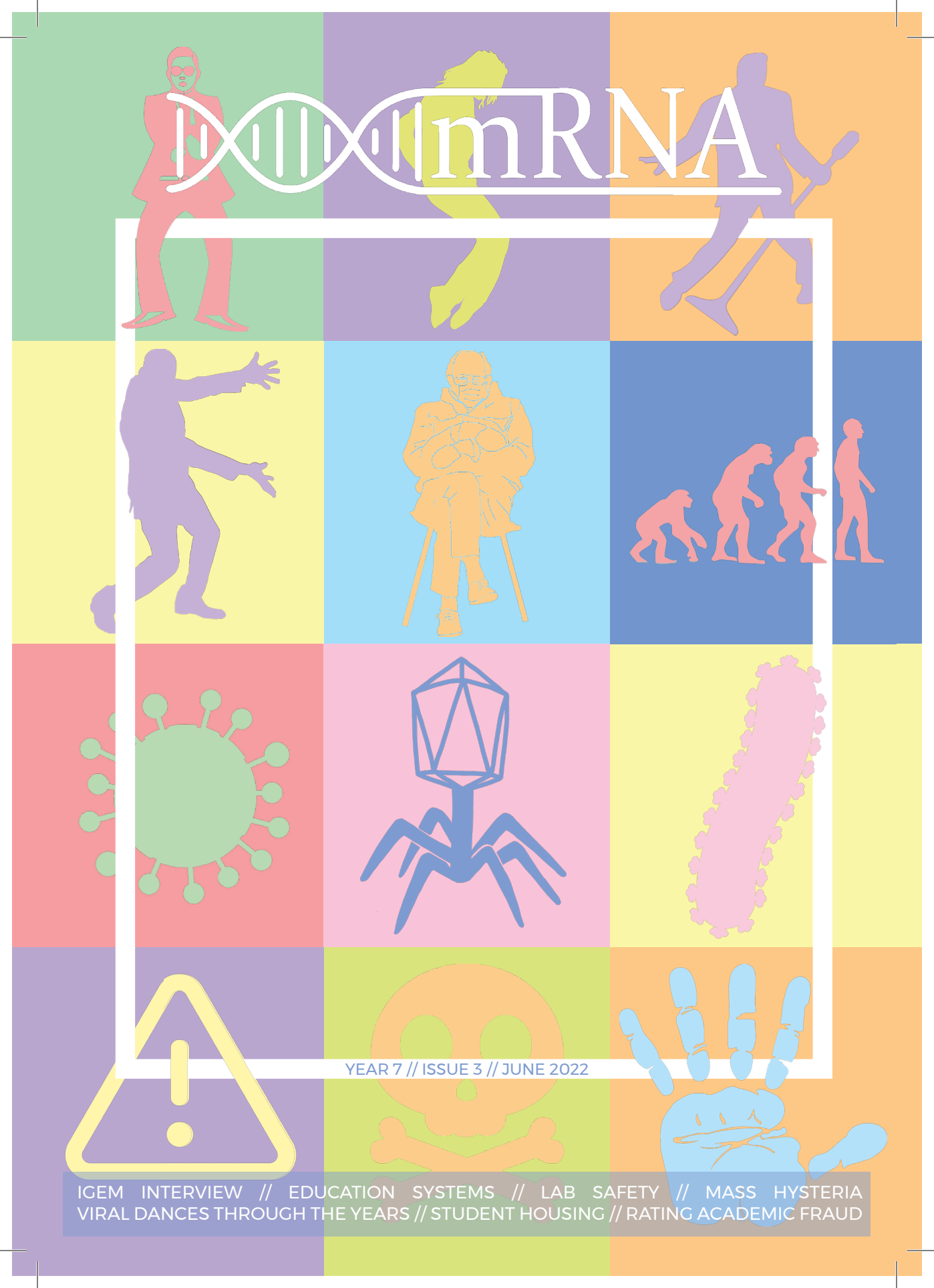
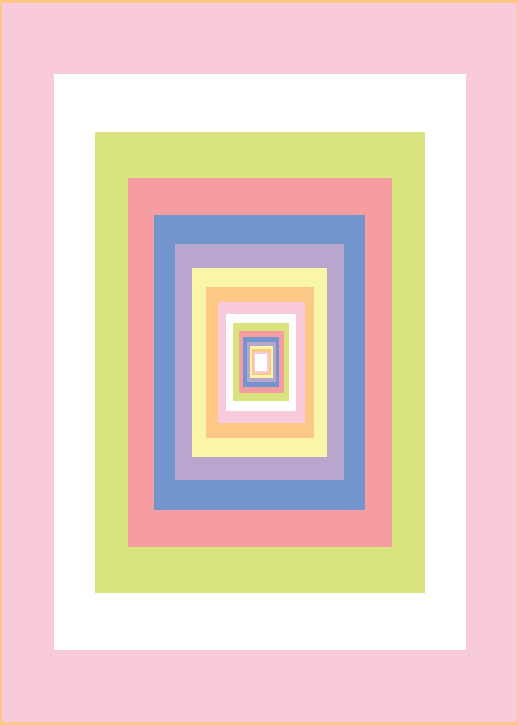


YEAR 7 // ISSUE 3 // JUNE 2022

IGEM INTERVIEW // EDUCATION SYSTEMS // LAB SAFETY // MASS HYSTERIA
VIRAL DANCES THROUGH THE YEARS // STUDENT HOUSING // RATING ACADEMIC FRAUD



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EDITORIAL

FINN VAN DEN BRINK

Dear reader,

A gentle, salty sea breeze through your hair, the slow swinging of your hammock, and the tender warmth of the evening sun on your skin remind you it is that terrific time of the year again: summer. As the soothing rhythm of the waves slowly but surely erases all the knowledge you gained last academic year, this fresh new mRNA is more than willing to fill these gaps in your brain with much more useful information, from the creation of mass hysteria to the rating of academic fraud.

As the coronavirus is finally under control in most regions of the world, this summer promises to be a memorable one. In this edition we will take a closer look at other viruses. For example, you can read about the different biosafety levels of labs handling pathogens. We will also dive into even more contagious hazards, like TikTok dances and memes. I personally have very fond memories of doing the Gangnam style in a recorded flash mob in primary school, which can unfortunately still be found in some dark corner of the internet. On top of all viral related topics, you can also read about the student housing crisis, an enormous telescope, and much more.

As is customary, mRNA is mutating like soft skin in the absence of sun cream. Kelly and Josephine have been a great addition to our team and roles have been redistributed, which is why you must look at my face right now (do not worry, this edition is filled with beautiful pictures of viruses as compensation). As it is the last edition for many of us, we did everything we could to make it one to remember. We hope it goes viral.

Enjoy reading and all the best,

Finn van den Brink
Editor-in-chief of mRNA 6

FROM THE BOARD
TOM DE LAAT

Dear members,

In your hands, you have the last mRNA of this academic year. The summer break is finally here after a last quarter filled with exam stress, BEP / MEP presentations and a lot of Hooke activities. As this is already my last 'From the Board' as your president, I think it is a great time to look back on the year we have had.

We started off strong with a lot of lunch lectures, a symposium and drinks in Bar het Lab, right up to our Dies week. Then our lives were once again disrupted by a virus that shall not be named. Even though we ended up in another lockdown, I saw many of you finding ways to adapt to the situation once again. Luckily, this situation didn't last for the entire year and in February we got to go back to Gran Canaria again for a wonderful week of surfing. With all the postponed activities, we experienced a busy couple of months. A Dies party, the Gala, rally weekend, and many more activities, all organised by enthusiastic committees that I would like to thank for their dedication. Despite the interruption of that certain virus, we had an amazing year. A year in which I hope we got to bring our members together, improved your career perspectives and of course your education.

In this mRNA, you will read a lot more about other viruses. The committee made another beautiful edition for you again, and I would like to thank them for all the wonderful editions they made this year. I hope you enjoy reading it!

I have spoken.

Tom de Laat

President of S.V.N.B. Hooke 2021-2022

FOLLOW-UP WITH A FIRST YEAR
INTERVIEW

To round out our coverage of the first-year Nanobiology experience, we interviewed Francisco Pinto about his thoughts on the programme after his first year. Hailing from a small Portuguese village, Francisco has taken quite a journey to end up in Delft.

Do you have any comments in general about Nanobiology?

I do have to say, I am really satisfied with it. Initially, I had quite high expectations when I heard it will be more research related and with a mix of everything: physics, biology, maths and even programming. In the end, it lived up to and exceeded my expectations, because I was not expecting them to give us such a strong background in how to do research.

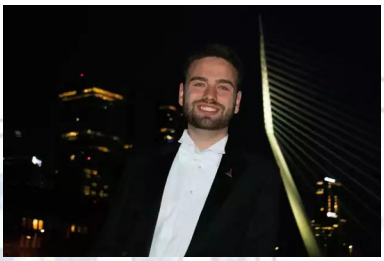
Are there any particular courses that you've enjoyed this year?

Ah, Biophysics was nice. The programming not so much, but the actual Biophysics, starting to explain the relationship between physics and biology, which I found most interesting, was amazing. Also the Analysis courses were great, mostly thanks to Fokko.

Have you had any culture shock moments?

Oh, yes. I don't know where to start. Food: why don't you have lunch? That's it. Also, Dutch toilets. Really? Why is the water in the front? What is the purpose of that? It makes no sense at all.

Source (background): Wikimedia Commons



Do you cycle? How do you feel about cycling here?

It's a radical sport. I mean, it requires concentration, it requires bravery. Please do not crash into cars. I made that mistake. Sometimes the owners of the cars are angry, especially when they realise you hit their car. That was my first morning in the Netherlands.

Lastly, the most important question: have you been to a borrel?

I haven't been to that many borrels or cantuses, only like three or so a week. But they feel nice. In general, borrels are always very nice experiences. You have drinks, you have beer. So, just for that, already a point. And sometimes you can get to meet new people there, or chat with the ones you already know. I also advise you to go to two borrels in different places. For example, during my first exam week, between my first Analysis exam and the Introduction to Nanobiology final project, I decided to take my chance to go to Groningen for a cantus, and I recommend it. It was a really nice evening. The way back was not that nice though, especially since I had to present without sleeping, but those are the small sacrifices one has to make; just make sure that you find a little time to study.

BIOSAFETY LEVELS
VIRAL CONTENT

If you are like me, then you also feel the strange draw towards the deadly and dangerous aspects of biology (much to the concern of our non-scientific parents, who think a lab disaster is moments away). As a Nanobiology student, some of you find your way into labs which study and manipulate viruses, bacteria, or other harmful pathogens. But how many labs are out there, and what specifically do they study? In Labcourse, we learn the basics about biosafety (BSL) and microbiology laboratory (ML) labs, but this article will delve a bit deeper into the different levels, what they entail, and most importantly, how (not) to go viral.

I've heard of BSL and ML levels, what is the difference?

The World Health Organization (WHO) recommends, and most countries (including the USA, EU, Canada, etc.) use some version of a four-part biosafety system, usually with Level 4 being the highest. For clarity and the sake of international cooperation, we will be investigating BSL labs, which seem to be the most widespread classification. It seems that 'ML' labs are a term used only by the Dutch, but hold relatively similar meanings and ranking.

What does one study in each of these biosafety levels, and what are some basic preventative measures needed?

BSL-1: Here, agents and toxins that are not typically known to infect people are studied. There are no BSL-1 specific requirements, aside from basic lab hygiene rules, called the Standard Microbiological Practices.

BSL-2: This is where it starts to get interesting - for something to qualify as a Level 2 agent / toxin, it poses a risk if it is inhaled, swallowed, or comes into contact with the skin, such as HIV. Safety requirements begin to take prevalence; researchers must work under a laminar flow hood, in which everything that passes in or out must be thoroughly sterilised (meaning a lot of ethanol spraying on your hands). Gloves and lab coats are mandatory, as well as hand washing, eye washing stations, and doors that automatically shut and lock. Some form of sample destroyer, be it an incinerator or autoclave, must also be on hand.

BSL-3: Agents qualifiable for BSL-3 are ones that can cause potentially lethal infections and are transmissible via air, one such example being the bacteria that causes tuberculosis. BSL-3 safety requirements build off of BSL-2; not only is typical personal protective equipment (PPE) needed, but wraparound gowns (and potentially respirators) are necessary. Airflow is key; biosafety cabinets have constant directional airflow with safety filters, and the lab must be separated from the entrance hallway by multiple doors, with the flow of air always leading into the lab. This is the highest BSL level that Erasmus MC has, and is in fact one of the largest BSL-3 labs in the world, and the only one in the Netherlands. The video celebrating the construction of this project can be found on the next page, where you can also see Marion

Koopmans sitting in front of a massive wall of what look to be safety crocs.

BSL-4: This is the highest level of biosafety, and the rarest. According to an (incomplete) list on Wikipedia, there are 62 BSL-4 facilities worldwide. Why is this list incomplete? It is unclear whether this is unintentional, but the imagination sparks the idea of X-Files-esque clandestine facilities operating on aliens. And in fact, BSL-4 labs are used to study those diseases which are not yet identified, and in theory should be used to study extraterrestrial samples that are potentially biohazardous. However under normal circumstances, BSL-4 labs focus on aerosol-transmitted agents with high risk of infection, for which there is no treatment (hemorrhagic viruses such as ebola). BSL-4 safety isolation and safety restrictions are so complex, they usually have their own dedicated building. BSL-4 labs come in different categories, each with their own specific protocols.

Sounds fun! How can I work in these labs?

Whoa there, hold your equine influenza! There are (expectedly) lots of checks and certifications that go into working in a BSL-2 or higher lab. For BSL-2, it seems each institution / country has their own particular checks, but on higher levels this seems to be more uniform, and in line with NIH, CDC, and WHO guidelines.

Luckily if you are interested in working in a high biosafety level lab, and unfortunately if you are a human being, new and old pathogens are (re)appearing with great frequency. This is a symptom of increasing international travel and trade, climate change, and further encroachment onto animal habitats. This also means there is a corresponding greater demand for scientists who can work in high level BSL labs, so wash your hands and get back to your studies!

Erasmus MC's release video of their BSL-3 lab

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https://absa.org/lab-accred/
https://www.safetytraining.nih.gov/default.aspx?m=Please-Log-In
https://www.who.int/publications/i/item/9789240011311

Source (background): Wikimedia Commons

VIRAL DANCES THROUGH THE YEARS
VIRAL CONTENT

What is viral content? Perhaps the better question is what makes online content go viral? Generally, content that evokes a strong emotional response tends to go viral. A special brand of viral content are dances, something that is extremely prevalent nowadays with the rise of social media platforms like TikTok. How many viral dances over the years can you remember?

I think the first dance that comes to my mind would be *Gangnam Style*. The song and its accompanying dance was wildly popular for a while. What makes this song so funny? According to music researcher Steen Kaargaard Nielsen from Aarhus University, western countries enjoy the music but more importantly the music video because it defies cultural conventions. The *Gangnam Style* video emulates pop culture but also displays an unfamiliar layer.

Not too long after *Gangnam Style*'s release in 2012, another dance went viral: *The Harlem Shake*! Throughout 2013, people uploaded their version of the *Harlem Shake* even though the original version was released in 1981 by dancer Al B.

A more recent example of a viral dance craze is the whip and the nae nae. This dance originated in Atlanta, Georgia. However, due to Silento's music video of *Watch Me* in 2015, this dance move spread all over the world.

Source: Flickr


Source: Wikimedia Commons

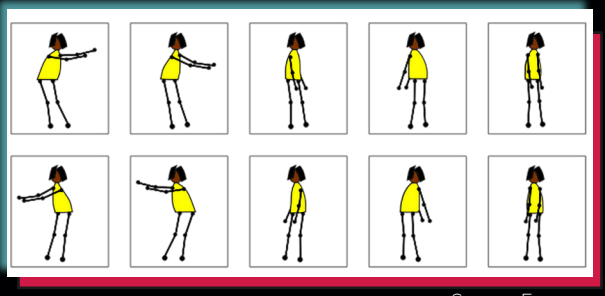

Source: Wikimedia Commons

And who could forget the infamous flossing! It went viral after an appearance of Katy Perry on *Saturday Night Live*, where a then 14-year-old Russell Horning debuted it in his performance to the singer's song called '*Swish Swish*'. Among others like the *Best Mates* or *Flapper,* it belongs to a family of dances popularised by *Fortnite*. For the unpermitted use of such dances, the studio behind *Fortnite* has been subject to several copyright lawsuits.

With the rise of social media and in particular platforms such as TikTok, dance crazes have been all around. However, these are not necessarily a new phenomenon. Dance crazes have existed for years before social media. Some dances we might now refer to as classic or timeless actually gained popularity in a way similar to the dances described above, such as the salsa, but also dance moves such as the robot or the running man dance.

As the popularity of these dances increases and social media is more often used as an advertising platform, the questions arise: Who gets the credit for these dance trends? Can you get paid for coming up with a viral dance move? In the Netflix documentary *Explained: Dance Crazes,* this subject is thoroughly discussed. Giving credit on social media is ingrained in the platforms, almost every post has an @... in the description. However, as influencers copied the viral content and used it to sell their image, this credit was lost.

Here is another dance craze you might have heard about:



Source: Freesvg

Source: Pixabay

Why is it important to assign credit to these dances? This is due to the way TikTok works: when people are credited for their work, more users will visit their page, and the odds of their content going viral skyrockets. A high follower count opens doors to sponsor deals and mainstream fame, allowing a TikTok account to be monetised. TikTok has over 800 million active users who use the app an average of 52 minutes per day, so this can amount to a lot of money!

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THE STUDENT HOUSING CRISIS
IN THE FIELD

Source: Pixabay

Did you know that the Netherlands is the most densely populated country in the European Union? And that Delft is the sixth most populous municipality in the Netherlands? Based on these facts, it is not that surprising that it is quite a challenge to find a place to live.

Student housing in Delft has always been a major issue. This is largely due to the fact that proportionally, so many of the inhabitants of Delft are students. Combine this with the growing number of students each year and it becomes a crisis of astronomical proportions. This number will only increase in the upcoming years. Perhaps you have some first-hand experience with this yourself. Perhaps you do not feel like moving out from your parent's house just yet. Looking for a room can be quite daunting. Firstly, you have so many decisions to make. Do you want to live with roommates? If yes, how many? Others include: if you would prefer to live in Delft or in Rotterdam, or if your roommates would be the same gender or a mixed group. Once you have figured out what you want, you can start applying for houses.

Because the need for rooms is so high, student houses can be quite picky in deciding whom they invite or not, and essentially in whom they accept as their new roommate. This often makes it much harder for international students to find a room. TU Delft supplies some housing, but their contracts are for a maximum of one year and they supply nowhere near enough for all new international students starting their studies each year. As more and more international students are accepted by TU Delft, the responsibility for providing these students with proper living arrangements falls more and more on the university. This dilemma was also a hot topic in the previous municipal elections, as the housing shortage extends to non-students.

One reason why not enough student accommodations are built is due to subsidies provided by the government. Currently, the government subsidises studios, but no shared living spaces. Therefore, any new student accommodations that are built tend to be studios, even while a survey by TU Delta showed that students prefer to live in shared accommodations rather than on their own. Luckily, there are also many initiatives starting to battle the housing crisis, such as the local-to-global project on the housing crisis in Rotterdam, focused on international students.

In Delft, the SHS has a board of five TU Delft students working full time on transforming empty office buildings into student accommodations. SHS stands for "Stichting Herontwikkeling tot Studentenhuisvesting" which translates to "foundation for redevelopment into student housing". They are a non-profit organisation founded in 2011 to solve two major problems within Delft: vacancy and affordable student accommodation. Besides that, their mission is to tackle other current issues; for one of their projects, they worked with lonely elders in a care facility, renovating it for students to also live there and keep the elders company. As their website states, the SHS has currently completed four projects, creating 420 new living units.

Since more and more students are expected to start studying in Delft in the upcoming years, innovative initiatives such as the SHS can provide part of the solution to the housing shortage.

VIOLETTE DEFOURT: FROM DREAM TEAM TO STARTUP

INTERVIEW

Every year, students from all over the world work on a synthetic biology project in the iGEM (international Genetically Engineered Machine) competition, where creative ideas are transformed into fully integrated projects. These projects not only focus on the science, but also integrate other aspects as well, such as entrepreneurship, sustainability, inclusivity, and human practices. Some of these projects are so full of potential, they can become something more than "just" an iGEM project.

The iGEM project called Rapidemic from the Leiden 2020 iGEM team was one such project, where the team members recognised its potential. Their project, creating a rapid, point-of-care DNA / RNA sensor for diagnostic purposes in epidemics, won them several awards and the Grand Prize in 2020, and has now evolved into a startup.

The iGEM competition is a worldwide synthetic biology competition. The teams are free to choose their own project and try to build and design biological systems, which they will work with in laboratories over the summer.

Source: igem.org

Violette Defourt
BSc Maastricht Science Program
Science-based business minor
MSc Biomedical Sciences Leiden

Violette Defourt, one of the members of the Leiden team and now CEO of the startup Rapidemic, told us all about her journey from participating as a student in iGEM to working as the CEO of the startup that originated from their iGEM project.

Violette's story

I remember, before participating in iGEM, I was a little culture-shocked at the beginning of my master's in Leiden. The study was very intense and specific, digging deep into research and studies, and not as creative as I had hoped. I really needed another challenge, so I was looking for opportunities. I ended up at one of the iGEM info sessions. I thought to myself: Why not apply? Why not go to the interview? Then I received the letter that I got into the team. From the first meeting on, I already thought it was cool. It was precisely what I love about science: it's interdisciplinary, and integrated, but it's also human. I like the person-to-person interaction around the scientific question. It was the kind of

project I go for 100%. It might actually also have been the reason I was able to finish my master's, although at some point the project might have even become more important to me than my master's.

The project also fit my personality well. I liked being creative and thinking about shaping a project. When we were brainstorming in subteams, one of my team members came up with the idea of making a DNA / RNA sensor. I could see this idea coming together with my personal interest, the human side of biology, and I became super passionate about it. We then thought about turning it into a diagnostic device, and that is when I started to push for this idea with the team. I was really excited about how the project was taking shape and it was also a pretty relevant moment to do so, going into that niche of infectious diseases. I also liked the molecular biology techniques, I liked the field of innovation in diagnostics of infectious diseases, and I liked that it was solving an important problem and providing a solution to that problem. And in the end, the project did turn out quite nicely!

"...when you're together you can find a way to make it work."

Eventually, in the corona year, I was very open to what was next. I had no plans for after my master's and I didn't have another field of science that I particularly wanted to focus on, so I wanted to continue with the project. Had I had an entirely different plan already, perhaps I would not have done this. Also, I wasn't alone. There were two other people from the team who were willing to continue with the project. That really helped, because when you're together you can find a way to make it work. At the end of iGEM we had some conversations with the team who wanted to continue with the project, but the words "startup" almost never truly came up. Eventually, this concept took shape as we went forward, but it surely didn't start by asking: "who wants to make this a multi-billion company?". You take it as it goes and it takes shape as you move forward.

"I do always like to say that the idea was created during iGEM."

After the iGEM competition, we participated in the *after iGEM* track. It had an entrepreneurship track, which was like a bootcamp. You got assigned a coach, and received the opportunity to pitch and meet investors. When you win in iGEM, you win a fantastic sign of approval, but that's it. If teams were given more means, whether that's access to a network, vouchers or prize money, teams might be much more incentivised to continue their project, as there are so many good ideas! With this new entrepreneurship track, they are trying to improve this. As iGEM is an international community, the bootcamp is online. Because of this, it's hard to feel very close to the community. But I do notice that whenever I share something on LinkedIn from the company, there is always someone from iGEM that picks it up, shares it, and is supportive of any iGEM initiative that still exists today. Even though many things changed from the original iGEM project, we still somehow always have a link with iGEM. I do always like to say that the idea was created during iGEM, and of course also the name!

The old logo of the iGEM 2020 team Rapidemic

Source: 2020.igem.com/Leiden

Now, however, it doesn't look at all as it used to in iGEM. We still use the RPA (Recombinase Polymerase Amplification) technique, but the rest has changed quite a bit. I've also had to adjust to and evolve with the company's needs. I started off spending a lot of time in the lab, but I felt I was wasting my time there. I needed someone else doing the lab work so I could focus on developing the company together with my other team members.

"Someone once said that the CEO in fact stands for Chief Everything Officer, and that resonates."

Today, that's where the majority of my time is spent. I'm ensuring that everyone in the team has everything they need to operate optimally. I'm an all-round employee now. Someone once said that the CEO in fact stands for Chief Everything Officer, and that resonates. You have to do legal matters, create your team, ensure that the contracts are right, that you're treating people fairly and pay them what they deserve. Also, the lab needs to be fully equipped, the accountancy should be right, and money should be getting into the company. It's really a bit of everything.

"There is no one above you who will tell you if you're doing a good job or not, so you need to find feedback somehow."

To deal with all of this, we have surrounded ourselves with bright people with experience, such as a lawyer, or someone who is in the same industry, but just five years further. They are a tremendous help. Of course, you have to build that network, and I had to build it from scratch. Places like "PLNT Leiden" or the "Unlock" incubator, that support starting entrepreneurs, are a really great way to catalyse those relationships. Secondly, you have to realise that the first time you do everything it's going to be slow and it's going to be bad, and you have to be okay with that. It's trial and error and you have to go through that learning phase, so you will mess up. You will have to remind yourself that it's fine to do so and ask for help. There is no one above you who will tell you if you're doing a good job or not, so you need to find feedback somehow.

Rapidemic aims to bring its first product to the market in the near future. Right now the field that we're looking at is that of sexually transmitted infections. We're building a business and are adjusting the product for it. Eventually we want to get our product fully approved and on the market and try to push it to the field of point-of-care diagnostics in Western Europe. We can then scale up in two ways, one is by entering in different markets in terms of different diseases or maybe even antimicrobial resistance susceptibility testing, although that is still an idea at this point, another is by entering other geographical markets, so by selling also in other continents, such as North America, or Africa.

The new logo of the startup Rapidemic

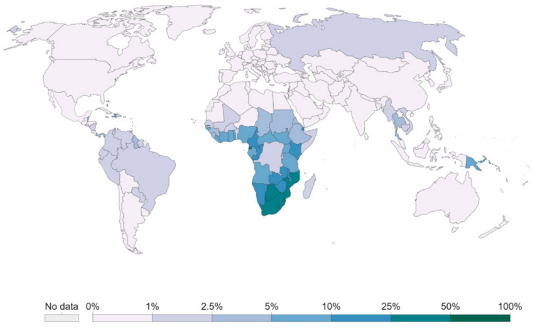
Are you interested in doing an internship at Rapidemic? Contact them via: violette@rapidemic.com.

HIV: THE HIDDEN VIRUS

VIRAL CONTENT

Human Immunodeficiency Virus (HIV) is one of the deadliest viruses worldwide today, especially in developing countries. 38 million people currently live with the virus, and the disease has caused an estimated 33 million deaths worldwide. There is no way to be cured completely, the only option available is inhibiting medicine, which has to be taken for the rest of your life. This can be a great financial burden on those infected, if they can even get the treatment at all. Sub-Saharan African countries in particular continue to struggle to provide the medicine, causing Acquired Immunodeficiency Syndrome (AIDS) to be the leading cause of death there. Luckily, a lot of progress is being made: over the last decade the number of deaths caused by AIDS worldwide has been halved, due to the antiretroviral treatment slowly becoming more and more accessible to most people. How did HIV emerge in the first place and why did it take so long to get research going? What do we know now and how does current medicine work?

Share of deaths from HIV/Aids in 2019



Source: ourworldindata.org

Early discovery

As the virus slowly spread around the world unseen in the eighties, doctors were flabbergasted when lots of otherwise healthy young men were infected with very rare diseases, ranging from obscure fungal infections to virally induced cancers. The connection was not clear yet, only that a lethal disease spread primarily among the gay community and some drug users. As the transmission method was still unknown, discrimination against these groups increased enormously, to the point where families abandoned their children. The virus even became known as the "gay cancer".

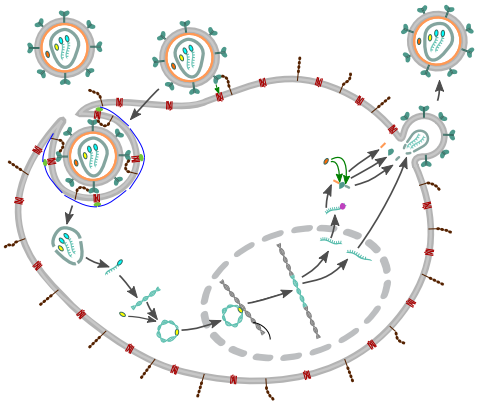
*= Pre-exposure prophylaxis

Sources:
Chimp: Pixabay
Pills: Publicdomainvectors
Shield: iStock

All this prejudice led to funding problems and severely slowed the research process. If you want to know more about the social impact of this epidemic in its early years, I strongly recommend the *This Podcast Will Kill You* episode about HIV.

Life cycle

More and more became known over the years, leading to this specific information we have now: HIV is a retrovirus that infects immune cells, which normally coordinate the immune response upon contact with an outside agent. HIV completely shuts this defence down. It does so in a very sly manner: first, it merges itself to the immune cell, and injects its mRNA into the cell, where it is eventually incorporated as DNA into the host's genome, and becomes effectively invisible. This DNA can remain dormant and undetected for days, months, or years. But when transcription begins, a new viral protein envelope and genome are assembled and go on to infect other cells, killing the host cell in the process. If the disease is not treated soon enough, this accumulation of infected immune cells will severely impair the immune system and lead to AIDS.



Source: scistyle

Current medicine

There are many different types of HIV medicine which all have one thing in common: they stop the virus from spreading to other cells. Every different type targets another phase of the viral life cycle; ranging from blocking attachment receptors to preventing the viral DNA to get incorporated, or even preventing that the RNA can be transcribed in the first place. To achieve the best result possible, multiple types of medicine are combined in one cure. This treatment works like a charm and completely stops the replication of HIV inside one's body, giving the body time to create more healthy immune cells. These destroy almost all active HIV cells. Even so, the dormant HIV cells still form a great danger; they cause a big relapse when drugs are not taken. This means the combination of drugs should be taken for the rest of the patient's life, causing financial burden and side effects.

Future research

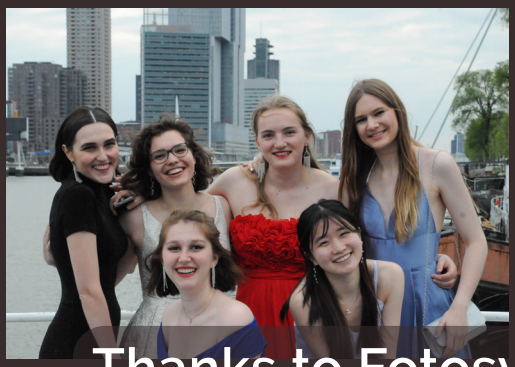
One strategy to solve this issue is the "shock and kill" approach: activating the dormant HIV cells, while drugs stop new infections and destroy the activated cells. *In vitro* studies seemed successful, but *in vivo* results were not great. This was caused by multiple problems: not all dormant cells could be activated and some defective virus cells distracted the immune system by creating proteins.

This year, the National Institute of Health also started a clinical trial testing three mRNA vaccines. Each encodes a different spike protein that is usually used to enter host cells. More research is on its way, and hopefully a cure is found in our generation.

Sources: https://scienceofhiv.org/wp/life-cycle/
https://www.verywellhealth.com/what-are-antiretrovirals-and-how-do-they-work-49639
Pace, M., & Frater, J. (2019). Curing HIV by 'kick and kill': from theory to practice? Expert Review of Anti-infective Therapy, 17(6), 383–386.
Ho, Y. C., et allis (2013). Replication-Competent Noninduced Proviruses in the Latent Reservoir Increase Barrier to HIV-1 Cure. Cell, 155(3), 540–551.







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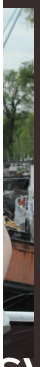



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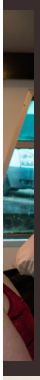






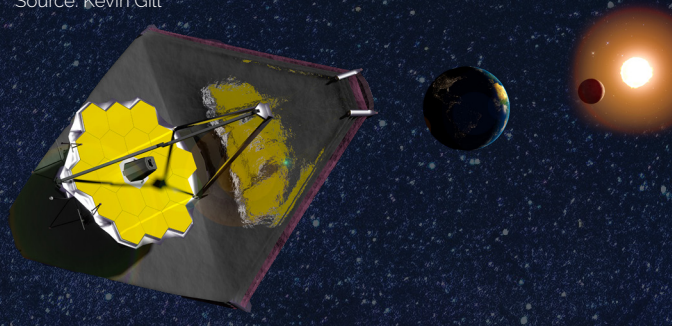
JAMES WEBB SPACE TELESCOPE
GIGANEWS

What did the universe look like in its earliest years? How did galaxies evolve? How did planetary systems form, and how did life on Earth start? NASA researchers hope to answer these and many other fundamental questions about our universe and life itself. The newly launched James Webb Space Telescope (JWST) has the potential to lead to great insights to these questions.

On December 25th, 2021, the JWST was successfully launched into space. Since then, it has travelled an incredible 1.5 million kilometres from Earth to the Lagrange Point L2. This is a point in space, directly behind the Earth with respect to the sun, where it will move with the same period as the Earth. As it orbits this point, it will observe the universe and our humble little solar system in a large range of infrared light. In space, it will not have to deal with the interference of dust particles in the atmosphere like telescopes here on Earth. The dust particles scatter the light before it enters a telescope, resulting in noise. The resolution of this telescope is therefore not limited by this interference but only by its mirror size, which is a whopping 6.5 metres. However, before this immense apparatus could start imaging our universe, it still had some quite challenging tasks after launch.

After finally arriving at L2, the telescope first had to unfold its compactly folded sunshield, then its secondary mirrors. Lastly, it had to unfurl its beautiful golden-plated wings, made from 18 hexagonal mirrors, and align these mirrors properly. Not an easy task, as it took almost three months before it had correctly aligned

Source: Kevin Gill



JWST on its Lagrange point directly behind the earth, shielded from the sun by its sunshield

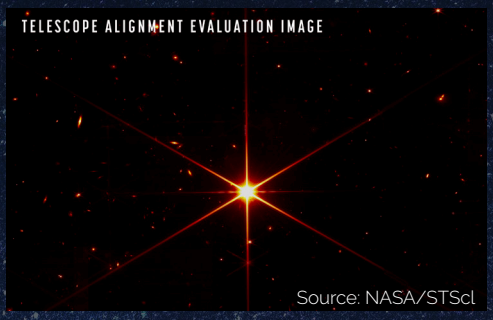
everything. Each hexagonal mirror, in a sense, acts as a separate telescope.

So at first, when the telescope was pointed at a known star, 18 different points of light could be visualised. Each point was allocated to the mirror it belonged to, focused, and aligned in such a way that together they all formed one image. A "selfie" camera helped this alignment process, eventually showing all 18 mirrors being lit in unison by one star.

Source: NASA/STScI

Alignment was not the only challenging task for the JWST, it also had to cool down to a temperature close to 0 Kelvin. Otherwise its own heat, which

is also infrared radiation, would interfere with its measurements. With both passive cooling by its sunshield and active cooling by its cryocooler, it has after 3.5 months finally reached sufficiently low temperatures.



All our patience has been rewarded. After several months of waiting, the JWST has delivered stunning, crisp images of the universe in the infra-red range. However, taking pretty pictures is not Webb's only skill. The JWST contains four powerful optics and spectroscopy instruments, each with different imaging capabilities. Together they have 17 modes of operation, such as coronagraphy, imaging in different ranges of infra-red and several forms of spectroscopy. All of these modes have to be checked and verified one by one. Then, with the JWST's sensitivity to infrared light we can observe incredible far away stars. The light of these stars is shifted to the near- and mid-infrared range and has travelled for so long that once it is observed by the JWST it will be the first look upon the early universe.

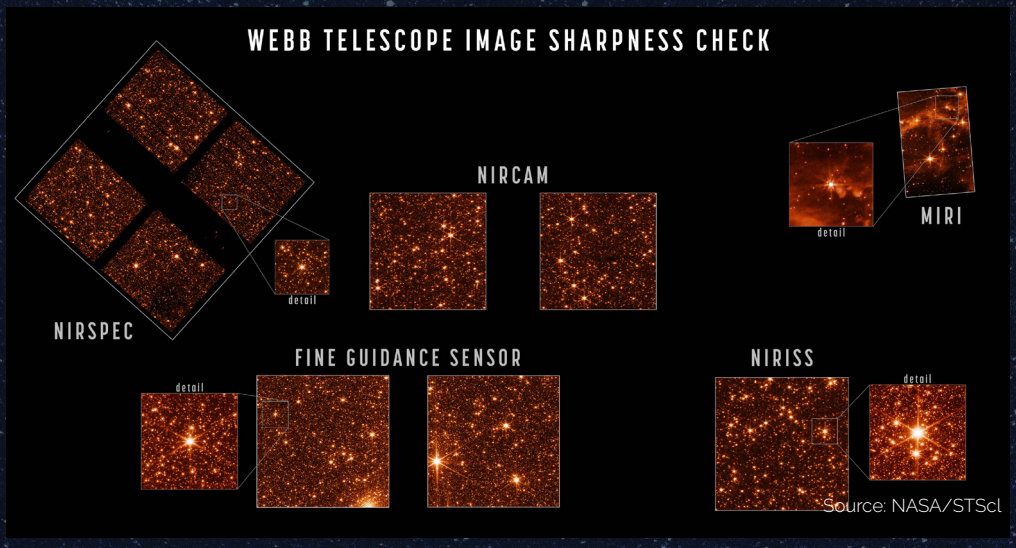
Although there are still some steps to be taken, the team is in the last stages of preparation before the JWST can start its first science observations this summer. Soon, the JWST will hopefully provide us with insightful data about our universe. Who knows, maybe these insights on the larger scale might also help us understand the universe on a nanoscale.

Sources:

https://www.space.com/news/live/james-webb-space-telescope-updates

https://www.nasa.gov/press-release/nasa-s-webb-reaches-alignment-milestone-optics-working-successfully

https://www.jwst.nasa.gov/index.html



Images created by the different optical instruments on the JWST, demonstrating the high resolution of the telescope.

HOW TO CREATE MASS HYSTERIA

VIRAL CONTENT

Do you suffer from MPI? Probably not. MPI stands for mass psychogenic illness, also called mass hysteria. It is a condition where symptoms spread rapidly in a population without an actual infection taking place. Originating from the nervous system, the patient recreates the metabolic signs of someone else's actual disease, usually in situations with high anxiety levels. Due to its special nature, it is hard to research. The literal way of diagnosing MPI is "Well I can't find anything, so let's call this MPI!" We will now present a guide on how to create your own case of this mysterious disease.

1. Find a high-pressure environment

MPI appeared throughout history in workplaces, schools, churches, and other crowded and high-pressure environments. It provides the necessary breeding ground for anxiety, leading to hysteria. In a school in Nepal there is a notable case of recurring mass hysteria present. In the same school almost annually a child presents crying and shouting episodes and soon after several others join this outbreak.

2. Get an efficient vector

For any disease to spread, there needs to be a vector which transfers antigens. This is no different in the case of MPI. Of course the most notable in this case is sight. You see someone vomit, you do it too. Other senses, like olfactory in the case of fake gas leaks, are also able to transmit. That is a really simple form of MPI. One of the first known cases is from the middle-ages in Europe, where dancing mania* was spread, because it was believed that a spirit possessed them through wolf spider bites. There is even current investigation into the internet's capacity as a vector. After the content of several Tourette's syndrome influencers went viral, some viewers began to develop (sometimes similar) tics. Research into this has understandably received backlash when trying to understand whether the two were related, as this is a very delicate issue and the exact origins of Tourette's syndrome and Functional Movement Disorder are still unknown.

3. Show believable symptoms

Dizziness in a hospital or coughing in the influenza season can all be a sign of MPI if people exhibit symptoms around us and our anxiety levels raise high enough. It does not even have to be rational, like the case with the spider bite. The important thing is that people believe it. You would probably not have much luck with trying the dance mania right now in TNW, you would probably just be escorted out of the building.

Sources:
Bartholomew, Robert (2001). Little Green Men, Meowing Nuns and Head-Hunting Panics. Jefferson, North Carolina: McFarland & Company, Inc.

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7368451/

Source (dancers): Smithsonian Magazine

Source (painting): medievalist.net

*__Dancing mania__: in large groups, sometimes for weeks at a time. The dancing was accompanied by stripping, howling, making obscene gestures, or even laughing or crying to the point of death.

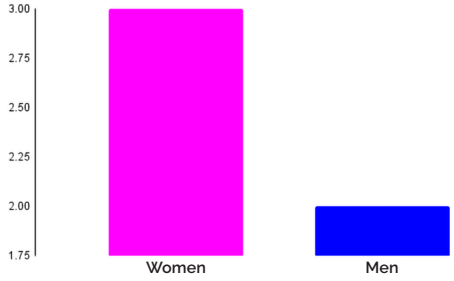
USELESS GRAPHS

VIRAL CONTENT

Graphs, graphs, graphs. They can be the best and yet the worst at what they do. How valuable, misleading or tangible information you can get from them really depends on the illustrator. We went ahead to create the greatest graphs that you will probably ever see!

There is a scandal on the rise! Look at how women-focused Hooke has become. As we know, the potential board is trying to continue this trend. Just look at this gender disparity!

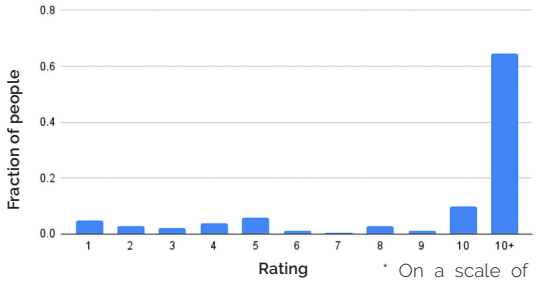
The gender distribution on the current Board of Hooke



Do you like boxplots? No, me neither. With enough incentive though, we were able to dig up the most relevant, accurate, and meaningful of them all. Due the artistic nature of the graph it is copyrighted, please do not reuse.

Movies are the greatest. They entertain, make us laugh, cry, and eat unnatural amounts of popcorn. In this edition, sadly, we could not fit a movie review, but this graph hopefully will give you some consolation.

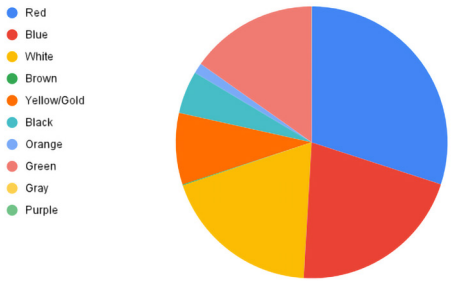
Rating distribution for the Emoji Movie*

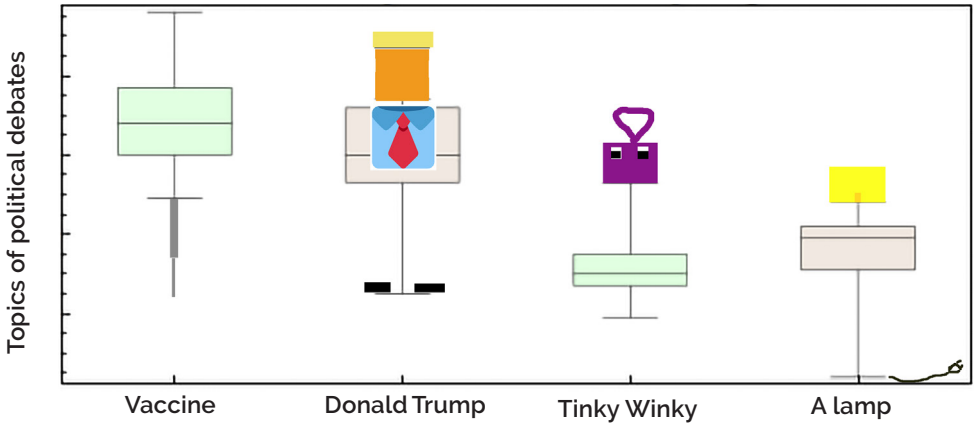


* On a scale of 1-100.

Here is one for the flag lovers out there! You know who you are... But even if you are not a flagthusiast, this might be interesting.

Percentage of colours in country flag





EDUCATION SYSTEMS AROUND THE WORLD

EDUCATION

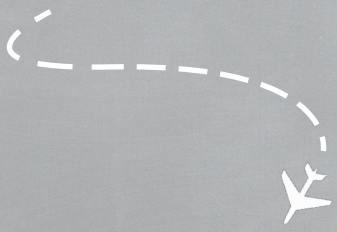
International student presence in Nanobiology has grown from four non-Dutch speaking students in 2017 to 50% of this year's freshmen. All these students are eligible for this academic programme, but how they got here has differed widely. In my continuing legacy of mRNA articles unrelated to the edition theme, I asked several students coming from non-Dutch lower education what their country's (or programme's) educational structure looked like.

Calin - IB diploma programme

Although he spent the first three years of his life in Romania, Calin started school in the Netherlands and participated in the international baccalaureate (IB) diploma programme. This programme is a Switzerland-based international programme found in schools both public and private worldwide. It is one of the most well known and popular baccalaureate programmes. There are two different programme levels; IB Diploma and IB Career, with IB Career focusing on more vocational training classes. Each student takes six subjects, for an IB diploma a maximum of three of them are at a standard level, and the rest at a higher level. Some kind of maths, science, humanity, literature, and a second language must be five of the six, and the last can be some kind of music, art, or something else entirely. For example, Calin studied Maths, Physics, Biology, English Language and Literature, German, and Economics. Everyone must also take Theory of Knowledge (epistemology) and write an Extended Essay in a subject of their choosing.

Calin had no difficulties switching over to Nanobiology, although he did extra calculus in preparation for the entrance exam. His high school Biology and Physics (aside from quantum mechanics) seemed more difficult than that of Nanobiology.

Notable alumni of the IB Diploma programme include our own King Willem-Alexander, and Kim Jong-un, leader of North Korea.



Annemieke - American public school

Coming from the United States myself, I had my own unique experience in American public school. Here, instead of predefined tracks, everyone in a community is in one school. They must satisfy a minimum number of credits in each of the core fields (foreign language, English, humanities, science, mathematics, etc), but can choose different levels of each class. Throughout their high school career, they have an increasing amount of freedom for electives or higher level (even college level) classes. Electives vary between schools, but most provide opportunities for art, music, or more in-depth options in the aforementioned areas, with some examples from my school

being Pottery, Environmental Studies, Mandarin, Child Development, and Film Production. These electives could also be switched over time.

Although most Americans are enrolled in public school, the quality of this education and the variety of classes and electives can vary widely depending on which community a child grows up in, as school resources are funded (in part) by the income taxes of the people living in that town. Standardisation is mostly at a state-level, and teaching curriculum, particularly in the health sciences and America's history with racism, can also be divided across state lines, where some systems continue to teach abstinence and ignore subjects like critical race theory.

As someone who was lucky enough to grow up in the right school system and who prioritised the sciences, I felt very prepared for Nanobiology, aside from needing to take an extra Chemistry class. And of course, I did not have to overcome a language barrier in Genetics!

Phu'o'ng - Vietnamese public school

For sorting into the final three years of study, an examination is necessary. Students have a choice of pursuing vocational school or high school, and within these high schools, there are different options. For Phu'o'ng, this meant the High School of Gifted Students - the only type that Dutch universities will directly accept students from (although it is also hypothetically possible if high school graduates were to otherwise take pre-bachelor courses beforehand).

For Vietnamese public high schools, science and literature classes are compulsory, but not as much humanities. Students in the Gifted High School can choose a track, but aside from this there is not much freedom in course selection. For Phu'o'ng, this track was Biology.

Private schools are increasing in popularity in Vietnam as well, but they cannot compete in national exams and competitions the way public schools do because of a different curriculum structure.

When starting Nanobiology, there were indeed some difficulties to overcome for Phu'o'ng, but they mostly related to living for the first time in Europe, and not as much academically. She was the first non-EU student to be in the Honours Bachelor Programme, but has been happy to see more and more talented internationals joining since then, and has appreciated the improvements to the programme.

Marissa - New Zealand public school / NCEA

There are several different accredited public systems in New Zealand (also some taught in Māori), but for senior secondary education, the primary system is the National Certificate of Educational Achievement (NCEA), and there are

Source (background): Freepik

three levels. Until the age of 16 there are exams one must pass to continue to the next year, but they hold no further weight. At 16, students can enrol in NCEA Level 1, and need 60 credits in that year to go onto NCEA Level 2 (the next year), and 60 more in Level 2 to continue onto Level 3 (the last year). A certain amount of credits are needed from NCEA Level 3 to be able to get into university. There are no different difficulty levels, aside from a rarely seen option to do a class from a year ahead. There are six subjects total, and as a student progresses from each level to the next, they have more freedom to choose which subjects to take, with similar options as those seen in the Netherlands. In that way there are no specific tracks, but everyone can create their own.

NCEA is heavily standardised - the averages are national averages, and exams are graded by teachers across the country. Public and private schools are considered to be of equal quality.

Content-wise, Marissa felt quite prepared for Nanobiology, but primarily because she made the conscious choice to select courses that would prepare her sufficiently. What most struck her was the examinations; in the Netherlands these were much more knowledge / fact based whereas she was taught with an emphasis on trying to understand a concept and how to apply a certain way. For this reason, she found the biology subjects challenging.

Because many students leave school at 16 for vocational work, at the moment New Zealand is pushing for more students to enrol in university. It has thus lowered this barrier by, for example, providing more scholarships.

Sárá – Slovak public school

Primary school is a maximum of nine years long. Vocational schools begin after the full time has been completed, but starting in year five of primary school, children start to get sorted into different secondary programmes. These all add to 13 years of total education and usually end in similar certificates, but can have a focus in different areas. For example, Sárá left for bilingual school and got more exposure to English than most, and could choose a track that focused more on either mathematics or languages (although courses such as Slovak Language, Mathematics, Geography, and Physical Education remained mandatory regardless, and Physical Education is mandatory even in Slovak universities). With her experience, Sárá still felt a gap in knowledge when she joined Nanobiology, specifically in Mathematics. Thankfully, her experience in Physics competitions meant the gap was not as wide as it could have been.

Public school remains the more popular option for most children. Although there is a standardisation programme for these across the entire country, certain communities have better teachers, more positive pressure, and a more nurturing learning environment. This also means that people in more disadvantaged communities and groups, historically the Romani people, do not have as high quality of a learning environment. They can end up being heavily segregated and discriminated against in terms of educational potential, with some

even being automatically placed in schools for the mentally disabled. Sárá finds it essential to raise awareness about this, as Slovakia's efforts to rectify this issue have so far been largely ineffective.

Francesco - Italian public school / European Programme

In Italy, public high school is similar to that of the Netherlands - after eight years of standard programmes, students are sorted into high schools of different levels and tracks. Levels include a HAVO-like practical education, and a VWO-like university preparation programme. High school tracks can include options such as classical, scientific, arts, managerial, and linguistics. Within a high school's track, there is little variation in curriculum.

In terms of standardisation, there exist national exams (INVALSI) for moving from elementary / primary to middle to high / secondary school, which ensure a standard 'skeleton' curriculum. However, these exams do not ensure equal quality across different regions in the country, especially when considering the infamous North-Centre-South division. High schools also used to be (political) party schools, where part of the curriculum was the agenda of the party. Although this is no longer the case, there remain high school cultures and students that grow either left or right wing leaning depending on where they studied.

At the age of 12, however, Francesco moved to Brussels and into a European School. This is an international school controlled by the EU and EC. Its baccalaureate is similar to VWO levels, and tends to be quite standardised. European Schools are located all over the EU near European institutions, but most notably in the Benelux area. Students choose their preferred subjects to study from 13, and go on to make decisions on their courses every two years to confirm their preferences or change topics. Students control their own tracks by determining which subjects they will spend more time on, with more time equating to more in-depth lessons. Topics like Geography, History, two languages, Maths, and Biology are mandatory for students, but there are optional courses like Chemistry / Physics / Biology laboratory hours, Latin, Ancient Greek, and a third or fourth language.

Unfortunately, there are understaffing issues given that not many professors know about the system and even fewer apply for it. However, this has not stopped European schools from churning out notable alumni such as Ursula von der Leyen and Boris Johnson.

For Francesco, his European Baccalaureate education meant he was prepared for a highly international environment. For the most part, Nanobiology courses picked up right where his highschool had left off. What he felt less prepared for was the workload amount!

Source (background): Freepik

RATING ACADEMIC FRAUD

EXPERT OPINION

mRNA will be providing some background information on notable cases of academic fraud for your reading pleasure before rating them based on five criteria, each weighted from 0 to 2, to give an overall score of up to 10. Our five GREAT criteria are:

G - Groundbreaking. How groundbreaking would their discoveries have been, had they been real? Would they have changed our lives?
R - Retractions. How many papers has this person gotten retracted?
E - Effect. What was the effect of their academic fraud on them, their field, and the world as a whole?
A - Absurdity. A wide-ranging criterion; how absurd is the story behind their fraud? This could range from the methods behind their fraud to the excuses they came up with. We will elaborate on a case-by-case basis.
T - Time. How long had they gotten away with it?

Wait, who let Tobias in? That henchman of the Underworld, who was specifically requested not to appear anymore due to his lack of entertainment value and significance. Really? Has to? Contract? Oh come on, but this one was supposed to be serious…

Tobias: 'As always, it is a pleasure. It has been a great journey this year with you nRMA folks. But as much as I hate to say this I am leaving after this edition. Probably. Or not.'

Andrew Wakefield

Our first case tackles what is probably the biggest name in academic misconduct, Andrew Wakefield. His 1998 Lancet study on the possibility of a link between the MMR (mumps, measles and rubella) vaccine and autism spawned the modern anti-vax movement and has led directly to thousands of children remaining unvaccinated. For this research, Wakefield was paid over £400,000 (over €900,000 today) by lawyers suing MMR vaccine manufacturers, which he of course did not disclose, leading to him being charged with professional misconduct and being struck off the United Kingdom medical register. Now, onto the ratings:

G: 1. There would have been some benefits to his findings, but not much would have changed; Wakefield just promoted taking three separate vaccines rather than the MMR 3-in-1.
R: 1. Wakefield only had three of his papers retracted, one of which being his Lancet study.
E: 2. The modern anti-vax movement would probably not exist without Wakefield.
A: 1. While he has become the face of a stupid movement, there is not much absurdity directly surrounding his fraud.
T: 1. His fraud was being fully uncovered by 2004, but he was not barred from medicine until 2010.
6/10

Tobias: 'He was paid AND he got to do whatever the hell he wanted. That man is a genius. 9/10. Also did you spot the hell joke? It is good right? That is the only one I know, so I will give it 7/10. Oh, that is not what I do?'

Yoshitaka Fujii

Writing on topics from anaesthesia to ophthalmology, one might call Fujii the retraction world champion, with 173 papers retracted. Concern about his work was first raised in 2000, when other researchers found his data to be "incredibly nice", but it was not until 2012 that this was further investigated and the extent of his fraud discovered. A committee looking into 212 of his 249 papers found that only three were valid; 172 contained fabricated data, and 126 were "totally fabricated". Further investigation found that Fujii went as far as forging the signatures of scientists he listed as co-authors without their knowledge.

G: 0. His findings were pretty obscure and remained mostly useless.
R: 2. Anything but a 2 would be a crime against this world champion.
E: 1. The poor contributors to retraction watch must have been swamped.
A: 2. Forging signatures and wholly fabricating 126 papers reaches a special level of absurd; one great quote from the report on his misconduct stated "It is as if someone sat at a desk and wrote a novel about a research idea".
T: 2. He got away with completely fabricating over half his research output for nineteen years.
7/10

Tobias: 'I mean, if I remained that irrelevant by doing that much naughty stuff... Wait, I did. 2/10.'

Jan Hendrik Schön

Our personal favourite. Schön single-handedly revolutionised physics, discovering organic high-temperature superconductors, organic lasers, and single-molecule transistors while working at Bell Labs. He was nanotechnology's wünderkind; by his early thirties he was on track to be nanotechnology's Einstein, with probably enough discoveries for three Nobel Prizes already under his belt. At his peak, Schön was publishing a groundbreaking paper every week, with just one caveat: none of his work was real. Schön would fabricate data based on theory, so when his results matched theory, nobody batted an eye. This went on for years. Eventually, his colleagues noticed some of his graphs had the exact same noise as previous graphs, and years' worth of nobody being able to replicate his results came crashing down. TU Delft researchers were some of the ones trying to replicate Schön's work; an October 2002 article on TU Delta titled "Finally, we've caught Schön" captures the zeitgeist of the period. Please do yourself a favour and read more into this scandal, there are so many insane details.

G: 2. He almost certainly would have won at least one Nobel.
R: 1. 28 retractions is impressive but not huge.
E: 2. Bell Labs' reputation was significantly damaged. Some peers in his field quit because they could not replicate his results, and thought he was just better than them.
A: 2. He kept getting away with fabricating data by being amicable and fabricating more data. Due to downscaling at Bell Labs, nobody questioned how secretive he was around his work; everyone was focusing on keeping their job.
T: 0. He was caught in less than three years.
7/10

Tobias: 'How does paper break the ground? I will have to check with the Underworld security experts. Anyway I do not like people with three names. It is messy to document. 4/10.'

Diederik Stapel

A Dutch social psychologist, Stapel is currently the Dutch author with the most retractions, at 58. Getting his PhD from the University of Amsterdam in 1997, Stapel went on to become a professor at the University of Groningen and Dean of the Social and Behavioural Sciences Faculty at Tilburg University. Everything was looking up for Stapel, now an established and respected contributor to his field, right up until his past caught up with him in 2011. Like many before him, Stapel had flown too close to the sun; his data was too clean, his findings too polished. This prompted an investigation into his work, which found that Stapel was essentially simulating his experiments; he would come up with a hypothesis, explain it, and create a theoretical framework, then just invent data to neatly match what he "found". Often, nobody would get to see his raw data, not even his own graduate students, most of whom would never even get to conduct an experiment. Two of his retracted works stand out among the rest due to their popularity: coping with chaos and selfishness in carnivores, which found that disordered or cluttered environments promote discrimination and that carnivores are more selfish than vegetarians, respectively. Stapel renounced his own PhD in shame and wrote a fairly popular memoir, titled "Derailed", telling the story of what compelled him to fabricate so much of his work.

G: 1. His work was popular and near the forefront of his field.
R: 2. If you hold a title beginning with "most retractions", you deserve a 2.
E: 2. Tilburg's reputation was damaged, his field's reputation was damaged, and the academic careers of many of his students were stunted.
A: 0. Nothing absurd, just sad.
T: 1. He got away with it for at least eight years, possibly more, but not very long compared to others mentioned here.

Tobias: So we are going out on a Dutch angle? Haha. I made a second joke. 8/10. The scientist though. Genius! Using his fraud as a publicity stunt for book sales is amazing. Also what is a PhD? Does anyone else feel this sudden tummy ache? I looked on Wikipedia, a PhD can take up to 3 years and is painful. So A for effort. 10/10. Wait what is happening, help, HELP!!!

Source: Vectorstock

Tobias? Tobias! Holy Hades, he just got sucked back into the ground! I hope he managed to safely make it back to the Underworld, and that that was not just some random sinkhole. Bye Tobias, thanks for stopping by! Jeez, I hope that means he can make it to the next edition. I know I was annoyed at the start of this review, but what can I say, the guy (or demon, whatever) grows on you. Whose whimsical, unfounded perspective will I be able to balance out with my cold analytic one now? Stay tuned to find out!

Sources:
https://www.delta.tudelft.nl/article/finally-weve-caught-hendrik
https://en.wikipedia.org/wiki/List_of_scientific_misconduct_incidents

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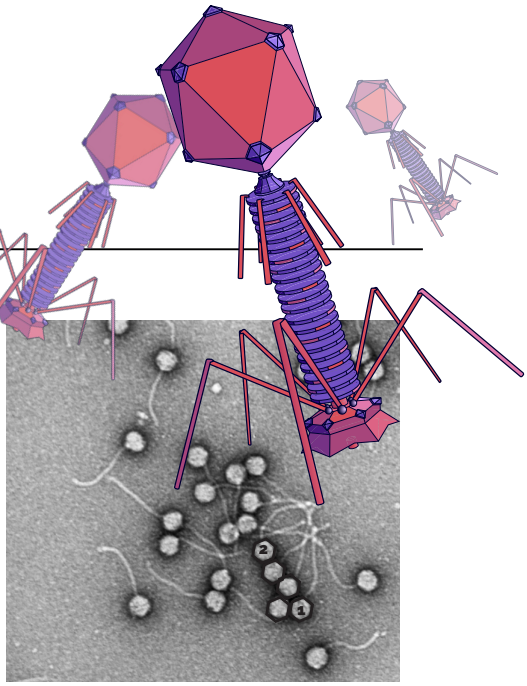
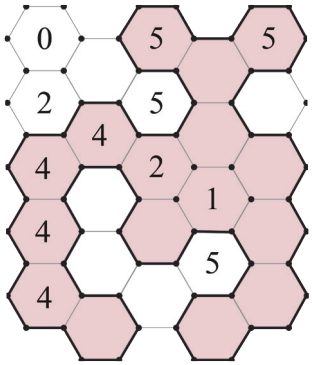


Source: ucsf.edu

During your research project you are investigating bacteriophages. However, the craziest thing happens while you are investigating your hexagon shaped phages under a transmission electron microscope. The phages have clustered together in a honeycomb-like shape, and some of them are even displaying some numbers!

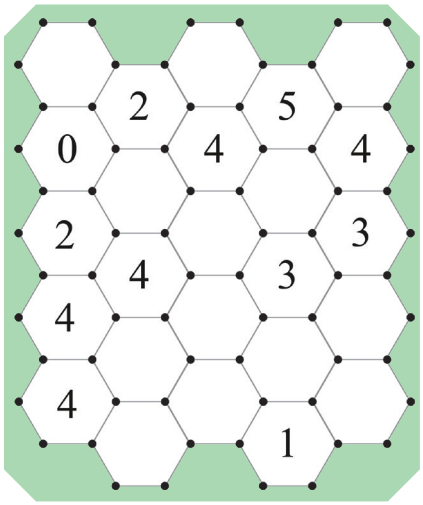
Flabbergasted, you ask your supervisor whether she has any idea what is going on. Luckily, your supervisor has encountered this peculiarity once before and explains that your goal is now to find an unbroken loop along the edges of the bacteriophages, using the following rules:

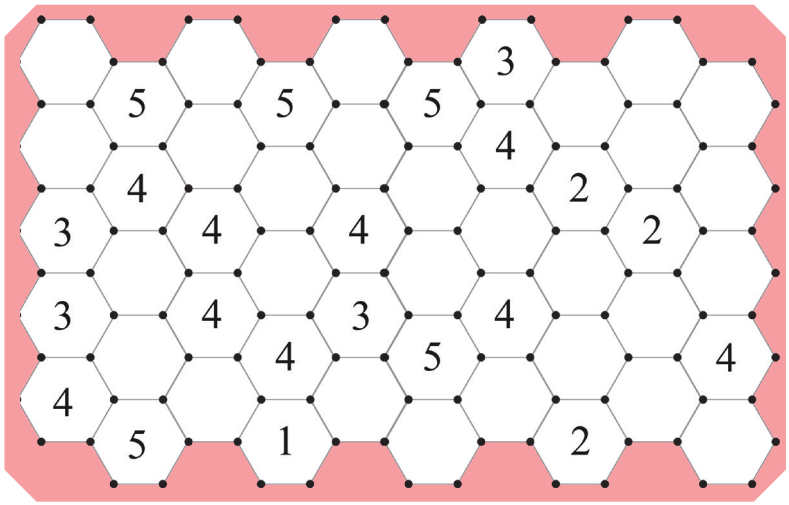
1. The line forms one continuous loop, and does not intersect itself anywhere.
2. The numbers inside the phages represent how many edges of the phage are part of the loop.



Your supervisor's solution

To help you, your supervisor shows you one of their samples that they had already solved, so you know what a solution could look like. Can you find the continuous loop in your samples?



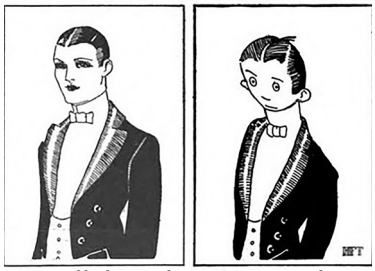


Source (bacteriophage): adepted from Adenosine,
Source (puzzle): chiark.greenend

Hints: Start with a pencil, and draw the lines you can already deduce (you can already deduce something about the corners!). Also, mark the edges you know are not part of the loop. Do not guess and use the power of deduction and logic!

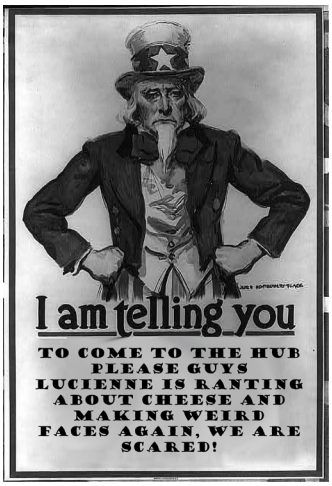
VIRAL MEMES

VIRAL CONTENT



Negrello's code Your code

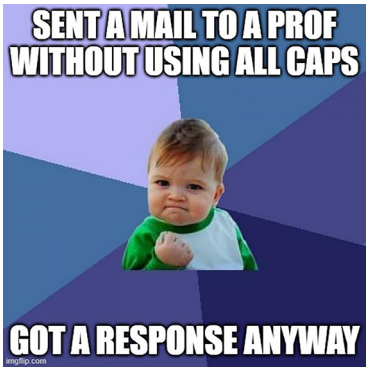
1920



1943

Space research, before the James Webb telescope was launched.

1972



2007

2017

Redoing pipetting for the tenth time during Lab Course

The pipettes

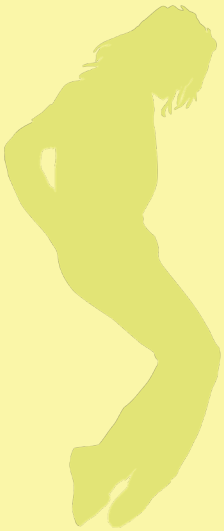
2019

2020

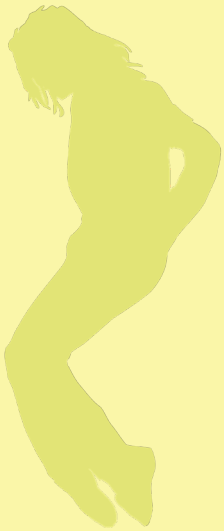
UPCOMING ACTIVITIES

HOOKE AGENDA

August		September	
15 - 18	Eurekaweek	8	Changing GMA
19 - 21	IntroN	17	World Record Pipetting
21 - 25	OWee		



For 3rd year and older students, if you want to keep receiving the mRNA scan the QR code, and sign up!



Source (images): Pixabay