mRNA

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EDITORIAL

MARIO ROMÁN CABEZAS

Dear reader,

As the temperatures drop and the days grow shorter, one must have at least once found itself peeking outside the window, momentarily forgetting its Analysis homework; when all of a sudden, (and I am sure we have all experienced this situation) a bemusing scene outside steals our attention: a bearded man, surrounded by a group of sidekicks, violently throwing pepernoten into the streets. Awestruck, it is too late before you realize you are standing on a chair, fiercely clamouring: "He's here! He's here!"

You guessed it, it is finally Sinterklaas season! The perfect time to open gifts, eat chocolate letters and gather around the heat of a hearth. We are delighted to announce that this year there will be 4 editions of the mRNA instead of 3. This decision implied that we changed the issue dates, making the first edition the one you have in your hands. While we're talking about the edition, what a great one is in store! With our mind set on Breakthroughs, we have a wide range of stories of successful scientific discoveries: from Nobel Prizes to liquid cats.

As every year Sinterklaas comes on his boat, all the way from Spain, a new batch of members joins the mRNA. Just like magic! Hence, we welcome our newest additions: Simon, Ruben and Roos. Enthusiastic and hardworking, they are set on a mission to make the most out of our magazine. Sadly, we realize that some of our 'Zwarte Pieten' have left the boat. To Nico, Aisha and Niels, thank you for being with us and teaching us the importance of consistency. We will try to keep up the good work!

Enjoy the edition and merry Sinterklaas!

Mario Román Cabezas,
Editor-in-chief of mRNA 3.5

AMÁRIA VLEDDER
FROM THE BOARD

Dear Members,

I think of the bond between Nanobiologists and Hooke as fluorophores and their excitation laser. Without the right equipment, the beauty and usefulness of fluorophores cannot be seen, but when excited with the correct wavelength, they shine bright and they can fulfil their purpose in our precious experiments. If Nanobiologists are the fluorophores, Hooke is the excitation laser, trying to get the best out of you.

As fresh President of Hooke, this is my debut in writing 'From the Board' as well as my debut in the mRNA. I feel honoured. In my year as president, I will make sure Hooke will emit the right wavelengths to excite the broad spectrum of people we have in our wonderful association.

Good apparatus to pursue this goal are workshops, activities and vacations. Take for instance the members' dinner we had in October. Pizzas or pasta at *Very Important Pizza* with very important people; the members of Hooke, your fellow Nanobiology students. While dining, new bonds were created and old bonds were strengthened, ultimately leading to a brighter fluorescence.

We have the skiing trip and study trip coming up. In the February vacation, Hooke members are going to spread across Europe, carrying out very diverse activities. From skiing to sightseeing, from après-skiing to visiting a company. There is going to be something fitting for every individual. The moments to come certainly excite me. How about you?

I have spoken.

Amária Vledder,
President of S.V.N.B. Hooke

LIEDEWIJ LAAN ON EMBRACING COMPLEXITY

INTERVIEW

Dr Liedewij Laan has a background in Applied Physics with an interest in Cell Biology. She did her PhD at the AMOLF Institute, where she studied force generation of microtubules in minimal model systems, and a post-doc at Harvard University, where she focused on the robustness of cells to genetic perturbations. She then came to the TU Delft, where she works as an Assistant Professor. In her research group, she combines approaches ranging from Physics to Cell Biology to study cellular organization at cell cycle as well as evolutionary time scales.

We asked her about her beginnings:
At school, she was interested both in Science and in Classical Languages, like Latin and Greek. What she sees in common in these two different branches of knowledge is that they open up a whole new world to you, and at the same time, they are tools to explain the world we live in today. She was particularly fond of physics because she felt that if she learned about physics, she would be able to understand the world around her a little bit better: how a computer works, how a rocket goes to the moon…

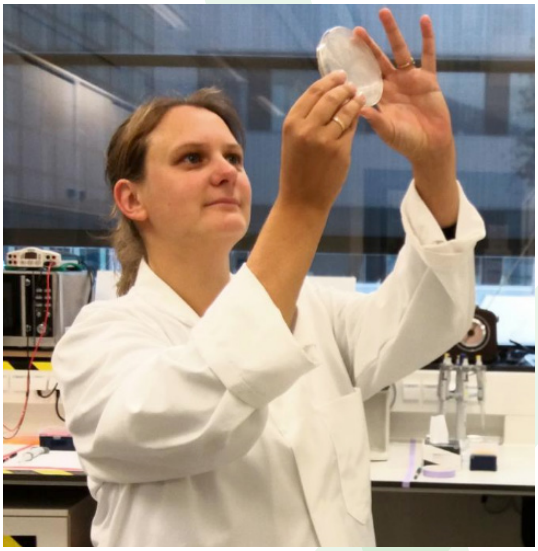
We inquired her about breakthroughs that lead her towards her current position:
She explained that there were several moments in her life where she encountered a decision, defining moments that shaped her path. As a student she was initially interested in High Energy Physics. However at some point she started to realize that even if she would know the basic laws, she still would not understand the macroscopic world we encounter in daily life, or human psychology so the idea of understanding everything completely bottom-up; she did not believe so much in that anymore.

Another reason she switched her interest from High Energy Physics to Biophysics she explains, was at a research introduction about the Higgs particle at the Physics institute NIKHEF, which made her feel like a tiny wheel inside a gigantic organization. She wanted to make her own discovery. Coincidentally, during that visit she saw that there was another physics institute next to NIKHEF, the FOM Institute AMOLF, with a focus on Biophysics. *"At the moment the field of Biophysics was exploding, there was so much excitement going on".* She got in contact with Marileen Dogterom, and fascinated by the simplicity of the kinesin motor, she would not want to do anything but Biophysics anymore.

When she entered the field of biology she came across another conundrum: *"In Biology there seem to be two routes: You can either study the Physics of living systems or you can develop tools".* Trained as a Physics engineer, Laan liked developing techniques and tools, but after a Cell Physiology course she took in the US, she realised that she really wanted to study life itself, and find her own biological questions. Throughout her career, she feels like she is still gradually leaning more towards Biology, taming the rigidness of Physics. *"At some point, I realised that if I wanted to understand Biology I had to look at the cell as it is, not being afraid of all those complex interactions and their un-understandable behaviour."*

You said you wanted to find your biological question. Have you found it? To rephrase; what would be the central axis of your research?

"A way to understand my research is imagining a cell as a house built with blocks. Now, we want to how a cell evolves without losing function. So how can you reorganise step by step, stone by stone, a whole living system, without it falling apart?"



You could say that in her lab they study the more physical perspective of this question: How do the self-organising properties of matter help evolution? Many people think about evolution in the genome, where you have genes that can go into the population, etc, they focus less on how the phenotypic level helps evolution. She wants to understand how the fact of a cell consisting of regulatory networks and proteins with physical shapes and interactions, helps or constrains evolution.

Can you show us one of your experimental approaches?

A theoretical experiment, she wants to buld experimentally, sums up a great deal of the direction of her lab, and is the following:

"Imagine we create a droplet in which we enclose proteins A, B and C, which together form a polarized protein pattern in the droplet. A, B and C are all essential for polarity. Now we play a game. How many proteins do we have to add, change or remove – one at the time- untill I can remove A? The only requirement is that the protein network can create polarity and that the rate of polarity establishment does not get reduced."

"I realised that if I wanted to understand biology, I should not be afraid of its un-understandable behaviour."

Via studying this very simple system, where she knows all of the components, she hopes it will help her understand better how complex networks, such as the polarity network in budding yeast which consists of ~30 proteins can evolve with maintenance of function.

What are some amazing things that have happened because of your research?

Thanks to her research, she has been able to make contact with the International scientific community, meeting people from all around the world. She is happy with her life at the Kavli Institute because it is always different and stimulating; recently, she had a symposium in Oslo together with some colleagues and representatives from every Kavli Institute worldwide, where they talked about Neuroscience, Nanoscience and Astronomy. After the discussion, they handed out the Kavli prices, which are awarded in the spirit of celebrating science and societal contribution, and they got to celebrate in a big Banquet with the King of Norway. *"That was quite nice because as scientists we should communicate our research, and take the effort to talk to others. And I appreciated all those kind words said about the work the laureates did."*

Apart from science, what do you do when you are not working on research?

She likes to hang out with her family. She has two kids who she loves to play with and to take to the beach. For her, science is very fun, but also very time-consuming. *"A young family plus science is a big job"*. She is also very fond of week-long hikes, visiting museums and reading.

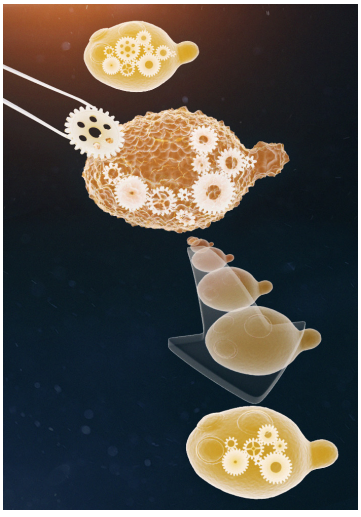
What do you like about teaching Nanobiology?

The students. She finds them very good and interesting, having chosen to do something non-standard. She sees that people in Nano are sincerely interested and willing to take the challenge to combine the holistic view of Biology, with the bottom-up quantitative exact world of physics. She says it is fun to help in that process, knowing that it is not easy.

Trip with colleagues to Kavli Banquet in Oslo

She is determined to make students think, and to help students appreciate and deal with the fact that the world is more complicated than was taught in high school, so how to use math, physics and biology to understand cellular complexity.

"Especially when I teach Physical Biology of the Cell, students come to me after the course to ask really good questions, and the subsequent discussions we have, that is the best there is. That is what the world beyond textbooks looks like."



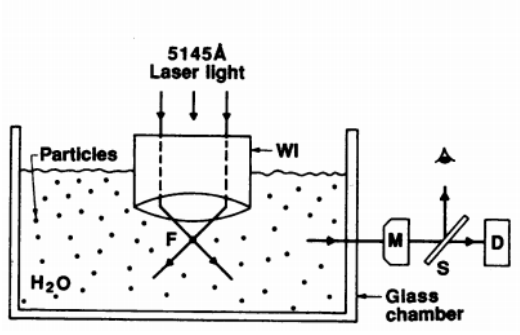
Experimental evolution in yeast.

SMALL SCALES, ARTIFICIAL PROTEINS AND MORE

NANONEWS

Observe the smallest scales

This October, the Nobel Prize for Physics has been awarded to three researchers for their work on lasers. One of them, Donna Strickland, is the third woman to ever win this prize. She cooperated with G. Mourou to make a system to amplify laser pulses, with which they achieved an 8-fold decrease in pulse width to a single micrometre, which would be present for just 2 picoseconds. With these lasers, A. Askin has improved the optical trap and manipulated bacteria and viruses without damaging them. The Nobel Prize Committee stated that this was science fiction for a long time, but now that it has been made possible, this former unreachable scale can be explored.



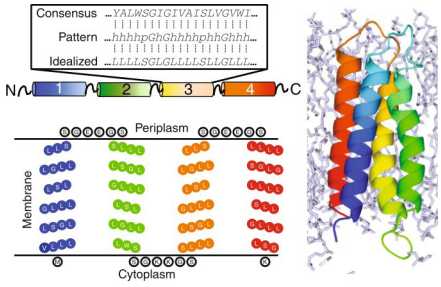
A Ashkin, JM Dziedzic, Science 20 Mar 1987: Vol. 235, Issue 4795, pp. 1517-1520, DOI: 10.1126/science.354765

COMPRESSION OF AMPLIFIED CHIRPED OPTICAL PULSES, Donna STRICKLAND and Gerard MOUROU, Optics Communications Oct 1985:, Vol. 55, Oct. 15, 1985, p. 447-449. DOI: 10.1016/0030-4018(85)90151-8

Press release. NobelPrize.org. Nobel Media AB 2018. Wed. 3 Oct 2018. <https://www.nobelprize.org/prizes/physics/2018/

Artificial proteins

Building up a cell from scratch has been a dream for many researchers in the field of life sciences. P. Curnow et al. have contributed to this challenge by designing membrane proteins with just a few amino acids, using the method REAMP. Here, all polar amino acids are replaced by Serine and the hydrophobic amino acids by leucine. Only glycine and tryptophan remain in the sequence for their important helix-helix interactions. Using only these four amino acids, the secondary structure of the resulting protein remains the same as its original version. This artificial protein is stable and cofactors can still bind to it. The group has thus successfully simplified membrane proteins in such a way that they can be incorporated more easily in an artificial cell.



https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6167376/

https://www.ncbi.nlm.nih.gov/pubmed/30275547

Lalaurie, C. J., Dufour, V., Meletiou, A., Ratcliffe, S., Harland, A., Wilson, O., … Curnow, P. (2018). The de novo design of a biocompatible and functional integral membrane protein using minimal sequence complexity. Scientific Reports, 8, 14564. http://doi.org/10.1038/s41598-018-31964-8

Producing Hydrogren Gas with Artifical Cells

Researchers at Uppsala University have recently synthesised an artificial enzyme that can use its own energy to produce hydrogen gas from solar energy. [FeFe]-Hydrogenase, the metalloenzyme that is used in this research, produces hydrogen with great catalytic abilities, and is therefore a main focus in bio-sustainable energies. They used its enzymatic maturation machinery and synthetically activated it in Synechocystis PCC 6803, a unicellular cyanobacterium that continually grows either by photosynthesis or heterotrophic growth. Hydrogenase is activated in the enzyme and linked to the metabolic processes in the cell, consequently producing hydrogen gas. Uppsala University has discovered that we can now use cells to produce hydrogen gas instead of water, and by using semi-synthetic cells we eliminate the need of biological regulation and maturation.

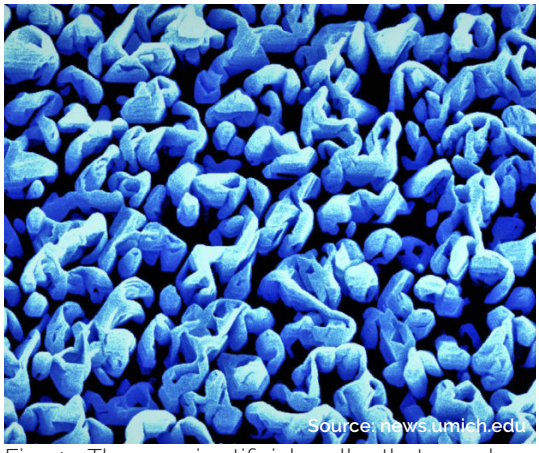


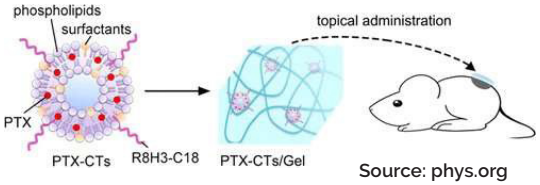
Fig 1: The semi-artificial cells that produce Hydrogen gas

http://www.uu.se/en/news-media/press-releases/press-release/?id=4464&area=3,8&typ=pm&lang=en

https://pubs.rsc.org/en/content/articlepdf/2018/ee/c8ee01975d

Paint the Cancer Away

We usually treat skin cancer from inside out, but what if we do it from the outside, without taking pills, an injection, or being lasered? Bingfang He, Ran Mo and other researchers are developing a cancer treatment that you can directly apply to the skin tumour. This cream consists of transfersomes, which are nanoparticles that encapsulate drugs. These particles affect the lipid matrix of the skin to make sure that the particle can enter the skin. In their research, they tested it with mice, and after painting the cancer away for 12 days, the tumours were reduced to half the original size. Comparably, researchers in South Korea have found a cancer spray that they can spray on tissues after surgery. However, they needed to find a way to make the nanoparticles in the spray stick to the tissues. To solve this they looked at the 'mussel glue' that allows for mussels to stick to rocks in wet and salty conditions. These Mussel Adhesive Proteins (MAPs) were first bioengineered and then used in the 'chemo spray'. The MAPs were also positively charged, allowing for an even stronger glue to the negatively charged cancer cells. All of these new ways of treating cancer highlight the possibilities that nature provides to help us defeat this deadly disease.



Source: phys.org

https://phys.org/news/2018-08-chemo-alternative-conventional-chemotherapy.html

https://phys.org/news/2018-09-paintable-chemotherapy-skin-tumors-mice.html

DOING YOUR MASTER'S INTERNSHIP AT DELMIC

CAREER - SPONSORED ARTICLE

During the Nanobiology Master's Programme, every student does an internship. This is normally done at TU Delft or Erasmus MC, but working for half a year at a company is also possible. Since that has not been done very often, we invited Marit Smeets and Jasper Veerman for an interview about Delmic, the company they both did their internship at. Delmic integrates light and microscopy for the life sciences.

What are the differences between doing research at a university and in a company such as Delmic?

Jasper:

I personally like to work towards application. While our study is mostly theoretical, I prefer to apply my knowledge, to be able to hold it in my hands, and to know whom I am doing it for. This really gives me motivation. I like to work towards a goal and try to get there as soon as possible. At the internship, it was really a process of reading papers, and hopefully stumbling upon a new technique, which you then discuss with your colleagues to see if we can implement it into our project.

Marit:

In both, you are given a project to design and perform experiments for. However, the environment is very different. I did my Bachelor End Project in a very small lab, with only 5 or 6 people. Another difference is the size of the company. Delmic only has 20 people working there. Also, in an academic lab everyone works on their research and in a company, a lot of people have different functions. Furthermore, during my BEP, I got someone like a PhD student who really helped me, but here I had to work a lot more independently.

Jasper Veerman

What was your role at Delmic?

Jasper:

Well, let me first say something about the company itself. Delmic develops innovative microscopy systems and solutions. The project I was busy with was on integrated correlative microscopy, which combines the two main paradigms: fluorescence microscopy (used to label molecules and look at dynamics) and electron microscopy (popular for its high resolution). These two are not mutually exclusive, so Delmic makes correlative microscopes that can do both and then create an overlay of the data. This way, you can tag a protein to locate it by fluorescence, and at the same time, you can look exactly where it localises in the cell using electron microscopy.

The system I worked on is widely accessible and we therefore wanted to explore possible

applications in healthcare, especially in diagnosing skin diseases. My job was to see if implementing these integrated correlative microscopes is really possible. I would go to the specialist, look at images and ask for the needs in fluorescence and spatial information, and then go back to the microscopes to see if and how we can serve those needs.

Marit Smeets

Marit:

In my internship, I worked with the microscope SPARC. If electrons hit something within the microscope, light emits from the specimen and goes through a detector. That is what the SPARC measures to get more insight into what the material is. That is what it is used for normally. I was looking into the Transmission Imaging Method. Normally for Transmission Imaging, you need a very expensive and difficult Electron Microscope. So our idea was to put the thin biological material on a material that will emit light when electrons hit it. There was a thin biological material on top of it, which would absorb and reflect electrons.

The thickness of this material would correlate to amount of light emitted by the plate. We wanted to see if we could decrease the dwell-time and increase the sharpness of the images.

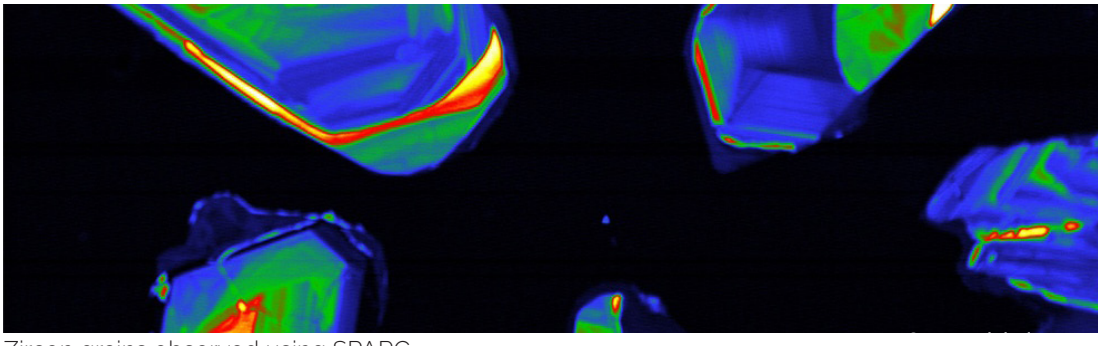
Do you have any tips for current students?

Jasper:

I think doing an internship is a really nice opportunity to have a look at the research culture and to explore what is out there. Life at a company is something new, it is very interesting to find out more and see if there is something of your liking. Ultimately, that is most important: to try to find something that makes you enthusiastic.

Marit:

For me, the atmosphere at the workspace is always very important. During the internship, I found that the company was very nice to work in. People were very open and even though I was only there for half a year, they really wanted to get to know me, which I found nice. It was just fun to be there, to talk to people, and have coffee breaks with them.



Zircon grains observed using SPARC

BLACK MIRROR

MRNA REVIEWS

In a world that is constantly changing by technical innovations, one might find it difficult to foresee what next year will bring in terms of technology. Black Mirror's episodes examine a single possible future scenario, one invention or change per episode, to see how the breakthroughs of the future will change the present. We, the mRNA, have watched some of the episodes to give you a sneak peek of what the future might look like. Spoiler alert!

Nosedive (season 3, episode 1)

In this picture-perfect, pastel-coloured world, not only restaurants and cab services deserve a 5-star review. Everybody you pass on the street will give you a rating, and you are expected to rate them likewise. The rating could be based on anything, so be mindful to always put on your best fake smile! You do not want your rating to drop too low, as the ratings can be compared to a caste system: with higher ratings come more privileges.

The episode follows Lacie Pound (Bryce Dallas Howard), a young woman overly obsessed with her rating. Her morning ritual consists of practising fake smiling in front of the mirror and buying a cup of coffee to post on social media, even though she does not drink the coffee. The plot starts when Lacie needs to achieve a better rating in order to qualify for a potential new house. Lacie goes incredibly far to achieve more 5-star ratings; even resorting to a rating coach. It turns out that a rating from a highly scoring person has a bigger impact than a low scoring person. This leads to ridiculous behaviour by those with a lower score, to appease those of a higher score.

This society might seem like an unrealistic, future scenario that filmmakers try to scare you with. However, this scenario is not as far away as you might think. Although it is a different execution, the same concept is planned to be fully operational in China by 2020. The 'Social Credit System' will score every Chinese citizen through mass surveillance. Announced in 2014, the system is presented as a way to strengthen societal governance, which can be seen as a tool to steer the behaviour of its citizens.

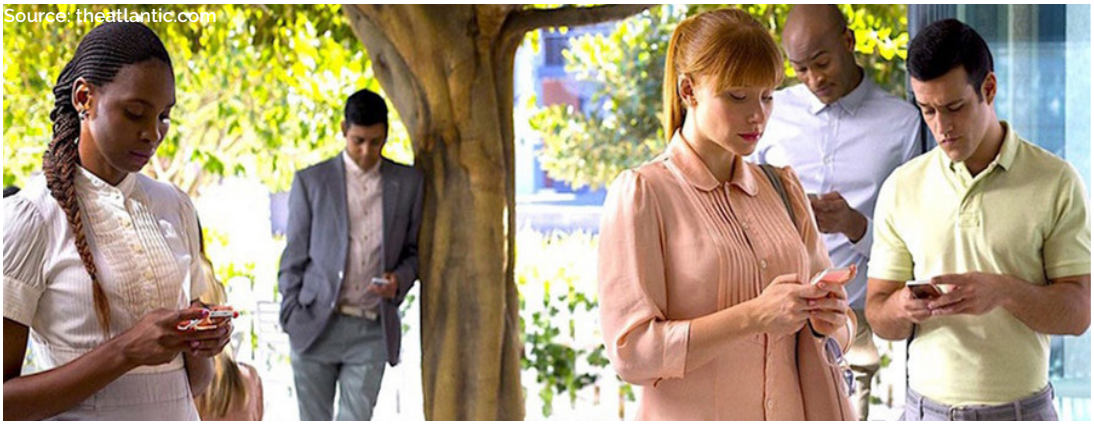


Fig 1: Black Mirror episode Nosedive

The data that will determine your score will come from people's own accounts as well as their network's activities. Factors that will play a role are location, health records, insurance, private messages, financial position, etc.

A dilemma that comes with this system is that the government gets to decide which actions count as good or bad. The consequences of this system are far-reaching. The idea is that people will be motivated by earning benefits, however, the repercussions can also be more serious: your child might not be able to go to the top schools in the region. You might get a lower chance of obtaining a loan at a bank or an apartment, travel bans or having to wait in a longer line at the hospital.

The Waldo Moment (season 2, episode 3)

The episode revolves around Jamie (Daniel Rigby), a failed comedian who has been struggling with reality all along. His job is to be a funny likeable blue bear, Waldo, who is playing a part in Britain's politics. Despite creating Waldo, Jamie does not truly believe in its ideals. This poignantly portrays the social media world today. How real are we on social media? How disconnected are we becoming from the political establishment? Is being a personality better than being yourself, or a politician?

Waldo's mission is to mock all political contestants in the current presidential race, while being as rude as possible. This makes him very popular, in contrast to his rival Monroe. In a later scene, a meeting takes place in which they decide that Waldo is going to run for president. Let me repeat that: a character, a big blue bear, nonexistent, is running for president... Now, even though this may come as a surprise to you, we did some research and this has happened numerous times in the past. For example, Mr Peanut ran for mayor of Vancouver in 1974. The person in the peanut costume was ironically trying to learn more about contemporary mythology. In the end, Mr Peanut got 3.4% of the votes by running a very similar campaign to Waldo.

Ironically, because people see that Waldo is not associated with anything political, he is admired within the political race. Jamie's boss continues to force him to be Waldo to gain more votes. In the end, he is just a character on a screen that represents Jamie's self-disappearing. The next time he looks at a screen it will just be a Black Mirror. The episode ends a few years later when Jamie sees a screen again and sees that the world is run under Waldo regime.

So next time you watch a Black Mirror episode, or any other futuristic or dystopian series, just realise that the future might not be as far away as you might think.

BREAKTHROUGHS

Looking back at history, there have been a lot of breakthroughs that started small, but ultimately have changed the whole world we live in now. Here are some breakthroughs made last year that may impact our society in the future.

Robotic skeleton

Students of the TU Delft have won the annual event Cybathlon in Dusseldorf for the category exoskeletons. At this event, technologies are shown that help people with a disability to move. For this race, Sjaan Quirijns, who has had paraplegia since 2000, had to overcome multiple obstacles with a programmed robot skeleton. She can control the skeleton using a panel on her crotch. For fulfilling these tasks, points are awarded depending on the difficulty of the task and the time it took to succeed. After four days of exercise, the team Project March from the TU Delft has won.

City of the future

In the eastern part of Toronto, Canada, a huge amount of building sites are left unused and filled with silos and remains of industry from the 1950's. To change this, a company named 'Sidewalk Labs' has set up an ambitious plan to make this area a model city for smart cities around the world. Plans include robots transporting garbage in underground tunnels, traffic lights that keep track of public activity and adapt to it, together with driverless shuttle buses that should replace cars in the city centre. While all this may sound very pleasant, these plans are still under a lot of criticism due to the enormous amount of private data of the citizens

they are planning to keep track of (think of sensors that keep track of how often garbage bins are used). Despite all this skepticism, the creators are still optimistic about their plans and the project is going to start next year.

The beauty of self-organization

Researchers at Cambridge University have been able to make an 'artificial embryo' in the absence of egg cells and sperm, only made from stem cells. While the resulting structure looks like a real mouse embryo, it is not able to fully grow into a real mouse. This does, however, give a good indication on the pluripotency that embryonic stem cells have. The experiment employed a 3-dimensional scaffold, that helped the stem cells self-organise and multiply in the right way. Using only this scaffold, the stem cells were able to develop into a structure exactly as they would in nature, giving a beautiful insight into the powerful potential that stem cells have.

Multilingual earbuds

Have you chosen your minor abroad, but just realised that you do not speak the language? Do not worry, Google has your back! This year, they have invented a special connection between earbuds and their phones. The owner of the earbuds can speak its maternal language through the earbuds. The text will be recorded and translated with hardly any delay and played aloud on the phone of the other user. He can respond easily and you will immediately hear the translation in your ears. Unfortunately, other attempts to develop such a system have failed, since it was quite hard to time whether a person had stopped speaking in order to not interrupt the user. This problem has been solved by holding a finger on the earbud when speaking and releasing it when you are finished. Maybe one day, everyone will have access to these earbuds so that languages will no longer be a barrier for communication anymore

Farm ruled by robots

Due to the huge labour shortage in the United States, 'Iron Ox', a company that grows and sells vegetables to grocery stores is using artificial intelligence on its farm. The entire process has been taken over by machines. They lift and transport growth media or even harvest the plants. Harvesting plants is unfortunately quite hard for machines, so the machine has multiple sensors to find the exact position of the plants and even detect diseases. All these machines are controlled by the artificial intelligence 'Brain', which divides the tasks and controls the timing of the actions made. Of course, few tasks are still done by human beings, like seeding and packing. Maybe someday this farm will be 100% run by robots.

Self-driving trucks may take over the world

Roughly a year ago, Uber performed the world's first shipment by using a self-driving truck. It is not very hard to believe that this technology will be implemented for all driving purposes in the near future. These self-driving systems will, of course, be implemented step by step, starting with only some functions automated by an AI system while the truck is still in control of a driver, but in a few years this self-driving system may already take over control during long routes of highway driving, giving the driver the opportunity to sleep.

The future looks bright. Let us be a part of it by making our own Nanobiology breakthrough.

IG NOBEL PRIZES
RESEARCH

Let us be real; not every research project will result in a cure for cancer. Still, a lot of researche projects and experiments have a clear application. Then, of course, there are research papers that might not be so clearly applicable. However, few experiments make you actually lose a little faith in science. These research projects can be nominated for the Ig Nobel Prize. The concept, created by Marc Abrahams in 1991, was made to give awards to the research that 'makes you laugh and then makes you think'. Moreover, it is research that cannot, and should definitely not be reproduced. Here are some projects that we thought were noteworthy.

A blink-free photo

Awarded with an Ig Nobel Prize in 2006, a paper written by Nic Svenson and Dr Piers Barnes of the Australian Commonwealth Scientific and Industrial Research Organisation found out what the chance is to take a blink-free photo. Svenson first researched how long the average blink took and how many times per minute a person blinked. In addition, she had to find out how fast camera shutters went.

Barnes worked out that blinking is a random event, not influenced by another person's blinks or your own blinks, unless something is stuck in your eye.
The conclusion was that when a group of people is smaller than 20 people, you can divide the number of people by three to know how many photos to take. However, bad lighting causes the camera shutter to be opened longer and therefore you would have to divide the number of people by two. As the size of the group increases, the number of photos you have to take increases exponentially. Therefore, by the time there are 50 people in your photo, the chance of a blink-free photo is virtually zero.

N. Svenson, P. Barnes. The chance of taking a blink-free photo. *Radio national.*

Plants have dignity

In 2008, the Ig Nobel Peace Prize was awarded to not only the Swiss Federal Ethics Committee on Non-Human Biotechnology, but also the entire population of Switzerland, for recogniing and legally adopting the principle that plants have dignity.
The Federal Constitution requires that when handling living creatures, one takes into account their dignity. Living creatures can mean animals, plants and other organisms. With regards to animals, this implies taking into consideration the needs and interests of the animal when weighing them up against human interest. One cannot cause them suffering, pain, harm, or fear, at least not without justification.
The dignity of plants must not be taken as literally as the dignity of animals. What is meant with the phrase is that plants are entitled to inherent value, which is independent of human interests. The motivation for this law to be put into place is that plants use fragrances to communicate in dangerous situations, such as during an insect attack. Plants can support relatives, fight off strangers and make alliances. On top of that, plants can form underground networks where they exchange information and nutrients. As scientists gained understanding about the complexity of plants, the discussion among

Swiss Parliament members as well as in the scientific community got more and more lively until the government decided upon the law: "the Confederation (...) shall take into account the dignity of living beings (...)."

A. Willemsen. The dignity of living beings with regard to plants. April 2008.

Liquidity of cats

Whether a cat is a solid or a liquid is something we have probably all thought about… right? Luckily, we did not have to go through the effort of finding it out ourselves, but Dr. Goulu published a paper in which he did the research for us - and received an Ig Nobel Prize for Physics in 2017. He started with what defines the flow of a fluid, the Deborah number: $De=\tau/T$. T is the duration of the experiment, whilst tau is the characteristic rate of expansion of the material. If De >>1, it is a gas, if De<<1 it is a liquid. When we look at the figure, it is clear that De <<1, as it fills the container perfectly, just like a liquid. Dr Goulu goes into great detail about other values used in this analysis, such as the Troutan ratio and the Reynolds-Weissenberg number.

It gets even more complicated when we take the age of cats into account. Are older cats more likely to be a solid than a liquid? Are cats liquid or solid when seen in a different axis, seeing as when we measure them along their principal axis, they tend to be more relaxed, suggesting that they are more likely to be a fluid? Unfortunately, Dr Goulu does not actually come to any conclusion as to if a cat is a liquid or a solid, and suggests more work should be done.

Note: No cats were harmed in the making of this story.

Source: boredpanda.com

M.A. Fardin. On the rheology of cats. *Rheology Bulletin,* 83(2) July 2014, pages 16,17,30.

Side effects of sword swallowing

As you have read up till now, Ig Nobel prizes are given to research that we might have all thought of before, but the researchers receiving the prize had the courage to write a report about it. The same goes for Brian Witcombe and Dan Meyer who received the Medicine prize for the medical report on 'Sword Swallowing and its side effects'. 110 sword swallowers from 16 countries participated in this research. Their goal was to find out how exactly sword swallowing can go wrong. All 110 participants are able to swallow a sword that is at least 2 centimetres wide and 38 centimetres long, and the longest recorded sword that someone swallowed was 60 centimetres.

One person even swallowed 16 swords altogether! Anyway, the conclusion was that many people suffered from throat aches, chest pains, lacerations, internal bleeding and in one case, someone had brushed their heart. There are many techniques to this art form, but they concluded that you run a higher risk of injury when you are distracted or adding embellishments to your performance. Sounds obvious, but it had to be in a medical report for it to be true.

B. Witcombe, D. Meyer. Sword swallowing and its side effects. *BMJ,* December 2006.

MINOR ABROAD

EDUCATION

Virgil (Sweden)

Which minor do you attend?

I am attending a free minor in Lund, which means that I picked 4 subjects which are Nanobiology related. I am attending Protein Engineering and Computational Physics and in the second half, I will do Medical Image Analysis and Lasers. We started with an introductory period of a month, which is actually only specific for the Faculty of Engineering. Within the Faculty of Engineering, there are a lot of weird traditions. People in other faculties are always really jealous of the people in engineering because they never do anything.

Are there differences in the set-up of courses?

I think in general the set-up of the courses is really similar to the set-up of courses in Delft. There are some small differences, for example in Protein Engineering, we will have to make the test at home, rather than in school and for Computational Physics, we have a test, but we also have four separate projects which we have to hand in, which are related to programming.

Did you have a culture shock?

I did not really have a culture shock. The people here are not really too different compared to the people in the Netherlands, and everyone speaks English really well. So there is not really any difficulty adapting to living here in Sweden.

Do you have any tips for students?

If you want to go to Lund or any other place that has a shortage of housing, try to find a place to live as early as possible.

Raman (Canada)

Where do you study now?

I study at Waterloo University in Ontario, 100 kilometre from Toronto.

What is Waterloo University like?

I follow three nanotechnology courses, a biology course and a physics course. I chose nanotechnology because I wanted to deviate slightly from the Nanobiology field. It was quite difficult to find five courses that did not overlap. The methods of teaching differ quite a bit. I have 50-minute lectures, barely any tutorials and classes as small as 18 students. They also take fewer breaks here. Some of my floormates have 3-hour lectures with a 5-minute break halfway.

Did you have a culture shock?

Students pay ten times more than students in the Netherlands, so they experience much more pressure to pass all their courses. Some university buildings are open 24/7 for studying, and there are students who sometimes do not go home but sleep for a few hours at the library.

What do you like better in Waterloo?

I appreciate the Canadian friendliness (the memes are true)! For instance, when Aisha and I arrived in Waterloo, we were struggling with our luggage and a car stopped and offered to drive us to our destination!

Any tips for next year's students?

Do not let yourself get intimidated by the idea of being away for a few months, you will meet new people and feel at home very soon!

Céline (Switzerland)

Where do you study now?

This semester I am studying at Ecole Polytechnique Federale de Lausanne in Switzerland. Lausanne is located in the French-speaking part of Switzerland. From the sports centre you have a beautiful view of the lake and the mountains on the other side, in France.

What courses do you follow there? Why these?

I am following courses in the field of biotechnology and chemical engineering. I like this field of study and I would like to follow more courses on these subjects. One course that I very much enjoy is Pharmaceutical Biotechnology. In this course, all kinds of biotechnological findings are discussed and you get a really good overview on biotechnology of today. Compared to Delft, classes are much smaller, there are 30 students per course on average. This makes it easy to contact the professor. I feel like the level of the courses is kind of the same at TU Delft.

Did you have a culture shock?

I think the prices for food are maybe the biggest shock. After a while, you get used to it, but when you go to France or Italy you realise that Switzerland is extremely expensive. Another difference is that all stores and shops are closed on Sundays, even the supermarkets. This resulted in having no dinner in the first week.

Any tips for next year's students?

I would say: just go for it! Going abroad will really change your perspective and you will have a great time. It is really fun to meet people from all kinds of countries and universities and also to explore the country that you are studying in! There is much more out there than just the clouds and rain in the Netherlands.

Natasha (Japan)

Which minor do you attend?

I am doing the exchange programme at Tohoku University. You partly work in a lab on your own project, and you also take elective courses. I am attending a Japanese language course and a Japanese Culture class. It is not obligatory to learn Japanese. I am also taking a computer science course, but that was just arbitrary.

Are there differences in the set-up of courses?

In Holland, the test is representative of your grade. However, here it is more subjective, so you have to come to the lectures to get a good grade. In one course, I do not even have a test. You only have to come to the lecture, and at the end you write a summary of what you have learned, and that is it. It is a bit more like high school and feels childish.

Did you have a culture shock?

It is very different. For example, you are not allowed to call in an open place, and you are not allowed to walk on the escalator. You also cannot eat while you are walking on the street, it is not polite, whilst I always did that in Holland. Also how they behave towards professors is different, as you have to show so much respect. Once, I saw a girl and her professor. When he took a taxi, she bowed politely at him, and continued doing this when he had already left.

Any tips for next year's students?

Please study the language. Please do it. You will never get around without it. If you already know where you are going, it is good to learn about the culture, and whether you want to live like that or not.

BREWING NANO BEER
IN THE FIELD

We interviewed Dennis Kenbeek, a student of Nanobiology who is very fond of brewing beer, with a special Nanobiology twist.

Dennis started making his own beer a year ago with his brother. His mother gave him a small kit on how to brew your own beer, and he really liked it so he just continued. His favourite beer to make are IPA's, they allow him to play around with them. ***"Because I make those the most, I also drink those the most, so by that standard, that would be my favourite beer."***

What is unique about your beer?
Well, the fact that it is my own makes it pretty unique. It also takes time to develop a particular style. Actually, the one I am brewing at the moment is with hops that I harvested myself, so that is pretty unique, there is no one using those kinds of hops right now.

Tell me about those hops
They come from somewhere in Zaandam, where I am from, and they should be harvested around the end of September. You just harvest them by picking out the flowers, then letting them dry on a sheet under the sun. If you do not have enough sun you can use your oven.

Warm or cold?
"Cold, no discussion about it. Some say there is more flavour in a warm beer. I don't buy it."

How do you culture your yeast?
After the whole brewing process, when your beer extract is at the right temperature, you need yeast to begin the fermentation process. The problem is that it is very expensive to get good yeast, so I thought I might apply my Nanobiology knowledge: I got some Petri dishes, I made my own agar and I am growing my own yeast on those. It is a work in process, and so far it looks like it is going fine.

What would you say is a basic mistake to make?
Not working sanitised enough; you need to work very clean. The slightest contamination in your wort is going to mess it up because it basically consists of sugar water at a warm temperature, the ideal place for undesirable microorganisms to thrive.

In the future, he hopes he still sees himself always brewing beer, just as a hobby. "If at some point I decided to start my own brewery, which I find unlikely, then that would be very cool. For now, it is still a hobby."

Let us look now at how it is made:

Please use:

- Malt grains
- Grinder
- Thermometer
- Linen bag
- Airlock system
- Hops
- Yeast (S. Cerevisiae)
- Sugar

Instructions:

1. Grind the grains using a grinder. Not too fine, you need a coarse grain size.

2. Heat up water to 50°-60°C and pour in your grains. Raise the temperature slowly up to 75°C. That interval of temperatures is where the enzymes in your grains work best at metabolising sugars. A higher temperature will denaturalise the proteins.

3. After 1 hour and 15 minutes, raise the temperature up to 80°C and then stop heating. Time to take the grains out. Dennis uses the "grain in a bag" method, using a bag that contains all the grains in the water, which you lift out to separate them from the wort, which is the solution that is left in your pot.

4. Heat up until there is foam forming and then add the first hops (for the bitter taste). There are many different programs to follow, but normally you add the bitter ones first, and at the end, the hops that supply the aromas, because they are very volatile and lose their aroma if cooked for long. Using a predesigned program will make your life a lot easier.

5. Filter the hops and wait for some time until the beer has cool down to around 20°C (room temperature is also fine). Now it is time to add the yeast, which is needed to get the bubbles in your beer. They feed on the sugars in the wort, creating CO_2 and alcohol as waste products of their metabolism. During fermentation, let some CO_2 escape through a special airlock that prevents air from coming in.

6. After a month of fermentation, transfer the beer into bottles, together with a little bit of sugar. These are called priming sugars, and help to correct the amount of CO_2 in your beer.

7. After 3 weeks, you will get a nice beer. Enjoy!

SCIENCE (FICTION?)

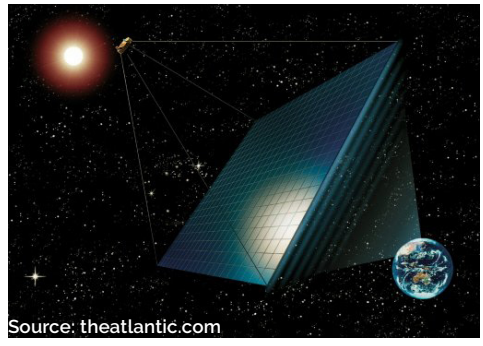
HISTORY

If we look at mankind from a historical perspective, one of the most powerful driving forces of human creation and invention has been curiosity. Curiosity to find new land, curiosity to discover new kinds of animals, and curiosity to find out what is fundamental to the world we live in. This interest not only makes us behave in new ways (even if it may not be the safest option of living), but it has also made us philosophise about our world: how can we extract more knowledge about life and what are possible futures?

This question has lead to an enormous amount of predictions about the future and these give us a very clear perspective on how the people that made these forecasts saw their world. Let us see which elements of predictions from several decades ago have really been implemented into our society.

Genomic engineering and space exploitation

The first predictions to discuss are a series of lectures organised to celebrate the 25th anniversary of NASA in 1983. These are four talks of historian James Burke, science reporter Jules Bregman and scientist and science fiction writer Dr. Isaac Asimov in which they give their views on the present society and their perspectives on the future society. Their predictions consisted of various categories: on healthcare they already predicted the increased genetical research and, funnily enough, they also mentioned the 'retirement at age 65' to be totally untenable. Dr. Isaac also thought space would have many possibilities in the form of outsourcing solar-power stations and polluting factories to space. While these ideas are not yet economically viable, they might still come true in the future.



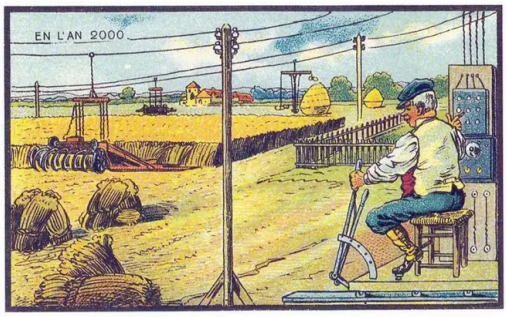
Source: theatlantic.com

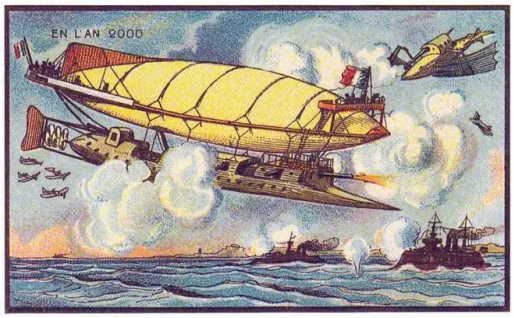
Is this how our future power sources will look like?

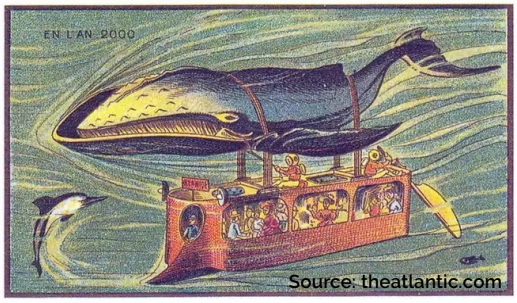
The rich fantasy of the French

Around the year 1900 Jean-Marc Côté and other artists made a series of paintings under the name "France in the Year 2000". While they may not all have been very serious predictions for the future, it is still funny to look if there are aspects that give a good image of the actual situation.

In the upper left picture, we can see a farmer sitting on his porch, overlooking his land, which is automatically being tilled and harvested. The wheat is collected, and put into various places all over the field. For a drawing made in 1900, this is surprisingly accurate for today. A lot of functionality shown here are regular commodities in everyday agriculture, and those that are missing, like self driving tractors, are being worked on as we speak. It is a lot easier to plan a route along an empty rectangle, than along a curved road filled with unpredictable hazards, it would seem.







Source: theatlantic.com

The next image denotes a scene in which a blimp is travelling along with various airplanes, accompanied by boats in the water. This image immediately seems a lot more dated. While the idea of flight was well ingrained into the minds of the populace as something new and exciting, the clear lack of a Wright-inspired airplane should clearly indicate the age when this was drawn. No one could have expected a century to start with a plane that barely comes off the ground, to a jet which is easily able to break the sound barrier.

The third image might seem ridiculous at first glance, but the concept of firefighters from the sky is not that far off from what we do today. The delivery method of that water is just different. Another interesting thing to note, just as with the second image, is that steam clouds are predicted to still be prevalent today. While today, we mostly dream of a clean sky, with fresh air, apparently the clouds were so ubiquitous that their staying power was seen as an inevitability.

The last image is outright ridiculous. I mean, really? Transport by whale? Those creatures are as stubborn as they are large!

Dystopia

Of course, not all fiction is so optimistic. Various authors have tried to puncture through the veil of technological progress and integrate societal change into their fiction as well. Cyberpunk as a genre might seem very much science fiction at the surface, but if you ignore the 'alluring sci-fi element' (replicants in Blade Runner, sleeves in Altered Carbon), what is left is an exaggeration or even a culmination of current-day societal trends and technologies. Big companies that have more power than the government, a stigma against the poor, and rampant uncontrolled criminality are all themes that frequent this genre. The stories within might seem too cruel to be real, but current trends show a progression more towards this outcome than away from it.

NANOBIOLOGY SYMPOSIUM 2018

MRNA REVIEWS

Seated in an elongated hall, with various gems and minerals layering the ceiling, we awaited the first speaker of the Nanobiology Symposium *'From Cell to Self'*.

Prof. Dr Ana Akhmanova brought us all back to Physical Biology of the Cell 2, showing us how far research has come concerning microtubules. Throughout her talk, she emphasised the importance of working with other labs and looking further than seems necessary.

The next speaker to grace our ears was Prof. Dr John v. d. Oost. As part of a bigger initiative, John was leading the labs on integrating genes into a single organism to create the minimal cell. Unsurprisingly, this work is complicated, and while the 10-year deadline looks doubtful, John stressed that the journey is far more important than the destination. A lot of good research has already come out of the initiative.

After all that technobabble and deep dives into experiments, it was very refreshing to hear from someone who is used to a broader audience. Prof. Dr Ronald Plasterk enlightened us on his idea to create a vaccine for a specific diagnosis of cancer. It shows that there is so much untapped potential in our field.

Afterwards, the audience and the speakers engaged in a fruitful debate, coordinated by 'debate master' Dr Bertus Beaumont, which left everyone inspired.

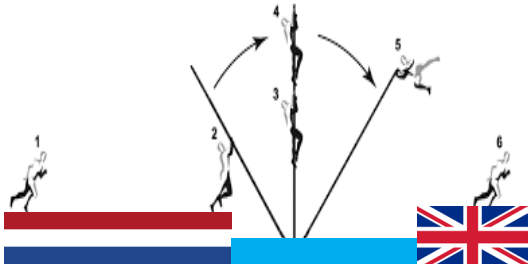
 Simon van Staalduine

POLE VAULTING AND MAPLE LEAVES

MRQNA

Regarding the upcoming visa restrictions in the UK I was wondering: how fast do you have to run and how long does your pole have to be to pole vault [fierljeppen] to the UK?
Anonymous

Assuming you depart from the Netherlands, the minimum distance to overtake would be 64.2 kilometres. A schematic of the situation would then look something like this:



If you want to minimise pole length, it is wise to choose a pole that is just half of the total length to overcome and because the depth halfway the North Sea is around 100 metres, this will result in a minimal pole length of 32.1 kilometres.

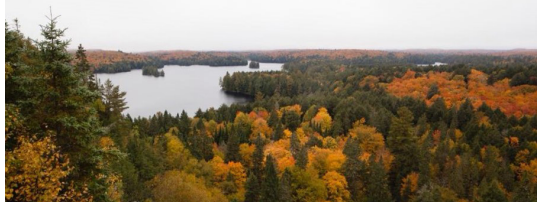
Looking at pole vaulting from a physical perspective, it is a process of converting kinetic energy into gravitational energy:
Poles made of carbon have a mass of around 3 kg/m giving a total mass for the pole of 96300 kg. To then arrive at the 'dead point' situation when you are halfway your jump and all your kinetic energy has been converted into gravitational potential energy, you need to gain a total of 15.2 GJ. Assuming the average human mass to be 70 kg, this results in a minimal speed of 47900 km/h, which is just twice the speed of the average space rocket!

In other words, make sure you place your pole in such a way that you do not hit any ships and you are good to go!

Dear mRNA,
Why and how do the leaves of (maple) trees change color?
Love, Raman and Aisha

Dear Raman and Aisha,
Such a good question, 100% in theme with the seasonal circumstances both in the Netherlands and in Canada!
There is an interesting explanation for this annual event. Leaves start turning from green into different shades of red and yellow because in autumn, trees have taken all the food they can from the leaves. Chlorophyll absorbs energy from light from the sun and is makes a leaf green during spring and summer.
When autumn starts to set in, trees catch less and less sunlight. Due to this, leaves stop making food, and the green pigment is broken down into colourless compounds. The space is filled with yellow and red pigments, causing the tree to flourish in the traditional fall colours.

Lots of love,
mRNA



BACK INTO THE STUDY BOOKS

RANDI

>> rng ('shuffle');
>> randi(nr_leden)
ans = 70 %Michael Stolk

Hi, My name is Michael Stolk. I am 22 years old and I am a pre-master student. The only one starting this year, I believe. After Mario asked me to write something for mRNA, I read the previous issue and I was surprised to find that Daniel Landré, my OWEE mentor, wrote the last one. My story is reminiscent of his, in the sense that I find myself feeling like a 'Sjaarsch' at the age of 22. I have already completed a bachelor, worked in two laboratories for a year and now I chose to study a different field. So why would I leave my comfortable social environment in Eindhoven, adding two years to my student career to study somewhere else?

"Why would I leave my comfortable social environment in Eindhoven to study somewhere else?"

First of all, I felt that my previous program was not as fundamental as I would have liked. Biomedical engineering may sound like Nanobiology, despite my mother claiming she knows it is a totally different thing, but it is a whole other box of frogs. Second, I felt I was not being challenged anymore. You know that feeling when you start a new class and you feel like the dumbest kid in the room?
Getting good at something that kicked your ass at the start of the semester and turning that feeling around feels incredible. I just did not get that anymore in my previous program.

Sidenote, for anyone thinking about taking a year between your bachelor's and master's degree to work – I highly recommend it! My favourite part was the 6 months I worked at SCK-CEN, a

Belgian nuclear/space research facility where I worked on an antimicrobial coating for the water system of the ISS. This is a facility under heavy military guard, by the way, and it is great to start your day driving through a garage-sized Geiger counter blasting King Kunta by Kendrick Lamar. The looks I got were priceless.

"It is great to start your day driving through a garage-sized Geiger counter"

Anyway, now I am here, I have a mix of first, second and third-year courses for the upcoming year (sometimes reminding me that wow, I feel old as hell) and then I am starting my master's degree. With Landré's ~~pressure~~ advice I joined Laga, and with only 30 ECTS this year I find myself rowing twice a day now. Delft is looking pretty good so far, and I am glad I took the steps I did. One thing I regret about leaving Eindhoven? I left my bike there, and I have been Mobiking my way around campus. Does not help with the 'Sjaarsch' feeling.

Have a great year,

Stolk

UPCOMING ACTIVITIES

HOOKE AGENDA

Events	
BEP/MEP Event	14/11
Course Evaluation Year 1	15/11
Course Evaluation Master	16/11
Diesweek	
· Beerpong tournament	19/11
· Food festival	20/11
· Dies Party	20/11
· Brakke bingo	21/11
· Bubble football	22/11
Course Evaluation Year 2	26/11
General Assembly 2	28/11
Master activity: Venture Cafe	29/11
Lunch lecture Exon mobil	04/12
Sinterklaas	05/12
Midterms	
Year 1	
· Physics 1A	11/12
· Analysis 2	13/12
· Chemistry 2	14/12
Year 2	
· Physical Biology of the Cell re-exam	10/12
· Systems and Signals	12/12
· Electronic Instrumentation	13/12

BEP/MEP EVENT

Do you want to know which labs you could do your Bachelor End Project or your Master End Project at? And are you curious about the types of projects they have for you? Come to the BEP/MEP Event at November 14th at the Erasmus MC in Rotterdam and learn everything there is to know!