nl. They rent out homes surrounded by nature, and even give you a 'contactless stay' option.

With beautiful locations in the Netherlands such as the Veluwe, Waddeneilanden, Zeeuwse kust and the hills of Limburg, being a tourist in your own country doesn't sound that bad.

Renting a boat

With the temperatures on the rise, frolicking around in the water seems like the perfect idea. Unfortunately, many people agree with this idea, leading to overcrowded beaches. So why not rent a boat, the perfect way to spend time on the water while easily being able to keep your distance from other people. When it comes to boats, the options are endless. If you're into sailing, you could rent a larger sailboat and explore the IJsselmeer and Randmeren, or go island hopping in Zeeland. The Grevelingen lake in Zeeland offers many small islands and marinas, or hop over to the next lakes and go visit Zierikzee, Middelburg or Vlissingen. A more adventurous way to explore the Dutch lakes is to hire a smaller boat (Valk or Randmeer) in Friesland and go and explore the Frisian Lakes. Many moorings along the Frisian Lakes, known as Marrekrite moorings, also allow you to set up a tent and camp for a selected amount of time. Not into sailing? No worries! Rent a sloop for the day at the Kaagerplassen and tour around with a nice, cold beer in your hand.

Hiking in the Netherlands

You were supposed to go hiking the West Highland Way in Scotland, or trek through the mountains in Austria, and now you find yourself stuck in the boring landscapes of the Netherlands. Because the Netherlands does not offer beautiful hiking trails or long-distance hikes, or does it? The Netherlands is home to some beautiful long-distance hikes, through all types of landscapes. Most long-distance hikes (Dutch: lange afstandswandeling, or LAW) offer guides and can be hiked in sections. Some hikes even offer lists of accommodations along the path. You can hike two or three sections with longer breaks, or hike with your own tent and camp along the path. You can make it as easy or hard, cheap, or expensive as you want.

Bike vacation

If you're more into an active vacation and don't like sitting around at the same campsite for a longer period of time, why not go on a bike vacation? Prep your bike, throw a tent, some food and clothing on it and see where the sun leads you. If you're a bit tight on money, this can also be a great vacation for you! Just check out some cheaper campgrounds or maybe ask a relative if you can spend a night in their garden.



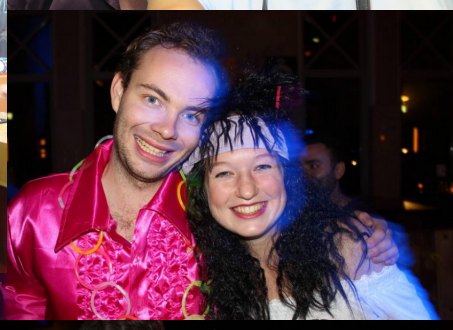












"TRUST ME
YOU CAN

4-Ingredient Flatbreads

Maybe during the lockdown baking craze you have tried to obtain that warm, crusty sourdough bread, but found it to be slightly harder than expected. This flatbread recipe is easy, only needs 4 ingredients, and is almost foolproof!

Ingredients for 6 – 8 flatbreads

- 250 grams of Flour + additional for rolling (All-purpose or whole-wheat)
- 200 grams of Greek Yoghurt
- 1 teaspoon of Baking Powder (NOT baking soda)
- 1 teaspoon salt

Instructions

Combine your ingredients in a big bowl and start kneading. All ingredients should be fully incorporated to form a firm ball of dough. If the dough is too wet, add some more flour, if it is too dry, add some yoghurt. Once you have formed your ball of dough you can divide it in either 6 (larger flat-breads, good for wraps) or 8 (smaller flat-breads, delicious as a side with curry). Roll out your flatbreads into an oval shape on a surface covered in flour. Don't forget to flour your rolling pin - or wine bottle, if you don't own a rolling pin like me. Cover the flatbreads in a little bit of cooking oil (olive or sunflower oil work great) and bake them in a pan on high for about 3 minutes on both sides.

These flatbreads can be used for dipping, as wraps or as a side with curry. They are really delicious with some baked chicken breast, butter lettuce, tomato, bell pepper and a dressing made of Greek yoghurt, hot sauce (sriracha), some Italian herbs, garlic powder and a pinch of salt and pepper.

Summer Sangria

During summer it is nice to stay hydrated, but what is the perfect drink for your staycation? We found out that on hot summer days it's very nice to sit in the shade and get a sip of your own homemade sangria.

Ingredients

- 1 bottle of affordable Garnacha (also called Grenache) or Pinot Noir or other fruity low-tannin red wine, chilled
- 2 oranges
- ~ 250 g thinly sliced seasonal fruit (apple, pear, strawberries, peaches, or nectarines)
- 1 lemon
- 100 ml of brandy
- A bit of (brown) sugar or maple syrup, to taste
- Ice, for serving

Instructions

1. To prepare the orange, slice it in half from the stem end downward. Squeeze the juice of one-half of the orange into a pitcher. Thinly slice the remaining orange in half and place the slices into the pitcher.
2. Add the prepared seasonal fruit and lemon. Add the brandy and 1 tablespoon of the maple syrup. Pour the wine into the pitcher and stir to combine. Taste, and add another tablespoon of sugar if it's not sweet enough for your liking.
3. You can serve this sangria immediately, or let it marinate for 2 to 8 hours for a more fruity flavour. Serve in wine glasses with a few ice cubes to keep it chilled.

Enjoy!

Put your TP where your mouth is!

Maarten van Dorp

The apocalypse. One that involves pooping, copious amounts of pooping, so much pooping. That is what the future holds, or so large parts of the western world seemed to think not so long ago. Not unlike American doomsday preppers, Dutch shoppers turned out in force to strip supermarkets of all their canned food halfway through March. They also stockpiled vast amounts of toilet paper, lest their bottoms be dirty in the middle of an unending and martial law enforced lockdown.

Luckily, that extreme quarantine never came to be, and toilet paper stock was quickly replenished, leaving the hysteric masses to deal with their towers of worthless rolls. Some of the hoarders tried to return them, to no avail, but most are simply toiling away at flushing their reserves over a long time. If only the paper could be transformed into a more valuable commodity. Something that could help us stay entertained throughout the summer. Well, that sounds like a problem for us chemists to solve.

So what product is it that we are going to produce from humble toilet paper? Alcohol. This might seem far-fetched at first, but on second thought it will make perfect sense. Hopefully every reader knows that ethanol is produced by yeast fermenting glucose into alcohol. One of the most common places to find glucose, is trapped in the polysaccharide chains of cellulose, and luck has it that cellulose is the main component of paper. The only hard step in making alcohol from toilet paper then is the breaking-up of these polymers. Chopping up cellulose chains is a notoriously difficult task, it's why cows have several stomachs and ruminate after all, and the chemical procedure reflects this. Most methods use sulphuric acid and high temperatures to brute force hydrolyse the β-glycosidic bonds. Not ideal for making a product that we might want to drink. That brings us back to the cow.

Inside one of the guts of cows are microorganisms that help the animal digest the cellulose. These organisms use enzymes to break down the polysaccharides, and this is done at much more favourable reaction conditions and doesn't require any possibly toxic reactants. These cellulases are readily available commercially and are easy to use. Simply dissolve your amount of toilet paper in some tap water, boil it to break up the biggest cellulose chains (and sterilize it) and then add the cellulase. A paper by Jacobus P. H. van Wyk from 1997 advises refluxing the paper mush in a 10% w/v NaOH solution before adding the enzyme to increase activity, but it will perform fine without. Not using the NaOH also avoids having to neutralize the mixture later on. Depending on the enzyme you have chosen, reaction times and temperatures will differ, but several hours at temperatures around 50 C° are the norm. An enzyme that works optimally at conditions favourable to the yeast strain you will be using for fermentation is preferable. If you matched the enzyme and yeast, simply allow the hydrolysed mixture to cool and add the yeast for fermentation. Close the reaction container, add a fermentation airlock and let it sit for several weeks.

After waiting some time, several distillations are required to get a nice aqueous ethanol solution, and then some more distillations to tap off any unwanted side products like methanol. The last few should be done carefully to extract the ethanol fraction at around 78 C°. Any fractions before and after that should be tossed.

After all that hassle the toilet paper has been fully converted into drinkable alcohol, and it is time to put your TP where your mouth is. Cheers!

Bachelor Thesis Project

A Design Principle to Influence the Hydrogen Bonds in Hydrogen-Bonded Systems

Anissa Haim

During my bachelorproject in the group of Prof. Dr. Célia Fonseca Guerra at the VU, I did a computational research into the effects of substitutions on the hydrogen bond strength in hydrogen-bonded systems. As most of you probably know, hydrogen bonds are weak interactions that are often described as a pure electrostatic interaction between an electronegative atom and a hydrogen atom, but in fact also have a partially covalent character. Especially the strength of such a weak interaction can be interesting and useful to predict for the synthesis of new materials.

One of the main goals of my bachelorproject was to investigate if the strength of hydrogen bonds can be tuned. I focussed on the previously investigated quadruple hydrogen-bonded tautomers DDAA and DADA, see **Figure 1**, where D stands for the donating group of the hydrogen bond and A for the acceptor group of the hydrogen bond.

Previous research on the DDAA and DADA tautomers revealed that the hydrogen bond energy is stronger in the DDAA motif than in the DADA motif, which was mainly caused by a larger and favourable charge accumulation in the frontier atoms in the DDAA system.[1] This led to an enhancement of both the electrostatic interaction and the orbital interaction. I continued with this research by investigating if substitutions with electron withdrawing groups (EWGs) and electron donating groups (EDGs) can be used to further promote this favourable charge accumulation, and thus to tune the strength of the hydrogen bond energy in DDAA and DADA dimers. The substituents replaced the hydrogen atoms on the opposite side of the frontier atoms.

From basic organic chemistry, it follows that these substituents can affect the electrostatic interaction and the HOMO-LUMO orbital interaction between the donor and acceptor groups in hydrogen-bonded systems. It is expected that an EDG will donate electrons to the frontier atoms that form the hydrogen bond, which will become more negative. If the acceptor group becomes more negative, it will result in a

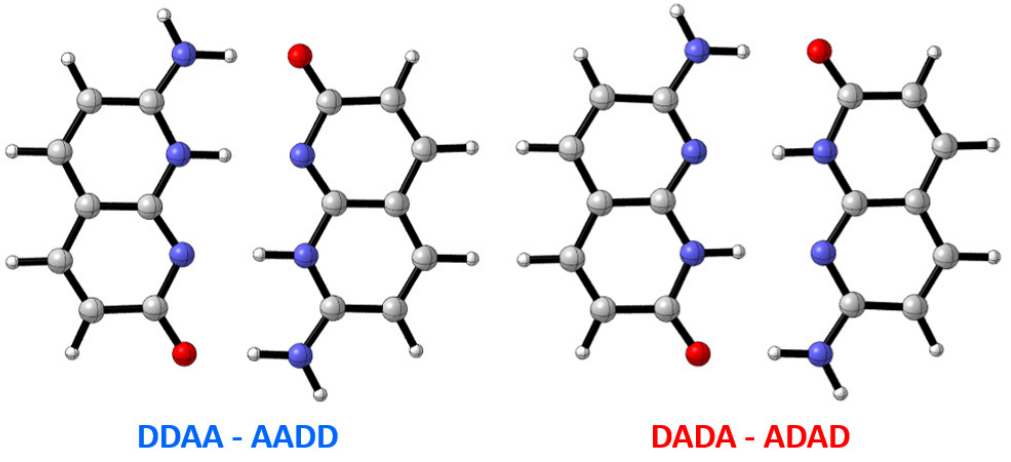
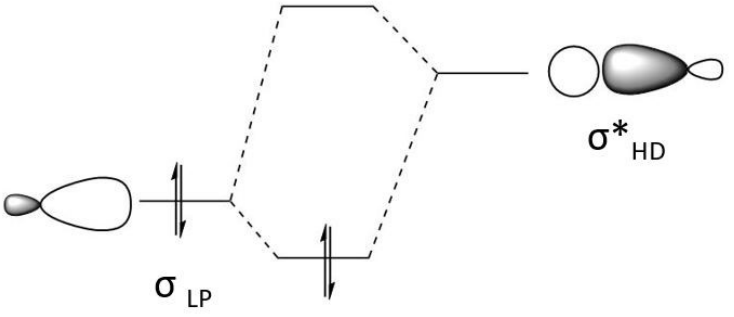


Figure 1. *The quadruple hydrogen-bonded DDAA and DADA dimers.*

stronger electrostatic interaction with the opposite hydrogen atom on the other system and thus a stronger hydrogen bond. As for the orbital interactions, it is expected that the HOMO will be more destabilized after substitution with an EDG and this will result in a smaller HOMO-LUMO gap. Therefore a stronger hydrogen bond is expected. A schematic overview of the HOMO-LUMO interaction is given in **Scheme 1**. On the other hand, substitution with an EWG will have the opposite effect. An EWG will cause an increase in the positivity of the frontier atoms. For the acceptor groups, this will result in a weaker electrostatic interaction with the hydrogen atom of the other monomer and a weaker hydrogen bond is expected. For the orbital interactions, a more positive acceptor group causes the HOMO to be more stabilized and this will result in a larger HOMO-LUMO gap. Therefore, it also results in a weaker hydrogen bond. The effects of the substituents on the donor groups are the other way around. So, a more positive donor group (i.e. hydrogen atom) will enhance the electrostatic interaction and orbital interaction (because of a stabilized LUMO), while a more negative donor group will weaken the electrostatic interaction and orbital interaction.[1,2]

To analyse the effect of the substituents, I have compared the hydrogen bond energies of the systems with substituents with the systems without substituents. The hydrogen bond energy is defined as the energy difference between the energy of the optimized dimer and the sum of the energies of the optimized monomers: $\Delta E_{HB} = E_{dimer} - (2 \times E_{monomer})$. Surprisingly, the expectations that are based on organic chemistry knowledge were not all found in the results. It became clear that these substituents have unpredictable effects on the hydrogen bond strength. It appears that the effects of the substituents are not primarily on the neighbouring atoms, but affect the whole system. Since each monomer has the same number of donor and acceptor groups, the hydrogen bond strength is thus difficult to tune because the effects cancel each other. So far, I can conclude that the hydrogen bond energy was not easily tuned with the chosen substituents and more insight into these systems could provide more information on the tuning of hydrogen bonds.

If this computational research is something that you are interested in or you want to know more, don't hesitate to look into the research groups of the Theoretical Chemistry Department at the VU!



Scheme 1. *Schematic overview of the donor-acceptor orbital interaction between the filled σ orbital of the lone pair on one system with the empty σ* orbital of the hydrogen donor group of the other system.*

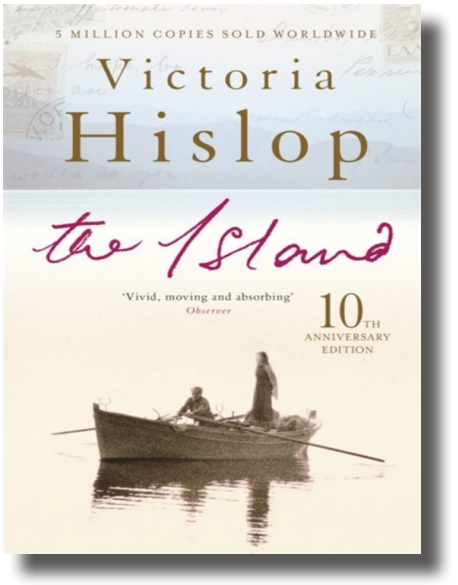
1. van der Lubbe, S. C. C.; Zaccaria, F.; Sun, X.; Fonseca Guerra, C. *J. Am. Chem. Soc.* **2019**, *141*, 4878–4885.
2. Fonseca Guerra, C.; Bickelhaupt, F. M.; Snijders, J. G.; Baerends, *E. Chem. Eur. J.* **1999**, *5*, 3581-3594.

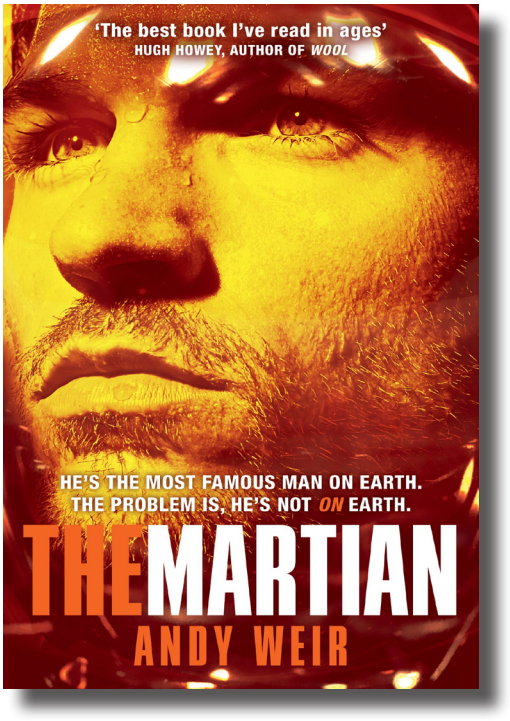
What to read?

Stuck inside? Bored? Read a book. Which one? Those listed below of course. The Blad committee gives their recommendations for the best summer reads of 2020.

Nadav: The island - Victoria Hislop

Sick of living in isolation due to a disease; so were the citizens of Spinalonga as well, a former Greek Leper Colony. The Island tells the story of Sophia's family history. Growing up in England, her mother always kept silent about this history until Sophia was given the name and a letter of an old family friend. She travels to Crete, to a small village to find out what the connection between her family and the island of Spinalonga is. This historic novel is about hope, even if you are banned from 'normal' life and have to live on an island with only sick people. Find out how life can still be wonderful even if you are sent away from society. The citizens of Spinalonga stayed positive, and so will you reading this book during our time of disease. Enjoy reading this book this summer.





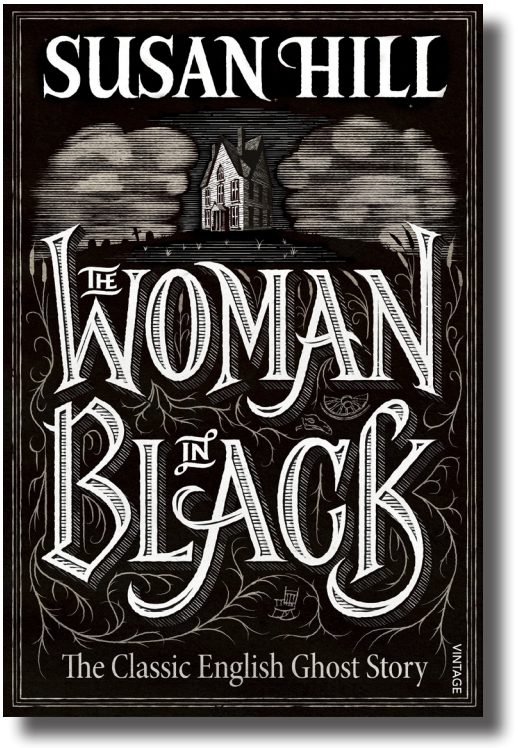
Myrthe: The Martian - Andy Weir

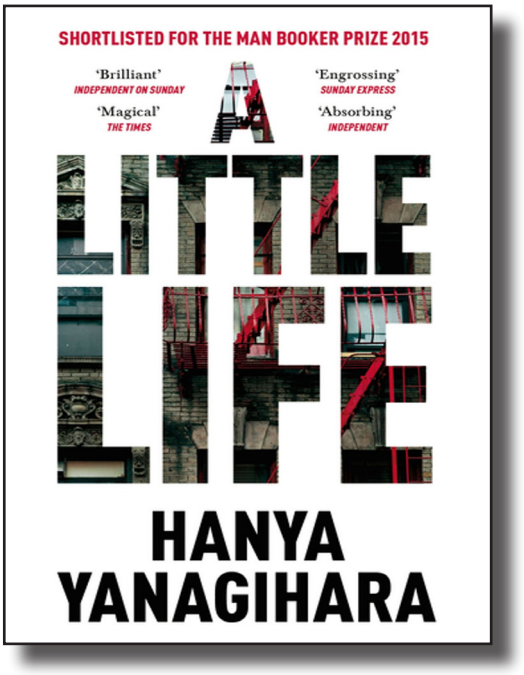
After a dust storm nearly kills him and forces his crew to evacuate while thinking him dead, Mark finds himself stranded and completely alone with no way to even signal Earth that he's alive - and even if he could get word out, his supplies would be gone long before a rescue could arrive.

The story follows Mark Watney through seemingly insurmountable obstacles as he tries to survive on Mars after being left for dead. Although he has many setbacks, he decides to never give up, even when he only has his own wit and skills to keep him going. This book is simply brilliant and although Mark faces some incredibly depressing situations, he always stays positive, lifting your own mood while you are reading. Although Andy Weir did not have any contact with NASA until after publication, the science actually (mostly) checks out. He even wrote a program to compute the orbital dynamics simulations! This book is the perfect read for this summer, positive, light and incredibly funny.

Michelle: The Woman in Black - Susan Hill

No summer bonfire is complete without an evening of classic ghost story telling, which makes you appreciate those long hours of sunlight even more. The Woman in Black written by Susan Hill in 1983 is one of those English ghost stories you can't miss, bringing you back to the roots of the classic gothic novel. In this book, you follow the young and naive solicitor Arthur Klipps who is sent on a journey to the superstitious little town Crythin Gifford to finalize the affairs of the recently deceased widow Alice Drablow. Locking himself and his companion dog Spider up in the deceased's mansion Eel Marsh House (I know, idea of the year right?), he slowly discovers its heartbreaking and horrifying past while experiencing terrifying encounters with a woman in black and other things that go bump in the night. Susan Hill's writing will have you at the edge of your seat every minute and might even have you throw the book to the other side of the room from time to time; I sure know I had to. Believe me, the chills you get by watching the movie adaption with Daniel Radcliff is not even a fraction of what you can experience by reading this book on a cloudy night with a plot leaving you breathless.





Maarten: A Little Life - Hanya Yanagihara

Our current predicament makes us yearn for any and all forms of escapism but be careful what you wish for. A Man Booker finalist, the book details the life of Jude, a young urban professional from New York City, and his group of friends. Hiding his trauma from the rest of the group Jude slowly descends down a rabbit hole of self-harming mental illness, and you will be there to be witness to it. With A Little Life Yanagihara presents a gut-wrenching study on pain, deeply ingrained trauma, and human relationships, that has more than once forced me to put the book down in order to catch my breath and suppress tears. Even so, I could not manage to keep my cheeks dry. A very high accolade for a book.

If you pick up this book, which I highly recommend you do, and read it cover to cover, you will truly live A Little Life, but not a happy one.

What to Watch?

Slowly but surely COVID restrictions are being lifted and more and more activities become available again. Nonetheless, acquiring a ticket to your favourite film or theatre show will remain a challenge as the amount of seats are limited. So if it's a rainy day, or if you are simply less inclined to partake in a sports activity outside, we have compiled some of our favourite films and series you could watch online.

Maarten: Ozark - Netflix

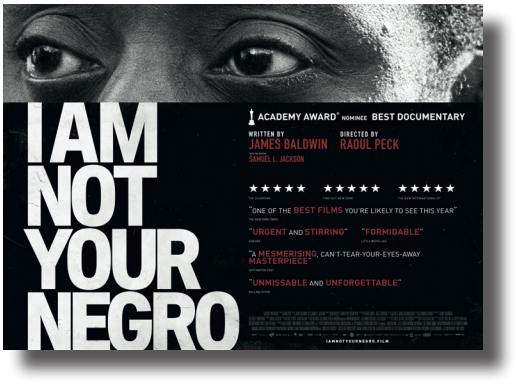
A perfectly quaint suburban family with a father in the financial sector and a mother that works in politics. Well... Financial sector... In reality he launders money for the Navarro cartel by means of chains consisting of shell companies in jurisdictions all over the world. This is a smoothly running business until his partners get executed right in front of his eyes for supposedly skimming money, forcing him to take his family to the lake of the Ozarks, a popular holiday destination in the U.S., ripe for laundering operations. Oh and politics? Turns out that is just professional bribery. Money, webs of lies, organized crime and funny family dynamics: this series has it all.

Maarten: I Am Not Your Negro - NPO start

People across the globe are protesting against racism, and the Black Lives Matter movement has taken the world by storm. This isn't a movement that has materialized out of thin air and finds its history in the American civil rights movement, which this film details. Based on an unfinished book by the brilliantly erudite James Baldwin, it displays what has and hasn't changed in the fight against racism in the U.S. and gives a deeply personal account of life under systemic racism. A film that is not for the faint of heart, but also one that educates and inspires. A must watch if you want to understand current race relations.

Nadav: After life - Netflix

When someone dies there are always people left behind. Some people are handling it better than others. In 'After Life' you meet Tony, whose life is turned upside down after his wife dies from breast cancer. He contemplates suicide, but instead decides to live long enough to punish the world for his wife's death by saying and doing whatever he wants. Although he thinks of this as his "superpower", his plan is undermined when everyone around him tries to make him a better person. This black comedy is really worth your time.



Myrthe: Snowpiercer (the series) - Netflix

After a too successful bid to cool the earth down, it is left a frozen wasteland. With outside temperatures as low as -100 °C , the last of humanity survives on a perpetually moving train. The train is divided into four classes, based on wealth and influence, with the worst conditions imposed on the 'tailies', the illegal inhabitants of the tail wagons who did not possess a ticket upon boarding. When mutilated bodies begin showing up in Third, a tailie former detective is promoted to train detective. With a murderer on the loose, countless secrets being unraveled and growing dissatisfaction about class separation and social injustice, this train becomes a powder keg, ready to explode. All aboard Snowpiercer, and may the Engine Eternal keep you alive.

Michelle: Merlin - Netflix

"In a land of myth and a time of magic, the destiny of a great kingdom rests on the shoulders of a young man; his name is Merlin." Sounds compelling, doesn't it? It is the first two introduction sentences of the series Merlin, which is indeed about the magic wizard that assists king Arthur of Camelot. But don't expect an old wizard with a long grey beard and a king with an already united kingdom. No, this series starts from the beginning, when Merlin is just touching upon his magical powers and assists prince Arthur as his head servant, while at the same time secretly protecting his future king from the evil forces within and outside of the kingdom. This series is the perfect combination of fantasy, adventure and enormous amount of laughter.

Michelle: The Haunting of Hill House

This series has been an enormous hit on Netflix and not without reason: not many paranormal series know how to establish well-rounded characters and a superb storyline keeping you guessing about the events until the end of the show. In The Haunting of Hill House you step into the life of the Crain siblings - Steven, Shirley, Theodora, Luke, and Eleanor (Nell) - and their father, 26 years after the terrible death of their mother in their former residence Hill House. Still traumatised by this event and other paranormal occurrences that happened in the house, the story unravels itself through flashbacks of the Crain family until everything comes together in the present. Or well, the present? This story highlights how time is a delicate concept and that not everything is as steadfast as it seems. While watching, don't forget to look for the hidden ghosts in every scene.

Chemistry vs. Hospitality Management

Michelle van Dongen

With our eyes already focused on the well-deserved summer holiday often accompanied by a trip to a hotel, restaurant or bar, we decided to visit a student familiar with the course of events in hospitality. This edition, we moved away from university life and interviewed a student of Hospitality Management at the Hospitality School in Amersfoort where they learn all the aspects of managing hospitality businesses (Dutch: horeca) such as hotels, restaurants and bars.

The Hospitality Management Student on Chemistry

First of all, what is your name and why do you study Hospitality Management?
N: "I'm Nanna Karelse and ever since I was twelve, I've wanted to work in hospitality related businesses, so I applied for this programme as soon as I had finished high school."

What do you think chemistry entails?
N: *5 minutes of silence* "I'm sorry, I really don't know. I know from you (Nanna and I are best friends) that you have practical labs and also courses in mathematics. So, you still follow courses just like I do. Do you still have language courses such as Dutch and English?" I told Nanna I don't "Oh, that's weird. Well, I guess I only know that you guys work in the lab with those strange test tubes and also partake in internships in the lab with research groups. Also, you do all this mathematical stuff."

Who is 'the' chemistry student?
N: "Definitely smart. Perhaps the chemistry student is also more focused on his/her education than for example a student of law. I think you guys are a bit more serious and don't join student associations (Korps, studentenverenigingen) that often. You are more serious and I believe also more motivated with really a goal in sight to work towards. I have the feeling that in other studies people choose the programme more with their sights on making money. Speaking of physique, the chemistry student is probably just your common Dutch man/woman."

How do chemistry students overestimate themselves?
N: "I think that you, as chemist students, receive such specific training that you will be able to do everything within your branch itself on an adequate level. I don't really believe you guys overestimate yourselves in the sense that you think that you can carry out all the tasks efficiently in for example health care or the hospitality business. You guys know what you can do and what you can't."

What are Hospitality Management students better at than chemistry students?
N: "Entrepreneurship, because our whole study revolves around it. We learn how to manage every sector in the hospitality branch from restaurants/hotels to big events such as festivals. We make these skills our own by partaking in every aspect of it, so we learn how to run a kitchen, how to manage reservations at a restaurant/hotel etc. We have to draw up business, operational and budget plans. I also believe we are better at serving guests, in remaining hospitable, as this is an intricate part of our programme. We might also be better at multitasking, but I believe you guys can do this as well, just in a different way."

What are chemistry students better at?
N: "Well, studying obviously. I'm not of studious nature and I know half the people in my class aren't as well. I also believe you are better in English and Dutch."

What do chemists do all day?
N: "I guess studying and working in the lab hahaha. I think your day looks rather similar to ours, but just involves a lot more self-study time with your nose in the books. We can rarely be found studying, but rather spend more time in the workplace."

The Chemistry student on Hospitality Management

What is your name and why do you study chemistry?
S: "My name is Siebe Lekanne Deprez and I study chemistry, because I always was and still am interested in why things are the way they are and how they work, especially on the molecular/particles level. I love to sink my teeth into these kinds of questions. It is very fun to think about and at the same time you learn about how the world works."

What do you think Hospitality Management entails?
S: "When I think of Hospitality management, I think of learning how things work in a hotel, partaking in every aspect of it. You learn how to receive guests and make reservations as a desk clerk, but you also learn how to manage a restaurant and know what the cleaning of such a business entails. You mainly learn, I believe, about properly serving your guests, about the correct practices of hospitality."

Who is 'the' Hospitality Management student?
S: "I think a Hospitality Management student is calm of nature and likes to work with people. I don't dare to say anything about gender or their preference of work experience over theory, as I believe this might differ per person. I do believe that these students are good at keeping an overview of the situations and have the capacity to deal with annoying guests. They have to know how to keep their calm in such a situation."

How do Hospitality Management students overestimate themselves?
S: "Perhaps they overestimate themselves in their people managing skills, but I don't want to draw any hard conclusions. They might extend their managing skills to their own household, suddenly seeing this place also as a hotel and start ordering people around."

What are they better at than chemistry students?
S: "Being polite. I think we as chemists can be pretty direct. If something is not right, you will hear it. I think Hospitality Managements students are a bit more down to earth regarding this respect and watch out for directness. They might find the 'people aspect' more important than the discussion."

What are chemistry students better at?
S: "Cleaning. If you're in the lab, you must know how to clean and plan your lab day, since you can't leave the lab before everything is nice and tidy again."

What do Hospitality Management students do all day?
S: "I'm actually more curious about what they don't have to do in a day, as it seems really busy. I believe they take on different internships of hotel life and learn how to manage every facet of it. It probably takes up a lot of their time and I do hope these internships give them a lot of energy back."

Smaakmatrix

Inspired by the Parool

Scientific

Sangria-related

Horrible

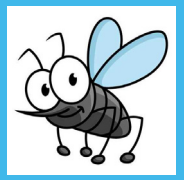
Brilliant

- The lack of common knowledge and basic understanding of science in the USA
- This bottle

- Online meetings and lectures

zoom Video Communications

- Mosquitos and stupid mosquito bites



- No more awkward handshakes or physical greetings

- Lukewarm drinks on a hot summer day
- Cool drinks on a hot summer day