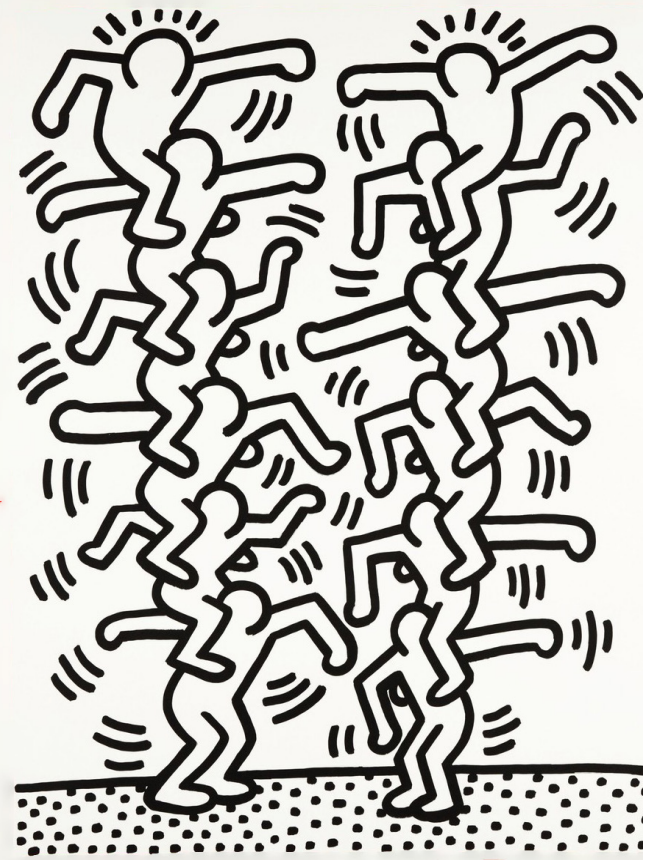

mRNA
YEAR 6 - EDITION 3
TOMATO
SOUP



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CONTENT

COLOPHON

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EDITORIAL

STEN DE SCHRIJVER

Dear reader,

As the sun is once again still shining well past nine PM, and the days are getting warmer, people spend more time outside and on the terraces. The campus is slowly but surely opening up, enabling students to follow physical practicals of Labcourse, Nanotechnology, or Bachelor End Projects. After this long and online academic year, we are close to its end. A new group of students will soon join the Hooke family, and some of her older children are starting new adventures after summer.

I am in the lucky position to tell you that we decided to treat this edition a little bit differently. As you may have noticed, there are more pages! This means more interesting, fun, and helpful articles. There are even articles included that require thinking from your side. Besides, we decided to be extra creative concerning the layout of this edition. Have a good look at the style of each page!

Whether you are spending the summer in Delft, at your parents' or in some country far, far away, we hope this edition gives you a bit of joy. Wherever you go, we offer you the chance of letting your friends and family know where you are having an adventure this holiday!

Since this is the last mRNA booklet of the academic year 2020-2021, I would like to thank all of you for your sweet and supportive comments about the booklets, the podcast (to which we uploaded new content!), and the two mRNA promos that joined the campaign posters around the time of elections in March in Delft. I can safely say that each of us enjoyed giving you awesome content to read over the last year.

Happy reading!
Sten de Schrijver, on behalf of mRNA 5

FROM THE BOARD

LULU NOTSCHAELE

Dear members,

As I am writing this, sitting on my rooftop, surrounded by colourful flowers, I can feel my skin getting sunburnt. Summer is here! And with that more things are finally opening up. You can visit museums again right around the time that you get this little exhibition of different art styles delivered to your doorstep. I hope it might inspire some to do so.

For my last 'From the board' as president, I would like to take you on a little trip down memory lane to one of my favorite lessons in high school. It was the art class where postmodernism was introduced, which my teacher did in a very dramatic way. He would make a gun using his fingers, walk up to a student, and say: "Imagine you had an actual gun against your head right now. Answer my question or I shoot: what is art?". If you google this, you get the following:

> **Art** / ɑ:t / noun
> *the expression or application of human creative skill and imagination, typically in a visual form such as painting or sculpture, producing works to be appreciated primarily for their beauty or emotional power.*

He would disagree with this definition. What about a monkey making a painting? Could the flowers surrounding me not be considered art? These are the kinds of questions that during the rise of postmodernism people got really into and they started to test the limits. For example by putting canned soup (hence the cover) and old toilets on exhibition in museums. If they called it art, who could dispute it?

Visiting museums to check out toilets is by far not the only thing we are able to do again. The board is very happy that before we hand over the reins to a group of five new people, we get to organise some physical activities at last. With Mario characters popping up all over campus during the rally, a paintball tournament, the end of the year "barbecue" and maybe even more, I can add some more great memories to this year. I am so proud of my board, and all the other wonderful people that kept Hooke going through these difficult times. Things are looking up again, and I can't wait to see what next year will bring.

I have spoken.

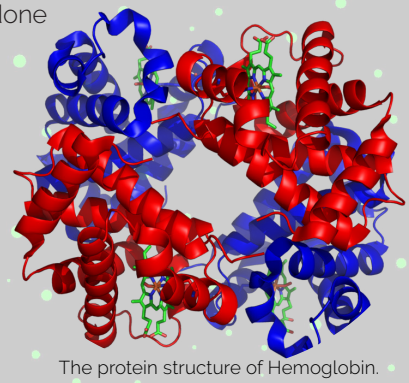
Lulu Notschaele
President of S.V.N.B. Hooke

REVOLUTIONARY PROPOSAL ON NEW SEQUENCING TECHNIQUE

NANONEWS

Our very own Biophysics and Physics 2 teacher Chirlmin Joo received a VICI grant in April this year. This is awarded to him for his proposal on a new technique that allows researchers to sequence one protein at a time. The method makes use of probing the protein profile.

Proteins perform most of the functions in living cells, forming the basis for life. To understand biological processes, including diseases, it is critical to monitor the protein composition of cells by identifying each protein species. This can be done by sequencing; however, in practice protein sequencing remains an enormous challenge. Joo proposed to develop a novel single-molecule protein sequencing technique, which will overcome the drawbacks of the existing methods.



The protein structure of Hemoglobin.
Source: wikipedia.org

This novel sequencing technique is based on a new single-molecule method, FRET X. It is an advanced version of the widely used method single-molecule FRET. This is the technique in which a protein is tagged with different fluorophores, where one of the two is excited using fluorescent microscopy. The excited fluorophore emits light at such a wavelength that the other fluorophore becomes excited and emits light at its own specific wavelength. This can be very helpful to study protein dynamics. However, in order to study the structure of biomolecules, a new approach is needed.

This is exactly what Chirlmin Joo Lab set out to do. In his proposal, Joo described a technique in which proteins are labeled with multiple short DNA strands which are in turn bound to fluorophores. By sequentially exchanging the DNA strands, the distance between each pair can be measured very precisely, which tells us something about the structure of the protein of interest.

What makes this technique so revolutionary is its accuracy. Using FRET X, researchers can probe a single protein many times, to increase the accuracy of its structural measurements. This makes that this technique generates ultrahigh-resolution data. By comparing these results to protein databases, researchers will be able to make accurate predictions about a protein's amino acid sequence.

As the Chirlmin Joo Lab is part of Bionanoscience at TU Delft, it is open to BEP students. Who knows, maybe in some time you can experience working with this technique yourself!

In case you are very excited to read more about Joo's proposal, a reference can be found using below.

M. Filius, S. Kim, I. Severins & C. Joo, 2021. 'High-Resolution Single-Molecule FRET via DNA eXchange (FRET X)', Nano Letters 2021, 21 (7), 3295-3301

Source background: vecteezy.com

ON THE ORIGIN OF CREATIVITY

ART

From a banana taped to a wall to the prehistoric depictions of animals in caves, art has always been a part of what makes us human. Though arguably not the only animal capable of making art, we have made it an intrinsic part of our cultures and communities. No matter who you are and where you live, art will have influenced your ideas and perceptions of the world, whether consciously or not. How did the concept of art originate and what even allows an organism to be creative in the first place?

Creativity

What is creativity and which areas of the brain are responsible for creative thought? Psychologists and anthropologists do not all agree on the origin of creativity and multiple theories exist. Some people hypothesise that the center of creativity lies in the frontal lobe, which is known for its crucial role in cognitive and executive functions. The frontal lobe also represents the evolutionarily newer part of the brain, it being the biggest in mammals.

Others think the answer lies in the parietal lobe. The parietal lobe is the only brain area that shows growth not just relative to an increase in size when comparing modern humans to our more distant human ancestors. Other researchers have hypothesised that language allowed for creative thought or that the cognitive demands necessary for tool making kickstarted the development of innovation.

All these theories, however, share a common root: the evolution of our cognitive capabilities. Maybe they got it the wrong way around.

What if it is not the evolution of other cognitive abilities that allowed the emergence of creativity? Instead, it could be the emergence of creativity that allowed language and tools to be made and used. Whatever the answer may be, it seems clear that creativity is indeed something that has been a part of the human condition for as long as we have existed.

Art

When you think about the origin of art you probably think of the cave murals like the ones found in France. One of the most famous caves in France is known as Lascaux and was discovered before the Second World War by a guy walking his dog. When he found this cave and the art inside, he protected it for over a year together with friends by camping outside of it. After the Second World War, the government took over his task. For a while, it used to be open to the public, but it has now been closed off again to protect the paintings. You can still visit a replica cave with replica art next to the original.

Inside, the cave depictions of prehistoric animals had been drawn using coloured pigment. There are also a lot of negative hand stencils similar to the ones you might have drawn as a child, outlining your hand on a piece of paper using a pencil or marker. What the purpose of these paintings was is unclear. What we do know, however, is that these paintings were important to the people that made them. Some paintings were made on the ceiling, too high to reach for a human. Some form of scaffolding had to be used to make murals in these hard-to-reach places. Additionally in a time where survival

Source: vectorstock.com

required hunting and gathering, time spent on illustrating animals is time not spent on gathering food.

Some experts believe the paintings had a spiritual or religious nature while others believed they may have served as a guide on what animals could have been dangerous. An even wilder hypothesis is that some of the paintings on the ceiling of the cave represent the sky and stars. That would mean these paintings are a kind of primitive constellation map.

In the end, we will probably never know what the purpose of these paintings was and will always be distracted by our own beliefs and interpretation, just like any art that came after these incredible paintings.

Humans

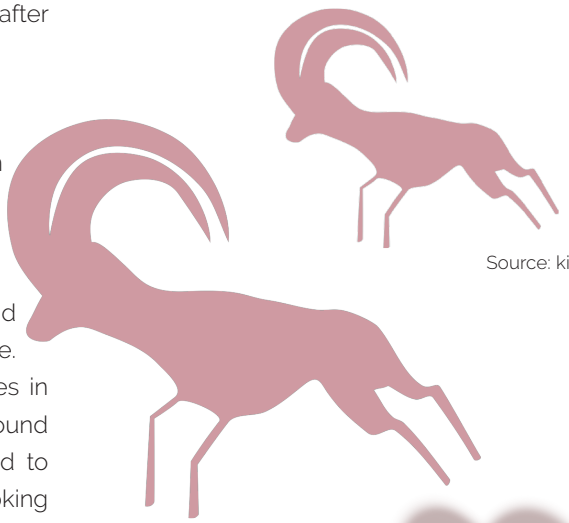
In their YouTube video, 'The past we can never return to', Kurzegesagt has animated a part of John Green's podcast in which he talks about these cave paintings as well. He mostly focuses on these negative hand stencils and how distinctly human they are. I have actually been to one of these caves in France and was fascinated by what I saw around me, especially these hands that belonged to humans living over 17.000 years ago. Looking at these hand stencils in these caves helps you realise how similar we all are and were. It makes you feel like you can touch the past.

Picasso, when walking through Lascaux, allegedly said 'We have invented nothing', and I think that sums it up quite well actually. Art and creativity are not something we do or invented but something that is intrinsically part of being human, something we are.

https://www.sciencedirect.com/science/article/pii/B9780444538215000014

Elias, S., 2012. Origins of human innovation and creativity. Amsterdam: Elsevier.

The past we can never return to - The Anthropocene Reviewed. 2020. [video] YouTube.



Source: kisscco.com

Source: vectorstock.com

INTERVIEW WITH PAULIEN HERDER

INTERVIEW

For this edition, we interviewed the new dean of our very own faculty: Paulien Herder. Over the time she spent in Delft, she has seen the university flourish. We talked to her about the transition from student to dean, about what she wants to do as a dean, and about how the university has changed.

The road from student to the dean of a faculty

I started in Delft as a student in 'Scheikundige Technologie' (Chemical Engineering). When it was time to find a graduation project, I came into contact with "Interduct", the TU Delft institute for clean technology. This institute had interesting graduation projects for students interested in process systems engineering. After graduation I was offered a PhD position in the brand new faculty of Technology, Policy, and Management (TPM), in a project very much in line with my MSc project work. My project was a crossover between the field of process systems and chemical engineering, and the field of policy analysis and project management. I was attracted to this project because it would allow me to work in an upcoming field and discipline of socio-technical complex systems.

In the years that I worked at TPM, from PhD candidate to full professorship, this field matured and it now really integrates knowledge from engineering and social sciences. Most importantly, in this period, I experienced that other disciplines speak quite different languages and have different research methodologies and approaches – and it takes time and effort to really understand each other. This made working at TPM a very enriching experience that has shaped me and my career.

"I have enjoyed exploring new fields, connecting people in these fields, and showing to the outside world that Delft has so much great research and education to offer."

After quite some very enjoyable years at TPM, I moved to 3mE (Process & Energy), broadening my horizons, meeting new people with new disciplines, and in June 2020 I moved to AS (Applied Sciences), I have enjoyed exploring new fields, connecting people in these fields, and showing to the outside world that Delft has so much great research and education to offer.

Now that I am dean of this beautiful faculty, my time spent on education and research will become less. On the one hand I will miss it, but on the other hand, this new role offers many new challenges.

This moving away from direct, personal research and education happened gradually in the past few years, and I am enjoying it.

It was not a conscious choice that I made twenty years ago, but I experienced that I enjoyed the managerial and governance roles that I have fulfilled in the past years. And, since a university needs all kinds of people, with different jobs, interests, and roles, I could follow my passion without leaving Delft, and this led to the pathway that I now see behind me.

Developments around Delft University of Technology

When I started in Delft in 1989, about 20% of the students in Chemical Engineering were female. This was far from an equal distribution, but for Delft standards not bad at that moment. Throughout my studies, this did not change much, but I never felt it to be a bad or undesired situation. It was just a fact of life. The teachers, however, were all male, so there were few female role models in the programme.

I was very lucky to have a female promotor (Margot Weijnen) who built a group in TPM that was very balanced, in terms of disciplines, gender, and background. A promotor is the professor that promotes one from PhD candidate to doctor. This made it very clear to me how important it is to be inclusive and that this also creates more interesting teams. Fortunately, the gender balance is changing for the better, and I am very happy to see that TU Delft is making a strong and conscious effort to diversify and become an inclusive university in all aspects. I can use my experience to bring that goal closer.

"I am very happy to see that the TU Delft is making a strong and conscious effort to diversify and become an inclusive university in all aspects."

Throughout my career in Delft I have seen quite some changes. One that really stands out to me is the increasing collaboration in larger institutes and programs across the campus. Breaking out of your own individual discipline, to venture out to the fringes of it and find colleagues in other faculties who can bring new or complementary expertise to the table, is difficult but very rewarding. I have always loved to build these larger networks, and that is why I like the more recent formalisations of the collaborations with Erasmus and Leiden. Fundamental, free science remains key to realising breakthroughs, and such larger collaborations can inspire us in our research and can help bring the results to society faster. I expect that new disciplines will emerge from such collaborations. I have experienced it myself firsthand while at TPM, and I see it happen elsewhere in AS as well.

"Every programme will slowly evolve to reflect progress in science, when new teachers come on board."

Such evolution in scientific disciplines will also be reflected in the programmes we teach, with Nanobiology as a prime example! So, without a doubt, education programmes will change, new programmes will be started and 'old' programmes may be refurbished. I have seen that the Chemical Engineering programme that I followed is very different from the current programme, exactly because of these gradual changes in the scientific disciplines, and changes in the needs in the job market.

Change in education is inherently slow, as we

need to balance renewal and administrative burden. Without a doubt, every programme will slowly evolve to reflect progress in science, when new teachers come on board. And every programme needs a big overhaul now and again in which programme goals, methods and topics are re-evaluated. The current education portfolio of AS is contemporary and of high quality, and I am proud to be dean of the faculty that offers these programmes.

"I am proud to be dean of the faculty that offers these programmes."

Paulien as a dean

One of the nicest things about working at a university is that you get to interact with students. As a dean, I will no longer have day-to-day interactions as a teacher, but I talk to the FSR (the faculty student council) and to the study boards, to share thoughts and ideas on education, on sustainability, or on-campus life. For example, in order to reach the univeristy's high ambitions in climate action and CO_2 reduction, both close to my heart as you know, students are key in developing ideas and solutions. In a less formal sense, I hope to interact with Nanobiology students in various on-campus 'fun' activities, such as drinks, BBQs, conferences, or any other activity that might be organised.

I look forward to opening the campus again for 'regular' student life and education. I miss the buzz, the casual interactions, the fun, and the inspiring projects of students. We follow the national guidelines for opening up, and it seems that September might give us some more options to go back to more real-life education.

Lastly, some words of advice

So, looking back now, my best advice would be to do the things that give you energy, that you really enjoy doing. And, for me, it has always been important to work with people whom you really trust and with whom you can also share things from your personal life.

"I look forward to opening the campus again for 'regular' student life and education. I miss the buzz, the casual interactions, the fun, and the inspiring projects of students."

Hopefully, you now know a little bit more about the new dean of our faculty. After all, it is good to know that the strings around Applied Science are pulled by a talented and competent person. We would like to congratulate Paulien Herder on her function and thank her for this interview!

THE SCIENCE BEHIND RESTORATION

ART

To keep paintings and other artworks as majestic and neat as they were when they were just finished, restoration is needed. Did you know that the restoration process is actually very scientific? From X-rays and infrared imaging to the use of enzymes and bacteria; many different techniques and technologies are implemented. In this article, I will take you through this scientific process of restoration.

There is not a one-size-fits-all approach to the restoration of paintings. Different types of damage require different solutions. There are, however, general guidelines to follow when repairing and conserving a painting.

The first step is the initial analysis. In this step, the restorator gathers information about the time period the painting was made, the style, and the materials used. If relevant, they also look at how the painting was restored before. To determine the original composition of the painting, X-rays are used. They can display the number of layers of the painting. This makes the process a lot smoother since the outlines of the painting are now determined.

In the next step, infrared imaging is performed. This technique is used to explore the painting underneath the surface and this can reveal the original drawings and show the losses of paint. The use of cameras with fixed wavelengths also plays a role in this step. Different materials and pigments reflect light at different wavelengths, so this way they can be distinguished from one another. This can also be used to identify destructive techniques that restorators used before.

Now that there is a complete overview of what the painting looks like and what needs to be restored, we can get started on the real work. First, the painting needs to be properly cleaned. An organic solvent mixture with enzymes is applied to the painting through tissues, sponges, and gels to remove discolored varnish and restore the pH. For the removal of dirt, lasers can be used. Short laser beams heat and expand the surface of the painting, creating pressure waves that cause the dirt to burst and detach from the painting. In some cases, bacteria are needed to clean inorganic crusts or animal glues. Bacteria are very useful since they possess a lot of metabolising enzymes to get rid of complex dirt.

The final step is the actual reparation of the painting: the damaged areas are painted in and a new varnish coat is applied. Now the painting is ready to be displayed again!

Source background: mymodernmet.com

Source background: freepik.com

MRNA REVIEWS: DELFT

ART

Ahh, Delft, the picturesque town where our little study is partly situated. Chances are you have wandered through the streets of Delft, searching for the Steck with Google Maps in one hand and a beer in the other. But did you know that Delft has much more to offer than some sweaty students dancing in a bar? It turns out that Delft is known for its cultural excellence, like historic churches and its blue-and-white pottery. If you are ready to leave your desk behind, then scan the QR code below and follow our route to explore this amazing city.

Source: thibautdesign.com

The starting point of the walk is the station of Delft. When you step out of the train, you immediately arrive at the first cultural stop: the railway station itself! The building is designed by Mecanoo, an architectural firm situated in Delft. The building was made carrying out the principle of form follows function. The focus lies on the process, context, and sustainability of the building, and thus not on the aesthetics of it. This fits within the modernist approach that was very popular in the 20th century.
Fun fact: Mecanoo also designed the TU library.

After having stared at the glass structure of the station long enough, it is time to walk to the old church. It is characterised by its 75-metre long tower that leans to the side. The church was founded in 1246 and finished in 1440. Then something horrible happened: the Delft town fire of 1536 caused significant damage to parts of the church. Furthermore, the church has some scars from the turmoil of the protestant reformation and the explosion of the Delft gunpowder store in 1654. The church has been renovated multiple times, which has had an impact on the authenticity of the building. For example, the current stained glass windows are from the 20th century, which is very new relative to the rest of the building.
Interesting google review: "three stars, Smelled like extremely burned bread inside" - Anonymous.


Source: wikepedia.org


Source: tripadvisor.nl

After a long walk through the city, you will reach the Oostpoort. The Oostpoort is built in the Brick Gothic style that was quite popular in northern Europe in the 13th century. It is the only city gate of Delft that was not destroyed in the 19th century. The other eight city gates were demolished to make more space in the city. Nowadays, the Oostpoort is used as an art gallery. At night, the Oostpoort is illuminated from multiple sides, which gives a really nice and cute atmosphere.
Tip: This is a really popular place to sit by the Schie, have a picnic, and enjoy the sun!

Scan me for the route for a nice walk through Delft!

MASTER'S DEGREES
FUTURE PROSPECTS

"I was happy with the Bachelors degree and didn't feel the need to change cities of focus, so I was happy to follow through with Nano!"

Fiona Murphy was part of the second cohort of BSc Nanobiology students. Currently, she is pursuing a PhD at the Center for Neurogenomics and Cognitive Research at the Vrije Universiteit Amsterdam. She has been so kind to grant us an interview so we can get to learn more about her experience as a Master's student and beyond.

How did you decide on which Master's degree to get?
It wasn't a very conscious decision actually - I decided I wanted to participate in iGEM after I completed my BSc, and I was able to use iGEM as elective ECTS if I carried on with the Nanobiology Master. I was happy with the Bachelors degree and didn't feel the need to change cities of focus, so I was happy to follow through with Nano! In the end, I was really glad with how things went, as I greatly enjoyed the Nanobiology Master. I think you really get to see why Nanobiology is so cool during the Master programme, much more than during the Bachelor's!

Did you always have the same ambitions throughout the course of your bachelor's degree or did you go back on forth on them?
Not at all. At the start of my Bachelor's I had no idea what I wanted to do after my studies, but in any case I didn't see myself working in a lab. That changed dramatically!

At which university did you apply for your master's degree and why?
TU Delft and Erasmus MC, because Nanobiology is one of its kind!

"The Nanobiology Master is a very good preparation for a PhD, regardless of the field you wish to join."

What are you up to nowadays?
I am currently pursuing a PhD in Neuroscience at the Vrije Universiteit in Amsterdam. Something very different to Nanobiology, but I think the Nanobiology Master is a very good preparation for a PhD, regardless of the field you wish to join.

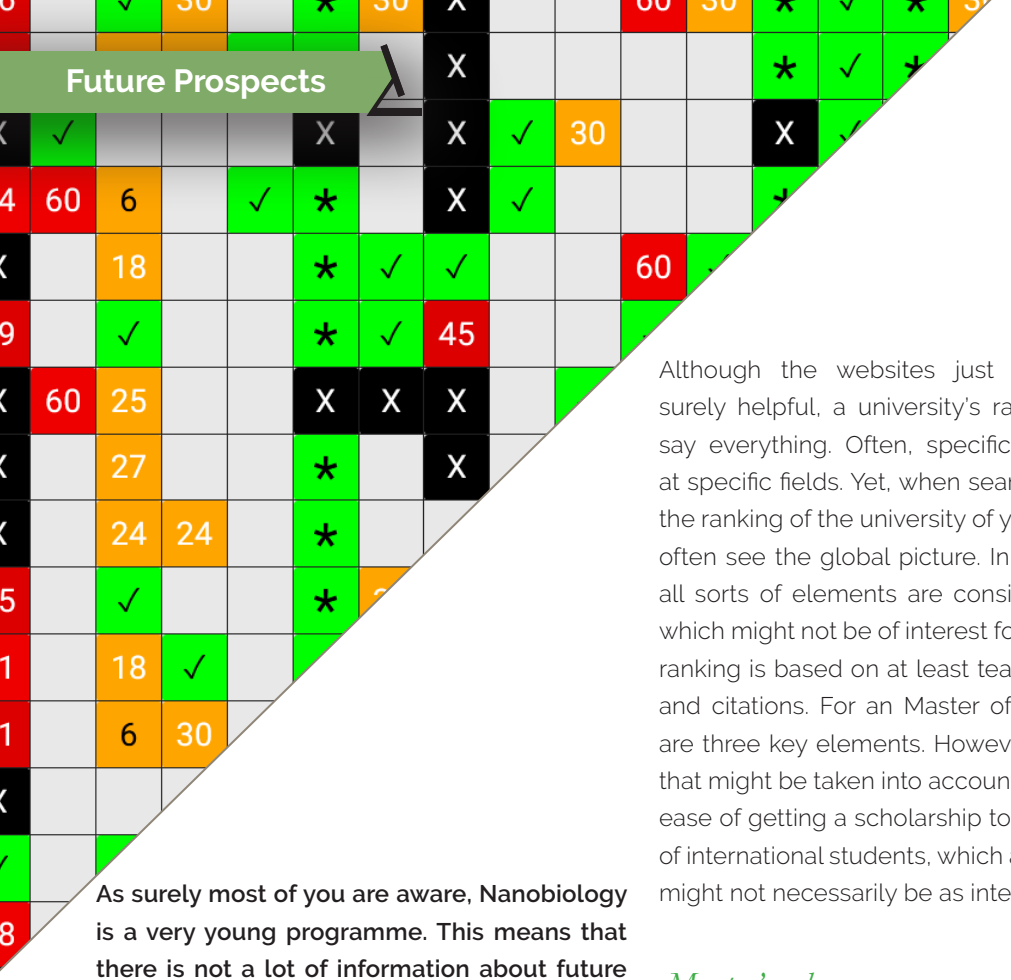
What has your experience of this next step been so far?
I have almost completed my first year, and have really enjoyed myself so far. A PhD is not easy but can be very rewarding. Despite the difficulties and ups and downs, I just think it's really cool that my job is to try and understand complex, unknown things!

What is your favorite cell organelle?
My favourite organelle is the Golgi apparatus, because it has a beautiful structure and complex function.

On behalf of mRNA, I would like to thank you for telling your story. Good luck!

"A PhD is not easy but can be very rewarding."

Future Prospects



As surely most of you are aware, Nanobiology is a very young programme. This means that there is not a lot of information about future possibilities. In this article, we would like to go over how you can find something that suits you after finishing the Bachelor Nanobiology.

There is lots of information available, for a vast amount of different situations. Firstly, if you are certain that you would like to stay in the Netherlands, you should have a look at the so-called "doorstroommatrix" (*doorstroommatrix.nl*). This is a website that gives you an overview of every Master's you could follow at any university in the country, based on your bachelor's degree. If you are not eligible right away, it is even specified how many credits you should gain additionally to become eligible for many options. If you want to go abroad, though, you need different databases. *findamasters.com* or *topuniversities.com* can surely help you to narrow down your options.

Although the websites just mentioned are surely helpful, a university's ranking does not say everything. Often, specific faculties excel at specific fields. Yet, when searching online for the ranking of the university of your interest, you often see the global picture. In these rankings, all sorts of elements are considered, some of which might not be of interest for you. Often, the ranking is based on at least teaching, research, and citations. For an Master of Science, these are three key elements. However, other factors that might be taken into account range from the ease of getting a scholarship to the percentage of international students, which are qualities you might not necessarily be as interested in.

Master's degrees are very different to Bachelors in structure and learning style, specifically.

One of the first things you should consider when thinking about master's programmes, is what, and how you want to learn. Generally speaking, Master's degrees are very different to bachelor's degrees in structure and learning style, specifically. The two major categories of master's degrees are those that are applied, versus those that are theoretical. Maybe needless to say, but there are very big differences between the two, which can result in a very different skill set. Mostly theoretical masters are often similar to bachelor's degrees, in the sense that they are purely conceptual, which is treated by means of lectures, working

classes, and practicals whenever necessary. Master's degrees that emphasise application however, are accompanied by much more independence. You will work on projects or maybe even conduct your own research, while you have teachers to rely on.

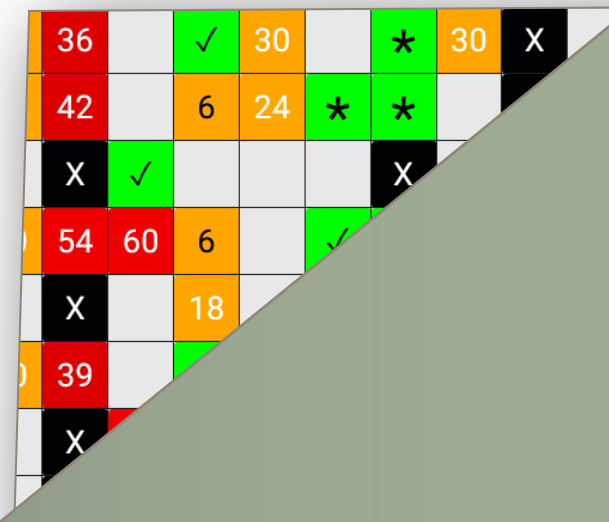
When thinking about how to continue your career after recieving your bachelor's degree, one of the first things that should pop into your mind is the fact that the opportunities are endless, partly because the Nanbiology programme is in English. You can therefore choose to continue your career anywhere across the world! Plenty of people have already done so.

If you decide that you want to study far away from home, there is a lot more to keep in mind. Look into more than just the degree of your dreams. Instead, do some research on the university itself, the area, and even the culture or the country in general. On the website of many universities, you will find results of surveys for example. You can have a look at the university's reputation internationally, or by the university's students themselves. Besides, something that might be important is the quality of research at the institute you want to go to.

Although the internet is a great way to help you orientate about your future wishes, there is more information available than what you can read about online. When you have made a decision, or at least narrowed it down, consider taking a real look on the campus.

Besides everything mentioned above, remember that you should always talk to people! You can talk to the study advisor, but talking to a student from the master's degree of your interest would probably already help a lot.

Perhaps most important of all, stay calm. Your master's degree does not specify a specific path for the rest of your career. It can, however, guide you to a specific field of work.

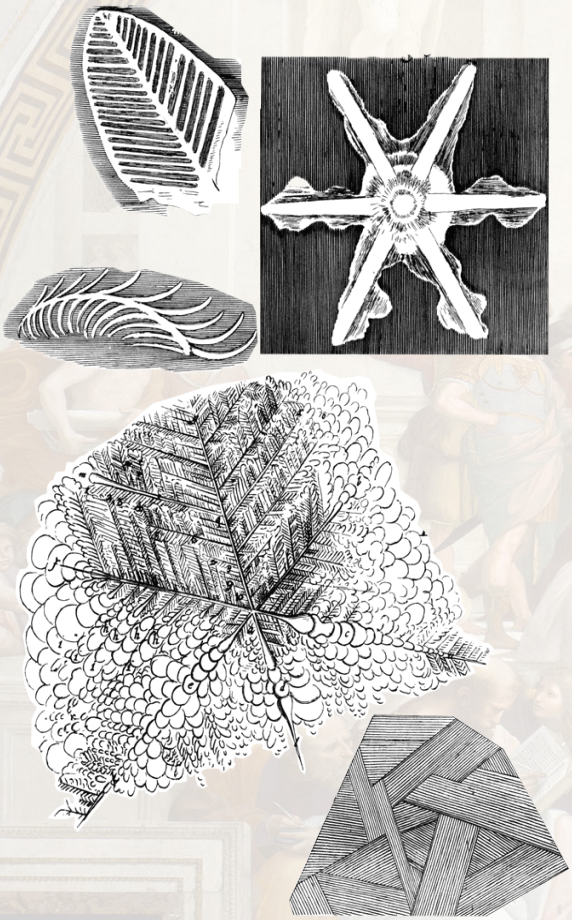


Source matrix: doorstroommatrix.nl

MRNA CRITIQUES: DRAWINGS FROM MICROGRAPHIA

ART

In his book *Micrographia*, our big inspiration Robert Hooke takes us on a journey through all his research with his microscope. Not only was Hooke a talented scientist, architect, and polymath, he could apparently also draw very well! We took it upon us to review some of his drawings from *Micrographia* and rate how skilled Hooke was with some ink.



Source: alina_stefanescu.typepad.com

'Several observables in the fix-branched Figures form'd on the surface of urine by freezing'

Thijn: *'Personally, I really enjoy seeing how much liberty Hooke is taking when it comes to the placement and arrangement of these figures. It really looks like he just illustrated as he went along. Most of all, I have a profound respect for how much effort and craftsmanship must have been necessary to actually get these illustrations paper at all. Life must have been hard without Control-C; Control-V. I think it is a real testament to the skill of Hooke that he made frozen urine look this cool.'*

Nathaniel: *'I love the different types of snowflake structures. The amount of detail is amazing, you can see the little imperfections around the points of the snowflake and the way light refracts through it.'*

Margot '*So pretty! It reminds me of the glass-made snowflakes you can hang on your Christmas tree. However, the square image is less satisfactory than the hand drawing down the page.*

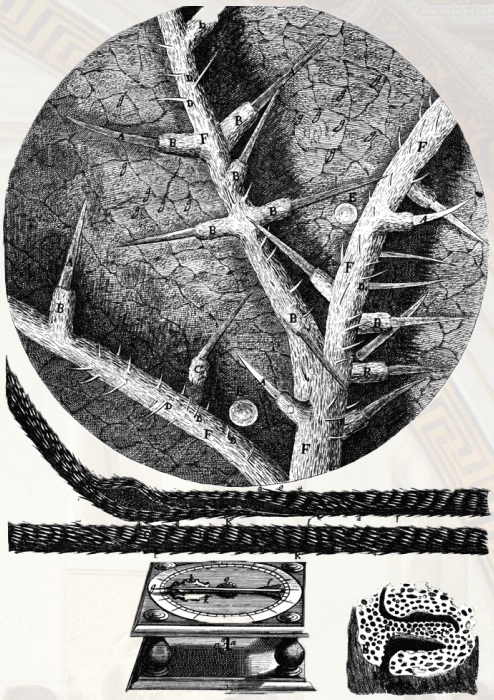
'Of the surface of Rosemary, and other leaves'

Sten: *'In his book, Hooke calls rosemary a "nature's needlework". I think this is incredibly accurate! If you look at the branches you see the side branches becoming very thin of course, which itself looks similar to needles to me. I also am amazed by the fact that in the seventeenth century, Hooke was already able to see the "hairs" on a rosemary leaf, which cannot be much thicker than a human hair (~0.1 mm thick).'*

Anna: *'I did not expect rosemary to look so… hairy?'*

Margot: *'I agree with Anna: I thought it would be more smooth.'*

Elise: *'I'm getting flashbacks to high-school plant biology. I think the water droplets add a nice touch.'*



Source: academia.dk

'Of the Water-Insect of Gnat'

Sten: *'I must say I was a little caught off guard by the missing wings of this "little creature". Still, the amount of detail is amazing. Hooke was able to both see and draw the segmented body in an amazingly accurate way and again, he was able to see and draw the super tiny hairs on the Gnat's body. Impressive for 450 years ago!'*

Nathaniel: *'The amount of detail in the placements and bundling of the hairs is amazing. I am very uncomfortable with the big eye on the upper left but the details are once again astonishing, especially considering everything was drawn by hand.'*

Thijn: *'Out of the three pages we have seen so far, I think this one is the least appealing. That is not to say that it isn't impressive on a technical level. On the contrary: the level of detail here is impressive. Maybe gnats are just not so pretty to look at?'*

Source: longstreet.typepad.com
Source background: fineartforall.net

HORRIFYING TESTIMONY

ART

It was Thursday night, all the lights were out except the blue hue of my laptop. The library was already closed, even though it was in the XL open times because of the exam week. It was three AM and my heart was pumping quickly as a result of all the cups of coffee I had. While trying to keep my eyes open and set on the S&S book in front of me, I listened to Indian YouTubers explaining amplitude manipulation to me. The content alone was scary enough to keep you awake, but I needed to finish my revision as the exam was tomorrow. Tears began to swell in my eyes, but I quickly blinked them away. Trying to finish my exercises, the words and numbers mixed up in my brain, I pushed through. I was determined to finish this problem. Suddenly, I open my eyes and raise my head. I seem to have fallen asleep face down on my book. Looking around me, I don't recognise my surroundings.

If I remember correctly, I was in front of my computer in the library, but I was in a room that seemed infinite. A weird floating collection of words and images zoomed past me. Most of them were in Dutch, which I didn't understand. But the poor English sentences that wooshed past me were no help at all since they were barely sentences. With terror, I realised where I was: The teacher's brain. Horrified, I looked for an exit, but this room seemed to be endless.

Finally, I saw something in the distance. As I ran towards it, the shape began to form. It was huge, twice as big as me. It wasn't human, it had claws the size of my forearm, as many teeth as a shark has, each tooth like a stabbing knife. It looked ready to kill me. A MACROPHAGE. As it was ready to eat me, I woke up.

I looked at my watch. It was already 08:30! The exam starts at nine AM at Erasmus MC. I could still make it, but I needed to be really fast. I jumped to my feet, ran to the station, and hopped on the first train in the direction of Rotterdam. To my horror, I realised too late that I was on the wrong train. I would never make it to the exam on time. Still, I was hoping I would have enough time. How wrong was I? The train then completely stopped and the little NS jingle played. The amplified voice announced that the train had a technical problem and could not move anymore. And with that, all hope left my body and I began to silently sob.

Source background: thedyrt.com

Source ghost: pngitem.com

Source flashilight face: fearnaughttales.com

Source Monster: the13thfloor.tv

Source background: news.uga.edu
Source jewelry: boutiqueacademia.com

NERDY JEWELRY

ART

While studying Nanobiology, some images become all too familiar to you - from bacteriophages to microscopes. But have you ever thought about how they would look as jewelry? The company Boutique Academia did exactly this, and it is so cool that we want to share some of their creations with you.

Who would have thought a bacteriophage to be so aesthetically pleasing? That viral capsid is definitely an epic structure. This piece of jewelry may also function as a great conversation starter, and help you get a position at the Brouns lab.

It might very well be the molecule from which we see sketches most often: DNA! These earrings are a little bit curved, so that the double helix seems more three-dimensional. The only problem? You might get some remarks from nerdy nanos about the handedness of the right one.

Tardigrades are ridiculously cool, out of the question. Is it not incredible how an organism can be so ugly, yet somehow so pretty at the same time?

Yes, microscopes! Since we spend so much time looking through them and looking at them, trying to make sure they work properly, we might as well wear them.

For those who think the other pieces are a bit too flashy, this antibody-shaped necklace has a truly clean design. So simple, and yet so pretty.

Nanonerds are home in a lot of fields, so this line is all too familiar to us. Do you remember when we thought Python was just a snake? Well, some of us might argue the programming language is a snake as well. But others might appreciate the beauty in this line of code engraved into a tie bar.

FASHION REVIEW

ART

What makes a great committee outfit? Is it the type of clothing, the way it represents the committee, or is it all about style? We think it is about three things; story, creativity, and uniformity. By story we mean the way the outfit both represents the committee and how it matches a potential theme the committee is dedicated to. Creativity is not only the creativity of the pieces of clothing themselves but also the way they are put together. Lastly, we have uniformity, a committee outfit also serves as a uniform for the committee, and thus all committee members should be recognized as belonging to one committee.

First off we have ATP 6's outfit consisting of a blue overall and a yellow or red beer cap. The beer cap is very clever and a good nod to the ATP motto. We do miss a stronger link to the committee colours and the cap and overall feel a little disconnected. A yellow shirt or belt would have really helped to tie it all together. Overall, no pun intended, although everyone is wearing the same outfit it does not feel like a uniform. We do love the beer cap though!

We continue with the next iteration of ATP, with their sunny fashion which is a simple bright yellow shirt. The yellow is omnipresent, thus it is clear that it is the committee's colour. The design and their interpretation of the ATP acronym is a great fashion statement '*Alcohol 'Till Poisened*', and one that is very relatable I might add. However, it is still just a shirt, thus not the most creative of our contestants. It is also not very uniform as the rest of the outfit is left to each member's interpretation, thus the pants and accessories are not uniform throughout the ATP members.

Background: subpng.com

This stunning outfit by designer Thijn Hoekstra surpasses everything we thought a committee outfit could be. The NASA-style logo on the dark blue background tells a clear story. Meanwhile the simple, yet stylish overall creates a clear identity tying the committee as a whole together.

We now make our way to the past with Wnt 4 and their outfit: the Gran Canaria Vest. It is a nice avocado design, which linked beautifully with the hostel we stayed in. Also the green design resembles Gucci's scaly skin, which goes with the committee's spirit. Thus the conveyed story line is consistent. However, a minor thing is, it is simply a vest. A great vest, but a vest nonetheless. Thus the creativity part got fewer points, but stays above the average. A big plus is the vest resembles Gucci making the committee as a whole pretty uniform and including of their mascot.

Story: 7
Creativity: 6
Uniformity: 9

S.o.S keeps it simple and it works. Their simple white apron containing the Hooke logo on the chest tells you everything you need to know. The black shirt underneath really sells the uniformity of the outfit. One point they could have added, however, is the name of their own committee. A classy outfit that communicates what they are all about.

And lastly, we have Intron 7 and their *La Casa de Papel* outfit. We have to admit, the storyline is pristine and they really respected the outfit of the TV show with the Dali masks and everything. We also thought the idea of using the characters' costume was creative. However, our members believed it was more the creativity of the show rather than that of the committee. The overall and the masks also make it one of the most uniform committees of the bunch now.

AGAR ART

ART

If you have ever used an agar-filled petri dish to grow bacteria or fungi, you may have thought the colonies pretty in a strange way. However, did you know that there is actually such a thing as art in a petri dish?

The artwork is also known as microbial art, agar art, or germ art, and even has its own Wikipedia page! Artists use microbes like paint on an agar canvas. In contrast to paintings, the artworks are very temporary, as the colonies only live a short time. By sealing the agar with epoxy or acrylic, agar art can be preserved longer. Bacteria or yeast may be picked based on their colour, bioluminescence, fluorescence, or the shapes of the colonies they form. Genetic engineering can be used to generate microbes expressing fluorescent proteins or proteins of distinct colours. Some artists play with the medium used or use radiation to selectively kill bacteria and generate detailed images. The depiction of Einstein on the left is an example of the latter tecnhique.

Microbial art has actually been around for quite a while. The discoverer of penicillin, Alexander Fleming, already created microbial paintings in the first half of the 20th century. Rumour has it that he prepared a small exhibit for a visit by Queen Mary. However, the Queen was not amused by his creations.

Nowadays, you could call germ art a recognised art form: there is even a competition! Since 2015, the American Society for Microbiology has organised the so-called 'Agar Art Contest' every year. Scientists dive into the lab to create the most fantastic pieces of art. Quite some of the pieces on this page were submissions for this competition. The depiction of fertilisation, for instance, got the first place in 2016. Fancy giving it a try?

Source background: pinimg.com
Sources agar art, counter-clockwise from top: galileo.tv huffpost.com nationalgeographic.com demilked.com pinterest.com microbesrue.blogspot.com

SUDOKU & SPELLING BEE

ART

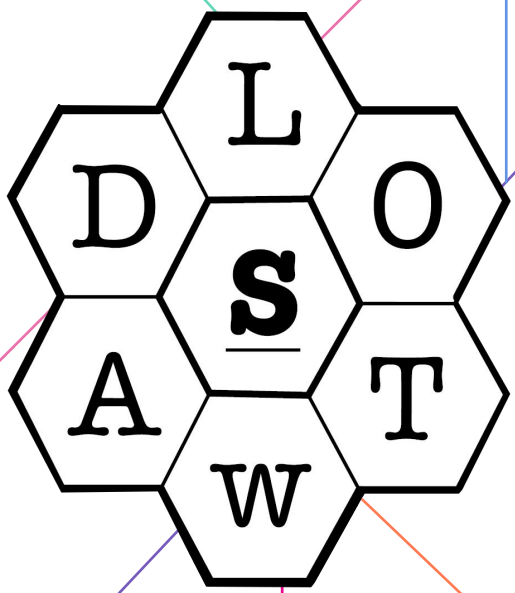
	5			1	3		8	4
	8							6
		2		4		5		7
1		8			4		5	2
			9				6	
3					8			
			7					
	9			3	6			5
7		6	1			4		9

Sudoku Rules:

Each small square contains only one number between 1 and 9.
Each three by three box has to contain all the numbers from 1 to 9 without number repetition.
Each vertical column has to contain all the numbers from 1 to 9 without repetition.
Each horizontal row has to contain all the numbers from 1 to 9 without repetition.

Spelling Bee Rules:

You need to find English words of five letters or more. All must containing the letter in the center.
Letters can be reused.
Finding a word with the seven letters is worth three points. Any other word is worth only one point.



If you finished the sudoku and/or the spelling bee and want to check your answers, send us an email at *mrna-hooke@tudelft.nl*
We will let you know how great you did!

Margot Meersseman

Source frame: pinimg.com

by Jeffrey van der Veldt

Source frame: IMGBIN.com

by Marianne Kersten

Source frame: fadigeorge.wordpress.com

by Corine Geertse

Source frame: pngimagesfree.com

by Anna Delhaas

Source frame: gallery.yopriceville.com

by Max Kaag

Source Frame: fadigeorge.wordpress.com

by Mart Groenendal

Source frame: fadigeorge.wordpress.com

by Robin Liu, @borkbin

Source frame: fadigeorge.wordpress.com

by Carlo Geertse

Source frame: depositphotos.com

by Lisa Baltus

Source frame: pinimg.com

by Risa Togo

Source frame: depositphotos.com

by Gabor Sophie

Source frame: pngimagesfree.com

by Marianne Kersten

HOW FASHION IMITATES NATURE

ART

“Art imitates life” is a common saying among artists and philosophers. Even though some would argue that life imitates art more often, inspiration is frequently found in nature. Symmetry, geometric patterns, and colour combinations used in art are often found in nature as well. This is true for paintings, statues, and also fashion.

Source Frame: freepngclipart.com

Fashion Biologique

The fact that so often patterns and shapes used in fashion can be found in nature was not lost on Jill Sherman. She runs an Instagram account called @fashion.biologique on which she compares fashion pieces with similar-looking organisms from nature. Whether intentional or not, the similarity is often stunning. She also gives a little bit of info about the organism in the description for those curious about these beautiful creatures.

This account is the perfect mix between fashion and science so, if that sounds like something you would be into, go check it out!

Source: nl.vecteezy.com

Source: trackr-media.tangiblemedia.org

Bacterial skin

You could also take the quote "art imitates life" in a more scientific context. BioLogic is a company that makes sportswear using bacteria. The bacteria act as a kind of detection mechanism for body heat. As moisture levels increase, the bacteria expand. The expansion of the bacterial cells causes flaps in the outfit to open when someone starts sweating. This allows sweat to evaporate and your body to cool off. The whole outfit works a bit similar to our own skin. How is that for art imitating life?

Biosynthetics

A related field of study is the one in biosynthetics. Biosynthetics are fibers that consist of polymers made from renewable resources. A lot of expensive fabrics were originally made from organic substances like silk. Nowadays we can easily fabricate artificial polymers like nylon, but further research into biology now allows us to recreate fabrics found in nature as well. Spider silk is a natural fiber created by spiders from a protein solution stored in the spider silk glands. Due to its flexibility and resilience, it has a lot of potential for all sorts of applications. Farming spider silk, however, is impossible due to the cannibalistic nature of spiders. Techniques based on genetic engineering could allow us to recreate this amazing fabric in the lab.

As we can see, inspiration on nature is found at all levels of complexity: from aesthetic to structural and all the way to the fabrics being used. Nature is the great inspiration for most things we do.

Yao, L., Wang, W., Wang, G., Steiner, H., Cheng, C.Y., Ou, L., Anilionyte, O., & Ishii, H., 2021, bioLogic, Tangible Media Group, <https://tangible.media.mit.edu/project/biologic/>

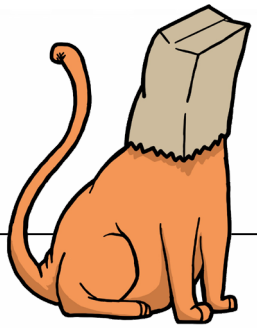
2021, Textile exchange, textileexchange, <https://textileexchange.org/>

Source: vectortock.com

Source: dreamstime.com

FIGURES OF SPEECH

ART



In conversations with students with another first language, you might sometimes think them as crazy as a door. Literally translating figures of speech often gives rise to hilarious statements. We discuss a few frequently used expressions, sayings, and proverbs in Dutch and French.

Dutch

Unfortunately peanut butter
Helaas pindakaas
Too bad; this expression has been around since the eighties, but it is unclear who came up with it.

It walks in the soup
Het loopt in de soep
It (a plan) fails completely; nobody knows what walks into the soup.

You can write that on your belly
Dat kun je op je buik schrijven
Forget it, that is never going to happen; hoping (don't hope) that your wishes are fulfilled is as pointless as writing your wish on your belly.

I take the legs-wagon
Ik neem de benewagen
I'll go walking; what is a better wagon than your legs-wagon?

Joost may know it
Joost mag het weten
I have no clue; Joost is not only a Dutch name, but also a name for the devil. So you are saying as much as the devil knows.

Small beans come by their small pay
Boontje komt om zijn loontje
You will experience consequences later from previous actions; similar to: chickens come home to roost. This proverb originates from a fairy tale.

To beat two flies in one clap
Twee vliegen in één klap slaan
Solve two problems simultaneously; similar to: to kill two birds with one stone.

To see it through the fingers
Het door de vingers zien
To condone; similar to: to turn a blind eye.

I don't trust him for a meter/cent
Ik vertrouw hem voor geen meter/cent
I don't trust him at all; similar to: I trust him as far as I can throw him.

I have a small apple to peel with him
Ik heb een appeltje met hem te schillen
I have an unpleasant matter to solve with him; similar to: I have a bone to pick with him.

Now the monkey comes out of the sleeve
Nu komt de aap uit de mouw
Now the truth is revealed; similar to: the cat is out of the bag, although monkeys are much cooler obviously.

Source background: pickpng.com
Source monkey: vertaalbureauengels.blogspot.com

French

There is a testicle in the soup
Il y a une couille dans la soupe
There is something suspicious happening, there is a problem.

Press the mushroom
Appuie sur le champignon
Finish quickly; similar to: step on the gas.

To piss in a violin
Pisser dans un violon
To waste time on something pointless, similar to: talking to a wall.

To become goat
Devenir chèvre
To become mad, crazy.

Don't push grandma into the nettles
Il ne faut pas pousser mamie dans les orties
Don't go too far, don't exaggerate.

To make oneself shit like a dead rat
Se faire chier comme un rat mort
To be extremely bored.

To go and cook oneself an egg
Aller se faire cuire un oeuf
When in argument, saying to the other: get lost!

Source background: bleudeprusse.blogspot.com

Source: facebook.com

SCIENCE IN THE LANGUAGE OF ART

JULIAN-VOSS ANDREAE

By some people, science and art are seen as polar opposites of one another. This is not the case for Julian-Voss Andreae. He sets out to combine the two fields to create art and show the relationship between nature, science, and technology.

The German Andreae used to be a physicist. He studied at different universities in Europe and specialised in quantum physics and philosophy. His team performed some groundbreaking research in quantum mechanics at the University of Vienna. Nowadays, Andreae combines his knowledge of science, technology, and art to make sculptures with high-tech materials.

Source: wikimedia.org

One of the sculptures that Andreae proceeded to make was '*Angel of the West*' which is part of his Protein Series. It is a twelve-foot-tall sculpture that resembles a human antibody. The shape of the antibody also shows a parallel to da Vinci's *Vitruvian Man*. The sculpture is named 'Angel of the West' because Andreae sees antibodies like guardian angels that protect us from sickness and disease. The sculpture is made from 1400 laser-cut pieces of corrosion-resistant stainless steel. This was done using software that Andreae created himself. It took multiple years to make, because the process involved bending, welding, grinding, and sanding all these pieces. Today, the sculpture is located at the Scripps Research Institute of Florida.

After his Protein Series, Andreae started working on disappearing human sculptures. This series is heavily inspired by his work as a quantum physicist and the idea that even large segments of matter behave as quantum mechanical waves. The sculptures are made of thin slices of stainless steel that look solid from most angles, but when viewed from the front, the sculptures seem to disappear. The process of making the transparent sculptures is quite complex. First 3D scans of real people need to be made and these models are sculpted on the computer. After this, all the separate pieces for the sculpture are created and need to be put together into the final sculpture. The last step is to grind and polish the sculpture. The whole process takes hundreds of hours.

Source: sculpture.org

Julain Voss-Andreae is still alive and well and planning on making many more sculptures. Right now, he is working on a very big project concerning sculptures of antibodies made of stainless steel. We are very excited to see what this brilliant mind will bring to the table next!

DAVID GOODSELL

ART

David Goodsell is a molecular science researcher who studies the application of computational structural biology for the prediction of protein function. It is technology like this that might enable rapid and selective drug development in the future. Besides his whopping resume in academia, Goodsell excels in his effort to inspire the public with his research.

Goodsell, who has written four general-interest books on biology, collaborates with artists and educators alike to reach out to the general public. He faces the challenge of simplifying the complex biological world in order to make it appealing and easy to understand. Goodsell tackles this problem using watercolour illustrations. The watercolours he produces have a vibrant, cartoon-like nature that draws crowds from all walks of life. Take a look for yourself.

Those with some background in biology will realise that these illustrations are more than an aesthetic triumph, they are just as much of a technical achievement. Goodman creates images that could never be captured under a microscope, as the illustrations have a vast field of view, yet contain a fantastic level of molecular detail. In microscopy, there is a trade-off between the detail and the expansiveness of an image. Perhaps the pen is stronger than the microscope?

Goodsell, David [Online]. Scripps Research. Available: https://vivo.scripps.edu/display GoodsellDavid [Accessed Jun 7 2021].
Ideas, V. 2014 by Ideas, V. Australia: YouTube.
Illustration by David S. Goodsell, RCSB Protein Data Bank. doi: 10.2210/rcsb_pdb/goodsell-gallery-030

LYSE RECAP

FRANCESCO GUIDO VINZONI

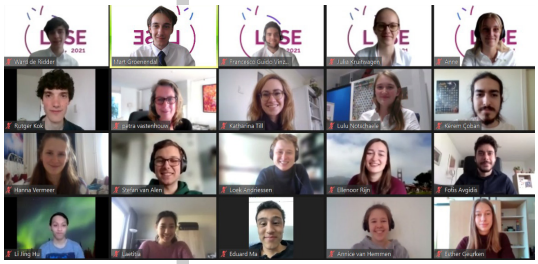
At the end of the night of March 24th, we were all asking ourselves the same question: "Why does HEMA have SO MANY tompouce-themed products?".

It all started about 24 hours earlier, the first day of the Lower Years Student Excursion. Bags of food were delivered from the Hub across all of Delft to prepare the participants for the next three days. Our first visit was that afternoon to the company NOCI to see their work on Organs-on-a-Chip. After the presentations, we all joined in a borrel to relax with the presenters.

The activities were only just beginning. Later that day the first evening activity was launched: an online gathering on gather.town where everyone could mingle with their peers and play games in the virtual room.

Saturday we visited the top-notch laboratories at Leiden University Medical Center (LUMC) and the Princess Maxima Center. LUMC teams showed us their research setups and prototyping with organ systems and the group PMC showed us how they use Big Data to understand and treat childhood cancer.

That evening, we had the pubquiz. After four rounds of hard questions, we kept chilling and talking about the myriad of tompouce-themed products at HEMA including water bottles, inflatable floaters, underwear, and even 'tompouce-frageranted' SHAMPOO!

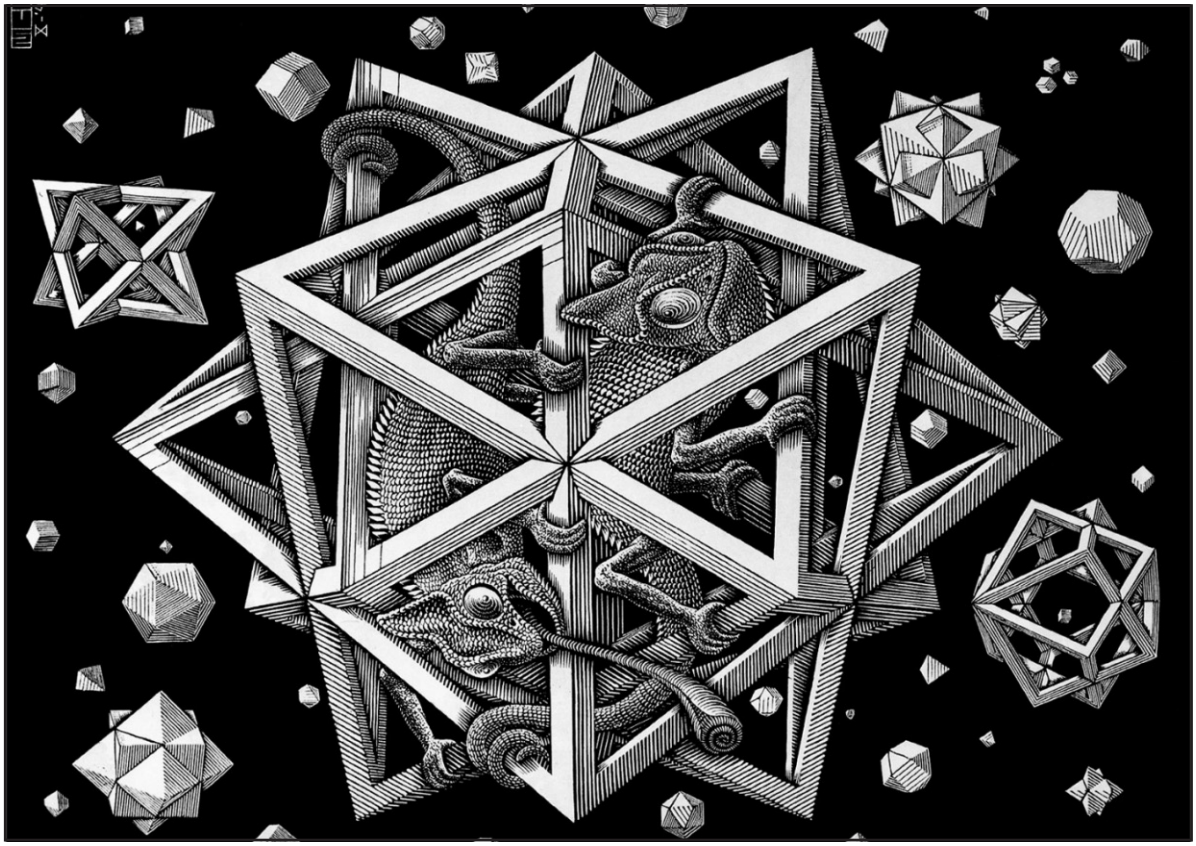


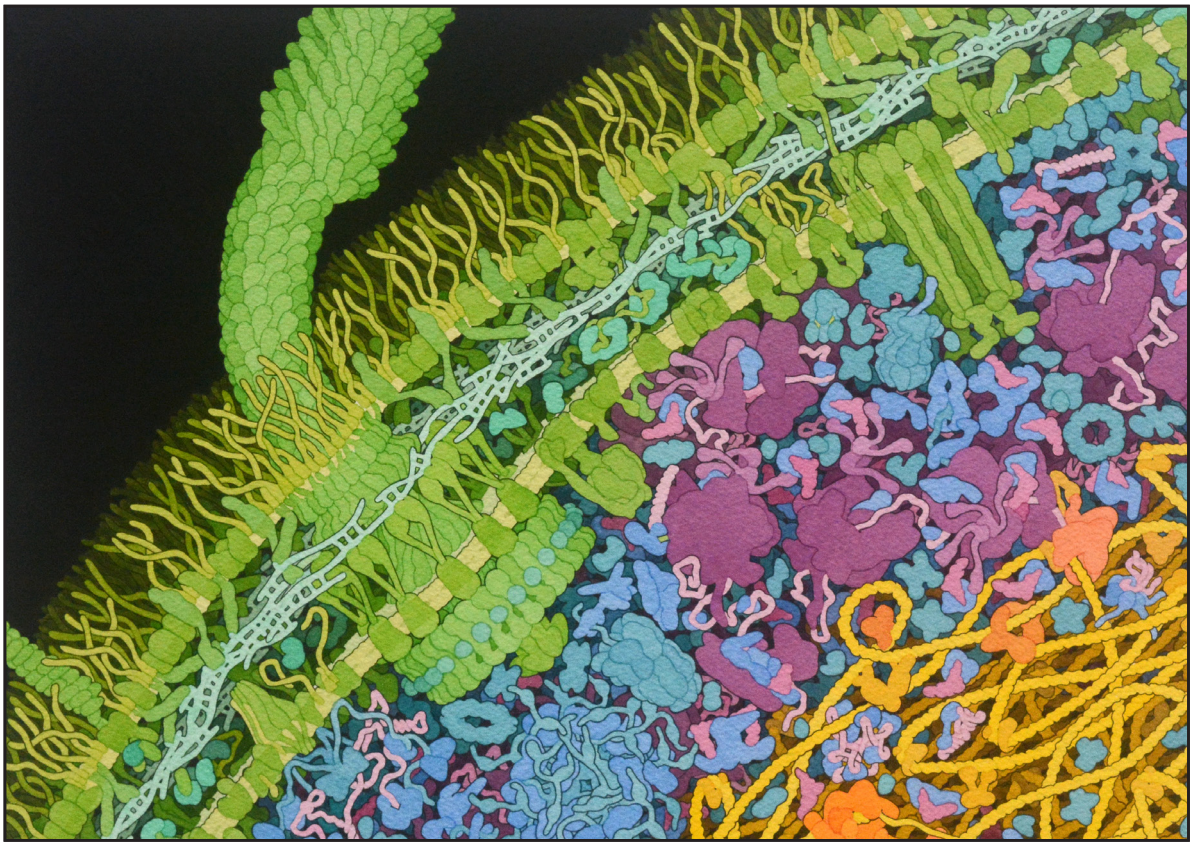
We woke up once more for an amazing visit to Idris Oncology and MyLife Technologies, which are companies developing technology for diagnosing tumours, and new vaccine delivery systems respectively. Next, we invited everyone to go out and do a Photohunt, after which we visited the company AMOLF, where we heard about their fundamental and applied biology research.

After the last question round for the participants, we had a cooking session, using a recipe from S.o.S.! We relaxed together thinking about all the visits we just had and the fascinating work these people were doing.

It was an amazing weekend and, although tiring, I would do it all once more if I could. I hope next year we will all get a chance to experience it in person.

Source: reddit.com
created by: Senjor Schnorr





Maurits Cornelis Escher
Image source: paper.com

Illustration by David S. Goodsell, RCSB Protein Data Bank. doi: 10.2210/rcsb_pdb/goodsell-gallery-028

Source: washingtonpost.com

WHY DO BANANAS TURN BROWN

ART

Why do bananas ripe? It actually has to do with hormones. Airborne hormones to be precise. I know, I know. The term 'airborne' has gotten a very negative connotation ever since 2020, but hear me out.

Bananas have hormones. One of these is the gaseous ethylene. This hormone stimulates ripening by boosting metabolic processes. Specifically, ethylene stimulates two enzymes, beta-amylase and pectinase. The former is a class of enzymes related to the fast-acting alpha-amylase in human saliva. Amylases catalyse the hydrolysis of the fruit's starch reserves into sugar. As a consequence, the banana starts to taste sweeter as it becomes ripe. The second enzyme, pectinase, breaks down a polysaccharide mix called pectin that fortifies the cell walls. This makes the banana softer and easier to peel.

But what is up with the onslaught of the brown spots? There is a third enzyme at play here, polyphenol oxidase (PPO). PPO oxidises phenols, turning these compounds into so-called quinones. Further oxidation and reaction convert quinones into melanin, which is the same natural pigment found in your eyes, hair, and skin.

This chain of reactions will spontaneously occur when PPO, phenols, and oxygen come into contact. This is why brown spots crop up when bananas experience mechanical impact, an inopportune fall for instance. Due to the mechanical stress, the cells shear open and expose the intracellular enzymes to the air, kickstarting the reactions that produce melanin. Surely, you will be awestruck by all the complexity that lies underneath that curvy peel, next time you reach for a banana at the store!

Lohner, S. 2019 *Fruits Gone Bad?* Discover
Enzymatic Browning, Scientific American.
Palmieri, T. 2018 *Why Do Bananas Change
Color?*, Scientific American.

GOOGLE AUTOCOMPLETE INTERVIEW WITH ROBERT HOOKE

ART

Every day, people around the world ask Google questions about the scientist that gave our study association its name. What if he could answer those queries? We present: an autocomplete interview with Robert Hooke.

Source: lifenlesson.com

When was Robert Hooke born?

I was born on 18 July in 1635 in a town called Freshwater on the Isle of Wight in England.

Why was Robert Hooke important?

Smiles smugly *Where to start? I contributed to many scientific fields, including astronomy, paleontology, horology, gravitation, and microscopy. In my work, I adhered to the scientific method. I discovered the law of elasticity you know as Hooke's law. The term cell was coined by me, and my observations led to microscopic investigations by others. I was the first to hypothesize that heat is a form of energy, among other theories which are now widely accepted. I realised that fossils were once living creatures. Oh, I also did architectural work. After the Great Fire in 1666, I helped rebuild London. And I designed grand buildings as well, such as a cathedral and a library.*

Why did Robert Hooke call cells cells?

I looked at the bark of a cork tree with my improved microscope, and I saw all these little pores. They reminded me of the individual rooms in a monastery, cells.

What did Robert Hooke do to make sir Isaac Newton mad?

Snorts *Well, that is not a question really, is it? But I can talk a little about our relationship. We had some scientific quarrels, that is one thing for sure. You know, he said light was made up from particles, I said from waves. Then he did not give me proper credit for a theory, that was extremely frustrating.*

What was Robert Hooke's book about?

Ah, I guess the Micrographia is meant with this? I heard there is an article about this on page 18, so I will not spoil the fun. Just know that it is a scientific piece of art.

How did Robert Hooke die?

Shifts uncomfortably *Well, my health went downhill in 1702. If I had lived today, I might have been diagnosed with diabetes. I died in London on 3 March in 1703.*

Source: blogspot.com

Source: wikipedia.com

MRNA REVIEWS: ROTTERDAM

ART

As things are opening up, or maybe already have opened up, you might feel like going out and doing something. Maybe all the talk about art in this edition has you hyped to go out and see some art. Good thing there are plenty of museums and open air art to be found in the most city-like city in the Netherlands: Rotterdam. Check them out below or find even more to do on www.rotterdam.info/kunst-cultuur.

Boijmans van Beuningen

For a typical art museum, Museum Boijmans van Beuningen is a good pick, located at the Museumpark, right next to Erasmus MC. This museum is well-known for its collection of drawings, one of the most important ones world wide. It also has some well known paintings like 'De kleine toren van Babel' by Bruegel.

Pinball

If paintings and history are not quite your thing, and you would rather do something interactive, love some nostalgia or really just want to touch the 'art', then the next museum might be just what you are looking for. The dutch pinball museum has over 70 pinball machines built anywhere between the 1900s and today. All machines are operable and the coffee is supposed to be alright!

Kunsthal

If you are not sure what you want to see maybe take a look at the Kunsthal. The Kunsthal doesn't have its own collection but hosts expositions throughout the year. Due to the size of the venue they can host up to five expositions at the same time allowing them to cycle through around 25 expositions in a year. At the moment they are hosting an exposition on youth called Youthquake. This multimedia exposition combines fashion, photography, and video to discuss how youth is celebrated in popular culture and the effects that has on people throughout modern history.

Outside

Maybe you do not feel like being inside this summer, as we have been mostly inside a lot this year anyway. Luckily Rotterdam has plenty of things to see outside as well. If you would like a route throughout the city highlighting some of the most iconic art and architecture, there actually is an app for that. *Rotterdam Routes* is an app that has different audio tours throughout the city from a tour focussed on architecture to one focussed on art and poetry.

Source: misstravelclogs.com

LAYOUT PSYCHOLOGY

ART

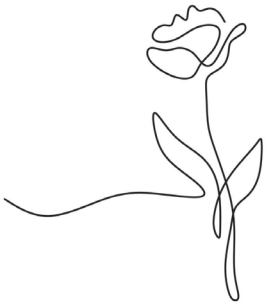
Over the past so many years, a lot of information has been published on the psychology of web design. This includes the effects that colours, structure and typography can have on the visitors of a web page. On some level, these effects are conveyed similarly by books or any other physical medium. We will discuss some of these.

Some psychological effects, conveyed by a page's layout, are quite difficult to comprehend. Others, however, are not. For example, the influences of a page's content are easy to grasp. In the early days of the internet, web pages used to be incredibly long. Articles of well over 10 000 words were really no exception (this article is about 750 words long!). Needless to say, this generally did not spark a lot of joy. Instead, these pages induced stress and anxiety.

Typography

Typography has more influence than you think. A certain style of typography is often associated with a specific feeling. Think about serif fonts, for example. Serif fonts are those in which letters have tiny feet, called serifs. One of the better-known serif fonts is Times New Roman. These fonts are associated with professionalism, knowledge and authority. Highly renowned newspapers, such as *The New York Times* write in these. Besides, the serifs make it easy for our brains to recognise the boundary between two letters.

Source: pinterest.com



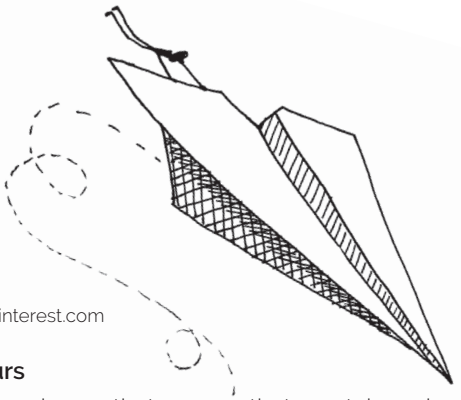
Source: vecteezy.com

Sans serif fonts, on the other hand, are those without these feet on the letters. These fonts can be used for people that are not as skilled in reading. In books for children, for example, you will likely see sans serif fonts. This is a direct consequence of the simplicity of these styles. Sans serif fonts, like Arial, are generally more used for web pages because the resolution of monitors is much lower than the resolution of printed works. This means that serif fonts will be likely to appear blurred because the screen cannot render the serifs properly.

Source: stock.adobe.com

Structure

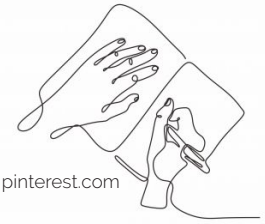
Another element that can influence the reader's mood drastically, is the structure of an article, book or web page. As you have surely experienced yourself, disorganised research papers or informative websites are very frustrating to see. Besides having a logical organisation of the text, it is important to have a structured layout as well. It is important for designers to include enough white space. This offers the visitor a visual break, every once in a while.



Source: pinterest.com

Colours

Did you know that pages that contain colour increase people's desire to read its content by 80%? This seems like an amazing opportunity to just throw all the colours of the rainbow on your page. However, you should be careful with the usage of colours. Colours are quite magical; almost all colours are associated with both positive and negative emotions. For example, red can be perceived as the colour of boldness and passion, but also of hunger and anger. The colour blue radiates power and trust, but also sadness and grief, and so on.

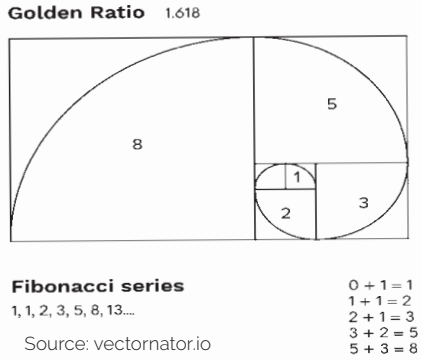


Source: pinterest.com

To capture the positive feelings of the colour and exclude the negative ones, you should play with the tint, hue and shade. Another way to capture the good qualities of certain colours is to combine them with others. For this, harmonious colour palettes that complement each other work best. When a page is full of different colours, it can get very overwhelming to read. This is why for most web pages, a lot of neutral colours like black and white are used. These neutral colours give the reader a sense of calmth and an opportunity to rest. To get the most inviting web page, a combination of blue and green with hints of yellow and orange on a white background will definitely do the trick. This specific combination of colours conveys the most positive emotions.

Images

It is probably no surprise that images can also affect your mood. We all feel a bit uneasy when seeing disturbing images and joyful when we see an image of a cute animal. These are quite trivial examples, but there are a lot of subtle things in an image that can affect us a lot too. As humans, we look for mathematical patterns in images and tend to find these very appealing.



Beauty lies in symmetry and good proportion. Images that possess these aspects can reduce stress and increase concentration and focus. Furthermore, the brain is more capable of scanning and interpreting images that contain mathematical patterns. The Golden Ratio and the Fibonacci Sequence are the mathematical patterns that are used most often in images.

We hope to have given you an idea on how the layout of a page can unconsciously affect your mood. Perhaps needless to say, there are many more elements that can either please readers or scare them off. Maybe this knowledge can help you to write an article, a report, or even your thesis project.

HOOKE'S OWN ARTIST

ASHLEY ZHANG

Bio art is an umbrella term, encompassing a variety of works and ideas that have an impact on either our perception of ourselves or that of the world. It is the bridge between science, philosophy, and design. Giving us the opportunity to imagine beyond the materials we have been given. Science is driven by discovery and understanding; bio art takes this and creates something tangible to a broader audience.

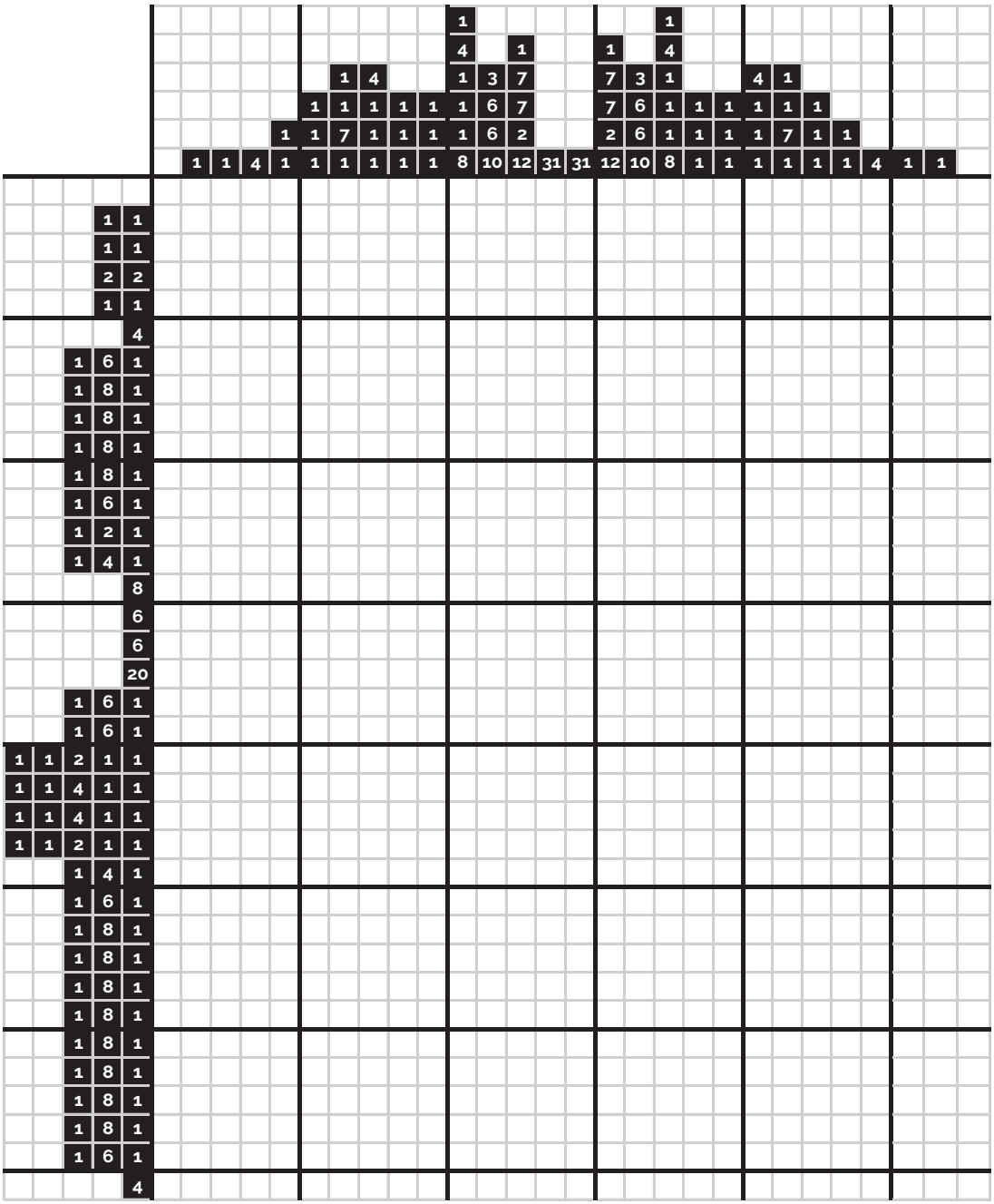
My immense fascination with art bled onto my love for science and motivated me to create works that showcase both. Currently, I am working with the Bio Art lab in Eindhoven as one of their talents in the Talent Pressure Cooker program. Over the summer I will create an art piece that is to be presented at the Dutch Design Week in 2021.

The idea is to create a sculpture that opens the public up to the concept that all elements starting from the nanoscale up, are interconnected. I will focus on the notion that those processes happening at the nanoscale make up everything around us and that they all use the same set of building blocks. That we as humans are not above nature but part of it, an idea I explore as a Nanobiology student and through the lens of Taoism. In order to convey this, I will create a microbial fuel cell (MFC) and shape it into a glass sculpture inspired by the shape of a neuron. The complete sculpture should show the public that essentially, the reactions within the brain are very similar to these in the MFC. By this, I want to show that there is connectivity present everywhere, in all organisms.

It is the redox reaction that is reoccurring in many processes that I want to highlight in this work. With this sculpture, I want to give a new perspective on how we should view our role in the ecosystems on earth and motivate people to find solutions to make our presence less harmful.

NANOGRAM

SO YOU CAN PUZZLE ALL SUMMER LONG



If you have found a solution and you want to check your answer, send an email to

mrna-hooke@tudelft.nl

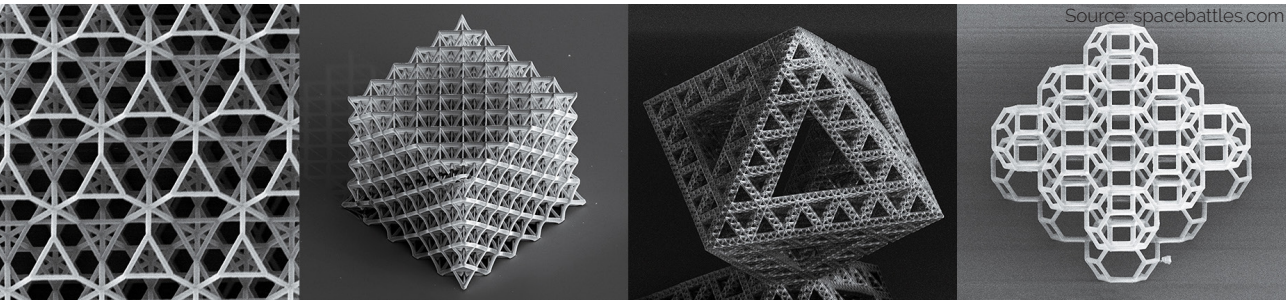
And we will let you know how well you did!

Elise Perton

THE SEVEN ARTS OF NANO

ART

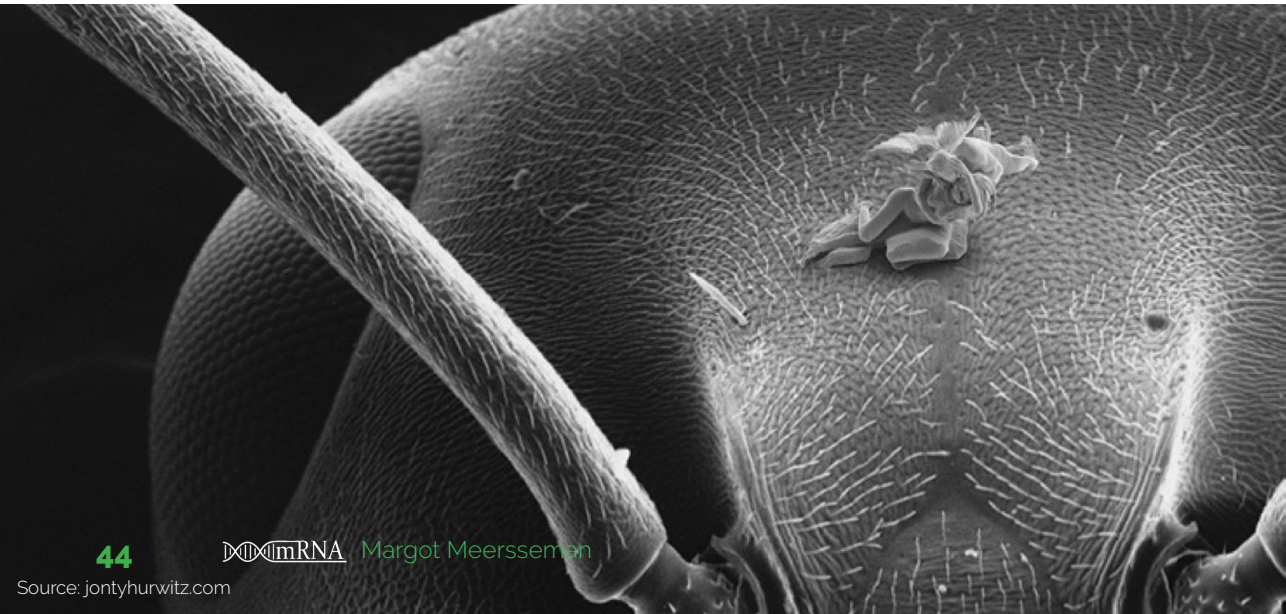
Commonly, arts and science are viewed as opposites. However, these examples will prove that the 7 arts are also represented in our everyday lives as nanobiologists.



Source: spacebattles.com

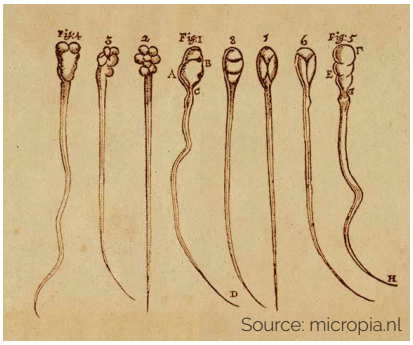
The first art is architecture. You would think it is impossible to connect architecture and Nanobiology. Nanoarchitecture is the use of materials at the nanoscale to improve buildings. It can do so by making the building matters stronger, making buildings greener and less harmful to the environment, etc. Nanomaterials could be an improvement for society as a whole, as they would also serve to build better defenses against catastrophes like floods or earthquakes. And in fact, nanoarchitecture could help build a greener society, thus helping reducing global warming.

Sculpture, the second art, is easier to relate to Nanobiology. Technically speaking, anything man-made at the nanoscale is sculpture. DNA origami is a perfect example of sculpture at the nanoscale. Here you can find the art of Jonty Hurwitz dubbed the smallest sculpture of the world, placed on the head of an ant. It is made with a 3D printer and with a special technique known as multiphoton lithography.



Source: jontyhurwitz.com

Thirdly, visual arts like paintings and drawings can easily be found too. Some drawings of tiny particles became very famous among scientists. A perfect example is the illustrated book *Micographia*, which we, writers of mRNA, reviewed. Another great example is van Leeuwenhoek and the very first drawings of objects not seeable with the naked eye. But now, it is more likely to use a camera to capture the image of the object of interest. Thanks to the progress of imaging, scientists do not have to be great artists anymore.


Source: micropia.nl

The next art is harder to relate to Nanobiology because music is not really linked to Nanobiology at all. There are two things you could consider to be nano music: people singing about nanotechnology (which I recommend you search on your own because words cannot describe the experience) and the music or more accurately, the sounds that molecules make. These sounds are waves that can be seen. They also serve another purpose: helping to localise certain molecules. It sounds crazy, but that is what a team of scientists created. It is called Acustico, if you want to further research on this.

Literature is the easiest to link by far, as every scientific paper is literature. No need to elaborate further. Even what you are currently reading is nano literature. If you want to deepen any scientific subjects, you can consult Science magazine, Nature, and so many others, I cannot cite them all.

The next art is performing arts, which is one of the art the furthest away from Nanobiology to me. However, with more deep thinking, a parallel appeared. When teachers are talking in front of us, students, they are producing a show of sorts. When talking in a conference, nanobiologists also put on a show in front of a crowd. Both of these examples are performing arts. TED talks could also be considered performing arts and a lot of well known and less known scientists give them quite a lot. The subjects are also very diverse, so it will satisfy everybody's taste.

The seventh art is cinema. Any of the captured films of dynamic particles can be considered movies, thus cinema. Thus dynamic vesicles movies captured in the lab make you a cineast as a nanobiologist. Some short film movies also talk about nanotechnology and its consequences. One of my personal favorite is called *Nano* (of course the title is also helping).

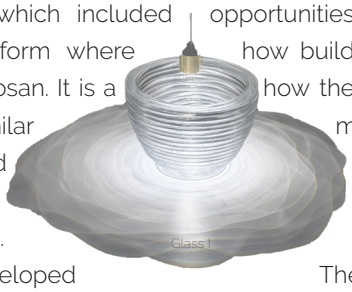
Source: vimeocdn.com

NERI OXMAN

ART

Neri Oxman is an artist known for her architecture combining biology, design, computing, and material engineering. Her work's shapes and structures are made in the context of its environment.

They include co-fabrication systems for building hybrid structures like the Silk Pavilion which was made with the help of silkworms, Synthetic Apiary made with bees. She also creates structures like the Ocean Pavillion, which included a water-based fabrication platform where structures were built out of chitosan. It is a water-soluble organic fiber similar to chitin. She also participated in making glass a translucent material available in 3D printing. Each of these can be further developed in sciences and architecture.



Her work is exposed permanently around the world in the Museum of Modern Art, the Centre Georges Pompidou, and numerous other places. In 2020 a major retrospective of Oxman's work opened at the Museum of Modern Art.
On becoming a professor at MIT in 2010, Oxman founded the Mediated Matter research group at the MIT Media Lab. There she expanded her collaborations into biology, medicine, and wearables.

She describes her work as pursuing "a shift from consuming
nature as a geological resource to editing it as a biological one."

With Material Ecology, Oxman has pioneered a field that promotes previously impossible opportunities for design. She is revolutionising how buildings and products are made and how their shape and material composition may perform in harmony with the ecosystems they inhabit.

The construction of products and buildings is therefore no longer limited to collections of discrete parts with homogeneous properties. Rather, objects, like organs, can be computationally 'grown', additively manufactured, and biologically augmented to create heterogeneous and multifunctional constructs.

As architect, scientist, engineer, and inventor, Neri Oxman has led the creation of scientific research and technologies with an emphasis on integrative design across scales and disciplines.

All the images are Neri Oxman work.
Source: Silk Pavillion I & Glass I: wired.com
Other images: oxman.com

THE NANO LEBOWSKI

MRNA REVIEWS

Nathan

Best character: Walter

Quote: "That's, like, your opinion, man."

Review: I got reminded of an old colleague of mine who was a serious movie buff, whose favourite movie is The Big Lebowski. "Plot does not matter," he said, "it is all about the characters." The Big Lebowski takes this idea and dials it up to eleven. The plot is barely coherent.

Stefan

Best character: The doctor, who is played by the same actor as Ranjit in How I Met Your Mother (Marshall Manesh)

Quote: "Strikes and gutters."

Review: The Big Lebowski also is the origin of a meme, when Walter has his gun drawn while accusing his opponent of a bowling foul. While watching that scene unfold, I was like: "I know this guy from somewhere..."

Lulu

Best character The Malibu Police Chief

Quote: "Strikes and gutters."

Review: Picture this: you are taking S&S. It is 8:45, you have just dragged yourself out of bed, and you are sat in the lecture hall. You are just sitting there, thinking: "A lot is happening, and I do not understand any of it." You are just like The Dude is and the lecture is the plot of The Big Lebowski.

Source ball: istockphoto.com
Source pin: pngkey.com

Thijn

Best character: The taxi driver

Quote: "The Dude abides."

Review: The Big Lebowski also has some interesting trivia. The audience is given a clue about when the movie takes place in the opening credits when we see George H. W. Bush's 1990 speech on TV condemning the Iraqi offensive.

Elise

Best character: The Dude

Quote "Am I wrong?"

Review: You see the Dude tuning in to the TV exactly when Bush says: "This will not stand, this aggression against Kuwait". I love that the Dude just blatantly repeats this in the office of the big Lebowski.

Sten

Best character: Walter

Quote: "Strikes and gutters."

Review: More trivia! There is a link between The Big Lebowski and biology. Two species of African spiders have a name inspired by the movie: *Anelosimus biglebowski* and *Anelosimus dude*.

Margot

Best character: David Thewlis' role, Knox Harrington

Quote: "This aggression will not stand."

Review: Spoiler alert! Did The Stranger (Sam Elliot) break the fourth wall at the end of the movie? This is a big no-no in acting.

BEPS

FUTURE PROSPECTS

Finding the right Bachelor End Project (BEP) can be a very challenging task. There is a lot of information out there to help you decide. The most important thing is that you find a project that excites you, at a lab that makes your heart beat faster. The question is, how?

For this article, we felt it was more useful to give some insight into the process of finding your ultimate BEP rather than interviewing students who are currently doing their project. Nevertheless, we value their input and we therefore asked multiple students for tips and tricks. We thank everyone who contributed!

Drylab vs wetlab

Once you start thinking about your BEP, you might already have an idea on whether you want to gain more hands-on experience in a laboratory or not. On the other hand, maybe you want to put your computational skills to the test.

Students that generally value the biology part of Nanobiology might feel like they are not as skilled in the lab as they wish to be. In that case, doing a BEP in a wet lab would of course be great practice. On the other hand, some students choose a wetlab because they want to know whether this is what they want to do after the bachelor's degree. Think about your future!

The students that are drawn to courses similar to Electronic Engineering or Computational Sciences, however, might be very enthusiastic about working with extraordinary computers. After all, quantum calculations might be a little tough for your own desktop laptop. The labs in Delft have very cool equipment. Besides, a drylab can offer very different experiences, as you will not be expected to perform routine and structured experiments. Instead, you might be able to work differently from day to day, especially since you might be able to get some work done from home, while working on campus other days.

Choice of lab

Possibly the most difficult task of the BEP is to find the lab that excites you more than any other. Overviews of the possibilities can be found on both the Bachelor Nanobiology page on Brightspace (make sure to enroll!) and on the Hooke website. Simply search for BEP and you will find a PDF that includes a huge list of possible labs. Still, time might be spent more efficiently by starting to think of what you would like to spend 20 ECTs worth of work on.

One of the first things that can help you orientate is the BEP event. Members of al lot of labs will be present here, and you can talk about your wishes, goals, and expectations. Once you have narrowed your options down a little, you can start communicating with laboratories via email individually. Members of the labs want to help you make a decision, so emailing them is only appreciated!

Source background: pinterest.com

Besides the subject of the research group you want to join, you might want to keep in mind your very own learning goals. Think about techniques that you find interesting and want to know more about. If you already have an idea about which master's degree to pursue, think about what kind of lab might help you prepare best.

Software

From analysing images and making graphs to keeping track of your references, the usage of software can be of significant help when working on your BEP.

First of all, you need a programme to put all the information you gathered for your BEP in one document. You can use something straightforward like Word or Google Docs, but this might be irritating to use when adding lots of images and graphs. More advanced and specified software like LaTex can enhance the quality of your project. These might be challenging to use at first, but there are multiple workshops available. Cohecie, for example, organised such a workshop once. There are also some paid online workshops and modules from PE&RC and the University of Akron. If you are completely lost and/or broke, YouTube tutorials are always a good option. YouTuber Michelle Krummer has a very extensive LaTex playlist.

ImageJ is a very useful tool to study the images you obtained in the lab. If you have followed Microscopy and Nanoscopy and Image Analysis, you already know the basics of this program, which makes it easy to work with.

A lot of the students emphasised the importance of keeping track of your references. Since you will probably use a lot of different material and sources, it can get very challenging to keep a neat overview. There are multiple programs that can help with this like Endnote and Mendeley. These programs cite while you are typing. They also suggest other articles that can be relevant based on the articles you have used before. Both of these programs are accessible via TU Delft and free.

Supervisor

The thought of a supervisor keeping track of your process and overviewing your work might be quite intimidating to some students. First and foremost, every supervisor is different in the way they interact with their BEP students (they are people after all), but it is important to be polite and professional to them. One important thing to realise is that your supervisor is not aware of the exact requirements of your project. They are focused on guiding you in the lab and not specifically in your BEP. Therefore, it is valuable to have a conversation with your supervisor about what the programme expects of you and what they expect of you. Also, talk about what you expect of them and what is important for you in your process. Another thing that is important is to be transparent with your supervisor about your schedule. Let your supervisor know which courses you follow and when the exams are scheduled so they can take this into account.

We hope to have given you a nice overview of what to expect of a BEP and some useful tips and tricks when working on it. And maybe you even have some inspiration and motivation to start to orientate on this super intense but fun project.

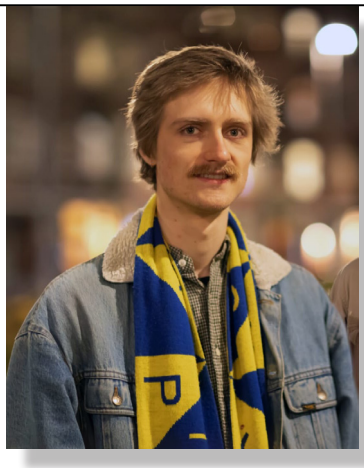
We want to thank Anna Hartendorp, Annemieke Mathissen, Anouk Dutrée, Aisha So, Susanna Tdlohreg, and Mart Groenendal!

Source frankhanswijk.nl

RANDI

NIELS WERIJ

>> rng ('shuffle');
>> randi(nr_leden)
ans= 274 % Niels Werij



I am currently pursuing a master's degree for Nanobiology and North American Studies (NAS) in Leiden. With my NAS thesis, I hope to connect both disciplines: I am researching the way American newspapers portrayed geneticists in their articles on the Lysenko Affair, a dramatic period in the history of Soviet science, and I aim to find how this portrayal relates to American Cold War ideology. Here is a brief discussion of my findings.

Science has contributed massively to the iconography of the modern age. The atom bomb, on the cover of the first mRNA of this year, and the structure of DNA are among its most recognised symbols, which in combination with archetypal depictions of scientists—such as in Doctor Faustus or Breaking Bad—and the narrative framing of science-related stories constitutes the public's collective imagination of science or the cultural interpretation of what science is.

Such imagination extends well beyond fiction, and it is shaped by a variety of different interest groups. Geneticists themselves, for example, attempted to "rebrand" in the wake of World War II. As their field was associated with eugenics and nazi ideology, geneticists presented it as new. Furthermore, to generate public approval (in the US), an effort was made to associate the field with nuclear physics; or the atomic bomb, which was in the cultural spotlight at the dawn of the Atomic Age. The destructive potential of the bomb could be counteracted with genetics, the promise went; radiation-induced mutations could and would be healed through genetic understanding. Without such care for its public image, the development of genetics might have faltered significantly.

However, the imagination of science can also be appropriated by those outside of the field. During the Cold War, for example, the idea that science is apolitical and value-neutral was a part of US propaganda and foreign policy. More recently, there have been doctors who have used their title to claim authority on unrelated topics thereby increasing the credibility of their narrative. As such, it is important to be critical of those appropriating the imagination of science.

AGENDA

HOOKE AGENDA

End of the year barbecue	2 July
Resits	9-13 August
IntroN	13-15 August
OWee	16-19 August
Start of the academic year	31 August
Symposium	12 Oktober
Changing GMA	9 September

For 3rd years and up: if you want to keep receiving the mRNA, scan the QR code.

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52 pages

Amount per serving
Calories 5

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MAY CONTAIN TRACES OF: RANDI // THE NANO LEBOWSKI
PACKAGED AT A FACILITY THAT ALSO PROCESSES: SCARY STORIES.