mRNA

YEAR 8 // ISSUE 1 // DECEMBER 2022

CLASSIFIED

BIO-WEAPONS // MYTH-BUSTING // SERIAL KILLER CASE STUDIES // CONSPIRACY MOVIES // FLAT EARTH // SMELL // MOLECULAR MOTORS // REACTORS

Source: openclipart.org

EDITORS

Editor-in-Chief: Calin Alecu
Editor: Avin Nayeri
Commissioner of Acquisition: Laren Kıryağdı
Commissioner of Acquisition: Carlo Geertse
Captain InDesign: Kelly van Strien
Captain InDesign: Leó Szücs
QQ: Josephine Sonneveld
QQ: Mijke Dijken

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

If you do not want to receive the mRNA, please send us an e-mail. Third years and up: opt in via the QR code on the last page to receive it if you have not done so yet.

CONTENTS

COLOPHON

The mRNA is the official magazine of the study association for Nanobiology, S.V.N.B. Hooke. Printed versions will be sent to and distributed among the members. The committee strives to enforce copy-right laws of the texts and images used. If you believe to have the rights to any media we used, we ask you to contact us. We reserve the right to shorten, alter or reject submitted documents and we thank all people involved for their contributions.

December 2022
Year 8. Issue 1.
Print run: 325.
A PDF version will be published on Hooke's website: https://svnbhooke.nl/index.php/association/mrna/

Sources cover: Freepik, Pxhere, IMGBIN, Flickr, Boredpanda, Science photo library/NTB, Unsplash and Wikimedia commons

EDITORIAL

CALIN ALECU

Dear readers,

New academic year, new beginnings, and a new face in the mRNA editorial; eventually, all things must change. I hope you are well and that time has been treating you kindly, especially if you are one of our new first years, for whom the transition to university life might be particularly hard. Of course, the beginning of a new academic year also brings about the end of the old calendar year, and 2022 has been one particularly filled with bravery; from the defence of Ukraine to the protests in Iran, many across the world have stood together for a brighter future. I hope 2023 brings the changes they fight for.

On our own scale, tinier in comparison, mRNA has also changed. We've welcomed new members, said goodbye to old ones, and built upon the foundations left before us to bring you this new edition. Part of this process involved thinking through what we want ourselves to be: broadly, we want mRNA to be the best it can be in terms of quality and relevance, and one way to tackle both of these goals at once is opening up. We want you to feel catered to, so if there's something you want to see in the mRNA, that you feel you can write well enough to do justice to, let us know; we are looking to become more inclusive to outside ideas and outside writing contributions. I can't make any promises, but I am looking for feedback; to quote my favourite computer, "there is as yet insufficient data for a meaningful answer", and I am looking to change that.

With that out of the way, fingers crossed you enjoy this new edition; we've worked hard on it, but the interpretation is left solely to you. The theme this time around is conspiracies, big and small, from the smallest viruses to Earth itself. We delve deep into smells, bioweapons, and flat Earth, but don't worry: it all comes with a palate cleanser at the end, a tutorial for how to avoid conspiracy theories, in case you find yourself particularly attracted to anything we talk about. Make sure you keep an eye out for hidden clues throughout this edition, as there might be a conspiracy left for you to uncover, make sure you cuddle up with your blanket for warmth as you watch the days grow shorter, and make sure you stay kind to yourself.

At your service,

Calin Alecu
Editor-in-Chief of mRNA 6.5

FROM THE BOARD

JOSEPHINE SONNEVELD

Dear members,

Welcome to the first edition of the mRNA of this academic year. Whilst I am writing this piece, we are already wrapping up the first quarter of the year. Time flies. For the board these have been a thrilling and interesting first few months! It feels like ages ago that we changed boards during the transfer GMA, so much has happened since!

We had our constitution drinks and the reveal of the locations of Diffucie and Wnt! We enjoyed a workshop afternoon and had a wholesome dinner activity with many dishes from countries around the world! Speaking for myself, I certainly enjoyed the first quarter! Hopefully you enjoyed the first few months of the academic year as well. Most of all, now that the exam week is over, I hope you all have some time to relax and recharge. I share this hope along with the organisers of the How Are U week. During this week, there was a lot of attention for student well-being. You could join many activities to help you relax, such as laughter yoga. Aside from this, there were many events that fostered a dialogue about difficult topics such as mental health, diversity, inclusivity, and gender identity. Talking about these topics is crucial to create an open and safe environment for everyone.

The theme of this edition is conspiracies: something that makes me think immediately of thriller movies and detectives. To mind come the words of Sherlock Holmes: "If you eliminate the impossible then whatever remains, no matter how improbable, must be the truth". Conspiracies tend to be elaborate and complicated and everything but straight forward. Rather as scientists we learn to uncover nature step by step and that the most parsimonious method tends to be the right one. Nature does not live by design but by chance and thus does not participate in conspiracies. However, that does not imply that nature is lacking in complexity. Something that a Nanobiologist knows all too well. Throughout your study you will learn all kinds of skills and knowledge you need to uncover these intricacies of nature.

The month of November is known for one of the oldest conspiracies, i.e. that of Guy Fawkes. There is however one more crucial date you should have on your calendar. On Sunday the 20th of November it is S.V.N.B. Hooke's birthday! This year our association is already turning 8-years-old! I cannot wait for the Dies week! We will be flying with Tinker Bell, singing along at the beer cantus and of course the Dies party! I hope to see all of you there!

I have spoken,

Josephine Sonneveld

MOLECULAR MOTORS

RESEARCH

What are molecular motors?

Molecular motors are proteins which transport membrane-bound organelles, vesicles, RNA, and protein complexes to their appropriate locations within a cell by moving along microtubules and microfilaments. They work by converting chemical energy, usually obtained from the hydrolysis of ATP, to mechanical energy. The two major types of molecular motors are kinesins and dyneins. They are classified according to their structure and the way they move, and understanding this movement at the molecular level is important in order to identify the basis of some molecular motor-linked diseases and syndromes, such as Down Syndrome. Molecular motors play a fundamental role in chromosome segregation; hence, the detrimental effects of malfunctioning molecular motors can be severe, such as in the case of Down Syndrome. I will now discuss how each type moves and their striking structural aspects.

Kinesin

Kinesins move their target cargo towards the positively charged end of the microtubule they are attached to. In its structure, kinesin has two extensions which resemble legs and it contains another site where the target organelle which needs to be transported is attached. These legs help the kinesin molecule move in a manner similar to a human walk, where one leg remains attached to the microtubule, and the other leg moves forward. Then that leg becomes attached to the microtubule and the other leg dissociates, taking another step forward. These series of steps are continued until the appropriate destination of the organelle is reached.

Dynein

Unlike kinesins, dyneins move towards the negatively charged ends of the microtubule they are attached to. Their structure consists of a head, a stem and a stalk which will bind to the microtubule. This difference in structure also gives birth to a different movement style, unlike a human walk: it takes a step and then moves the other foot to the same alignment as the first to complete one big step. This process is then repeated continuously.

The relevance of these motors in today's research

These molecular motors go way beyond any human made motor in terms of efficiency. However, both these methods of movement are delicate and even a single base mutation in the gene encoding for these motors might disrupt the structure of the molecule, hence producing non-functional motors that have life-threatening effects. With the extensive research being carried out on these motors, particularly on their replacement in cases of malfunction, this fascinating field could inspire Nanobiology students to pursue such research in the future.

Sources

http://book.bionumbers.org/how-fast-do-molecular-motors-move-on-cytoskeletal-filaments/

. Creau, Nicole. "Molecular and Cellular Alterations in Down Syndrome: Toward the Identification of Targets for Therapeutics." Neural Plast. 2012.

Lodish H, Berk A, Kaiser CA, Krieger M, Bretscher A, Ploegh H, Amon A, Martin KC (2014). Molecular Cell Biology (8th ed.). New York, NY: w.h.freeman, Macmillan Learning.

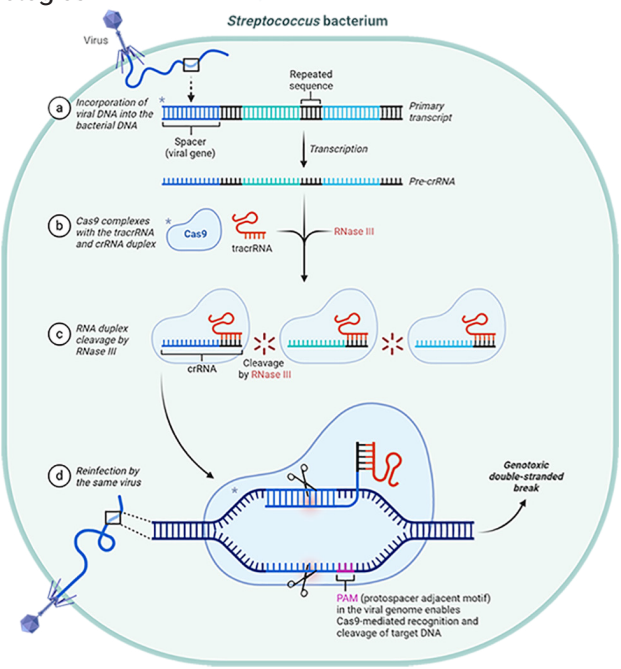
WHAT (MORE) WE CAN LEARN FROM BACTERIAL IMMUNITY

NANONEWS

CRISPR-Cas9 is a well-known gene editing tool, originating from bacterial immune systems. Its discovery resulted in a revolution in gene engineering, and the editing technique has various applications in diagnostics, medicine, and genome editing. However, we are still unravelling the secrets of CRISPR in bacterial immunity, as a new type of CRISPR protein dubbed Craspase is being researched by the labs of Prof Dr Ailong Ke from Cornell University and Dr Stan Brouns from TU Delft. Perhaps this new protein will be an innovation in the use of CRISPR technology and may prove to be a major addition to existing biotechnologies.

CRISPR (clustered regularly interspaced short palindromic repeats) was originally found as a bacterial immune response against bacteriophages. CRISPR, as the abbreviation already suggests, are short interspersed repeats in the genome of the bacteria. In between these repeats is spacer DNA that contains DNA from bacteriophages. They serve as a memory of infection, such that the bacteria can acquire an adaptive immunity against these phages. Upon re-entering, the virus will be recognised and neutralised. This is where the Cas9 protein comes in. The Cas9 protein is an endonuclease, and guided by an RNA template of the target created from the CRISPR and spacer DNA in the bacterial genome, it cleaves and neutralises the viral DNA.

This method of immunity of the bacteria has been developed into a tool that we now use for a plethora of applications because it allows us to cleave DNA at a specific site. In conventional CRISPR-Cas9 technology a combination of engineered guide RNA and Cas9 determines the cleaving site and cleaves the DNA at that specific site. Then with either NHEJ (non-homologous end joining) of the end sequences or HDR (homologous direct repair), the sequences can be edited and ligated. The result is a change directly in the DNA.

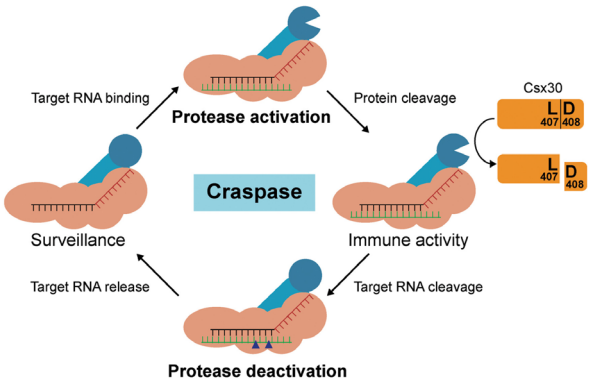


Adapted from "2020 Nobel Prize in Chemistry: A Tool for Genome Editing (CRISPR-Cas9)", by BioRender.com (2020).

The CRISPR-Cas9 mechanism is not the only method of immunity used in bacteria. As the bacteriophages have evolved methods in circumventing the CRISPR-Cas9 mechanism, over time a tug of war between bacteria and bacteriophages has persisted where the two coevolved their mechanisms in immunity and immunity evasion. The coevolution of host and parasite has resulted in complex bacterial immune systems. Various types of CRISPR-Cas-like systems exist that each serve a slightly

different function. They can be subdivided in DNA-targeting systems and RNA-targeting systems. The DNA-targeting systems are more well-known and used in the first line of defence, using the method described above to neutralise the virus. The RNA-targeting CRISPR-Cas systems target RNA instead of DNA. The exact role of RNA-targeting CRISPR-Cas is still an active subject in research, but they seem to be more involved in collateral responses that can even result in cell dormancy, and appear to cooperate with DNA-targeting CRISPR-Cas.

Craspase (CRISPR-guided caspase) is one such RNA-targeting protein, instead of DNA-targeting. In addition, it has been found to contain proteolytic activity. When it is matched to the target RNA, the protease becomes activated. The RNA can then be cleaved and released. This unique combination of proteases and endonucleases provides various possibilities in biotechnological applications such as RNA diagnostics and gene



Adapted from Hu et al (2022)

expression profiling.

The protein might also be promising in clinical settings, because it allows for proteolytic activity that can be switched on transiently with a specific target RNA, and it does not directly edit DNA. These properties distinguish Craspase from conventional CRISPR-Cas9. Especially in clinical settings, much caution is warranted when using CRISPR-Cas9 as the changes are directly made in DNA. The technology is not perfect and errors can still occur. That means that in somatic cells there is a risk of mutations in proto-oncogenes or tumour suppressor genes which can lead to cancer. In germline cells erroneous edits could potentially lead to hereditary diseases. The error margins of CRISPR-Cas9 are still too substantial for some uses in clinical settings. Additionally, there are also some ethical concerns for editing DNA directly, especially in germ cells, so Craspase can prove to be a complementary addition, as it only cleaves proteins and RNA; there is no tampering with the DNA. The effect of erroneous cleaving is therefore much less detrimental than with CRISPR-Cas9 gene editing.

However, before we reach that point a lot of research is still necessary, as there is still a lot we do not know about Craspase. Still, it seems like a promising protein, and will hopefully be a nice addition to currently existing bio-engineering and diagnostic technologies. Only the future will tell what more we can still learn from the bacterial immunity, and whether there is still another hidden gemstone that will further revolutionise molecular biology.

Sources:
Hu, C., et al. (2022). Craspase is a CRISPR RNA-guided, RNA-activated protease. Science, 377(6612), 1278–1285.
Mittal, R. D. (2019). Gene editing in clinical practice: Where are we? Indian Journal of Clinical Biochemistry, 34(1), 19–25.
Torres, C. (2022, September 21).
https://cornellsun.com/2022/09/21/cornell-prof-discovers-craspase-utilizing-protein-cleaving-instead-of-direct-gene-editing/
van Beljouw, S. P. et al (2022). RNA-targeting CRISPR–Cas Systems. Nature Reviews Microbiology.
Yang, H., & Patel, D. J. (2022). A type III-E CRISPR craspase exhibiting RNase and protease activities. Cell Research.
DNA adapated from Delesign Graphics

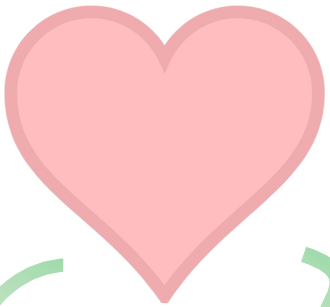
SOMETHING SMELLS FISHY

CONSPIRACIES

Smell is a weird concept, whether you take it as a verb or as a noun. Imagine this: every person has 400 different olfactory receptors, each encoded by a different gene, which makes this gene family the largest in the entire human genome. In addition, all these genes have different variants, and hence, each human has a unique combination of these 400 receptors, making it very unlikely that two people will perceive a distinct odour the same. How these receptors translate the stimulants which trigger them to perceive pleasantness remains a mystery, yet we know that if two humans differ by even one receptor out of 400, they will still smell differently.

Not only is how we perceive smell unique, but so is the scent that we radiate. Major histocompatibility complex (MHC) is a group of genes which encode immune system related proteins and give each person a unique MHC-specific odour. Again, it is unknown how these scents are perceived by other humans, but we know that it plays a role in partner choice. Human females tend to be attracted to males with dissimilar MHC scents to their own; this is thought to be a result of evolution to prevent inbreeding. Conversely, though, studies showed that women who were on oral contraceptives found similar MHC-odour men to be more attractive, which goes to show that these pills might interfere with mate selection.

Despite our shallow knowledge of smell, we can easily observe that this sense has many effects on our daily lives which are often overlooked. Whether it is picking a mate, recognising a friend or being able to taste your favourite dessert to the fullest, a scent-less life is senseless. However, further research and thorough understanding of smell might give birth to interesting consequences: let's say, hypothetically, for the sake of argument, I have a crush whom I'd like to impress. Would I be able to attract him if I were to analyse his MHC-odour profile and make myself a complementary scented perfume to make him fall for me? I guess we'll never know.



Sources:

Havlicek, Jan, et al. "Major histocompatibility complex-associated odour preferences and human mate choice: near and far horizons." The Royal Society, vol. 375, no. 1800, 2020.

Trimmer, C., et al. "Genetic variation across the human olfactory receptor repertoire alters odor perception." PNAS, vol. 116, no. 19, 2019, pp. 9475-9480.

Image source: Freepik

WHAT IF THE EARTH WAS FLAT?

CONSPIRACIES

Now I could make a joke, that the Earth is indeed flat, and make an article with that gag. Although that might have been a good idea, we wanted this topic to receive a much more mature take. To achieve that, we decided to list the top ten things that would happen if it turned out that the world was indeed flat.

10. We start with probably the least noteworthy of all. As the gravitational pressure it exerts onto itself far outweighs the rigidity of the flat Earth, it would most probably crumple into a sphere. How ironic.

9. Santiago-Sydney direct flights would be the longest flights available, and they would fly above Los Angeles. It would take around 64 hours to complete. Flights nowadays can do it in 14 hours. I imagine this would be the most impactful change to the readership of this paper.

8. As the pilots would not have to keep the nasty secret anymore, their salary would decrease, leading to a possible shortage in the industry.

7. You could call your friend in Hawaii to observe sundown together. Without the flat Earth they would probably just yell at you for waking them up.

6. Global warming would be even more problematic. The ice wall on the perimeter of our planet would have much more volume than the Arctic ice caps we have now, which would result in a rise in water levels no one could prepare for. But just maybe, by drilling a hole in the wall, we could regulate the level, just like in baths.

5. Birds migrating to warmer outer-ring climates would be very surprised to find that gravity pulls them back towards the centre.

4. Satellite orbits would alter significantly. By significantly, I mean dysfunctionally. By orbits, I mean trajectories.

3. Horoscopes would turn out to be meaningless… Could you imagine?

2. We would have access to a whole other side of the planet the British have not colonised before.

1. You would need to live with the fact that flat-earthers were right. I think we all agree that that is a punishment no one would ever live down.

HOW TO REDUCE YOUR GAS USE THIS WINTER

FYI

Do you ever worry about the gas prices? Good, you should! Nobody can pay for it anymore. Luckily, you are reading this article, as it will open your mind to the best and totally legit solutions that will save you from hypothermia, a less than ideal situation that would not be too fun..

Fifteen is the new twenty

Did you know 15 degrees Celsius is totally okay for your house? You will look younger, eat so much more without getting fat, and you might even find love. If it is colder, people tend to sit closer to each other, or perhaps even more…

Your friends are amazing

If you are not home, you don't have to warm your house. Essentially, crash at your friend's place as much as possible. Make them hate you and kick you out of their house. They will feel obliged to heat up the room for guests, and if not, just wait until they are fast asleep.

Do you really need a house?

Being homeless is amazing. Municipalities give you free shelter, free care and practical help. Not only does it save money on gas, but rent and food too. Be brave, do the bold move and you will be happier than you ever imagined.

Just dig a hole

Earth's centre is about 5200 degrees Celsius. Everybody prefers a different temperature for their living space, so grab a shovel and dig a hole as deep as you want. You can go up to 5200 degrees Celsius (really warm). I wish you a warm winter!

Cows will save us

Global warming is not a curse, it is a blessing. It means the end of winter. You will never feel cold anymore and you will forget gas even exists. So please hug some cows, give them all the love and attention they need as they fart, leading us all to a very bright future.

We asked students to submit ideas, and they had some really good ones, some of the best will follow on the next page. Don't hesitate to read the rest.

Eggs and pasta

Cooking takes way too long, and uses so much gas. Keep it simple: less time in the kitchen, more money in your pocket. Only cook eggs, pasta or other food that you can cook within 2 minutes. It saves both time and money. Two birds with one stone.

Uni is life.

Lectures from 8:45 to 17:00? You are so lucky. Stay a little longer, do some homework, procrastinate a little. University pays for gas, you do not. Just take a pillow with you and nap in the library. You can even study more afterwards.

We hate the rain

The Dutch weather always seems the same: rain and cold. Move to the South and it is always sunny and warm. You can just follow your lectures online and don't have to heat your house anymore. Covid-19 was actually positive; this wouldn't be possible otherwise. Be thankful to Corona, it helped so much.

Stop being tired

If animals can do it, so can we: hibernation. If you just sleep the whole winter, imagine how much you save. A student who is not tired? Impossible. We are always tired. That is why this is such a good solution. Maybe you can finally be well rested and save gas.

Burn it all down

Gas is not the only fuel for heating. Fire is perfect too. You can burn almost anything and heat your room as well. This solution is as old as mankind Find some junk, make a fire, and done, easy! Be careful with fire, you might light up your house, but as long as you're warm, does it really matter?

With those ideas you never have to worry anymore. I wish everybody a Merry Christmas and a happy hypothermia.

CONSPIRACY MOVIES EXPLAINED

CONSPIRACIES

For this article, we once again reach out to our favourite henchman of the Underworld, Tobias! Since we love him so much, and totally not because we have our hands tied by a contract, after his sudden reappearance, we decided to write about something he is actually an expert on, movies! In a twist, mRNA are going in blind instead, writing only based on what they can see in the trailer.

Da Vinci Code

Source: Flickr

mRNA: The Da Vinci Code feels like a trip, a total ripoff of Stargate minus the actual Stargate. Tom Hanks has to solve some code made of symbols to uncover some conspiracy hidden away by the Church that could change humanity forever... Stop me when you realise you have heard this before but cooler and with higher stakes in Stargate. Daniel Jackson even looks cuter.

Tobias: I mean it's basically Forrest Gump chasing the Mona Lisa in the name of Jesus. If you like unlocking your Apple, or members of the clergy punishing themselves, this is your movie. As a movie snack I would not recommend nachos, as they are triangle shaped, and too real. Just like the Illumination organisation.

End of Evangelion

mRNA: It seems like a weird fusion between Bakugan and Transformers. The sheer amount of characters appearing in the trailer convinced me that the conspiracy will be real, although it also contained a skyscraper, through which many 50 metre diameter holes have been poked. This makes me believe the conspiracy will be a bit more artificial than the others on this list. Also, there is a random penguin in the trailer.

Tobias: I love this, Asuka is kind of a mascot down here in the Underworld. This whole movie is a masterpiece, Hades made it required watching for the job so me and the guys get together every now and then for refresher training. Just ignore the hospital though...

The Matrix

mRNA: Wake up, dodge bullets, run away from demented clones at mach speed, I love Half-Life speedrunning. No idea what else this could be, it felt more like an LSD trip and a fever dream at the same time than a movie.

Tobias: It is the best movie I have seen about medical irresponsibility. I mean those red pills hit you hard man. Also the leading man has literally no spine. I think you should only see it if you are looking for new sunglass ideas. As for snacks the movie recommends a feeding tube, which was not the worst idea.


Source: Flickr

Sharknado

mRNA: For once I will probably agree with Tobias: this is absolutely nuts but I think I love it. Sharks, tornado, sharknado, it all just falls seamlessly into place.

Tobias: It is the best metaphor for climate change. I just read it on a blog that these hurricanes will be with us in five years tops! So watch this movie, get inspired and start using your AC to cool down the planet.

*Editor's Note: What a lousy way to hadle a cliffhanger...

RIGHT TO REPAIR 2: ELECTRONIC BOOGALOO

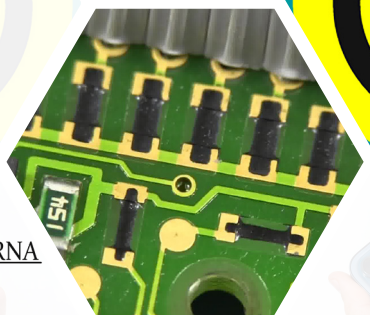
OP-ED

Last year, we took a dive into the topic of Right to Repair; your right to use, modify, and repair your electronic equipment as you see fit, without any arbitrary locks limiting your ability to do any of those things. We found that anti-repair design practices and policies, such as serialising parts to prevent replacement, are standard operating procedure throughout the technology sector, from the phone in your pocket to the medical equipment in the nearest hospital. All of these anti-repair standards add up and follow you throughout life, frustrating you when you break anything, from your phone to your arm.

Our case study last year was the iPhone; truly a masterpiece in unrepairability, with hurdles at basically every point in the repair pipeline. However, since then, Hell has frozen over: Apple launched a self-service repair programme! On paper, this addresses most of the complaints we had last year; you now have access to Apple certified repair guides, you can now buy repair tools and genuine parts directly from Apple, and you can finally pair these parts to your phone to maintain functionality. This seems like everything we hoped for, except for a handful of catches: this programme only supports the latest iPhones, starting from the iPhone 12, it only sells some parts but not others, seemingly arbitrarily, you must submit a valid serial number, so you cannot stock up on parts, and the pairing tool only works on parts sold by Apple.

Effectively, all this self-service repair programme means is that for newer iPhones (which are less likely to be broken anyway) you can now buy some parts (but not even all the basics) and replace them yourself (for barely cheaper than sending the phone directly to Apple, and with them still breathing down your neck). With these caveats, it is pretty clear that not much has changed; third-party repair is still often blocked behind serialisation, board-level repair is still locked behind unreleased schematics, and access to parts is still arbitrarily blocked. To be clear, it is indeed an improvement that could save you a bit of money, but it does little to expand your choices; someone more cynical might be inclined to believe this programme was designed this way to have something to point at when legislators ask "what have you done for repair lately?", while actually doing as little as possible.

Overall, this development to our story feels lacklustre. It feels more like a tip-toe than a step, but at least it is in the right direction this time; if even the "environmentally friendly" Fairphone removed its headphone jack this year, we must take any win we can get.

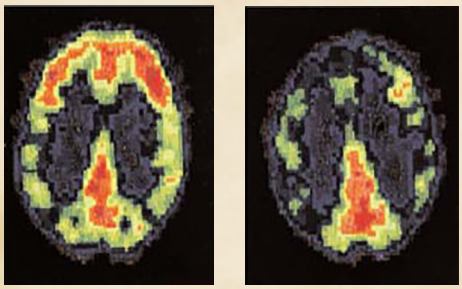


DECRYPTING THE MINDS OF SERIAL KILLERS

CASE STUDY

As a society, we often find ourselves simultaneously fascinated and revolted by the individuals who have an uncontrollable tendency to murder others. Serial killers provoke a particular curiosity that has inspired a multitude of scientists to utilise modern psychology and neuroscience to decipher the thinking and logic of such individuals.

If we could peer into the mind of a serial killer, what would we see? Would their brain activity and structure resemble yours or mine? Adrian Raine, a pioneering researcher of the biosocial bases of violent behaviour, was able to use positron emission tomography (PET) to study the brains of serial killers due to the rapid advancements of brain imaging technology. His team scanned the brains of 22 killers who had pleaded not guilty because of insanity or had been judged incompetent to stand trial. Then, they compared their brain scans with 22 non-killers matching in age and sex. Essentially, PET allowed them to measure the metabolic activity of different brain regions, including the prefrontal cortex, which sits behind the forehead and above the eyes.



Brain scan (PET) of a killer (right) and normal control (left), highlighting the lack of activation in the prefrontal cortex in the murderer. The prefrontal region is at the top of the figure, and warm colours illustrate areas of high brain activation.

In PET, a cyclotron (a type of particle accelerator) creates a momentarily radioactive isotope, fluorine-18, which is tagged with an analog of glucose-2-deoxyglucose. The resulting mixture is then injected into the subject just after they begin a challenging cognitive task that specifically activates a part of the brain suspected to be dysfunctional. Hypothesising that poor functioning of the prefrontal region may be causative, the researchers made their subject press a button every time they saw a "0" appear from a set of 0-9, for 32 minutes.

What does this lack of functioning of the prefrontal cortex tell us? At a personality level, frontal damage is associated with impulsiveness, loss of self control, immaturity, and poor social judgement. At a neurophysiological level, it can result in loss of control over evolutionarily older subcortical structures deep in the brain, such as the amygdala, which can result in aggressive feelings. It can also be linked to rule-breaking, emotional and aggressive outbursts and argumentative behaviour at the neurobehavioral level. While brain dysfunction can create a predisposition to violence, environmental, psychological and social factors can enhance or diminish such behaviour. Although this research sheds light on numerous elements that aid our understanding of what distinguishes a serial killer from an ordinary individual, such experiments do not illustrate the entire picture as many factors are either not included or assumed, potentially leading to inaccurate results.

This research is the stepping stone in understanding the actions of serial killers, and from the myriad of serial killers, three will be discussed thoroughly as examples.

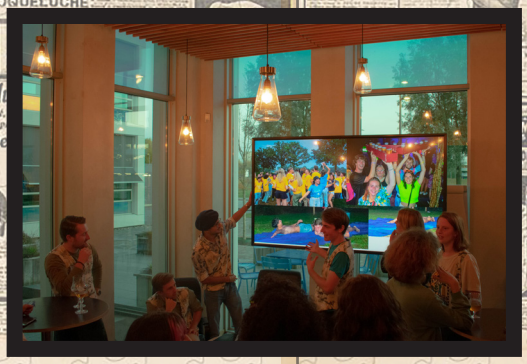
Firstly, the notorious Jeffrey Dahmer, an American serial killer and sex offender, who was responsible for the murder and dismemberment of seventeen men and boys between 1978 and 1991. He never just killed his victims, rather his murders comprised of necrophilia, cannibalism, and the preservation of body parts. Although he was found to be legally sane at his trial, he was diagnosed with borderline personality disorder, schizotypal personality disorder, and a psychotic disorder. These have been speculated to be attributed to the neglect he received as a child, primarily from his mother, a hypochondriac that suffered from depression and regularly argued with her husband. While unclear, Dahmer could have had a dysfunctional prefrontal lobe due to the trauma that resulted from his experiences with his parents. Moreover, a noticeable personality shift was noticed when Dahmer had his double hernia surgery after his fourth birthday: a joyous and exciting boy became timid and quiet. In his adolescence, he began fantasising about dominating and controlling a submissive male partner, and such fantasies slowly became intertwined with dissection, which eventually led to his trademark of dissecting and preserving body parts.

Secondly, John Wayne Gacy, an American serial killer and sex offender who tortured and murdered approximately 33 boys and young men. He is also known as the killer clown, as he regularly performed at children's hospitals and charitable events as "Pogo the clown". He would lure a victim to his home and dupe him into wearing handcuffs as a pretext of a magic trick. Then, he would kill his captive by either asphyxiation or strangulation with a garrote. Such patterns of killing can be related to his relationships with his family members. Close to his mother and sisters, Gacy had a troublesome relationship with his father, an alcoholic who physically abused his family. In fact, one of Gacy's earliest memories was of his father beating him with a leather belt for playing with car components. This distressing experience coupled with Gacy being occasionally molested by his family friend and silenced by fear could underline his predisposition to harm boys specifically.

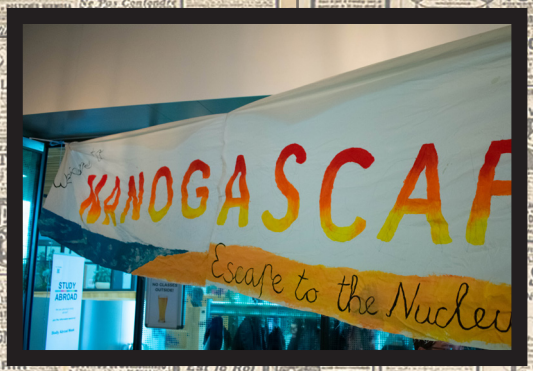
Lastly, Richard Ramirez, an American serial killer dubbed "Night Stalker", whose killing spree took place in California between 1984 and 1985 and was later convicted and sentenced to death in 1989. Abused by his father, he developed a gruesome, macabre interest from his older cousin who allegedly taught him the skills he implemented to kill his victims. Besides his clear disturbed tendencies, he also gained a strong interest in Satanism and the occult, which only fueled his violent and deranged habits further. Moreover, his indifference to the suffering of his victims and his inability to be successfully treated was theorised to be a result of his schizoid personality disorder, which appears to be common in many serial killers.

In conclusion, this advancing understanding of neuroscience has not only allowed us to decrypt the minds of serial killers, but could potentially allow psychologists or scientists alike to detect and reverse the components that differentiate them from us.

Sources:
https://dana.org/article/murderous-minds-can-we-see-the-mark-of-cain/
https://blog.oup.com/2021/04/what-can-neuroscience-tell-us-about-the-mind-of-a-serial-killer/
https://www.crimetraveller.org/2015/11/most-evil-brain-serial-killers-psychopaths/
https://en.wikipedia.org/wiki/Jeffrey_Dahmer#Childhood




Member


Escape to the Nucle


Which celebrity is this?


Welcome students!
Nice to meet you and enjoy your lunch!

HOW HAS SCIENCE AND TECHNOLOGY CHANGED WAR?

CONSPIRACIES

Despite persistent debates about the regulation of weapons and the use of diplomatic negotiation as a substitute for full-blown wars, could our perception of what war indeed is be deceived by the growing influence of science and technology?

As a global civilisation we have come far from the Battle of Megiddo in 1479 BCE, the first recorded armed conflict in history, fought between Thutmose III of Egypt and an alliance of former Egyptian regions ruled under King of Kadesh. As centuries passed, our understanding of technology and science has rapidly flourished, especially in the application of winning war. Now, we are no longer limited to swords and axes like the Egyptians; our modern civilisation utilises technologies that can be divided into five distinct categories. Firstly, there are offensive arms which focus on harming the enemy and defensive weapons which fend off offensive blows. Transportation technology moves weaponry, supplies and soldiers; communications synchronise the movements of armed forces; and sensors identify forces and guide weaponry.

Besides the obvious applications of technology in war, such as firearms or explosives, scientific creativity prospered the development of spy technologies. These gadgets are not novel to the James Bond movies we are all familiar with, but date back to ancient Babylonian law called Hammurabi's Code and the Bible's Old Testament, which describe espionage as a way to gain an edge over competitors. For example, during the Cold War, a real-life Bulgarian assassin utilised an umbrella to inject toxic pellets of the poison ricin into a Soviet defector in London. Additionally, the Soviets created a lipstick gun dubbed the "kiss of death" which could fire a single bullet at close range. Finally, the discovery of tetrahydrocannabinol acetate, commercially known as Indian hemp, was applied by the U.S. Army to lace cigarettes in the 20th century as part of the Edgewood Arsenal experiments, a set of classified medical studies used to test pharmaceuticals and evaluate the impact of low-dose chemical warfare agents on personnel. In this case, when these cigarettes were given to someone, it would cause uncontrollable chattiness. Although beneficial to most aspects of life, it is clear that promoting technological advancements means systematically changing the nature of warfare from weapons of mass destruction to weapons disguised as innocent. As such, how do we know where to draw the line? And more importantly, can we draw that line?

Technologies developed during times of war for the sole purpose of winning do not often go obsolete, but rather, become mainstays in the homes of many ordinary civilians, fundamentally changing the way we live. For example, the use of the prominent Enigma machine during World War II by the Axis not only advanced the field of cryptography, but fostered the development of computers we now use on a daily basis. This rotor mechanism which scrambles the 26 letters of the alphabet to produce ciphertext was cracked by Alan Turing, a misunderstood English mathematician who built the Bombe device. This device was constructed on numerous logical principles, and could execute two or three jobs simultaneously due to its complex structure.

Now, we have devices which are unlike anything Turing could have envisioned, we have created systems that can process trillions of instructions in less than a second, and they are only getting faster.

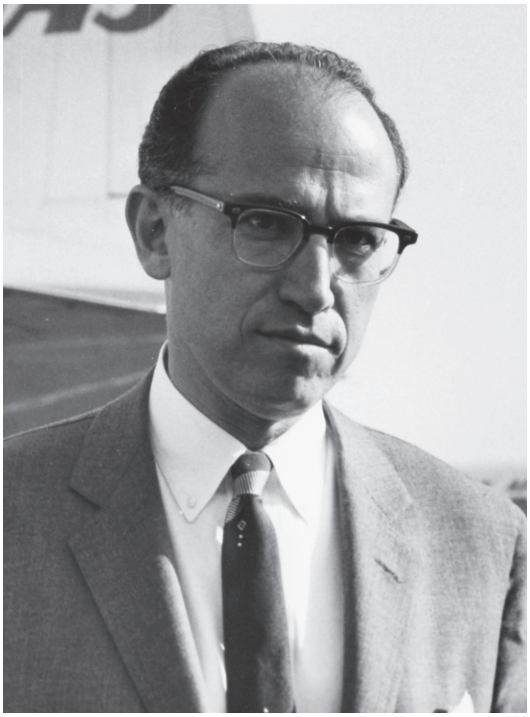
In the 21st century, we have become accustomed to the modernisation of kinetic weapons, such as ongoing programs to develop hypersonic glide vehicles. Such creations of technology are heavily regulated and discussed in the media due to their powerful capabilities and immense threat to societies, yet we rarely scrutinise the weaponry that goes unnoticed by the untrained eye. A simple outbreak of an infectious disease could be targeted to close down societies and invoke mistrust amongst allies, and perhaps create political turmoil. The Covid-19 pandemic should be a lesson to all of us, as although the speculations around the pandemic being an intentional method of population control are incredibly unlikely, it highlights the astronomical implications of infection on our economies, societies, and our security. Another example that resides more locally, at the Erasmus Medical Centre in Rotterdam, was when the team of Dutch virologist Dr Ron Fouchier excessively mutated the H5N1 spike gene by accident in 2011. Fouchier's team, along with another research team, had separately modified the deadly avian H5N1 influenza virus so that it spread between ferrets, making it more infectious. This event sparked serious concern, as in the hands of a bioterrorist, millions of people could have potentially been at risk. This, along with many other similar incidents, reinforces the need to regulate the development of biosynthetic systems.

It is unclear how the manipulation of advancing technologies will materialise in the future, but one thing is certain: it is becoming increasingly easier for amateur biologists to accomplish feats once impossible without high-end laboratories. This can be attributed to emerging biotechnological tools becoming cheaper and more accessible than ever before, and with the growing influence of the internet, the expertise required to develop dangerous systems is also becoming ever more attainable.

Sources:
https://wargaming.com/en/news/spy_gadgets/
https://www.nbcnews.com/id/wbna56729306
https://www.cryptomuseum.com/crypto/enigma/hist.htm
https://www.britannica.com/technology/military-technology
https://www.liebertpub.com/doi/10.1089/hs.2021.0165
https://www.worldhistory.org/war/#:~:text=The%20first%20armed%20conflict%20in,of%20the%20King%20of%20Kadesh.
https://weaponsandwarfare.com/2020/02/25/megiddo-15-may-1479-b-c/
https://www.atlanticcouncil.org/commentary/article/facing-the-future-of-bioterrorism/
https://www.science.org/content/article/exclusive-controversial-experiments-make-bird-flu-more-risky-poised-resume
https://warontherocks.com/2020/05/the-pandemic-and-americas-response-to-future-bioweapons/
https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3815869/
Image from Flickr by tec-estromberg.

THE STORY OF A MIRACLE WORKER: JONAS SALK
HISTORY OF SCIENCE

When one thinks of influential scientists, names such as Einstein, Newton or Tesla may be the first few to come up, but there are also lesser known names whose contributions to humanity cannot be overlooked, such as Salk: the hero of children back in the 50s.



Source: Wikipedia

The Story of a Miracle Worker: Jonas Salk

Jonas Salk, the so-called "miracle worker". The inventor of the first successful polio vaccine who was estimated to earn 7 billion USD if he were to patent his vaccine, but rather chose to call his vaccine "patented by the people". The vaccine was 90% effective and, together with an oral vaccine invented by another microbiologist, it helped eradicate two types of polioviruses.

Polio in a nutshell

Polio is the paralytic disease caused by the very contagious poliovirus. It was hardly the deadliest disease of all, but it was by far the most fearsome between the 40s and 50s because it caused unexpected death or paralysis in children. Families attempted to quarantine their children and public facilities were shut down to prevent the spread of disease. When the former president of the United States, Franklin D. Roosevelt contracted the disease himself and became paralysed, he founded the foundation called "March of Dimes", which was the main source of funding for Jonas Salk during his search for a vaccine, and ultimately led to success.

The Life of Jonas Salk

Salk first obtained a Bachelor of Science in Chemistry, then proceeded to study Medicine at NYU. However, interestingly, Salk was never interested in practising Medicine. During his studies he took a year off to practise and teach Biochemistry. He focused on Bacteriology while he studied Medicine, and in the last year of medical school he chose an elective course where he dealt with the influenza virus that introduced him to his real passion: virology.

He played a role in developing the influenza vaccine and was granted his own laboratory in Pittsburg, yet the laboratory he had was small and restrictive. This was until he was contacted by the director of research at the National Foundation for Infantile Paralysis (later called March of Dimes) to take part in research on polio in 1948. Through this foundation he had enough funds to carry out his research individually and he finally came up with a working vaccine in

1952. Salk's own kids and wife along with public figures such as Elvis Presley were vaccinated publicly, which gave rise to over a million volunteers being vaccinated by 1954. The vaccine was finally announced as safe a year later.

His discovery attracted a lot of attention, and he became a scientist who gained fame while still alive. However, Salk was just an ordinary man and he just wanted to "get out of the limelight and back to his laboratory". He never patented his vaccine, and he kept working on new projects to become a person who served mankind on a large scale rather than the one-to-one scale, which would have been the case if he were to pursue his medical career as a doctor.

After Polio

After developing the famous vaccine, Salk took a step to fulfil his second dream: creating an environment where researchers could collaborate to explore the basic principles of life. This institute would be the birthplace of life-changing discoveries, and Salk had both the financial aid by the March of Dimes and the land needed to build this institute on, which was gifted by the city of San Diego. In 1963, the institute officially opened its doors to all aspiring scientists. Distributed over 27 acres of land and facing the Pacific Ocean, Salk had created a facility "worthy of a visit by Picasso". The facility initially carried out major research on ageing and regenerative medicine, cancer biology, immune system biology, metabolism and diabetes, neuroscience and neurological disorders and plant biology. Fun fact, Watson Crick, a co-discoverer of the double helix structure of DNA, was also an active member of this society. Even to this day, the Salk institute is carrying out extensive research and hosting events which attract scientists from all over the world.

Sources:
https://nl.wikipedia.org/wiki/Jonas_Salk
https://www.salk.edu/

Source background: Unsplash

Source: The New Atlantis

MRNA REVIEWS: V FOR VENDETTA

REVIEW

In this newest edition of mRNA Reviews, we took a look at V for Vendetta, a darling among enjoyers of conspiracies and dark dystopias. The themes of a conspiracy surrounding a deadly virus and the struggle against authoritarianism feel evergreen in a year filled with protests and stands against authoritarianism as the world recovers from the Covid-19 pandemic. Be warned, this review contains spoilers.

Plot Summary

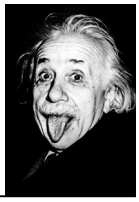
V for Vendetta is set in a fantasy Britain ruled by a fascist government who read 1984 and mistook it for inspiration; its oppression is almost comical, and it comes with levels of vranyo that would make Putin himself blush. In a chance encounter, Evey is saved by V, a Guy Fawkes-masked Shakespeare-quoting hero with a penchant for classical music and demolition. Evey witnesses these extracurricular pleasures firsthand as V takes her to a nearby roof to watch the eruption of the Old Bailey, with Tchaikovsky as backing music; this whole event is played off as a "surprised unannounced demolition" by the government. V promises another surprise demolition will occur in a year, but this time at Parliament. Evey is forced into hiding with V as they are hunted by Eric Finch, a detective sent by John Hurt, this time playing the role of Big Brother instead of Winston. V's gunpowder plot eventually reaches a boiling point; all Finch finds is a conspiracy that the government killed its own citizens with a virus to get into power, and thousands of other demolition enthusiasts take to the streets on the 5th of November to witness the destruction of Parliament.

The Good

We really liked how the movie portrayed the government's oppression; everything from how in your face it was to how it targeted minorities felt real, and its propaganda felt authentic. The scenes with "normal" everyday people glued to TV screens filled with propaganda, who knew it was all lies but continued watching anyway, still feel relevant to this day. Everyone is divided; I'm lying, you know I'm lying, everyone knows I'm lying, but I'm lying so openly and with such confidence that you're pretty sure you cannot do anything about it. Thus, the lies get propagated and become a daily fact of life, casual like a water cooler chat. We have an unspoken social contract: I do what I want, as long as I target people you don't care about until targeting you becomes normal enough. The final revolution also seemed grounded; it only happens because the army allows it to, in a last minute choice to not open fire.

The Bad

We really did not like a lot of the side-aspects of the movie; V's somewhat supernatural abilities, the relationship between V and Evey, and especially V's torture of Evey. All of these things felt off-key, uncomfortable, and at parts offensive, particularly the torture.



MYTHBUSTING: CREATIVE GENIUS OR WEIRDO?

CONSPIRACIES

Famous scientists or artists often get stigmatised for being weird or eccentric. These happen to be the minds with the greatest creative output, such as Albert Einstein, John Nash, or Leonardo (not the turtle). Is this correlation real, or is it just coincidence? Psychological literature has been trying to analyse this phenomenon for quite some time, and here I will provide you with some prominent arguments in the field.

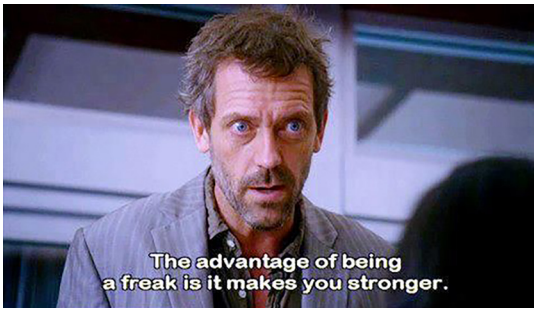
One thing we must not forget is that correlation is not causation. Simply because the eccentric scientist trope exists and has recently been inflated by media and entertainment, with characters such as Sheldon Cooper, Gregory House and the like, does not necessarily mean it has a solid foundation. Any point studied on a case-by-case basis is extremely selective, and thus cannot provide evidence towards correlation. As creative geniuses existed as long as mankind has, even a sample of a few hundred* would not provide enough data for analysis. In addition, cases that are notorious tend to be more memorable, which creates a bias in data acquisition.

In 1945, Max Wertheimer published a paper in which he explained that a truly creative process requires breaking the norms and patterns, which paved the way for the foundation of Gestalt psychology. Based on this idea another psychologist D.K. Simonton hypothesised that this tendency of breaking norms would be transferred onto one's social self, thus creating a persona that from an outside standpoint is "crazy". Throughout the years, several values have been correlated with extraordinary creative output.

*282 was the maximum done (in 2010)

One of these was intelligence, which might not come as a surprise. However the three that might be neglected, but are highly relevant, are work, motivation, and determination. Multiple studies have shown that developing creative skill, like any other skill, is tied to experience. Although the aptitude for development differs individually, without putting in much effort, creative output cannot be generated. Think of it this way: if Einstein had not put in the work he did for Physics, would he have been able to think of the photoelectric effect? Highly doubtful. Same as with artists; just consider how many paintings Leonardo produced in his lifetime, and how many are remembered today. This devotion, determination, and motivation for the specific fields of these geniuses could be a root cause for eccentricism as it could slowly evolve into obsession.

In conclusion, what I would highlight as the main point of this story: causality is complicated. Does the sentence "creative excellence correlates with eccentricity" hold merit? According to research, it does. But is it a misleading statement? I believe so. This, like many other stories, is much more complicated than a one-sentence summary.



Cropley, David H., et al., eds. The dark side of creativity. Cambridge university press, 2010

Wertheimer, M. (2020). Productive Thinking (1945). In Max Wertheimer Productive Thinking (pp. 25-257). Birkhäuser, Cham.

A REACTOR, A POWER PLANT, AND THE FUTURE

IN THE FIELD

Since 1958, the TU Delft campus has had its own nuclear reactor institute, where research into materials, health and sustainable energy is performed. Although the TU Delft Reactor is rather unknown in comparison to the one in Borssele, it should not be underestimated, as it has more to offer than you would think. This article focuses on the differences between a research reactor and a commercial nuclear power plant, like the one in Borssele.

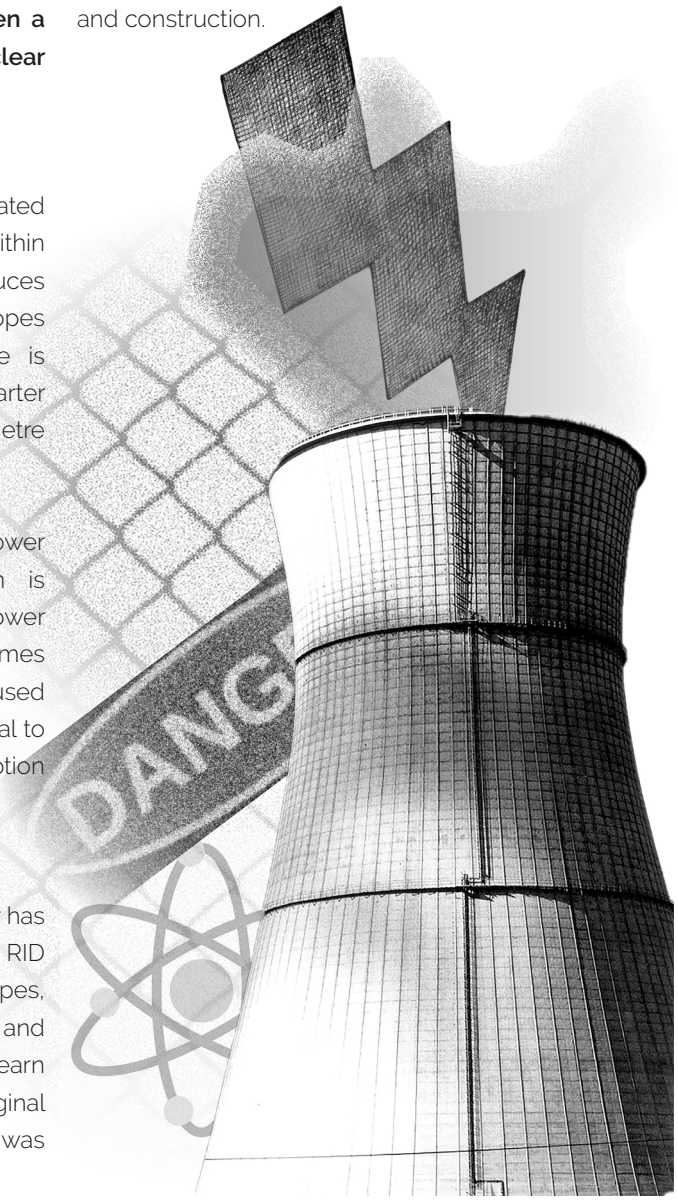
Facts

TU Delft Reactor Institute Delft (RID) is located opposite of the Applied Sciences building. Within its 28-metre-high dome, this institute produces neutrons, positrons, and radioactive isotopes through nuclear fission. The reactor core is located in an enormous basin filled with a quarter million litres of demi water behind a 2.5-metre -thick wall of concrete.

On the other hand, there is the nuclear power plant in Borssele. Here nuclear fission is performed on a much larger scale. The power of the nuclear power plant is about 650 times larger. That process produces heat, which is used for the generation of electricity, and it is equal to about three percent of the energy consumption of the Netherlands.

Purpose

Borssele is a massive power plant, but it only has a single purpose, the production of energy. RID produces neutrons, positrons and useful isotopes, which are utilised in fundamental research, and it offers a unique setting for students to learn about nuclear energy. For example, the original microscope of Antoni van Leeuwenhoek was investigated with neutrons to get a unique insight into its construction. Neutrons were fired at the microscope while the microscope was being rotated, producing unique photos and insight into the production methods used by Antoni van Leeuwenhoek. At this reactor, research can be performed in the fields of art, healthcare, energy and construction.



Source: Rawpixel

Safety

Reactor safety is often a concern, but at RID it is impeccable; standing inside the dome, you only experience a negligible increase in radiation compared to outside. The thick concrete walls and water surrounding the core decrease the radiation so much that it is safe enough to work there for a whole year; you would still be far under the maximum safe radiation dosage. It is even safe enough to tour and show people the famous Cherenkov radiation!

At the same time, the safety of Borssele is outstanding as well. The reactor core of a nuclear power plant is hermetically sealed, and the system is protected by several layers of steel and concrete. The power plant is resistant to many disasters. It is also not focused on tours, so it is less accessible for the general public.

The power plant of Borssele also performs a safety test every year. The power plant is then shut down, and periodic tests are performed. For example, the reactor vessel is checked at more than 50 spots annually. Nine years ago, a more elaborate inspection was performed after risks found at Doel (another power plant in Belgium). This check was performed with a special robot with ultrasonic probes on the outside. The robot was lifted in the reactor vessel and it scanned the wall.

The power plant uses water from the Westerschelde to cool its system. This water does not come into contact with the nuclear core, it is only used to cool the system. The cooling system uses power, but there is enough emergency power to cool the power plant for two weeks in case of a black out. The power plant is full of detectors, and when a large deviation is detected, the power plant will automatically shut down.

Waste

The research reactor produces only limited amounts of radioactive waste, especially when it comes to highly radioactive waste; in the many years of its operation, they only had to replace the core once. Comparatively, the power plant in Borssele produces much more radioactive waste, the spent fuel contains unused Uranium, and produces around 600 kg of high level waste per year. At the same time it has an annual energy production of 3,273 GWh.

New reactor type

In addition, could high half-life highly radioactive waste be soon a thing of the past? A new type of nuclear power plant designed to use Thorium mixed with highly radioactive waste instead of Uranium could eliminate the worst of this radioactive waste. The fissile material is dissolved in molten salt; these molten salt reactors turn the highly radioactive waste into medium level radioactive waste that is hardly toxic after 300 years. This new type of nuclear power plant could be the beginning of much more research in nuclear fission and a potential solution for the global warming crisis.

As a final point, comparing the two institutes was like comparing apples and oranges, because they are very different in purpose and size, but hopefully this article gives a brief idea.

For the full list of sources and references, follow the QR code below.

THE CONSPIRACY OF BIOWEAPONS: A BRIEF HISTORY

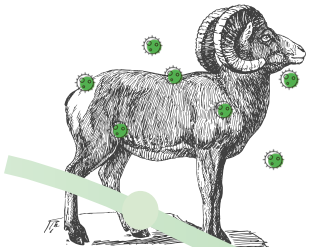
CONSPIRACIES

A controversial subject like the Covid-19 pandemic also came with its own conspiracies about its origin: did it escape from a laboratory doing legitimate virus research in Wuhan? Did it result from a botched bioweapon program from China? Or was it rather implemented as a bioweapon by the US? In times of crises, the amount of conspiracy thinking also escalates, and as our knowledge of synthetic biology increases day by day, it might not be a stretch that this knowledge is used in a more destructive way, in the form of bioweapons.

However, the concept of bioweapons is not a new one: even before the introduction of Microbiology by Pasteur and Koch, people have used infectious diseases in warfare. In fact, records of the use of bioweapons, or the idea of using pathogens in warfare exist from periods as early as the 1400s BC. The first recorded example is of the Hittites, who sent rams, infected with a pathogen, to their enemies to weaken them.

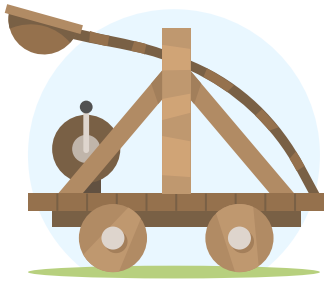
Another landmark of early biological warfare was in the Middle Ages. Caffa, an important, well-fortified Genovese seaport was under siege by the Tartars. However, the attacking army was suffering from the bubonic plague. They turned their misfortune into a weapon; they decided to spread their plague to the besieged city by catapulting their cadavers into it. The plague-infected Genovese, now also struck by the plague, fled on boats, seeking refuge in Mediterranean seaports. They transmitted their disease towards Europe, resulting in the 14th century plague pandemic, also known as the Black Death. Of course, the actual epidemiology and origin of the bubonic plague is much more complex than described by this single incident. It remains questionable whether the transmission of the plague towards the seaport was truly caused by this warfare tactic, or simply occurred due to the epidemiological nature and natural transmission of the plague. Thus, the actual effectiveness of these kinds of attacks remains uncertain. Still, this incident remains a good example of how the use of bioweapons could have detrimental consequences.

Other examples of deliberately using pathogens as a method of warfare can be found in the wars against native Americans. By distributing blankets and clothing from patients suffering from smallpox, the colonials intended to infect the native population. Following this, the native population indeed suffered from smallpox epidemics. Whether this was truly the result of the infected clothing and blankets is uncertain,



1400s BC

1300s AD

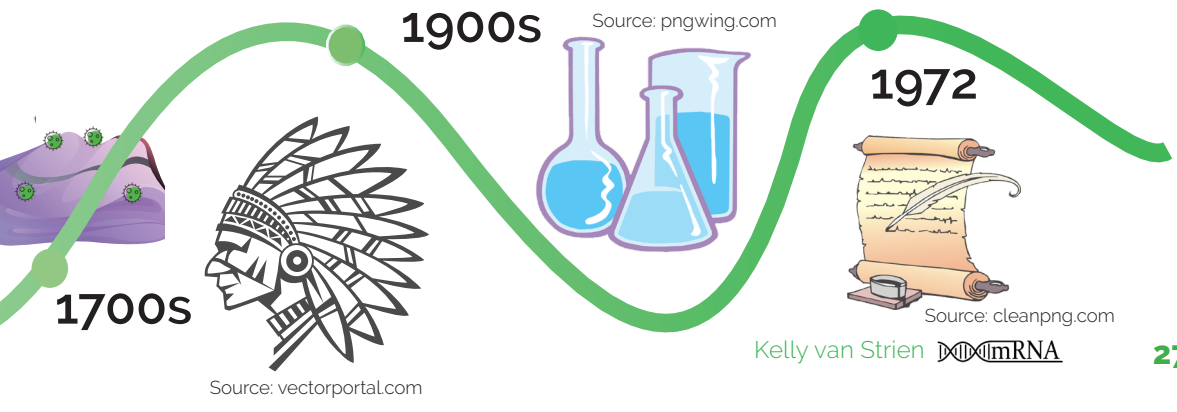


as these are not very effective vectors. Since other contacts between colonials and native Americans have been recorded, these may have been of greater influence in the transmission of smallpox, as respiratory transmission is much more effective. Thus, also in these examples it remains hard to distinguish the effects of deliberate attempts of infection versus the natural transmission of diseases.

After the discovery of Microbiology, biological warfare became more sophisticated. In World War I, cattle had been purposely infected with anthrax or glanders and shipped to America by the Germans. In World War II, various research facilities dedicated to the research of biological weapons existed, including experimental research on war prisoners. Even after World War II research in various countries continued, until experts expressed concerns, due to the unpredictability, uncontrollability, and epidemiological risks of bioweapons. This eventually led to an agreement in 1972 that prohibited the development, production and stockpiling of bacteriological and toxin weapons. Unfortunately, even after this agreement, the use of bioweapons has not been fully extinguished. Examples of the recent use of bioweapons can be found, such as the 2001 anthrax attack. It is therefore still important to prevent attacks by globally rejecting the idea of bioweapons, and to be prepared by early detection and fast responses toward biological attacks. We, as scientists-to-be, can play a role in this by being aware of the safety and security of our research, and to consider whether our research is ethically responsible towards society.

Still, even though bioweapons are not completely a remnant of the past, naturally occurring pathogens and infectious disease are still part of life. As we saw from history we cannot always distinguish a deliberate biological attack from a naturally occurring epidemic. Similarly, while many wild theories of the origin of Sars-Cov-2 rage on the internet, it might simply be caused by the normal course of nature.

Sources:
Barras, V., & Greub, G. (2014). History of biological warfare and bioterrorism. Clinical Microbiology and Infection, 20(6), 497–502.
Imhoff, R., & Lamberty, P. (2020). A bioweapon or a hoax? the link between distinct conspiracy beliefs about the coronavirus disease (covid-19) outbreak and pandemic behavior. Social Psychological and Personality Science, 11(8), 1110–1118.
Knight, D. (2021). Covid-19 pandemic origins: Bioweapons and The History of Laboratory leaks. Southern Medical Journal, 114(8), 465–467.
Riedel, S. (2004). Biological warfare and bioterrorism: A historical review. Baylor University Medical Center Proceedings, 17(4), 400–406. https://doi.org/10.1080/08998280.2004.11928002
Other images from free-vectors.net, wikimedia by Videoplasty and freepik



Formorrow: For tomorrow's shining stars

Formorrow connects talent in IT and life sciences with jobs to really grow in. With us, it's all about you. Who you are, what makes you happy, how – and where – you can grow. We will help you shape your future and excel as yourself. We connect employers to team members whose stars will shine bright in their organisations. In doing so, we are contributing to a sustainable and diverse labour market that revolves around the strengths of individual talents.

Dive deeper. Grow further. With the Formorrow method

We are here for everything you can do today and who you can be tomorrow. In three phases, our underpinned methodology helps you take your future into your own hands:

Know yourself

Your skills are important, of course. But during Discovery Day we'll start with who you are. Probe your strengths. Find out what makes you tick and share your dreams with our psychologists. You will be given a deeper insight into who you are. We will find out which jobs suit your personality and talents.

Find your match

Acting on insights obtained during the Discovery Day, we won't look for just any job, we'll look for a career. Together we will find the employer where you will feel right at home. Where all that you have in you will surface. And where you will have room to flourish. Today — tomorrow, and all days to come.

Grow ahead

Started your job? Then you'll also start at the Formorrow IT or Life Sciences Academy. For two years you will learn all you need to know to shape your career. Deepen your self-knowledge. Strengthen your professional skills. And develop a personal vision of your future, supported by your coach.

formorrow
grow ahead

Are you curious how the Formorrow method will work for you? Just call, email or check our website and we're here for you.

033-465 3205
hello@formorrow.nl
www.formorrow.nl

The benefits of Formorrow

It's all about you

We take our time in getting to know you. It is the only way to be sure which job and employer will really suit you.

Two years at the Formorrow Academy

At the Formorrow Academy you will develop yourself, your professional skills and a vision for your future. Your coach will support you every step of the way.

Choose a career

A quick match or convenient job is just not our style. We will connect you with a career you can grow in.

For all you can become

Formorrow looks further ahead, helping you to build an impressive, sustainable career based on your unique strengths.

Grow ahead with the Life Sciences Academy

Deepen your self-knowledge

We will prepare you for a career that is built around you. This means: knowing who you are to become who you want to be. In a thorough training programme focused on personal development and effectiveness you will learn what makes you tick, what energises you, how to work together optimally and above all: how to excel as yourself. All things that will benefit you throughout your career.

Become a better professional

Want to be more successful by developing your professionalism? Formorrow takes an integral approach to accelerating your professional development. On the one hand developing all the necessary skills with targeted training. And on the other hand supported by a personal coach to help you to flourish. Boost your career and prepare yourself for every opportunity that awaits you.

Shape your career

Together with your personal coach you will look way ahead. Where do you see yourself? And how do you want to get there? Your coach will answer all your questions about the realities of today and tomorrow. Your coach will guide you through minor frustrations and existential issues. In confidence, of course. And with every faith in you.

Sign up for an intake

Curious how Formorrow can help you shape your career? Just sign up for a phone intake with one of our Talent Advisors. We would love to hear all about your studies, wishes and plans. And of course we will tell you exactly what you can expect from your Formorrow journey.

How you'll make your Formorrow journey

1. Sign up at www.formorrow.nl/en/intake and upload your resumé. Prefer to sign up anonymously? No problem at all.
2. First we'll check if your resumé is a fit with us; then we'll confirm your intake.
3. Accepted? During our Discovery Day you'll get to know yourself better and find out which jobs are most-suited to you.
4. Based on your insights, we'll find the employer that brings out the best in you.
5. Starting your new job will coincide with starting at the Formorrow Academy.

HOW TO AVOID CONSPIRACIES GETTING YOU?
CONSPIRACIES

As a Nanobiology student, you are being prepared to cure cancer, develop new microscopes, and even to help feed the world with genetic engineering. Despite these arguably nice benefits, one of the most important uses of your degree often gets overlooked. Our world is full of dangers, dangers that we only hear from conspiracy sites, and that people only laugh at. But as any of us know, every catastrophe movie starts like that: making fun of the weird guy who was the only one capable of predicting how a rapid, malevolent ice age would suddenly develop until it is too late. Now we want to offer you some advice on how to use your studies as weapons against these completely real threats that should never be made fun of.

Rapid Ice Age *(Day After Tomorrow)*

In a rapid cooling of the atmosphere, you will need a perpetual source of warmth and nutrients. You have learned how to grow bacteria on surfaces, and you probably also learned that photosynthetic bacteria store only around 5% of the energy taken up, and release the other 95% as heat. So with enough bacteria from the lab, you should be fine. As for food, with the surplus heat you do not need, you can power up a greenhouse and grow plants.

Lizard people taking over the world

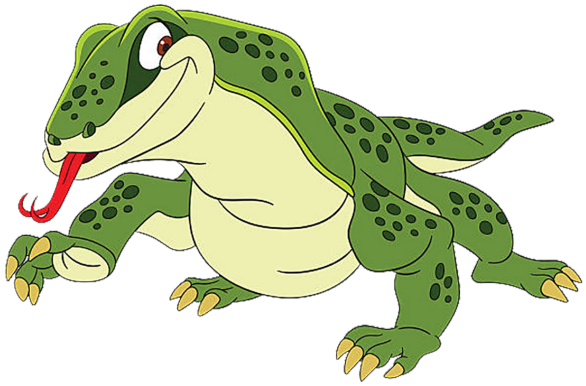
If this likely scenario would come about, you need to prepare yourself with the most high-tech weapons you can find. The high power lasers from the imaging department could prove themselves to be highly effective, and if you are not a stormtrooper you could probably aim it at the enemy as well.

End of the Mayan calendar

Thankfully, it was discovered that the Mayan calendar did not end in 2012, it just started a new cycle. But who knows, maybe a new discovery could shed light on another approaching end date! Your solution is simple. Just put this piece of code below in your Jupyter Notebook and you should be fine. It will give you ~27 more years to live. Make sure to set your kernel to 3.8 however, as 3.7 does not support this algorithm!

```
import mayancalendar as mc
import time
cal=mc.current()
for i in range (10000):
        a=time.day(1)
        mc.extend(cal,a)
```

Sources:
http://www.jstor.org/stable/20718709
https://doi.org/10.1007/978-94-009-0511-5_656



Agenda

Board interest drinks	28-11
Lunch lecture Diversity and Inclusivity	29-11
Lunch lecture Riverwise	30-11
GMA 2	30-11

BEP/MEP event	01-12
Purple Friday	09-12
Study with Nano's	12-12
Second year activity	16-12
In House visit Getinge	20-12
Christmas drinks	20-12
Cohecie workshop	21-12
Member dinner	22-12

Studying with Nano's	30-01
Wnt & Diffucie	04-02 up to 12-02

To be up-to-date with all activities, scan this QR code to receive access the official Hooke calendar!

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


$F_s = -kx$
CONFIDENTIAL
TOP SECRET
EYES ONLY
The Northwest
Scientists to kill ducks to see why they're dying
LOCH NESS MONSTER?
Genius?
Weirdo?