

mRNA



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INTERVIEW MAARTEN VAN DER SANDEN // POLITICS OF CELLS // JOURNEY TO SPACE
RESEARCH AROUND THE WORLD // ANIMAL PROTECTION // HOOKE ACTIVITIES



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COLOPHON

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EDITORIAL

ROOS KRAAIJVELD

Dear reader,

As Nanobiology students, we are used to being in two places at once. But during the summer some of us will spread all over the world, bringing back lots of incredible experiences and memories. Before any of that happens though, ahoy the mRNA boat and let us take you on a journey!

In this edition we went global... we dug deep into the field of research around the world. We noticed that politics, culture, and communication are becoming a bigger part of international research, so we decided to touch upon these subjects too. Even S.V.N.B. Hooke is spreading all over the place, with LYSE and MDE taking a trip to Groningen and Cologne, respectively.



As for the mRNA, Mario, Erik and Eva have left the committee, leaving some big shoes to fill. This will not be a problem though, because the end of the year also means that mRNA 4 has just begun. Welcome Lulu, Anouck and Lukas!

Fellow readers, we are happy to give you a little bit of home just before your summer journey. Take us with you and stay connected to us! Just like Hebb's rule states: cells that wire together, fire together.

Happy reading! :-)

Roos Kraaijveld
Editor-in-chief of mRNA 4



FROM THE BOARD

AMÁRIA VLEDDER

Dear members,

The summer break is here and the sun is out again: it slowly recharges us for the year to come. Relaxing moments in the sun are a good moment to reflect on the past year.

In my debut in the mRNA, I compared the bond between Nanobiologists and Hooke to fluorophores and their excitation laser. Hooke has to emit the right wavelength in order to excite and show the beauty of the fluorophores: its members. In this metaphor, I, as one of the scientists controlling the experiment, am now to do some image analysis. In my results I am pleased to see many bright fluorophores. We balanced fun, bonding activities with events to improve career perspective and education. We held activities that were already known to be exciting, like the skiing trip, the multiple day excursion to Cologne,



ASconnect and many more. In addition, we had new successful activities, like the big study trip to Scandinavia, the debate, the members weekend ExoN, and the pre-lustrum bike rally. Which one excited you the most?

That being said, I hope we have facilitated friendships that last a lifetime and a foundation to a successful career. I could not be more proud of what my fellow scientists have put out there. They dedicated a whole year to their experiments and learned a lot along the way. New scientists are ready to take over and I trust that, under their guidance, Hooke will maintain its growing curve, worthy of celebrating its first lustrum!

Enjoy the rest of your vacation!

I have spoken.

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

COMPETITION AND DIVERSITY AT THE COHECIE DEBATE

MRNA REVIEWS

As Fokko van de Bult took the stage in S.V.N.B. Hooke's first debate, he received loud applause. All other debaters, both students and professors, were amazed by his clever arguments. His summarising talk marked the end of the Cohecie debate, and it was certainly not the only impressive speech of the evening.

Before the start of the debate, all participants were warmed up in a crash-course 'structuring your arguments', given by our own Michael Stolk. He stressed that Systems & Signals or Analysis will not help you much in a debate. *"Do not lose yourself in the details"* is the main message: only clear-cut arguments that relate to the real world can lead your team to victory.

After clarification of the first statement: 'Genetic screening should be mandatory if a genetic disease runs in your family', Bas Nieuwenhuis opened the debate. In six different teams, three in favour and three opposing, the attendants confronted each other with arguments on free will, health, and compassion. Among them were

students from all years, but also the teachers Fokko (Analysis) and Hegias Mira Bontenbal (Evolutionary and Developmental Biology). The jury, starring Mario Negrello, decided that the opposing team won on the first statement.

The debaters were even sharper in the second round, where the teams discussed whether the growth of human backup organs in pigs should be allowed. The opposing team argued that these 'piggy banks' would only enlarge the gap between the rich and the poor. *"I am really surprised about the level of the debate,"* said Michael just before the pizza break. Mario Negrello disagreed with him: *"I see these students every week",* he declared, *"and I expected this high level all along."*

With Fokko's breathtaking closing speech about climate change and 'premium-organs', the debate wrapped up. After the applause came to an end, he returned to his team members: *"I could not have done this without your arguments",* he said timidly.



RESEARCH AROUND THE WORLD

MRNA ON TOUR

Congratulations! You have just been invited to go on a World Tour by a rich science philanthropist. What a time to be alive! You have the opportunity to go to exotic locations, meet indigenous tribes, and you are granted all the funding you need. What would you like to research? To see what kind of questions you would want to answer, the first thing you need to know, of course, is: what kind of questions are you allowed to answer?

As it turns out, most countries follow internationally set guidelines on bioethical research. The differences in legislation are found in the particular cases that animal rights activists and abortion activists fight for.

The subject of animal experiments is a particularly nasty one, as you can read on page 16. No researcher takes pleasure in experimenting on animals, and there are current research projects focused on finding surrogate experimental methods. In the short term, however, certain topics like behavior cannot be studied in a Petri dish. Concerns have also been raised about the aim of the Dutch government to be the first *European Union (EU)* nation to rid itself of animal experiments altogether. By 2025, that could leave quite a few researchers without a job, or with a job in another lab, in a different country.

Make no mistake in this: just because animal experiments and other contentious practices are outlawed in one country, does not mean that they can be phased out. Do you still have your ticket for that World Tour? Get ready for a very bumpy ride.

It is time to go to China. Because of all the talk about 1984-esque government surveillance concerns, it has come to light that China has a problem enforcing international ethics. An *EU* commission that looked into particular cases of exploitation of low-income areas by western scientists (*TRUST*) found that in 2000, a many ethical violations were committed by *Harvard* scientists to inhabitants of a poor area in China involving the acquisition of blood samples. In *TRUST*'s final report on this case and others, this was a particularly poignant quote:

"In particular, in those research projects driven by commercial interests, when capital uses its economic and technological advantages to exploit resources and benefits from low and middle income countries in the guise of scientific research, low and middle income countries find it difficult to resist. Different levels of exploitation might be found in this process, including the exploitation of local individual citizens as human research participants, the exploitation of the local scientific community, and the exploitation of local countries' national interests."

- ("Ethics Dumping' – *TRUST*'s Report on Paradigmatic Case Studies | *TRUST*," n.d.)

This practice is called 'ethics dumping.' In the United States, Europe and several western countries, bioethics are carefully regulated and observed. Countries of lower economic and social capacity are not able to regulate science as tightly. This can be interesting for those scientists who desire to perform experiments that fall outside of internationally set ethical boundaries.



Source: theneweconomy.com



The San People

The first living human head transplant was set to be performed by an Italian doctor in China last year (the patient cancelled the appointment). More well known is the announcement by Hè Jiànkui that the first genetically engineered babies had been born.

This exploitation of the lack of oversight does not limit itself to researchers in China, obviously. Indigenous African people have been the subjects of much more overt exploitation by foreign scientists. In one case, the San People were involved in a research project to sequence their DNA because it was speculated that these people had the closest ties to the most recent common ancestor of all humans.

The level of disrespect the researchers showed these people was staggering. The San leadership asked about the informed consent process multiple times without getting a comprehensive

answer. The language used in the resulting paper ('Bushman', 'Hunter-Gatherers') also revealed a lack of sensitivity on the scientists' part.

The *EU* has made recent efforts to combat this kind of ethics dumping by way of a new set of ethical codes, added to the standard protocols that ethics committees have to follow. The expectation is that this way, research grants handed out by the *EU* will have a lesser tendency to be dangerous or disrespectful to the people involved in the research.

So when you do go on your trip, be careful of your companions. The temptation to eschew ethics just because you can get away with it is a significant one. I wish you good luck, and a moral high ground from which you can correct any padawans that are led astray. The mRNA is happy to have given you your safety briefing. Thanks for joining us.

NANO SUMMER ADVENTURES

MRNA ON TOUR

In this tour, we have made a top-10 nano-related sightseeing places in Europe especially for you to visit this summer

Rosalind Franklin, Cambridge

Do we need to introduce her? The discoverer of the structure of DNA. You can visit the sculpture that is dedicated to her here.

Eden Project, Cornwall

Here lie two biomes that have flora from all over the world. One biome represents a rainforest environment, and the other a mediterranean environment. If you have time, visit the botanical garden there too! (Picture 5)

Freshwater, Isle of Wight

The birthplace of our hero Robert Hooke is of course a must-see for every Hooke member. (Picture 4)

The City of Arts and Sciences Museum, Valencia

One of the most beautiful and largest museums in the world and they even have a giantic DNA strand, partially made out of glass. (Picture 2)

Down House, Downe

The former house of well-known Charles Darwin is now a museum about both himself and his discoveries. (Picture 3)

CERN, Geneva

What is the universe made of? Although the large particle collider is not open to the public, you can visit the CERN museum for free or book a guided tour! (Picture 1)

Louis Pasteur Museum, Lille

Louis Pasteur is primarily known for his pasteurisation and development of the rabies vaccine. He once stated: "*chance only favours the prepared mind.*"

Marie Curie Museum, Warsaw

Did you know that she is the first woman to win a Nobel prize and the only person that has won two Nobel prizes in two different sciences? Marie Curie devoted her life to research about radioactivity.

Museum Mendel, Brno-střed

"The story of a humble genius." A museum about our founding father of genetics Gregor Mendel

Deutsches Museum, Munich

Step inside the world of technology in this 'museum of everything in science'. Visit expositions on computer science, brewing, bridge building, and of course do not forget the planetarium.

Image sources:

1: bfischool.org

2: lonelyplanet.com

3: english-heritage.org.uk

4: redfunnel.co.uk

5: youcouldtravel.com

Map: freepik.com

1. CERN



2. The City of Arts and Sciences



3. Downe House



4. Freshwater



5. Eden Project



POLITICAL SITUATION OF THE CELL

OPINION

Let us get political, because this is a topic that, among the general populace, is not talked about enough. In the era when people have tried to get more in touch with nature, rediscovered their chakra's with the resonant frequencies of healing crystals, and talked about the 'fundamental nature of lobster behaviour', I feel like we are forgetting a small part of nature. A part so small it can be measured in micrometres. I do not want to model our life after some crustacean creature, or creative crystal energy, I want the answers to come from within ourselves! Let us see if we can model behaviour after our own cells.

Take the pluripotency of cells. That is a much more accurate example of how, in real life, we specialise in our respective fields. We all start as little babies, infinite potential, zero special abilities, if we are not counting 'merely existing to eat and vomit'. Over the course of the lives of a cell and its offspring, we can see that the

things a cell *does* increases in effectiveness, while the number of things it *might be able to do* decreases. This is affected by its immediate environment and its lineage. Are humans also affected by parents and their immediate environment in such a way that they inevitably work in the profession that was destined for them?

I am calling this way of looking at ourselves as through a fractal lens. As we zoom in, patterns we might see in society can be reflected in patterns we see in our own cells. Not only is this nice for drawing parallels, but we might also be able to get answers to current day questions. The way that cells get their nutrients, without asking first, smells like socialism. The way cancerous individuals get excised immediately, lest they become a majority, reeks of fascism. Maybe we should seize the means of production and give it to the oligarchs!





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MICROSCOPES, GENES, AND MORE

NANONEWS

Fungus Modified with Spider Venom to Fight Malaria

There might be a new remedy for the ever-growing problem of malaria. A fungus genetically enhanced with the venom of the Australian Blue Mountains funnel web spider is supposed to kill malaria-carrying mosquitoes. The mosquitoes rapidly evolve resistance to insecticide, which is part of the reason why the disease is on the rise, especially in African countries. The new fungus could be an easy solution for this. The fungus used is already lethal to the mosquitoes, but when it was enhanced with this venom, test results showed a 99 percent decrease in mosquito population size after 45 days of exposure to the fungus. The idea is that local residents of high-risk areas can easily defend themselves by putting the fungus on a cloth with some locally produced sesame oil. If the mosquitoes land on the sheet, they get infected by the fungus. Other insects like bees are not affected by the fungus. This new technique is very promising and hopefully can someday be implemented in the troubled areas.

Source: Lovett, B., Bilgo, E., Millogo, S. A., Ouattara, A. K., Sare, I., Gnambani, E. J., ... St. Leger, R. J. (2019). Transgenic *Metarhizium* rapidly kills mosquitoes in a malaria-endemic region of Burkina Faso. *Science*, 364(6443), 894–897. <https://doi.org/10.1126/science.aaw8737M>



Source: yearofcleanwater.org

New 3D Microscope

Researchers at the *European Molecular Biology Laboratory (EMBL)* in Heidelberg have developed a new 3D microscope, with a higher resolution and a higher imaging rate than ever before. With this microscope, they are able to study the beating heart and blood flow in a small Japanese rice fish. They can even follow a single blood cell of the fish through the heart chambers in real time. In the image below you can see the laser setup, with which the microscope collects its data. Many biological processes move at such a high speed that previous microscopes could not capture enough images per second to accurately observe them. The microscopes for which this was not a limiting factor



Illustration of the heart of a Japanese rice fish

could not capture images in 3D, which is necessary to fully understand these processes. An advanced method using light field microscopy was used to create this 3D microscope, and it will hopefully make a lot of new research possible. Researchers at *EMBL* are already planning on studying the activity and dynamics in neural networks.

Source: Wagner, N., Norlin, N., Gierden, J., Medeiros, G. de, Balázs, B., Wittbrodt, J., ... Prevedel, R. (2019). Instantaneous isotropic volumetric imaging of fast biological processes. *Nature Methods*, 16(6), 497.



New Gene Emerges Under the Eyes of Researchers

A group of researchers at the *TU Delft* has seen a yeast named *Saccharomyces eubayanus* gain the ability to dissimilate maltotriose. This made them the first ones to experimentally observe the emergence of a new gene as a result of neofunctionalization. Previously, the process of one of two gene copies obtaining a function which was completely absent in the ancestral gene, had only been theorised based on posteriori analyses and not actually observed.

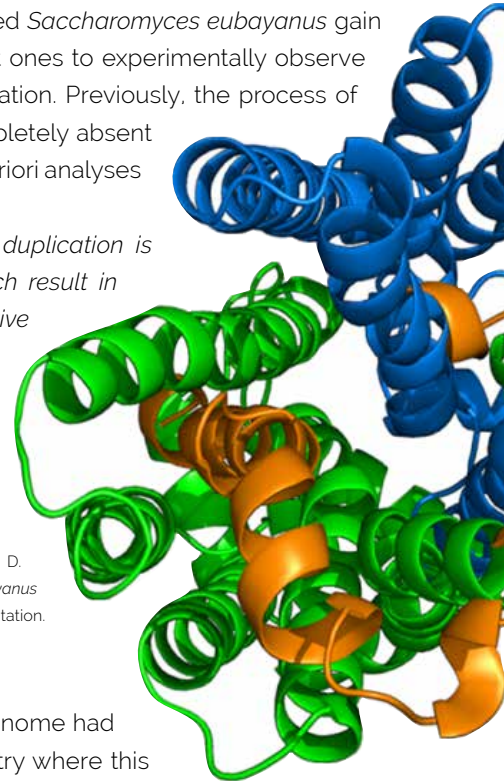
The researchers state: *that functional redundancy by gene duplication is critical to this process, as it enables mutations to occur which result in loss of the original gene function without engendering a selective disadvantage*. One might wonder about the use of this new gene. Well, after testing, it was concluded that the newly evolved yeast can be used to brew beer that *'combines the exotic flavours of wild yeast with the fresh taste of lager'*. Finally, some research with a useful application.

Source: Brouwers, N., Vries, A. R. G. de, Broek, M. van den, Weening, S. M., Schuurman, T. D. E., Kuijpers, N. G. A., ... Daran, J.-M. G. (2019). In vivo recombination of *Saccharomyces eubayanus* maltose-transporter genes yields a chimeric transporter that enables maltotriose fermentation. *PLOS Genetics*, 15(4), e1007853.

Genetic Data Regulation

Everyone remembers the CRISPR babies; twin girls whose genome had been edited using CRISPR-Cas9. Now China, the same country where this widely disapproved experiment took place, has introduced a new law regarding the unauthorised collection and use of the genetic data of its citizens. This not only includes the biological samples, but also the genetic data analysed from them. The law, which goes into effect on July first of this year, comes following a scandal that took place last year which involved a large amount of genetic material and data that was shared without government permission. Previously published drafts of the law were met with concern about the effect on international research from the scientific community. The current version does, however, not require additional approval from the ministry to publish the data in journals, provided that a few vaguely defined requirements are met. We can only hope this means that China's enormous population will not be isolated from future research which has yet to be carried out.

Source: Cyranoski, D. (2019). China announces hefty fines for unauthorized collection of DNA. *Nature*.



Prediction of the structure of the protein transcribed from the new gene



Source: Jerome Favre/EPA/Shutterstock



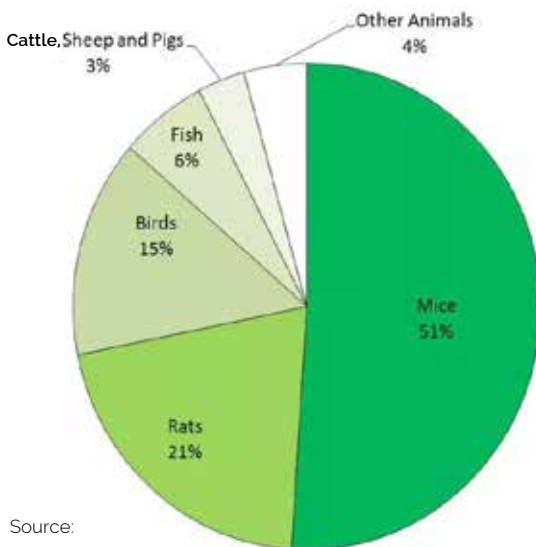


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ANIMAL PROTECTION AROUND THE WORLD

RESEARCH

For decennia, animal ethics have been an increasing point of focus in laboratories and therefore increase both the regulations and transparency of data of animal use worldwide. The three R's (refinement, replacement and reduction) are widely accepted in research around the world. In 2015 and 2016, the Netherlands popped a bottle of champagne: twice, the amount of animals used in research had been reduced by 10%, the campaigns had finally started to work. However, the data of 2017 have been published just a few months ago, with a disappointing conclusion: the use of laboratory animals has grown again with 17.9%, showing that we are still far from reaching our goal. This trend therefore raises the following questions: can we put these numbers in a global perspective, and how committed are countries around the world to protecting and improving animal welfare?



Source:

speakingofresearch.com

Animals used for research in the Netherlands in 2015

Remarkably, numbers on the amount of animals used worldwide do not exist. While the *European Union* collects the animal usage data of its members and publishes these, for most countries in the world we can only rely on estimates. There are also countries where certain species are excluded from the official data they publish. The United States of America, for example, exclude 95% of the animals used from the official data, as they do not take into account mice, birds, rats, reptiles or amphibians. This absence of data makes it very hard to tell whether there are any global trends in laboratory animal use. We can, however, use other parameters to evaluate the global situation.

Luckily, the organisation *World Animal Protection* has tried to help us by evaluating the worldwide animal welfare standards with its World Animal Protection Index. They have ranked 50 countries around the world on five different themes. These include treatment of animals, communication of animal protection issues and the degree of recognising animal sentience.

In general, Europe scores in the top regions of this index, with legislation that requires minimum standards for housing and care of laboratory animals. They also have a committee that reviews and authorises all animal experiments and restricts the use of certain animal species. Austria has an especially strict law that suggests protection of animal wellbeing to be of a value equal to that of humans. Switzerland is another notable country, with a unique law protecting an animal's dignity, prohibiting humiliation, and exposure to anxiety.

The scores of Asian countries are more diverse, with India especially standing out because of its animal friendly regulations. In India, five founding principles are used in ethical consideration for scientific experimentation with animals, that are based on pain avoidance, good living conditions, sentience-based species selection, and an emphasis on moral responsibility.

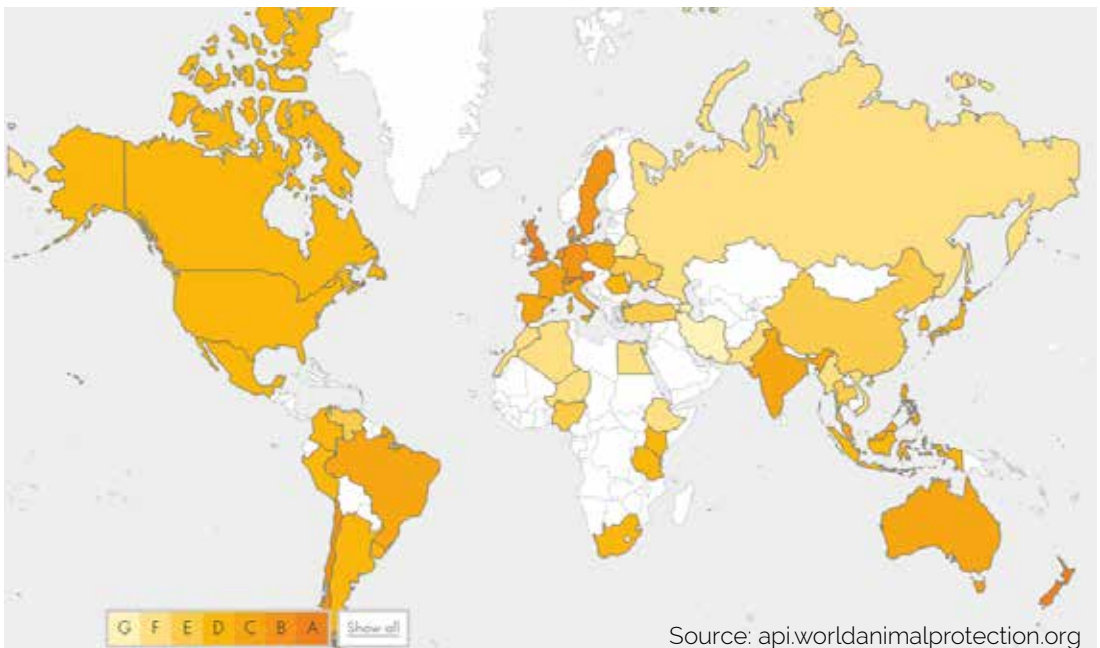
Since political stability and economic factors reflect on laboratory animal laws and regimes, the lowest ranking participants in the Animal Protection Index are countries from Africa and the Middle East. In most of these countries there is barely any regulatory oversight, nor legislation, and although international guidelines exist, following them does not have legislative priority.

As we can conclude, we still have a long way to go in communication as well as legislation in animal research worldwide. Since 2018, the

European Union has introduced stricter reporting requirements for its members, and hopefully the rest of the world will follow to increase the transparency of animal research.

“The opportunity to use animals in laboratory research is not an entitlement; it is a privilege accorded by society to certain members of the scientific

Fortunately, the perspectives for animal use in research are optimistic: extensive research is being done into the design of models to replace laboratory animals in the clinic. The advancements in these fields include advanced tissue models, 2D, as well as 3D cell cultures and complex physical modelling to evaluate drug properties. Now, the only question is where we could find the students with the right toolkit for this... Perhaps Nanobiologists are a perfect fit?



World animal protection rankings with labels of A, best, to G, worst

THE NETWORKS OF NETWORKING

INTERVIEW

Finding *"the structure and function of Vms1 and Arb1 in mitochondrial proteome homeostasis"* might mean something to many scientists, but to others in society it could seem a bit trivial. We do all this research in our lab for science, but in the end, we want to implement it into society. However, scientists often need a bit of help with collaboration, decision making and communication within innovation. This is where Maarten van der Sanden comes in: he is a social designer at the department of *Science Education & Communication*, faculty of *Applied Sciences TU Delft*.



Maarten has made many switches in his career. He started out as a biologist, later became a science journalist, and after a PhD at Science Communication on Social Medicine, he now works as an associate professor of communication design for innovation. The common thread in his career is systems biology: *to use the systems approach of biology to find out how people collaborate in networks of innovation, and to design these processes within social networks.*

What is your current research?

In our own communication lab (C-lab), we do research with scientists, businesses, industries and policy makers. We take their problems on innovation and collaboration into our lab and start designing a solution together using 'design-based research'. Through the design of prototype collaboration processes, which we use in the daily reality of these professionals, all C-lab members learn theoretically and/or practically. Our job is to see how factors such as culture, bias, urgency, dreams, and beliefs might affect our ability to

collaborate, innovate, and make decisions. As you can imagine, having 100 people in one network makes decision-making and collaboration turbulent.

More specifically, I like to research how a challenging environment can affect decision making. In a real environment, a bit of gossip and competitiveness can change the way people make decisions. Awkwardness is also important: if a decision-making environment is too sleek, people are not challenged.

How does culture play a role in science?

Countries may see science and technology completely different. There is a 'science communication law' which states that in more industrialised or digital countries, people are less attached to technology and science. In these countries, internet and smartphones are things that need to be there – they are already considered to be critical infrastructure, so people do not even

see them as technology anymore. They more or less get technology numb.

How can you communicate science to society?

You foremost need to be aware of your own identity and the according communicative roles and tasks. Ask yourself the question: 'who am I as a researcher?'. In communication, authenticity is very important; to be aware of who you are and the message you want to get across, along with what you want in return. A good researcher is someone who knows their own identity, as an individual, but also within a network, which can be one of the most challenging things in science and communication.

"Ask yourself the question: who am I as a researcher?"

What comes first: society or science?

There are certain trends in society, such as privacy, responsible research, innovation, and new technology. These trends morph the society into a certain direction, but this is an emergent process as there is no clear direction. In this pathway, sometimes, society is more powerful, and other times science is more powerful, they steer each other. This is called the co-creation of knowledge, as the two of them work together in an eternal braid.

How is the interplay between society and science going to change in the future?

It is going to be much more like a network society: nowadays, for example, the borders between university and society are becoming less clear, innovation will become a network initiative. Within a network society, power is distributed, which means that science communication becomes an important 'social lubricant' to connect, to energize, to discuss, and to dream together.



PHOTO CONTEST

**Send us a picture of your nano-related
holiday adventure!**

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mRNA** but also get a **signed copy personally delivered!**

Please send it to mrna-hooke@tudelft.nl



LYSE & MDE

MRNA REVIEWS

Lower-Year Study Excursion: Biotech in Groningen

What do you know about the city of Groningen? True, it is the city of the *University of Groningen* and the Martinitoren, and it takes a very, very long train ride to get there. However, the city is also home to several high-tech companies which makes Groningen the ultimate destination for Hooke's Lower-Year Study Excursion (LYSE).

The first stop, *ThermoFisher Scientific*, is a billion-dollar company that is world-leading in life science research and medicine. Their location in Groningen mainly deals with large-scale antibody production. We saw how much effort it takes to enter a cleanroom and glimpsed at the impressive 2000L bioreactors.

On our OV bikes we proceeded to the *European Research Institute for the Biology of Ageing (ERIBA)*. In the labs, research is being done on different aspects of ageing, including Alzheimer's and Parkinson's disease, nuclear pores, and telomeres. After we marveled at the high-tech lab equipment, the company invited us to their Friday afternoon drinks. Integrating with the *ERIBA* crew was not that difficult while competing together in a puzzling Kahoot quiz.

The trip offered much more to enjoy, not in the least the pizza in the hipster restaurant, going out on our hipster bikes and staying the night in the hipster hotel. There is nothing above Groningen!

Multiple Day Excursion: Cologne, Germany

On the 7th of June, we started our Multiple Day Excursion (MDE) to the fourth biggest city of our Eastern neighbours: Cologne. This three days long study trip gave us a beautiful insight into the variety of institutes and museums of Cologne and environs.

Our first stop was the *Max Planck Institute for Plant Breeding Research*, where they showed us their research facilities for studying molecular mechanisms in plants. This was followed by a presentation and poster review at the *Center of Molecular Medicine*, a research and education centre which focuses on facilitating the bridge between medical research and the clinic.

The second day was all about museums, and for this occasion we travelled to Bonn. The Arithmeum was our first destination, at which we made a surprising trip through time to see the development of the calculator by the museum's vast collection of historical calculating machines. The following visit of The Koenig Research Museum gave us a beautiful insight into the diversity of species through their exhibitions in zoology.

We concluded our excursion with a 'surprise' on the last day: a stopover at the Kölner Zoo with a newborn hippo as the absolute highlight. All in all, we can say it was a wonderful weekend.

A NANO-JOURNEY TO THE STARS

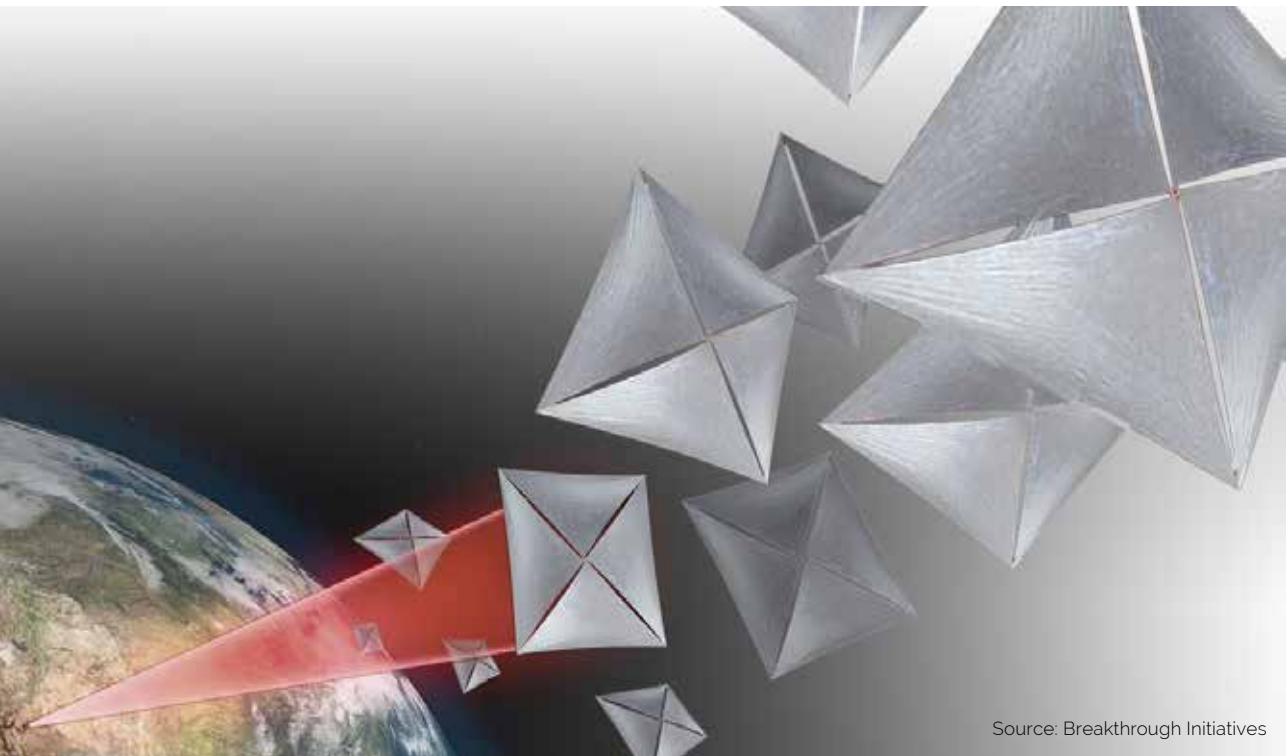
RESEARCH

Are we alone in the universe? A journey to the stars could answer that question. Within decades, nanotechnology might make it possible to reach Earth's nearest star system at a distance of 4.5 light years, Alpha Centauri. The research project *Breakthrough Starshot* designs low-mass nanocrafts, which are small spaceships driven by light sailing. A fleet of a few hundred nanocrafts is expected to reach Alpha Centauri within twenty years after its launch. That sounds just as exciting as it does impossible, but how does it work?

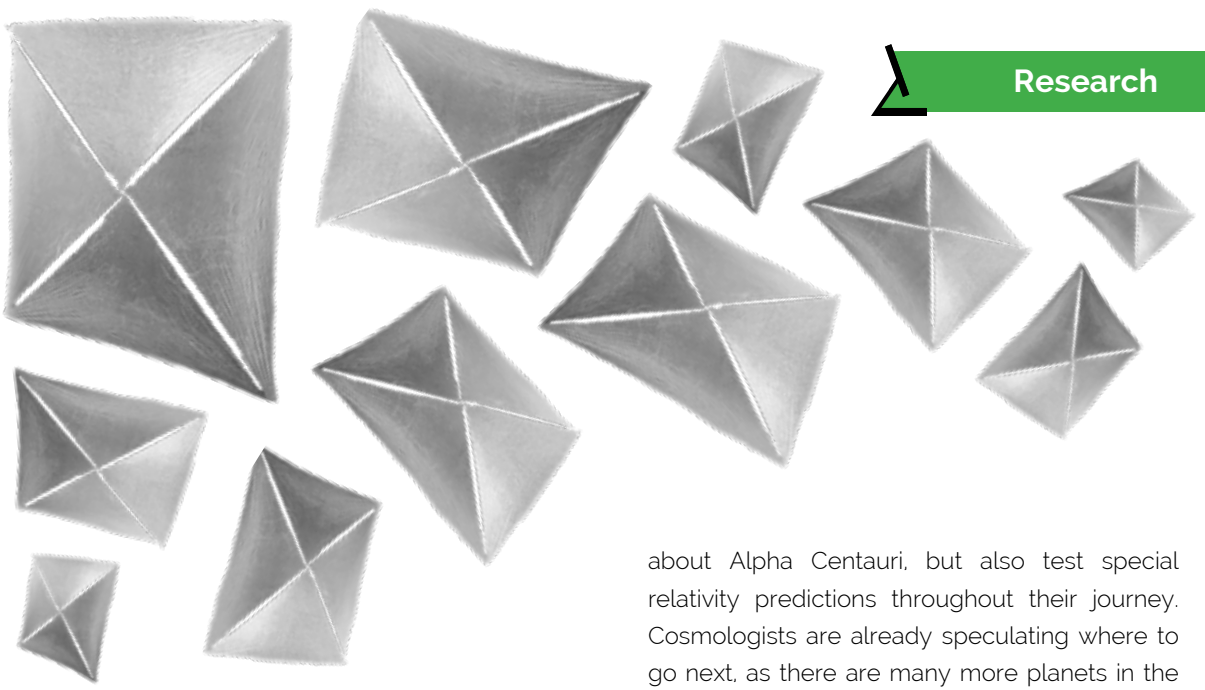
Initially set up by Stephen Hawking, Mark Zuckerberg, and others, *Breakthrough Starshot* develops nanocrafts consisting of a StarChip and a light sail. The design can be thought of as

a small sailing boat with an enormous sail, but instead of by wind the space sail is propelled by the momentum of laser light. Laser beamers stationed on Earth will accelerate the nanocrafts to up to 20% of the speed of light. With this enormous velocity the probes could possibly reach Alpha Centauri before Brexit takes place.

Both the StarChip and the light sail must be made of ultra low-weight material. The StarChip, carrying a camera and other radiation measurement equipment, has a weight of just a few grammes. A plutonium power source and other nanotechnological devices should keep the StarChip running for twenty years in space. The sail is four metres in diameter and only a few hundred atoms thick. Research into light sails



Source: Breakthrough Initiatives



is close to home: a *TU Delft* research group is currently experimenting with graphene sails for spacecraft propulsion. The responsible research team, *GrapheneX*, closely collaborates with the *European Space Agency* and was the first to test graphene as a material for solar sails.

Three main engineering problems need to be solved before we can start the journey to outer space. First of all, the nanocrafts must be able to withstand enormous accelerations and survive for twenty years in space. Also, the laser beam should be extremely sharply focused so it does not miss the target: Proxima Centauri B, a planet in the habitable zone. Lastly, the camera equipment needs to be very precise: the StarChip will have one camera pointed at the target planet and its transmitter must be aimed exactly towards the Earth. According to Stephen Hawking, all these problems are engineering problems that can be solved, so humanity will eventually overcome them and travel to the stars.

Once the nanocrafts are ready for take-off, hundreds of them will be launched at once. They will not only collect information

about Alpha Centauri, but also test special relativity predictions throughout their journey. Cosmologists are already speculating where to go next, as there are many more planets in the habitable zone waiting to be explored. Also, the question remains when humans will be able to travel outside the solar system, though that still seems like an impossible ambition.

"Of course there are major challenges to overcome. But these are not limitations set by the laws of physics: they are engineering problems. Engineering challenges tend, eventually, to be solved."

~ Stephen Hawking

Once they have reached their destination there is no way to stop the nanocrafts, so we will end with a special message for all extraterrestrial life forms: be aware of tiny objects flying quickly in your direction, and please remember that we will do no harm.

Breakthrough Initiatives. (n.d.). Retrieved June 22, 2019, from <https://breakthroughinitiatives.org>

Experiment with graphene as a material for solar sails a success. (n.d.). Retrieved June 22, 2019, from *TU Delft* website: <https://www.tudelft.nl/en/2017/tnw/experiment-with-graphene-as-a-material-for-solar-sails-a-success>

A MATTER OF TASTE



An eggplant is an eggplant. You would say. Elongated and black with a purple glow. But those who visit the local markets during their journey through Asia will see small white ones.

Eggplant is eaten all over the world but there are big differences in looks and size.

- Seed Valley is the international center for plant breeding and seed technology.

WHAT WILL YOU DO?
JOIN-SEEDVALLEY.NL



THE INTERNATIONAL BIOLOGY OLYMPIAD

RANDI

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ans = 44 %Yelle Tanesha
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Hi there! I am Yelle Tanesha, a first year student. Since most of us have been there, I will not go into detail about me being a freshman. Instead, I will go one step further back, to something I experienced even before becoming a Nanobiology student: the International Biology Olympiad (IBO).

First things first, for everyone who does not know what an olympiad is: it is a competition for high school students, and there are several olympiads for all kinds of different subjects: maths, physics, chemistry, biology, but also ancient Greek, astronomy, geography, informatics, and many more. They are all national competitions, but some of them also have an international final round.

So, the setup for the National Biology Olympiad (NBO) is as follows: everyone can participate in the first round, which is a test at your own school. Then the best 100 advance to the second round, consisting of a preparation day at a university and another test at your own school. The third round is the national final, a full week in Wageningen with the top 20 biology high school students, which is filled with lectures, practicals, tests, and some fun activities. The top four of these 20 will advance to the IBO. Because I placed second in the NBO (the winner of 2018 also won NBO 2019 and will be joining us in the Nanobiology program next academic school year), I proceeded together with three others to the IBO 2018 in Tehran, Iran. Together with 257 other competitors from 68 countries in total, we spent a week sightseeing, socialising, and experiencing the Persian culture. Oh, and



we also had some tests. In contrast to the NBO final, there were no lectures, and only two days of tests. However, the tests were much harder, of course. On Tuesday we had four 1.5 hour practicals with four themes: animal biology, plant biology, biochemistry and evolution & ecology. On Thursday we also had two three hour theoretical tests.

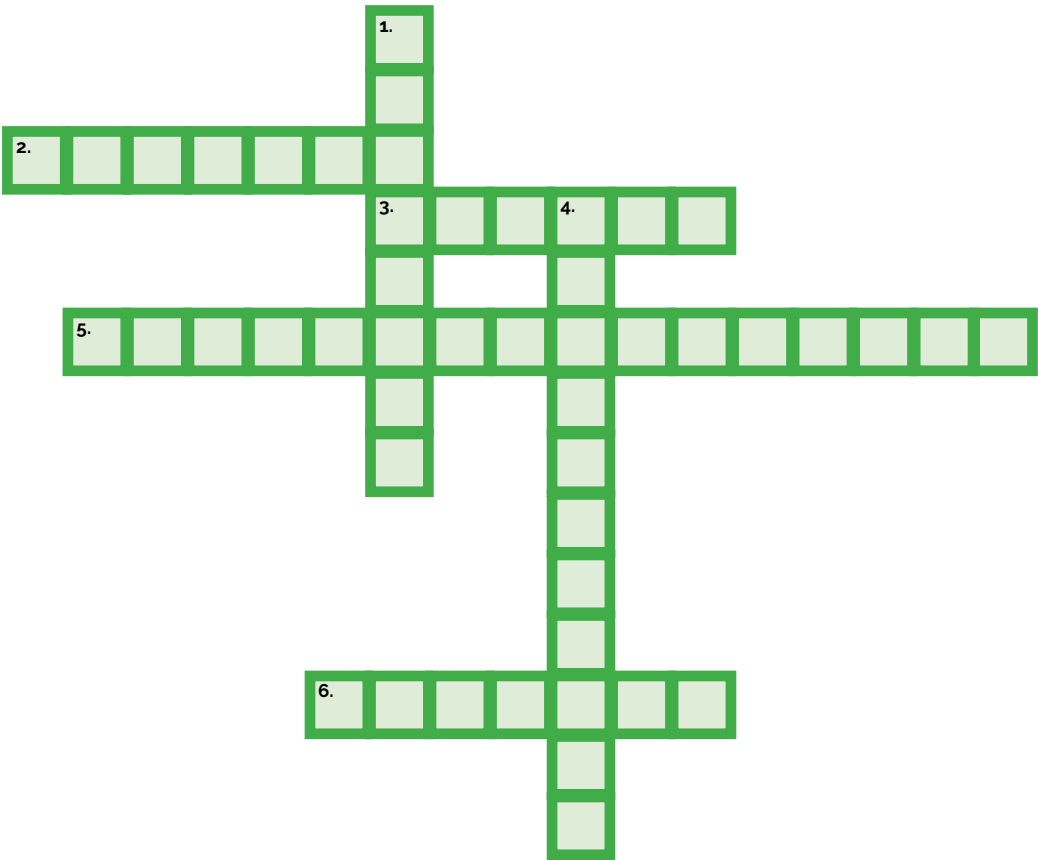
The people in Iran do like ceremonies and anthems. Even after already attending four or so other ceremonies on our last day, we heard three different anthems at every one. It also did not help that I had been playing games until four a.m. with some people from Argentina and South Africa the night before. But finally, the medals were awarded: the 10% best competitors got a gold medal, the next 20% get a silver medal and the next 30% get a bronze one. After the award ceremony we flew back home, having acquired three silver, one bronze, extraordinary experiences, and a lot of new international friends.

N.B.: The wuppie on the photo is our mascot, Geert-Ruud van Scheveningen.

SUMMER EDITION: PUNZZLE

PUZZLE

Warning: the puzzle in this edition contains jokes and puns! For every horizontal and vertical line, we have provided a set-up, and you have to guess the punchline.



Horizontal:

- 2. An essential kind of amino chocolate
- 3. The punishment you get when you use a specific fluorescence microscope wrong
- 5. This amino acid side-group stars Emma Stone and Ryan Gosling
- 6. A distant Spanish cousin of the DNA bases

Vertical:

- 1. This unique research environment between Rotterdam and Delft gives you ample opportunity to handle any fluid you might need
- 4. This coffee flavour tends to hit you hard, but you quickly recover

Answers: 1. Zwethlab, 2. Proline, 3. TRFje, 4. FRAPpucino, 5. Phenylalalandine, 6. Guanine

UPCOMING ACTIVITIES

HOOKE AGENDA

IntroN	16-18 August
Owee	18-22 August
Start of the new academic year	2 September
Stunt for opening lustrum	12 September
CoBo Hooke	24 September
Exams	30 September - 4 October



