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### **EDITORS**

Editor-in-Chief: Sten de Schrijver Minuting Editor: Anna Delhaas Commissioner of Promotion: Elise Perton Commissioner of Acquisition: Thijn Hoekstra Captain InDesign: Margot Meersseman Captain InDesign: Nathaniel Germain QQ: Stefan van Alen QQ: Lulu Notschaele

S.V.N.B. Hooke mrna-hooke@tudelft.nl Van der Maasweg 9 room C0.010 2629HZ Delft 015 2781639

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# COLOPHON

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# EDITORIAL STEN DE SCHRIJVER

Dear reader,

Even though the year has just begun, it seems that this year too will be one for the history books. I am writing this after having relived a childhood memory; ice-skating on natural ice. It had been quite some time since we had a week with sub-zero temperatures and I, for one, made the best out of it. The one thing I enjoyed the most was seeing groups of people together, while still feeling safe.



In the midst of this pandemic, we thought it would be nice to create a full edition of the mRNA around the brain. We included an article that explains the importance of dreams, an article on tips to stay sane and even a page dedicated to Ellenoor's creativity.

As you might have noticed, for this edition, we have a very special, custom-made cover. For this, we should thank Hanneke Perton. Creativity plays a big role in this mRNA which, I am sure, you will find out. There is some room for you to fill in a punzzle and practice the art of colouring as well.

The last thing I would like to mention is the fact that we have uploaded two new episodes to our very own podcast. Be sure to check it out on Spotify or on Apple Podcasts! You can find it as *mRNAudio*. We recently uploaded another interview and a review on the documentary *The Social Dilemma*.



Happy reading!

Sten de Schrijver, on behalf of mRNA 5



# FROM THE BOARD

### Dear members,

As I am writing this it is the turn of the second semester, a big change for all students. After the February break there is almost a complete shift in classes, with some people even starting BEPs. This shift in studies gives new exposure to all the fields that are open to us nanobiologists, and new knowledge on how to best be the link between them. After all, that is what we are working to become: a new link in an old network.

This scientific network is, however, far from the only one that we are a part of, whether we realise or not. The world around us consists of innumerable complicated networks, in which we all play a part in keeping them together. And just like the things we perceive, the very thing that allows us to interpret them could simply be described as nothing more than an extremely complicated network of interconnected cells. In fact, the brain has been described by some as the most complicated network known to man.



The brain's inner workings are fascinating, complex, and mysterious to us, but ultimately, they are not yet fully understood. As you all know this is still an active area of research, and very relevant for Nanobiology as well. As a matter of fact, some of you reading this might even find yourselves solving the mysteries of the brain in a few years time.

To give you a little head start, the lovely mRNA committee has been working hard to put together this edition for you. And they are not the only ones that have been doing so! Over the past few months, many committees have been putting in a lot of effort to keep the network that is S.V.N.B. Hooke strong. While ATP 6 organised their last activity: a chess tournament with an epic finale, Cohecie organised their first workshop. Fotosynthecie organised their first photo contest, and of course the break was marked by Wnt and Diffucie that both managed to organise a week full of great ways to bring people together, and learn new things!

With the LYSE and the first ever Hooke rally coming up, there is plenty more to look forward to. I hope to see you there.

I have spoken.

Lulu Notschaele President of S.V.N.B. Hooke 2020/2021

# UNCOVERING THE MYSTERIES BEHIND PROTEIN FOLDING

### NANONEWS

The British laboratory Deepmind has created an AI system that can accurately and rapidly predict the shape of proteins from the amino acid sequence. The AI system is called Alphafold 2 and it has already made a huge impact in bioscience. Alphafold can give a lot of insight in the mechanisms behind different illnesses and diseases, since knowing the 3D shape of a protein tells us a great deal about its function. Discovering the structures of proteins in the laboratory can be a very long and challenging process. Structural biology laboratories mostly make use of cryogenic electron microscopy. Although this is quite an advanced tool, it cannot give all the insights into the folding and twisting of amino acid chains. It can take years for scientists to find the correct protein structures. Alphafold 2 can discover the shapes of proteins accurately within a few days, which makes it a revolutionary system.



Source: towardsdatascience.com

Last November, Deepmind won the global CASP competition (Critical Assessment of protein Structure Prediction) with their AI system. Alphafold 2 was put to the test against more than a hundred other systems to prove that they could provide the most accurate 3D protein structures from the given amino acid sequence. The shapes of the proteins had already been determined by unpublished experiments. The critics of CASP then compared the system's predictions with the real structure by performing a global distance test. Alphafold 2 managed to obtain an accuracy of almost 90% on this test, outperforming all the other systems.



Deepmind's AI system can give us a better understanding of the mechanisms behind diseases and the consequences of certain mutations. Alphafold 2 even contributed to the discovery of the shape of SARS-CoV-2 ORF8, an immunoglobulin-like protein that inflicts pathogenesis. Deepmind stated that they want to continue to make a contribution to solving scientific problems with AI systems and sees this as the most significant application of AI.

E. Callaway, 2020, "It will change everything': DeepMind's AI makes gigantic leap in solving protein structures'. *Nature*, <https://www.nature.com/articles/d41586-020-03348-4>

Source: windhambrannon.com

# NEUROSCIENTIFIC EXPLANATIONS OF MENTAL DISORDERS THE BRAIN

According to the World Health Organisation, one in four people in the world will be affected by mental and/or neurological disorders at some point in their lives. This was stated in the WHO mental health report in 2001. Still, very little is known about the mechanisms behind them, which makes finding suitable treatments very difficult. Multiple fields of science are working to improve this: aside from the social science field, the neuroscience field is also invested in discovering explanations for mental disorders. Neuroscience does this by finding the brain regions involved in different mental disorders to get more insight, so that eventually better care can be provided. In this article we will discuss some of these neurological findings on different mental disorders.

All people are located somewhere on a spectrum of mental character traits. The definition of a mental disorder varies over time and culture. In general, a mental condition becomes a mental disorder when the functioning and well-being of the person are severely affected by that condition.

### Personality disorders

A personality disorder is characterized by the expression of extreme variations of character traits, like jealousy, perfectionism, sensitivity, etc. People suffering from a personality disorder have unhealthy thoughts and behavioural patterns. They are also often impulsive, dependent and, emotionally unstable. This makes the forming and maintaining of relationships quite challenging and can cause severe problems in work and social life. Disorders that fall in this category are paranoid-, borderline-, antisocial-, histrionic- and narcissistic personality disorder.

Source: psychiatrictimes.com



Figure 1. Corticolimbic system

DLPFC, dorsolateral prefrontal cortex; ACC, anterior cingulate cortex; AMY, amygdala; HPC, hippocampus.

disorders have yet to be identified, factors although certain that increase the risk of developing personality disorders have been established. These factors include a family history of mental illnesses, an unstable childhood, and variations in brain chemistry (hormones. neurotransmitters, etc.), and structure. Neuroscientific research shows that certain brain regions involved in emotional processing are divergent. This explains why people suffering from a personality disorder have an increased sensitivity to

The exact causes of these types of

emotion. Functional MRI (fMRI) analysis found that persons with borderline personality disorder have a higher activation of the hippocampus, the amygdala, and the posterior cingulate cortex while processing negative stimuli. The brain of people with personality disorders also showed a decrease in grey matter volume in the hippocampus and the amygdala. The grey matter in this area plays a critical role in the processing of chronic emotional pain, so loss of it can result in the symptoms of personality disorders.

### the anterior cingulate cortex, thalamus, and the amygdala. They also found a decreased activity in brain areas which are related to emotional and cognitive control. These brain regions together are important for termination of ongoing mental activities and replacing them by new ones. This could be the reason why people with mood and/ or anxiety disorders struggle with feeling the same way for long periods of time and struggle to get out of this state of mind.

### Anxiety and mood disorders

An anxiety disorder is characterized by the experience of an intense, persistent, and excessive amount of worry and fear about everyday situations. This can result in avoidance of certain situations and can lead to isolation. Anxiety disorder can be caused by health issues and/or trauma and stress build-up. It can also run in the family. People with an anxiety disorder can suffer from panic attacks, insomnia, depression, and are more prone to substance abuse.

A mood disorder is characterised by experiencing long periods of extreme sadness, happiness, or both. Depression and bipolar disorder are the most common mood disorders. Having a mood disorder can make it difficult to carry out routine activities. Like anxiety, it can result in avoidance of situations and places, and it can lead to isolation. Trauma, stress, and physical illness are a contributing factor for the development of a mood disorder. The function and structure of the brain also play a considerable part.

People with mood disorders and people with anxiety disorders share a lot of similarities in the abnormalities in the brain's control circuit. Brain scans show a very high activity in brain areas associated with the processing of emotional thoughts and feelings. These regions include A lot of research has already been done on mental health and hopefully a lot more will be done in the future. With new methods, techniques, and equipment more information can be gathered and we will get a better understanding of the underlying mechanisms of mental disorders.

Disclaimer: Please note that we could not include all symptoms of all the mental disorders. This does not mean they are not valid. We are not professionals on this topic and the content of this article is for informational and educational purposes only. If you have any specific concerns about your mental health, you should consult your doctor and you should not delay seeking medical advice or treatment for your mental health, because of information in this article. You can also make an appointment with our study advisor Ayana Jung.

World Health Organisation. 2001. 'The World Health Report 2001: Mental Disorders affect one in four people.' *World Health Report.* <a href="https://www.who.int/news/item/28-09-2001-theworld-health-report-2001-mental-disorders-affect-onein-four-people#:~:text=One%20in%20four%20people%20">https://www.who.int/news/item/28-09-2001-theworld-health-report-2001-mental-disorders-affect-onein-four-people#:~:text=One%20in%20four%20people%20</a> in,ill%2Dhealth%20and%20disability%20worldwide>

# MYTHBUSTERS

The brain is a really mysterious organ, and because it is not well kown, myth and false informations flourishes. Here are some corrections or debunking of severval of my favorite myths concerning the brain.

### Adults cannot grow new brain cells

In 2014, a team of the Karolinska Institute in Sweden measured traces of carbon-14 in DNAs, allowing them to approximate the age of cells in the adult brain. It confirmed what had been discovered earlier: new brain cells form in the hippocampus, a center of memories in the brain. The team also made a new discovery: another region of the brain, the striatum which is involved in motor control and recognition, also regenerates throughout life. This process of creating new brain cells in the adult brain is called neurogenesis. These findings suggest new therapies for degenerative brain diseases like Parkinson's disease.

Although cognitive functions decline with age, some also get better. Think about vocabulary, conflict resolution, emotional regulation. These tasks are performed better in the older brains

### Students learn best when teaching styles match their learning styles

Based on popular theories, each person has a preferred learning style, auditory, visual or kinesthetic that helps them learn best. However attractive the idea may be, there is absolutely no scientific data to back it up. In 2006, the University of California at Santa Barbara found out that students did not perform any better on a test when the instructions were in their preferred style. Even though there are no improvements concerning the teaching and learning style matching, there are broader principles that help everyone study better like through repetition, testing and spacing lessons out.

### We use only ten percent of our brain

We use 100 percent of our brain. Brain scans have shown that whatever we are doing (sleeping, eating, etcetera), our brains are always active! Damage to any part of the brain leads to severe mental and behavioural effects. The 10% myth is often used in movie and TV show plots like *LUCY* (2014). The myth is thought to have originated in 1907 from William James, psychologist from Harvard who stated that we still have room to grow and better ourselves. However, a journalist misquoted him, leading to the 10% myth.

### Brain damage is permanent

We often think brain injuries or damage are everlasting, but thanks to the brain's plasticity the part of the brain that has been injured can heal itself over time by making new connections. Areas of the brain that are not associated with certain functions can take over and allow the patient to relearn how to do things. Most of the time, the idea of relearning lost skills helps the patients to keep hope of regaining some abilities after the damage. For example, stroke patients can often regain speech and motor skills through therapy.





# BRAIN-COMPUTER INTERFACE THE BRAIN

Seriously, who was not freaked out when they saw Neo plug himself into the Matrix using a twenty-odd centimetre glorified AUX plug. I was for sure. What is enviable about Neo's cranial USB though, is his ability to master skills, Kung-Fu for instance, in mere seconds. I would wager many of us nanobiologists would not mind uploading Systems & Signals to our brains in an instant rather than having to actually learn it.

#### I know kung fu.

Sadly, Neo's brain-computer interface, or BCI, could never exist outside the world of the 1999 blockbuster. Or could it? Ever since the 1970s, us humans have been interested in augmenting our human brains using computers. The last two decades of research have been of particular note. Maybe we have the Matrix to thank for this?

Let us start close to home with a technique that might be familiar to many of you: optogenetics. As crazy as it sounds, it uses lasers to interact with cells that have been genetically altered via viruses in order to communicate with the brain with unparalleled precision. The technique is popular in the field of neuroscience and was given the Method of the Year distinction by Nature Methods in 2010. It is not fit for use on people however, due to practical constraints like skull thickness and the ethical implications of genetically engineering humans. Another tectonic shift in the world of BCIs has to do with exactly *who* is pushing the envelope. Before, scientists were the only ones partaking in the endeavour into the brain, but in recent years, tech companies like Neuralink, Facebook, and Microsoft have also shown a growing interest in the field. This could be a source of hope, as these companies bring along an influx of investment, but it might also be a reason for despair. Right now, you could reasonably argue big tech firms the likes of Facebook are impinging on our privacy and autonomy. With that in mind, are we comfortable with the idea of having a Facebookmade brain implant?

### Presented movie

### Decoded movie





The third disruptive force in the field is machine learning. "Brain decoding" is a prime example, which is a technique pioneered by Dr. Jack Gallant, Professor of Psychology and Neuroscience at the University of California. In brain decoding, you take a model of the brain and use it to convert brain activity to a reconstruction of the visual stimulus that elicited the activity in the first place. Arguably, this is parallel to some sort of crude mind-reading device and it certainly underscores the awe-

### inspiring power of machine learning.

2011, 'Method of the Year 2010'. *Nature Methods*, 8, 1-1 Gallant, J 2016, 'Engineering thoughts and memories', *YouTube* Nishimoto, S, Vu, A. T. Naselaris, T. Benjamini, Y, Yu, B & Gallant, J. L 2011, 'Reconstructing visual experiences from brain activity evoked by natural movies', *Current biology*, 21, 1641-1646 Velasquez-Manoff, M 2020, 'The Brain Implants That Could Change Humanity', *New York Times, Aug 28, 2020*.

Thijn Hoekstra MMMRNA

# AS GREEN TEAM

As the Green Team of the Applied sciences launched their instagram, I got to speak to two of their members: Puck and Tim, in charge of Nanobiology and Applied Physics respectively at Green Team. I wanted to get to know what they were working on to make our faculty greener.

# What is the Green Team? Who are you and what do you do?

Tim: "We are not the first Green Team. The first one originated from 3ME, which stands for Mechanical, Maritime and Materials Engineering. They decided to be more sustainable so they wrote an assessment report for their faculty on the topic of sustainability. Then they thought the report was such a success that it would be a good idea to do it for all the other faculties, including Applied Sciences, so that is how we came to be.

Last year, we wrote our assessment report based on four portfolios: Education, Operations, Communication (internal and external) , Research. Our conclusion was that our main focus was Education. We thought we could have a big impact by improving the curriculum. We are also working on Communication so that we can really bring across the message that sustainability is a part of everything and needs to be involved more in the faculty."

# What is the difference between GreenTU and each individual Green Team?

Puck: "There's the GreenTU board, which is the overall organization of all the Green Teams. Then there is one coordinator within the TU board who is the boss of all the Green Teams.

The Green Teams are really only involved with the activity of one factulty, whereas GreenTU is really for the whole of the university.

In the Applied Sciences Green Team, there's a member of LST, MST and of Nanobiology, Applied Physics so we are a team of four people, one to represent each program."

### Do you also organise activities to promote sustainability within Applied Sciences? What have you done and what can we look forward to?

Tim: "There are a lot of activities suggested from the GreenTU themselves, which are interesting for the larger part of the students. For example, the Day of Sustainability, organised online this year, during which you can see a lot of seminars and lectures on sustainability in daily and professional life.

There's actually an exciting thing coming up that we have been working on so far. It is an alumni speed date event for which we will be inviting alumni that are currently working in the sector of sustainability.

Today, we sent emails to invite these guests and they range from PhD students working on a sustainable innovation, or application to people working as analysts in sustainable finances, it could be anything. That's our little sneak peak. We will keep you posted on our Instagram"

@greenteamas

MINIMRNA Margot Meersseman

# What are your tips and tricks for students to be more environmentally friendly?

Puck: "First, they should find something that interests them. It could be finding sustainable clothing in a thrift shop or switch to a vegan diet or reducing your plastic waste. It all depends on what you find interesting.

It sounds a bit cliché but to make it a big difference, you need to make it a lifestyle.

I became a vegan quite a while ago, so I find it very easy. And cooking for my friends or giving them food really helps inspire them and gives them ideas because at the start, they don't really know that much.

There's also big organisations and boards you can take as an example. As the GreenTU or a member of a Green Team you can really make a change and I think it's a really positive thing to make those kinds of organisations more known in Delft. There's so many options, you just have to look in the right place."

Why do you think it is important for the students, the faculty and the university to make this change and to become more green? Tim: "Whether you are green or not, it shouldn't feel too binary, to be honest.

I think we are trying to raise more awareness that everything you do can have certain consequences that need to be taken into account.

I think the really cool thing about Applied Sciences, and TU Delft in general actually, is that we are always looking for alternatives and solutions to problems. There are so many other ways to have fun and not harm the environment, it will not badly affect your life."

# Do you want to ask anything to the Nanobiology students?

Puck: "Maybe ask for some tips. For example, I've been looking at the courses of the Nanobiology curriculum and I have not found one course that really interested me to make it greener. But if anyone has an idea, they can contact us. We have a lot of Applied Physics courses as well, so we've been looking at those, because it has been a little bit easier to find green ideas. If anyone has any tips, including tips about the faculty itself and its building, please let us know. Because we want to make a change even in the research labs, although no one is there now. And of course, if the students have any questions as well, they can contact us via instagram or email."

Source: vectorstock.com



Contrary to animals like jellyfish or starfish, humans have a central nervous system consisting of a brain and a spinal cord. The brain is the part of our nervous system with the highest neuronal density, consisting of over 86 billion neurons. It and can be considered a kind of central hub from which the rest of the body is controlled. There is a second hub that is less known, yet very important. This hub, located in the gut and also known as "the second brain", has more control over your behaviour than you might think.

#### The vagus nerve

The enteric nervous system lines your long intestine and consists of over 100 million neurons, more than the rest of your peripheral nervous system. Recent research suggests that these neurons are responsible for more than just making sure your food gets digested. One big hint that this is the case would be that that 90% of the fibers going between your brain and gut takes information from your gut towards your brain and not the other way around. This nerve, responsible for carrying information between the two, is known as the vagus nerve and is also the longest nerve in the body. Relatively recent research has discovered the different ways this vagus nerve is being used not just by our gut but, also by the microbes living inside the intestine.

> This "second brain" is thought to be involved in regulating your mood. Maybe you recognise being really frustrated or annoyed, but after having eaten feeling much better. Source: vectorstock.com

Source: vectorstock

Well, the vagus nerve might have been responsible for this. In the field of nutritional psychiatry the two-way connection between the gut and brain is researched.

#### Hijacking the nervous system

This connection goes further. Bacteria have been observed to alter rodents' behaviour and even perception. A famous example in rats is the bacterium *Toxoplasma gondii*. This bacterium has been observed to alter the usual fear rats have of cat odours into sexual attraction. When infected with the bacteria, areas in a rat brain related to sexual attraction started to light up when exposed to the smell of cats.

Researchers also managed to decrease anxietyrelated behaviour in mice by treating them with probiotics. In mice where the vagus nerve was severed, this effect was not found.

Nutritional therapeutics could reveal much more about the intimate connection between the gut and the brain, opening up new ways to think about mental disorders and how to treat them.

House, P. K., Vyas, A., & Sapolsky, R. (2011). 'Predator cat odors activate sexual arousal pathways in brains of Toxoplasma gondii infected rats.' *PloS one*, 6(8), e23277.

<https://www.health.harvard.edu/blog/gut-feelings-howfood-affects-your-mood-2018120715548>

Sampson, T. R., & Mazmanian, S. K. (2015). 'Control of Brain Development, Function, and Behavior by the Microbiome.' *Cell Host & Microbe*, 17(5), 565–576. <a href="https://doi.org/10.1016/j.chom.2015.04.011">https://doi.org/10.1016/j.chom.2015.04.011</a>

Source neurons: Clipart library

## WHEN WE ALL FALL ASLEEP, WHERE DO WE GO?

Dreams, the place where the most unimaginable things can happen, while somehow seeming very logical at that moment. From being chased by a group of angry, bloodthirsty dinosaurs to finally getting to kiss your crush. Everything is possible. Why do we have these strange scenarios playing in our heads overnight? In this article I will discuss a few different scientific theories on the functions of dreams.

### Theory one: Dreams contribute to mental healing processes

One theory about the function of dreaming is that it can help lighten the effects of traumatic experiences. During the REM (Rapid Eye Movement) phase, sleep might be able to stimulate emotional resolutions. This is because it is the only moment when the brain is almost completely free of noradrenaline, a stress inducing hormone and neurotransmitter. Furthermore, REM sleep is the time when memories are reactivated. This means that during REM sleep we can process our painful memories in a more calm and safe setting.

### Theory two: Dreams lead to creative problem solving

In a study performed by Harvard Medical School in 2010, subjects were asked to memorise a 3D computerised maze. Half of the group stayed awake during the break and the other half of the group went to sleep and were woken up multiple times to explain what their dreams were about. After the break, both groups were asked to navigate through the maze. It turned out that people who dreamed about the maze were ten times better at this assignment compared to the people who did not dream about the maze or did not dream at all. It seems like sleeping on a problem might actually be pretty valid advice, especially if you want to discover the structure of the benzene ring.

#### Theory three: Dreams are part of the reverse learning process

Contradicting the previous theory, this theory proposes that we dream to forget. In 1983, Crick and Mitchinson conceived the reverse learning model. This neurobiological theory proposes that during dreaming, the brain goes through all the gathered information of the day and sorts out the unuseful or unwanted content. The brain gets rid of these unwanted connections during REM sleep by blasting the cortex with impulses. Selecting information that should either be kept in the brain or be thrown out is crucial for the cortex. It cannot deal with so much information without developing parasitic thoughts, which disrupt the efficiency of memory organisation.

Although there are a lot of great and well known theories about the functions of dreams, the definite answer is not yet found. The rapid development of the neurobiological field and the inventions of new machinery might be able to give us an answer to this burning question soon.

Benjamin, V. J. 2010, 'Study Links Dreaming to Increased Memory Performance,' *The Harvard Crimson*, < https://www.thecrimson com/article/2010/4/27/maze-wamsley-group-navigating/>



Anna Delhaas MMMmRNA

# MINOR INTERVIEWS

As some Nanobiology students are finishing their minor, others are beginning to think about which one they want to do. We talked to three Nanobiology students who started a minor in September. How do they feel about the minor they picked?

### Floor van der Zalm: Genetics in Society, Erasmus MC

Floor was looking for a minor of 15 ECTS which was not too hard and somewhat interesting. She decided on the minor Genetics in Society at the Erasmus MC. The structure of the minor is interesting: no courses but lectures with a weekly theme. Attending these lectures, about seven each week, is obligatory. "Some parts reminded a bit of Intro to Nano," Floor found.

# "I learned some fun facts and to interact with Psychology students, and I took the first step to writing a decent paper."

The final grade is determined based on intermediate assignments (20%) and an exam about the lectures (50%). For the last 30%, one can either write a paper or choose the psychology track, in which you practice genetic counselling. The majority of the 23 minor students did a Psychology major. "The atmosphere was very different from the technical atmosphere in Delft," she explains. It took some getting used to, but eventually she liked it.

# "I think it was a great preparation for my BEP."



Floor decided to write a paper and does not regret this. She got a lot of support for writing the paper. Her feelings on the lectures are more mixed. There was overlap with Nanobiology courses and some lectures were not challenging. Still, she would recommend the minor "to people who want to earn ECTS in a fun way, without too much stress, and people who are interested in the social and medical aspects of genetics".

### Bastiaan van Dijk: Education, TU Delft

Bastiaan does not find it hard to explain why he decided to do the Education minor. "*I was looking forward to doing something different. And I like tutoring and giving exam training.*" This minor certainly is something different. It consists of equal parts internship at a high school, and supporting courses. In no time, Bastiaan was teaching mathematics.

# "After two weeks you teach your own classes already."

He really liked getting to do this so quickly. Also, he feels he got lucky with the school: the atmosphere was very nice, he had a kind supervisor, and the location was only a 25 minute bike away.

### **Future Prospects**





# Lucienne van der Geest: Computational Science and Engineering, TU Delft

Lucienne wanted to do a challenging minor with math and programming, so Computational Science and Engineering seemed like a good choice. The minor consists of several courses. She felt like there was a big difference in the guality of the courses: "I really liked Scientific Programming and I think the course on C++ was also taught well." She is more critical of Parallel Programming and the Final Project. In the Final Project, you work with a group of students on code for a supervisor. At least, that is the idea: Lucienne is disappointed by how little time she spends programming for the project. "I am just looking up things on chemistry and costs, which I really don't find interesting." Some of the courses could also improve their planning: "We have several deadlines in the third quarter."

## "As a nano, you can trust that you can manage this with what you have learned."

Despite these downsides, Lucienne is positive about the minor. She learned a lot, and says "I would recommend it to people who like math and want to get more knowledge of different programming languages". Before she started, she was afraid that it would be very difficult, but it turned out that her background knowledge of Python and math was sufficient for all the courses.

He is a bit less enthusiastic about the courses. "Sometimes, things were explained which would have been nice to have learned much earlier." After some time, the courses just felt like something that had to be done, while he was still hyped about the internship. Of course, such an internship consists of more than the teaching itself. Consider making a teaching plan. Many of the tasks are not that hard, but definitely time-consuming, Bastiaan finds. Luckily most deadlines are only a few days away, so that you cannot procrastinate a lot.

# "I learned how to write educational objectives and communicate information at the level of the audience."

There is also a more tangible result: a second degree education qualification. To obtain this, you need not only to finish the minor, but also get a positive assessment from your supervisor and finish the bachelor. Then, you are qualified to teach the onderbouw (class 1-3) of havo and vwo, and all classes of vmbo-tl.

Bastiaan is certainly happy he chose the minor: he is planning on doing a master Education as well. But for now, he is looking forward to some more Nanobiology-related courses.



Mireya



Mart Groenendal



Emilie de Vet



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# ME SINGING ALONG WITH THE SONGS FROM THE PUBQUIZ







Marvel: 'Infinity War is the most ambitious crossover event in history Me:





# THE MODERN HUMOURS

### THE BRAIN

Humourism, also known as the humoural theory, is the idea that human behaviour is regulated by chemical systems and has existed for thousands of years. The idea was first systemised by the ancient Greeks and applied to medicine by Hippocrates. Although modern medicine has evolved beyond the classical four humours proposed by Hippocrates, our modern understanding of mental health is not dissimilar to these ancient ideas.

### The classical humours

Humourism probably has its origins in ancient Egyptian medicine or Mesopotamia. and rose to popularity in Greece. The humours originally consisted of a long list including the fundamental elements. Humour is a word that originated from the Greek word *chymos*, meaning sap or juice or, more metaphorically, flavour. The idea of the humours being vital bodily fluids is attributed to Hippocrates.

He described his four flavours of vital bodily fluids as being blood, phlegm, yellow bile, and black bile. Each being either wet or dry and hot or cold and later connected to one of the fundamental elements by other philosophers. An imbalance in these humours was described as the direct cause for every disease.

These ideas were further developed by Galen, who described in his treatise *On Hippocrates' The nature of man* that psychological traits can be manipulated and caused by the humours as well. Intelligence would be caused by yellow bile in your soul and naivety by blood. These ideas were adapted in western medicine and dominated medical thinking for over 2000 years.

### Psychology

Now we know better of course. A system consisting of just a few substances that, when not properly balanced, causes every known disease, is probably reductionist and takes away from the complexity of the human body. A lot of people however, still think in a very similar way about mental health problems. A lot of mental disorders have been described as an imbalance of neurotransmitters.

The most well-known neurotransmitters are probably dopamine, also known as the reward hormone, serotonin, better known as the happy hormone, and oxytocin, best known as the love hormone. You might already notice that these neurotransmitters are given simple functions in popular thought. If you are sad, you need more serotonin and if you have a crush you can not get over, blame oxytocin. Although these ideas are not wrong per se, they are definitely hiding a lot of complex behaviour. This is not a big problem when you just want to meme about your last serotonin molecule in your brain, but does have consequences in therapies for mental health disorders.

### Depression

Major depression disorder has a long history. Our friend Hippocrates described a state similar to depression in which fear, sadness and delusions were common symptoms. He called this state melancholia and said it was caused by an excess of black bile. Nowadays depression is officially characterised by at least two weeks of low mood, reduced self-esteem and a loss of interest or motivation. In some rare cases delusions and hallucinations can still play a part and some scientists are in favour of a broader definition more similar to Hippocrates' melancholia.

Although the exact causes of depression are unknown and multiple hypotheses exist, there is usually a strong emphasis on the chemical imbalances leading to treatment often focused on psycho-pharmaceuticals. In the last century everything from beer to cocaine, and opium was used to "treat" depression. Currently we use SSRIs and other antidepressants which are much safer and can be lifesaving to a lot of people.

The combination of SSRIs, selective serotonine reuptake inhibitors, and psychotherapy can be quite an effective treatment for a lot of people, but it does not really get to the root of the problem. A lot of people still relapse. A potential reason might be that, while current therapies are great at relieving symptoms, they do not address the cause of these symptoms

### being overly connected and active could result in it being more difficult to get out of that state while the lack of connections outside of the network could explain a loss in creativity. These are two aspects of depression previously not very well addressed in models that focused on chemical imbalances but that new treatment might be able to resolve.

These models are still relatively new and the medical world has not fully caught up yet. Early experiments with the microdosing of several psychedelics are being done which could increase connectivity and thus creativity again. Another study looking into ketamine has found it decreases connectivity in the default mode network. These new medications in combination with psychotherapies that make use of these effects, and older therapies could revolutionise the way we treat these disorders as long as we do not forget the reason why these therapies work. A focus should lie on the model behind the disease and not just the effects of the medication lest we create new humours.

#### Present day

More research is being done on a variety of mental disorders and together with more modern views on how the brain functions new promising models for the disorders have been proposed. In patients with depression it was found that certain areas of the brain have a larger interconnectivity compared to a control group. These areas are part of a specific network of areas known as the default mode network and are active when you are not really doing anything. It is the "resting state" of your brain. This network

Tsiompanou, E., & Marketos, S. G. (2013). 'Hippocrates: timeless still.'Journal of the Royal Society of Medicine, 106(7), 288-292. https://doi.org/10.1177/0141076813492945 <https://www.nimh.nih.gov/health/topics/depression/ index.shtml> James C. Overholser, 2002. 'Treatments for Depression: Wisdom Imparted from Treatments Discarded', Sage journals - J [online] Available at: <https://doi. org/10.2190/89HB-8GXD-06XC-5BOK> [Accessed 20 February 2021]. Source molecules:: wikipedia.com

Source columns: depositphotos.com

# THE SOCIAL DILEMMA





nathan @captn\_indesign 35m

The thing that I liked the most, and disliked the most I guess, is the interview with the inventor of the Facebook Like button: Justin Rosenstein. He talks about how it is a problem that the social media companies are all about profit, but he does not quite identify the problem as capitalism itself. I feel like no one quite wanted to say, that maybe the problem is that we have these big companies *at all.* 



elise @worker\_ant 50m

What I found most interesting is that Tristan Harris, who worked at Google, said that he is addicted to email. When I think about phone addiction, I do not think about email. But then I realised that I personally do not have that many social media apps either. But on the other hand, I *do* spend quite some time on these platforms. The problem is broader than just Facebook and Twitter. There are a lot more apps that compete for your attention.



**lulu** @POTUH 5m

I watched a TED talk about AI. The speaker explained how AI was good at doing exactly what you tell it to do. But that can also be very dangerous, because ultimately it is programmed by humans and humans do not have the knowledge nor the foresight to predict what the AI will actually do with a specific assignment. This topic came back in The Social Dilemma, so I had this moment where all the pieces were coming together.



sten @king\_of\_zeeland 37m

A statement that really got to me was: *If you are not paying for the product, then you are the product.* That really got to me. It was pretty scary to hear it said out loud



**thijn** @founders413 35m

Sten Another phrase that struck me was that social media companies are a marketplace that trade exclusively in human futures. Just like there are markets that trade in pork belly futures or oil futures. I am not an economist, but I am still struck by that novel way of expressing what that industry fundamentally looks like.



**stefan** @thesauHooke 44m

The last thirty minutes I was constantly thinking: how in the world are we going to fix this? I feared The Social Dilemma would end like; *this is a huge problem – here is a nice documentary about it – goodbye.* I thought it would be like this at first, but then the documentary pivoted to a section where all the experts listed a bunch of countermeasures to combat the woes of social media. That was epic.



randi @queen\_ant 50s

Be a good #ant and listen to the complete discussion on the mRNAudio podcast! Find us on Spotify and Apple Podcasts!

Source phone: mockupworld.co Source code: unsplash.com

# MEME PAGE

### **ELLENOOR RIJN**

making a meme page for the mRNA

my to-do list

Someone: panik Hanna:

TEACHERS TRYNA TEACH ABOUT HOOKE'S LAW



Stefan: Write a nice note to one of your board members Stefan to Stefan: "Lezen is dopje"

FIRST VEAR STUDENTS WITH QUESTIONS ABOUT LAB COATS

Fix a

pre-order form for

The

website

breaks down

LULU WHEN SOMEONE CALLS HER

"VOORZITTER"

looke facen

21

Put

it on

the Hooke

website

The

website

breaks down

# DISEASES AFFECTING THE BRAIN THE BRAIN

The way that our brain, and thus intelligence, has evolved plays a major role in the success of our species. Like any other part of our body, the brain is susceptible to a wide range of diseases or pathological events. In this article you will find some elaboration on prevalent diseases that affect the brain. Mind you, this is still a strong oversimplification.

### Stroke

Strokes are very common. There are two sorts of strokes: the ischaemic stroke and the haemorrhagic stroke.

Ischaemic strokes result from atherosclerosis; the process during which arteries become blocked because of the buildup of fatty substances, such as cholesterol. The narrower the arteries become, the easier a blood clot blocks the artery completely. When this occurs in arteries leading to the brain, it is called a stroke. By leading an unhealthy lifestyle or by possessing specific genes, atherosclerosis can be more likely to happen. Source: scitechdaily.com

During an ischaemic stroke, part of the brain does not get enough oxygen, which causes cell death. There are multiple ways in which this can occur, but the main pathway is the following. The lack of oxygen and nutrients induces a significantly decreased concentration of ATP. This means that the K<sup>+</sup>/Ca<sup>2+</sup> channels malfunction, causing the intracellular concentration of Ca<sup>2+</sup> to increase strongly. In axons, this leads to an increase in glutamate, which excites glutamate receptors on the postsynaptic membrane. As a result, the postsynaptic cell is continuously depolarised. In other words, there is a large influx of Ca<sup>2+</sup> in this cell as well. This causes a chain reaction during which cells experience a dramatic increase in the concentration of Ca2+. This massive concentration of the ion stimulates proteolysis of specific proteins that in itself is already sufficient to start apoptosis.

- Cytoplasm

Synaptic Vesicles

Neurotramsmitters

Synaptic End Bulb -

Synaptic Cleft -

## The Brain

A haemorrhagic stroke is caused by blood vessels inside the skull that break. Cell death occurs in a couple of ways resulting from such a stroke. One of the major events in this process is an increase of Reactive Oxygen Species (ROS) which are known to damage DNA. Mitochondria are known to malfunction after a haemorrhagic stroke, as they start secreting ROS in high levels.

There is plenty of medication to decrease the chance of having a stroke, such as statins, which lowers cholesterol levels. Yet, there are surprisingly few drugs available to treat patients after having had a stroke. The only drug on the market is called Tissue Plasminogen Activator (TPA), which helps to break down blood clots. Even though blood clotting is a fairly complex process, the role of TPA is remarkably easy to grasp. It catalyses the conversion of plasminogen to plasmin, the latter of which dissolves blood clots.

### Huntington's Disease

Although only five to ten people per 100,000 suffer from Huntington's Disease, the absolute number of patients may still surprise you. According to the National Organization of Rare Disorders (NORD), 30,000 people suffer from this disease and another 200,000 are at risk of developing its symptoms in the United States alone.

Huntington's Disease is a genetic disorder, caused by an expansion of the trinucleotide CAG in exon 1 of the gene HTT. Normally, an individual has around sixteen to twenty repeats, but affected individuals typically have over 35 repeats. These nucleotides are eventually translated into glutamine. Therefore, in sick patients, the HTT protein consists of a long chain of glutamine; a polyglutamine tract. Due to this major disturbance of shape, this protein cannot be folded correctly and eventually aggregates, which is toxic to the cells expressing this protein. There are a lot of additional factors that influence the disease. Dopamine, for example, has been shown to speed up the expression of HTT when present in high levels.

HTT is expressed throughout the body, but its highest concentrations are found in the brain. The aggregation of the protein leads to cell death, which has a lot of consequences. The death of brain cells accounts for the majority of symptoms, ranging from involuntary movement to personality changes.

No cure for Huntington's Disease has been found. Treatment depends on the severity of the symptoms. When suffering from a lot of involuntary movements for example, one might take tetrabenazine. This drug decreases levels of dopamine, serotonin and norepinephrine. Tetrabenzene has therefore been shown to slow down the progression of this disorder.

There is a wide range of diseases that affect the nervous system, or specifically the brain. Now you know a little bit more of at least two of those!

NHS. (2019). 'Strokes'.<https://www.nhs.uk/conditions/stroke/ causes/>

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Source: wort.lu

# TIPS TO STAY SANE THE BRAIN

Keeping our spirit up during the pandemic is not easy. We all miss our normal day-to-day activities, from hanging out with friends to going to training. Yet exercise, social contacts, and good food are key in keeping your body and mind happy. What can you do to improve your days?



Exercise is not only healthy for your body, it can also improve your mood and concentration. After a workout, I often feel better and find it easier to focus. However, with training cancelled and sport facilities (gym, X, swimming pools) closed, being active has not gotten easier.

Although our options may have become more limited, there is still plenty to choose from. If you want to get out, running is always a possibility. You can also go biking: even if you do not have a road bike, it can still be nice to go for a ride. If you rather stay inside, there is a whole range of youtube videos to cater to your needs. Workouts, yoga, even Zumba: there is something for everyone. I actually did Zumba at home; you may hit the lamp every now and then, but it is still a lot of fun. You can also use this time to learn an entirely new skill. Maybe you always wanted to be able to do a split, or a handstand? The internet is your friend and there are also

> quite some apps available. Finally, if you have an X membership, you should know that they are currently offering online classes.

Making resolutions is always easier than getting to work. What can you do to get up from your couch? First of all, plan your training. If there is time booked in your agenda, it feels more like cheating if you skip. Secondly, try to involve others, for instance by exercising together. If you run, bike, or fitness, consider joining one of Hooke's sports clubs. If you do a workout at home, find a roommate to join you, or exercise together via video call. In case you train alone, make sure to tell people what you planned. That way, when you bail everyone knows! You may also get the app Strava, where you can upload your run, ride, or other training and get kudos from your friends. Positive feedback is motivating and you can also see your

What if you are really not into sports? Well, brain exercise is also exercise! You can make this a lot more fun by, again, involving others. How about a game of online chess? To warm you up, you can find some puzzles on page 30.

progress.

MMMRNA Elise Perton & Sten de Schrijver

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Besides your body, your mental state needs to be taken care of as well! Everybody needs some *gezellige* times every once in a while. What annoys me quite a lot, is the fact that it is very hard to meet new people. A great way of broadening your social bubble is by going for a walk with someone you have not spoken for a while, or that you are not even that close with. Now you can take in fresh air and find out some interesting stuff about other people too!

You may no longer be able to spend hours and hours studying in the UB, but there are some alternatives. Firstly, you can study together virtually. With the option of screen-sharing, this is actually more efficient than you might expect. In the first couple of months of this academic year, you could rent rooms at the UB for a couple of hours on request and have them all to yourselves. That was where the previous mRNA booklet was stitched together. In October the hotel "De Plataan" offered the same. Maybe more places will when the current lockdown is lifted.

Another way to boost each other's motivation during lectures might be to play fun games that allow you to focus. Make a bingo-card about a lecture or a course for example! We all know to whom "mentions the magic hat" would refer. After working out and socializing, it is time to eat! Food is not only important because of the nutrients, it is also something to enjoy. If you are not a great cook, this is the perfect time to improve your skills. Cooking can be nice to get your mind off things, the direct result (delicious food) is rewarding, and people will love you because everybody loves someone who knows their way around the kitchen.



The Brain

How to get started? Make a list with new things you want to make. On my list, for instance, are gnocchi and risotto. If you lack the inspiration, hit up your friends and family and ask for their favorite recipes. Food is more than dinner: you can also bake your grannie's famous apple pie, or learn how to make naan bread. If you have roomies, cooking together can be a great activity. In case you have a lot of leftovers, you should realise that most food can be frozen pretty well. That curry might also be nice for lunch. And your friends will be most grateful if you drop some cookies at their door. To get you started, you can find a recipe by S.o.S. on the next page.

Long story short, make sure to keep your brain and your body happy! This will make you happy just the same. Stay active, both physically and mentally and remember: there is light at the end of the tunnel!



RD

Elise Perton & Sten de Schrijver MMRNA

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## **DRIED BEANS RECIPE**

### S.O.S. 3

### What you need

- 300 grams of dried beans (preferably white)
- 2 litres of chicken bouillon (made from 2 litres water and 2 blocks of instant bouillon)
- 1-2 cans of tomatoes (peeled) (in summer you can use fresh tomatoes ±4)
- Pepper
- 2 chicken thighs seasoned with pepper and salt
- Pinch of salt
- Tomato paste
- 4 cloves of garlic
- Some basil, parsley and oregano
- Butter

### Vegan option





### How to make it

First things first

Put the beans in a pan with one litre of bouillon. Let it soak for one night and the better part of the next day.

### For the bean pot

Add the other litre of bouillon, some basil, parsley and oregano and put it on low heat. While you start boiling the beans, you should cut the tomatoes in parts, peel the skin off the garlic and add them to the boiling pot. Set a timer for 100 minutes.



### For the chicken

Melt some butter (about a medium tablespoon). Make sure the fire is medium high to high. Now put in the chicken thighs and fry them until they start to brown on both sides (about 8-10 minutes in total)

### To finish it off

Add the chicken and the tomato paste to the beans and let the entire pot simmer for another 60 minutes on low heat. Add pepper and salt according to taste

Source pan: meilleurduchef.com Source white bean: clker.com Source kidney bean: luolasto.org Source tomato: istockphoto.com Source cut tomato: veggies.my Source garlic: garlicmatters.com Souce salt: spectralightuv.com Source oregano: centraladomicilio.cc Source basil: wisegeek.com

MINIMRNA S.o.S. 3

26

# WNT RECAP MARIT VERHIJ

A wonderful Wnt. That is our slogan and was our goal for Wnt this year. Of course it was a little different compared to other years, but still bakken were vouwed and sg's were pulled. Our week started on Monday 1 February, with a Pokémon showdown competition. The winner of this epic double elimination tournament was none other than Stijn, proving he is the best Pokémon trainer of Hooke! Later on in the evening we had a Christmas dinner with a recipe for risotto and chicken or rösti by S.o.S. It was incredibly fun and the food was delicious! The winner of the special golden pollepel was Stefan!

The next day on Tuesday the second day, we made some delicious bonbons, which was a bigger success for some than for others. In the evening we put on our detective hats, or hawaiian shirts and tried to solve the Margaritaland murder mystery, where some amazing acting skills and props were shown.



Next on Wednesday evening, there was a crossover with Diffucie, where we had to solve puzzles in teams to try to reach The Promised Land. The team that won was Manilofanoek, consisting of Marit, Danilo, Stefan and Loek.



Quizlas

On Thursday we had a chill afternoon during which we watched Coming to America during a thrilling round of Netflix party bingo, the first person to get bingo was Carlo! In the evening we had the Masterchef mystery box challenge. Participants had to cook dinner for themselves with items that were unknown to them until the challenge started. Most people did a wonderful job, but the best looking plate was made by Kerem!

And now we are already on the last day of Wnt, the fifth ('vo) day of the fifth ('vo) week. In the afternoon we had a brewery tour with some amazing beers. The beer masters knew some drinking techniques, but they did not yet know about the sg. Luckily Jasper still had to pull a sg. and thus we taught them how it works. Our final activity was the wonderful pubquiz! During the bonus round the groups had to send in a gucci drawing, which resulted in some beautiful and terrifying drawings. Twefve groups battled for the first place, but only one group can win of course. The incredibly smart nanos that won were Thijn, Eva, Josephine, Sieb and Sten! We of Wnt5 hope everyone had as wonderful of a Wht as we had!

# COLOURING PAGE THE BRAIN

What goes on in the mind of a nanobiologist? Use your creativity to turn this brain into a nano brain, send us a picture (mRNAhooke@tudelft.nl) and you might find your artwork in the next edition!



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# RANDI LAETITIA GUÉRIN

### >> rng ('shuffle'); >> randi(nr\_leden) ans=202 %Laetitia Guérin

Picture this: it's October of 2019.

You are sitting at a lunch table at school with your friends, all daydreaming about your future university experiences. You talk about the newfound freedom of moving away from home, the autonomy of living alone and the excitement of meeting new people.

You imagine big lecture rooms filled with hundreds of students sharing a common interest with you, studying at the library between classes with friends, partying on the weekends...

At that time, you pictured normalcy. You envisioned familiar yet strange scenes. You expected routineness punctuated with the chaos of a traditional student life.

But instead, you received chaos turned ordinary from the apparent ceaselessness of the current pandemic.

In October of 2019, I complained to my classmates that I'd still be seventeen when I'd go to university; I'd have to watch my friends go to clubs and bars without me for four long months before I could legally go to one myself (and of course, we totally never, ever discussed the idea of me sneaking in).

I turned eightteen over a month ago now, and the prospect of going to a club any time soon has virtually left my mind. I never thought I would wish so badly to see my friends go to clubs without me, but yet here I am... I mean, ultimately, I'm just wishing for normalcy. Aren't we all at this point?

The COVID-19 outbreak has affected everyone's lives in more ways than expected, for a duration that no one anticipated. From our education, to our mental health, to our social lives, even to our perception of time: it has not been easy. It is important to remind ourselves that we are not alone in this situation, however.



As a first-year international student coming from the United States, I was quite worried about being isolated upon moving here. Lucky for me, I live in a building full of firstyear international students who had the same worries as me. Technology has also made it easier to maintain a social life online (though it still cannot compare to interactions in real life). My first friends here were made in person, but nevertheless, I met most people through a random WhatsApp group and Discord server that I joined. I never imagined that I would make the majority of my friends in university through a computer screen, but that's what ended up happening, and it has not been bad at all!

Yes, it could be better; I think we all know that much. I will say it again, though: we must keep our heads up (and our hands clean) to get through this pandemic. Do not forget that this new normal is temporary. There is a light at the end of the tunnel, as cliché as that sounds, with the vaccines being administered. But until we can return to the old normal, follow the guidelines to fight the spread of the virus, and take care of yourself, mentally and physically. Call your friends often. Sleep regular hours. Eat healthy foods. Go for walks daily.

Notice the silver lining; you will see, the clouds will clear before you know it.

# PUNZZLE THE BRAIN

### Across

10

13

1. How an axon tip feels upon Na+ and Ca+ entering

15

1

- 5. After love on first sight the fox was filled with
- 8. This neurotransmitter is a great musician
- 12. It takes some ... to ask that
- 13. New to thermodynamics: the scared system better known as the ...
- 14. How a brain greets another brain on the street 15. A fish that does brain surgery

### Down

16

2. To get to the brain, travel up the spinal cord and take the first left and ...

11

3. Pavlov's favourite hair product

12

14

- 4. See image 1
- 6. The not so clear yet, longest connection of nerves in the body
- 7. Another name for hallways in a mental asylum?
- 9. See image 2
- 10. Something that gets on your nerves
- 11. The coolest neurotransmitter
- 16. The brain's favourite band









Image 1



MMMRNA Nathaniel Germain & Sten de Schrijver

Source: pngwing.com



