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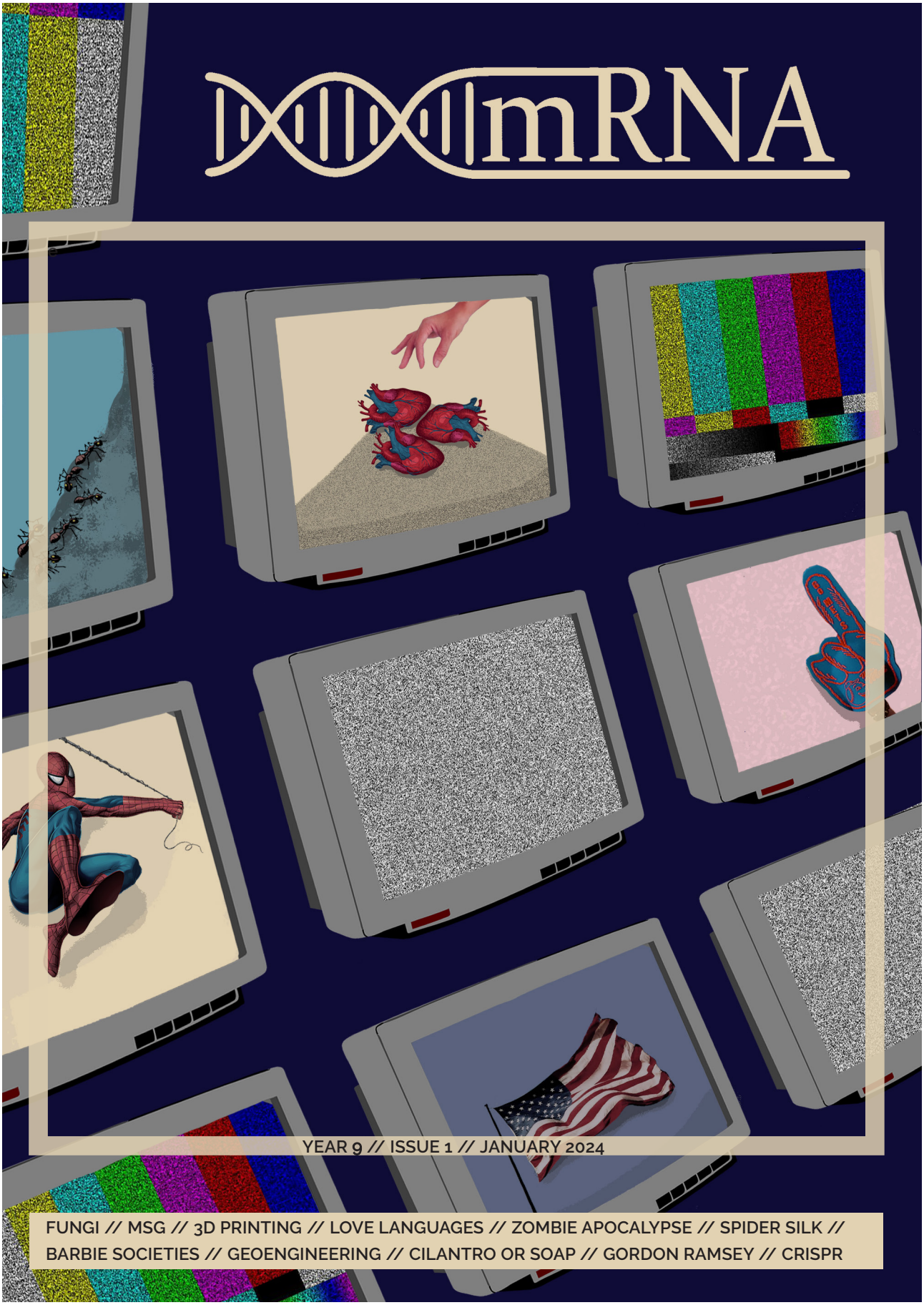

YEAR 9 // ISSUE 1 // JANUARY 2024

FUNGI // MSG // 3D PRINTING // LOVE LANGUAGES // ZOMBIE APOCALYPSE // SPIDER SILK // BARBIE SOCIETIES // GEOENGINEERING // CILANTRO OR SOAP // GORDON RAMSEY // CRISPR

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

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COLOPHON

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EDITORIAL
AVIN NAYERI

Hi there my mRNA fans!

While the sun continues to disappear earlier, and the rain decides to pour heavier, let us not sorrow but look forward to the brightness this new year brings us. Of course, words will never reflect the struggle of the actions: getting out of bed in utter darkness, cycling through a concoction of wind, rain, and hail, and even slipping one too many times more than any of us would care to admit.

It's the darkest days where I find myself wondering why I left Malaysia and its warmth to begin with, and have dreams of laying by the pool, book in one hand, a cold pepsi in the other, under the blazing sun with no sunscreen (careless, but the tan is too important).

If only such a reality could exist in the Netherlands for every month of the year: a world where I wouldn't have to check my weather app every morning or have to tolerate wet jeans during a lecture. But why stop there? Imagine a reality where you could print organs for transplants, or one where Spider-Man is a construction worker, or instead of a Covid outbreak, we faced a zombie apocalypse. Alternate realities live rent free in all our minds, some more questionable than others, but what if our imagination became our reality? Read this edition to find out, but prepare yourself, as a few may keep you up at night.

At your service,

Avin Nayeri
Editor-in-Chief of mRNA 8.0

FROM THE BOARD

FREKE DE MUNK

Dear reader,

As I'm writing this, most of our students are busy preparing for their upcoming exams. They're sitting in the silent room, walking in and out of the hub to get some new coffee to fuel their brains or to take a (deserved) break from studying. Normally, I would do the same, but this year I'm pausing my studies to be the board of our association with my four other amazing board members.

When I heard the theme of this mRNA would be 'alternate realities', it made me think. What would my life look like now if I hadn't committed to doing a board year? Or what if I hadn't decided I wanted to study Nanobiology at all 5 years ago? I'm writing this text on my left monitor while the group picture of IntroN is visible as the background of my right monitor. I glance over and start to smile: this is my reality and I'm grateful it is.

We're already almost halfway into our board year and we have experienced so many nice moments together with our members: the activities at the beginning of the year to welcome our new members, the Dies week in November to celebrate our anniversary, our member dinner to end the calendar year all together, and much more. The rest of the year still has so many other activities in store such as a multiple day excursion to institutes abroad, more lunch lectures by interesting companies and our study trip Diffucie in the summer holiday. I'm beyond excited to see what the rest of the year will bring us, but I know that no matter what our reality will be, I wouldn't have wanted an alternate one since you will all be part of it.

Your life, and especially your student life, seems so full of big and important decisions. Every one of them will cause new opportunities to open up and others to get pushed further down the line. But no matter which decision you make, which reality you choose, it will always work out in the end and I hope you remember that!

Lastly, I would like to thank mRNA for making another beautiful edition of this magazine and putting in so much time and effort. I would also like to wish all of you a great time reading!

I have spoken,

Freke de Munk
President of S.V.N.B. Hooke 2023-2024

COULD "BARBIE" LAND BE OUR REALITY?

ENTERTAINMENT INDUSTRY

Have you ever woken up with your hair in a picture - perfect position, turned on the shower at just the perfect temperature, and then continued your day with your full time job... "Beach". Neither have I, unfortunately. However, when I initially watched the 2023 "Barbie" movie, I was compelled to wonder whether such a matriarchal society could ever exist in our world.

The movie presents a society that is seemingly perfect, with everyone living in harmony and achieving their dreams. However, while the film's portrayal may seem idealistic, it fails to address the complexities of real-life societies.

Firstly, the movie depicts a world where women have a complete monopoly in every career field apart from lifeguards (and John Cena as a mer-man). In reality, a diverse and demographically encompassing populus is required for fields like politics and medicine. It is unrealistic to expect that every individual in this picturesque society is comfortable with the entirety of the medical field consisting of only women.

Moreover, the film neglects to address the issue of inequality. In any society, there will always be disparities in wealth, power, and opportunities. The Barbie movie fails to acknowledge these inherent inequalities and instead presents a utopian world where everyone has equal access to resources and opportunities.

Additionally, human nature itself poses a challenge to achieving such a society. People are inherently diverse in their beliefs, values, and desires. It is impossible for everyone to agree on what constitutes an ideal society or how resources should be distributed fairly.

In conclusion, while the society portrayed in the 2023 movie "Barbie" may appear desirable on the surface, it fails to consider the complexities of real-life societies. Achieving such an idyllic world would require overcoming numerous challenges related to inequality and human nature itself. Therefore, it is highly unlikely that this fictional society could ever be fully achievable in reality.

Image Sources:
icolorpalette.com
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GROWING FUNGI 101: A STEP-BY-STEP GUIDE

MYCOLOGY

Fungi are generally very overlooked as a kingdom when it comes to our daily lives. However, they are very nutrient dense and their naturally occurring active substances have a very wide usage within the medical field. Although you might see mushrooms growing naturally by the side of the road, growing them in a laboratory, or at home, requires a very laborious process with too little step-by-step information online. So, here is a dummy guide on how to manage this, for whatever reason you need growing mushrooms for. This is a great hobby to take up if you are already interested in growing plants but are looking for a new challenge. In my experience, there is a lot of information online about each step individually, but not an overall guideline as to where to start, what the mycology terms mean, and in which order the steps should be followed. So, take this as your surface-level guide to walk you through the order of steps in case you are curious. You can learn more about each step online with great detail.

1) Collecting spores from your desired sample (1 day)

To get started, you would need a sample of your mushroom of interest. Even a single mushroom cap could yield you kilograms worth of mushrooms if done right, because a single cap contains millions of spores, which are the reproductive cells of fungi. This step is usually referred to as collecting a spore print. If stored correctly, spore prints can last up to a year.

2) Making a spore syringe or an inoculated liquid culture sample (1 day - 2 weeks)

Once you have your spore print, you will prepare a spore syringe which is basically a syringe with spores suspended in a sterile liquid. This process usually takes a day to hydrate the spores, but the syringe itself may be stored for years. There are three paths you could take from here. You could either inoculate your spawn (which will be explained in the next step) with a spore syringe directly, an intermediate liquid culture or an agar plate. All these options have their own advantages and disadvantages. Even though it is the option which takes the longest, I would suggest inoculating your spawn directly with a spore syringe and not bothering with agar plates or liquid cultures as a first-timer, as it minimises the risk of contamination.

3) Making your spawn (1 day)

Spawn is the substance we are going to grow mycelium in. Mycelium is a root-like structure of fungi which provides a network for them to grow. Spawn could be any grain-like substance from brown rice to popcorn grains. Whatever your preferred grain is, the first step is to hydrate them by boiling for hours to ensure they collect a good amount of water in order to be able to supply the mycelium to grow after inoculation. After hydration, it is crucial to pack these grains into either glass jars or special plastic bags and sterilise them. Sterilisation is preferably done by a pressure cooker, but I have gotten away with baking in the oven for two hours, so you can look at oven sterilisation methods online.

An additional tip here is whether you are using a bag or a jar, they need to have ventilation holes covered with micropore tape, because the mycelium will require air exchange during the culturing phase.

4) Inoculating and culturing your spawn (1-2 months)

Once your spawn and your spore syringe are prepared, you are ready to inoculate your spawn. You must be very cautious during this step and keep everything sterile. With a spore syringe, the process is simply expelling your hydrated spores into your jars and then shutting the lid tightly. 2 ml of spore suspension is usually a good measure for a 1 litre jar filled with spawn, but don't be afraid to add more as a beginner. After this, all you need to do is wait for weeks under the right humidity and right temperature. But honestly, mycelium is very forgiving. As long as there is no contamination and the temperature is not too extreme, it will take over your whole spawn eventually, it is just a matter of how long it will take. After your spawn has been fully colonised by mycelium, there is a process called break and shake, where you break up the grain pieces by shaking your jars to increase surface area, and letting it colonise for a few more weeks.

5) Transferring your spawn to a substrate (1 day)

Once the whole jar is colonised, you prepare your substrate. Substrate is a medium that can be anything from wood chips to soil mixed with straw and coconut flakes. This is simply where the mycelium will grow even further into and fruiting will finally happen. Once your substrate is ready, you simply break up your spawn and mix thoroughly with your substrate. 1 litre of spawn to 5 litres of soil-based substrate is usually a good measure.

6) Fruiting and collecting (2-3 weeks)

Once you have your spawn-substrate mixture, cover with some sterile soil, spray with sterile water, and keep the environment humid. The percentage humidity and the optimal temperature will vary from species to species. In a few weeks, you will collect your mushrooms, and can probably get 3 to 4 flushes.

And just like that, your long journey comes to an end. You now have way too many mushrooms to consume before they go bad, and you are left wondering if you should have just bought some from the grocery store instead. Regardless, you could think of this as a cool science project where you can finally make use of your Nanobiology degree while following sterile techniques. Either way, you now have a great addition to your response to *"...tell us some fun facts about yourself"*: *" I can turn a mushroom into hund*reds*!"*.

Have fun!

Image sources: rawpixel.com, pixexid.com

AMERICAN DISCOVERY OF EUROPE: ALTERNATE TIMELINE

HISTORY

Ever since Columbus first landed in the Caribbean, Europeans have been able to colonise America, through the spread of diseases, superior technology, and a bit of sheer luck. Those events are crucial for much of history that followed: the rise and downfall of empires, reshaping people's view of the world around them, eventually influencing the lives of everybody. It truly was one of the major events in history. But what if, in an alternative world, this never happened? What if it was not Columbus, but a delegate of the reigning American empires who discovered a new continent: Europe?

Before Columbus, there had already been several major civilisations established in the Americas: the Inca, the Aztec, the Maya, and Mississippi culture for example, yet unlike the Europeans, those civilizations never crossed the oceans. The American people never developed the necessary sea fare technology and never felt the drive to cross the oceans like the Europeans did in their search for new trade routes to Asia.

In this alternative timeline, iron ores were present abundantly all over the Americas. This led to improved weaponry, tools and down the line to improved sea fare technology for the native Americans. European attempts to cross the ocean, however, all failed due to natural disasters. After the voyages of Columbus and Amerigo Vespucci had been shipwrecked, all further attempts were cancelled, especially after Portugal discovered the alternative route to Asia past the coast of Africa. In the Americas, tales of the lands at the other side of the ocean were not unknown. There were stories about strange men from across the ocean that settled in North America. This was in fact Leif Erikson, an Icelandic explorer who had discovered "Vinland", or America. These stories sparked the urge of discovery for the Americas.

The expedition that discovered Europe came from the Aztec Empire. Without the arrival of the Spanish and European diseases during the reign of emperor Moctezuma II, the empire was able to fight may wars and expand drastically. Due to the trade winds, the voyage was unable to cross the ocean directly from the Mexican coast, but after sailing north, suitable winds brought them to 16th century England. England at this time was ruled by Henry the eighth, and upon arriving ,the Aztec explorers met with Europeans for the first time. Through trade and diplomacy, these Aztec travelers acquired the necessary goods and "treasures" to return home. This was the first time the Aztecs had landed in the "New World".

In the original timeline, European diseases devastated the native American population, killing many in the process. In this timeline

however, the opposite happened. American diseases were unintentionally exposed to Europe and this would lead to major plagues and enormous death tolls. The impact of European diseases on the native Americans was negligible.

After the first voyage came back from the New World, Moctezuma II was introduced to the stories and the treasures the voyages broad back: new animals like horses, cows and pigs; new tools; new writing systems and stories about unfamiliar people and cultures. Fascinated, the emperor sent new voyagers and established more contact with the New World.

With the discovery of the New World, the desire for conquest began. Successive emperors hoped to seize these lands, and thus a war began between the Aztecs and England.. Aztec warriors fought great battles against English armies but they were unable to decisively defeat them. Over time, a peace deal was established and Scotland was given to the Aztec people, creating the larger Aztec empire. Other American civilisations also began sending voyages to the New World and establishing colonies. European culture slowly started changing American culture: books and paper were introduced, new food and animals were cultivated, and new architecture styles were introduced in the major cities like Cuzco and Tenochtitlan.

At first, the new people from overseas were met with curiosity, but after the Aztec invasion of England and the plagues that pursued, they were seen as a threat. Many more wars followed, but the new people had difficulties due to the long distances and lack of technological superiority to decisively conquer Europe. Over time peace deals and immunity allowed the European nations to enjoy the potentials of the New World. Moreover, trade colonies and new trade routes were established. Architecture, language, and religion all changed due to trade, and American and Europe continues to merge progressively together.

To summarise, if Columbus had never discovered the Americas, but the American people had discovered Europe instead, an entirely different version of history would have been created. This was a version I imaged could have played out, but the possibilities are really endless. It was really interesting to thing about what the consequences would have been for the coming centuries in this timeline, but maybe you might have an entirely different set of ideas of what could have happened. I dare you to write your own story about how you think this scenario would play out and what today's world would look like!

Image sources:
https://pxhere.com

LOVE LANGUAGES: IS THERE A SCIENTIFIC EXPLANATION?

MYTH BUSTING

Image sources: pixexid.com, flickr.com

Have you ever wondered what type of bread you are? Or perhaps what character you're most like in the latest popular sitcom? What about your personality type? All of these burning questions can be answered through the endless supply of online quizzes, the responses to which are far from being understood as a fact or taken too seriously. There is one quiz, however, namely the 5 Love Languages questionnaire, that is taken seriously. Whether there is justification behind it or not is yet to be determined.

Gary Chapman proposed the five love languages theory in his 1992 book "The Five Love Languages: How to Express Heartfelt Commitment to Your Mate" which claims that there are 5 explicit ways humans express love towards each other, and that each person has their own preferred or primary mode of expression. The idea behind the theory is that by understanding your partner's primary love language, you can better understand them as a person and cater towards their needs. The love languages mentioned are "gift giving", "quality time", "words of affirmation", "physical touch", and lastly, "acts of service". Examples of these include: having a meaningful conversation while going on a walk (quality time), hugging (physical touch), or completing an errand for your partner (acts of service).

Chapman's theory gained a lot of popularity despite being based purely off of observation, with his book remaining on the New York Times bestseller's list since 2007. Within the field of psychology however, it is a somewhat controversial topic due to the little evidence and research carried out. A 2006 study, conducted by Nichole Egbert and Denise Polk, used an anonymous survey which was later analysed with statistical techniques such as "confirmatory factor analysis" to test the legitimacy of Chapman's theory. The findings showed that a theory with 5 forms of expression has more validity than one with 3 or 4, however, their sample was too homogenous to serve as any kind of evidence. A more modern study dating from 2022 does not deny the theory but rather suggests a sixth language they labelled as "check-ins". There is very little evidence to suggest that partners with the same love language achieve greater overall satisfaction.

So next time you're browsing the internet, give the quiz a go, just keep in mind that understanding love takes more than answering a simple questionnaire.

Sources:

https://docs.google.com/document/d/10wJiGMYssBbdChb7mqeedkHDHAF2LMwgRuZRNgPJDM8/edit?usp=sharing

SPACE KNEE MENISCUS SCIENCE

Image sources: picryl.com, flickr.com, rawpixel.com

3D bioprinting often comes up as a solution when addressing the organ shortage in the medical field to supply those in need of organ transplants. Many tissues and organoids have been bioprinted successfully, but in terms of transplants there have not been groundbreaking milestones reached except for a bioprinted human bladder transplant back in 1999. This is because there are many challenges that are yet to be overcome which would make bioprinting a cost-effective and reliable method. Some of these issues include the difficulty in finding suitable bioinks, vascularizing the bioprinted organ to make it viable during the long printing process, and the chance of tissues collapsing under gravity.

However, in late 2023, a promising advancement was made that would eliminate the gravity problem — just eliminate gravity! The International Space Station (ISS) National Laboratory managed to 3D print a human knee meniscus under microgravity by using live human cells, then transferred it to the Advanced Space Experiment Processor (ASDEP) facility for culturing, and finally shipped it back to Earth intact. Using microgravity to their advantage, the scientists did not have to build a scaffolding for the organ to keep its shape, revolutionising the bioprinting world.

According to the crew scientists, this is good news for two reasons: human knee meniscus is already a very high-demand organ in the field, and this success may mean this process could be applied to other organs too, so the potential is beyond imaginable. So, what's next on agenda? ISS is already planning its next mission of making cardiac tissue and they say various microgravity organoids may also be of their interest in the future.

It is now a matter of solving the greatest issue in bioprinting, the vascularisation problem, and we might be closer to industrialising the 3D bioprinting process than ever before. And who knows? You, as Nanobiologist could play a part in it.

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PRINTING LIFE

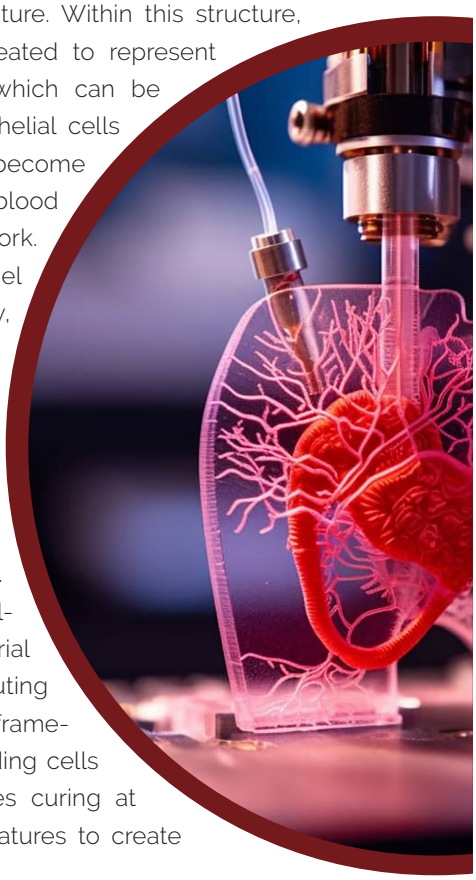
FUTURISTIC

Imagine you're performing open-heart surgery where the patient has a torn heart-valve. When starting the incision to remove it, an assistant presses a button on a machine in another room. Before you're done, they come running with a perfectly designed replacement valve, ready to be inserted. As much as this sounds like science fiction, it might be a possibility in the near future. How does 3D bioprinting work, and what are its challenges and recent advancements?

3D printing emerged as early as the 1980's with Chuck Hull developing his stereolithography-based printer. A UV laser would selectively solidify resin, and layers upon layers would ultimately form 3D structures. This idea of additive printing would later be applied to the extrusion of ink droplets, and now by using biomaterials instead, the concept of bioprinting has come to be born. However, as biomaterials are viscous, the need for scaffolding arises; otherwise, the soft, delicate structures would collapse during the printing process.

Several bioprinting techniques have emerged to tackle this problem, each with its unique advantages and challenges differing in terms of resolution, functionality, and structural integrity. The two primary techniques are extrusion-based and stereolithography (SLA) bioprinting.

FRESH (Freeform Reversible Embedding of Suspended Hydrogels) is the leading extrusion-based method, where bioink is deposited inside a support gel that maintains the printed structure during the printing process. To extract the structure, the gelatin is heated up to 37 degrees and melts away, leaving behind the desired 3D structure. Within this structure, channels are created to represent blood vessels, which can be filled with endothelial cells to eventually become a functioning blood vessel network. Although the gel provides stability, preventing collapse, this method comes with the disadvantage of heat-sensitive printing materials. For instance, collagen a material greatly contributing to the structural framework of surrounding cells in tissue, requires curing at elevated temperatures to create crosslinks.



On the other hand, SLATE (Stereolithography Apparatus for Tissue Engineering) is the leading stereolithography based method. Instead of the commonly used resin, a stem-cell-laden hydrogel is used, which becomes solidified under an intensive laser.

Although normal SLA works using an additive layer-by-layer process, a new method is being developed called volumetric bioprinting, where it gets solidified all at once. By projecting light from all sides of the hydrogel, the solidification process can be shortened to a matter of seconds, which opens the door to new possibilities in the field. Researchers in Switzerland together with Utrecht University medical centre were able to fabricate a heart valve and a meniscus through this process.

A noteworthy use of the FRESH method is the first printed personalized heart at Tel Aviv University in 2019. Using a patient's own cells, a fully vascularised heart has been printed matching the cellular and anatomical properties of the patient. Currently, it's still the size of a finger tip, but the researchers are developing methods to expand the expand the size and mechanical functions of the heart. fdexpand the size and mechanical functions of the heart.

age sources:
ww.advancedsciencenews.com

Tel Aviv University's first bioprinted heart from persoanlized stem cells.

Although it might still take a few years until printed products can be transplanted right into your body, the fact that we are able to construct complex living structures is an amazing feat. What is more, it is creating the path towards a new age of medicine. In the Netherlands, over 3000 people are currently waiting for a donor organ. This technology could make that process all the more fast. As Nabanita Panja says,

"A day is yet to come when patients will give their stem cells and happily wait in their homes to get their personalized organs 3D printed."

Sources:

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GIJSJE KOENDERINK: BIOMATERIAL RESEARCH

INTERVIEW

On the research and potential of bioinks, we have conducted an interview with Prof. Dr. Gijsje Koenderink from the Bionanoscience department who is currently working on the mechanical properties of cells and tissues.

Could you tell us a bit about your research on cell and tissue synthesis?

When you print with biomaterials, you generally print cells along some type of material to support them and to control the printing process. This is fundamental to control the bioink you need for printing and to choose the composition and the printing process so that the cells behave and organise as intended. So we look into the fundamental aspects that are needed to control the cell culture and its interaction with the surrounding material.

You recently collaborated on a paper with Mechanical Engineering on the development of 4D bioprinting. What are the significant differences compared to 3D printing?

So 3D is just the normal dimensions, x-, y-, and z-dimensions but for 4D, the 4th dimension is really the time component. At Mechanical Engineering, this is really where the expertise comes from, they are really interested in the concept of adding this time component so that you can make a material that upon a certain trigger changes its shape. For instance, it starts planar, then it folds up, which you can image for organs is useful as most organs and tissues have curvature. Our contribution, however, was more the material as we used a particular hydrogel material and needed to understand its mechanical properties in order to control the properties during and after printing.

What kind of experiments would be performed to measure those properties?

We measure the mechanical properties so for this we use rheological techniques. Rheology is the science of how materials can flow and for this, we use an instrument called a rheometer that can precisely deform a material with a certain amplitude and rate. Through this we can measure how a material deforms.

So all these materials are not "simple" materials but have very complex properties. For instance, if you increase flow, they become thinner, and this is very important for printing. You can imagine if you're pushing something through a nozzle, it has to be fluid enough so that it flows, but when it exits it must be able to stiffen and retain its shape. It's very important to have complex materials that allow this, so you can print it, and once it's printed you have a stable material.

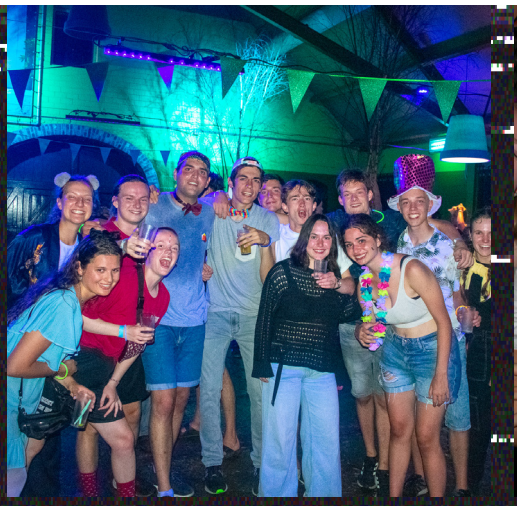
What are the current hurdles in your field you are trying to overcome?
Right now, we are working on materials that could fulfil different functions all at the same time, mimicking more closely what we have in our body. The cells in our body are supported by an extracellular matrix, which consists of collagen, integrin, and many other proteins, and this provides the proper mechanical environment for the cells but also gives them biochemical clues. Cells can interact with and adhere to it, remodel it, and can have biochemical interactions. Having a healthy environment is very important so that cells do not become virotic for instance. So we would like to work on materials that can capture multifunctionality which is really helpful for bioprinting, but also for remedial medicine and for in vitro human disease models.

In terms of bioprinting, what would be your time estimate for this to become a reality?
I am not an expert in the field as I am mainly focused on the biomaterial aspect, but my somewhat naive opinion is that organs are very complex in terms of structure and composition. However, some organs are more complex than others, for example: a kidney is more complex than a liver in terms of function.

We're actually currently discussing with people at mechanical engineering and Erasmus MC to set up a European project to do bioprinting of organs, and to use the liver as a more simple case and a kidney as a more complex case. I think we first have to work on smaller steps like that, which can still make a big advance and will probably take a few years before arriving in clinics. There are quite a lot of complexities, but the field is very fast growing so I think prototypes could emerge quickly especially for simpler organs. But to print whole organs and to really do it for more complex organs, we could be quite far off.

As Nanobiology students, how would we get into the topic of bioprinting and biomaterial related research?
I think you already have quite a good starting point with the Nanobiology training since this is a really interdisciplinary field. It is at the core of the program in combination with physics and hardcore biology. We are working on a nanoscale of course with interactions between cells and materials, so you really need to be comfortable with cell biology, biochemistry but also more the mechanical properties involving physics. The next step would be to specialise: take special courses and do a minor to get deeper into this topic of biomaterials and do research projects in this direction.

What are the BEP/MEP research projects currently being worked on in your lab about?
One master student is currently studying cell mechanics, the mechanical properties of cells by squishing them and seeing how they respond. We want to understand what the influence of the cytoskeleton is on the internal mechanics of the cell. Another student is currently looking more at how cells interact with their environment. By studying in vitro cell cultures, they are precisely controlling the environment of the cell and measuring how the cell responds to this. So they're really focussed on the intrinsic and extrinsic properties of cells.

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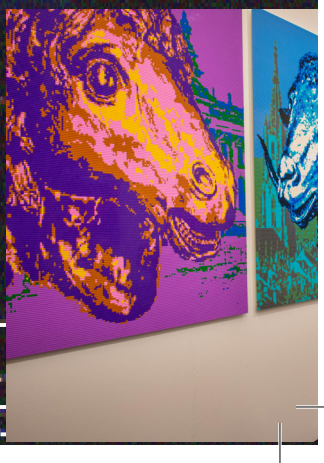

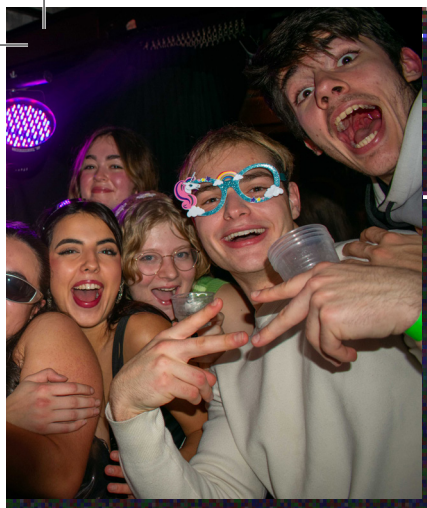

otosynthecie
ely pictures!

CRISPR CAS13, A NEW CRISPR TOOL

CRISPR NEWS

Image sources: pixabay.com

Ever since high school, I have always been fascinated by CRISPR-Cas9, a marvelous gene editing tool with endless opportunities imaginable. It was even one of the reasons why I chose to study Nanobiology. I assume each and every one of you have heard of Cas9, and will maybe even use it for your BEP or MEP. The same thing can be said for CRISPR-Cas12, but there is one more: CRISPR-Cas13.

All these gene-editing techniques originate from anti-phage defense mechanisms used by bacteria and archaea. This defense mechanism is called CRISPR: Clustered Regularly Interspaced Short Palindromic Repeats, and is closely mediated by one or several Cas proteins. To be more specific, there are six types of CRISPR defense mechanisms: type I, III, and IV are mediated by many different Cas proteins, while type II, V, and VI are mainly mediated by the proteins Cas9, Cas12, and Cas13 respectively (1).

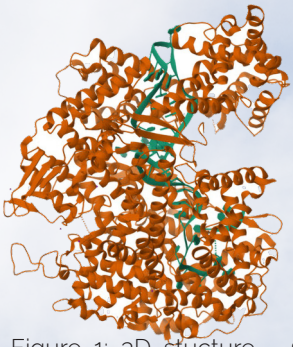

Figure 1: 3D stucture of Cas13

Cas13 has different properties compared to Cas9 and 12, and therefore different applications. Unlike DNA, Cas13 is a protein that targets ssRNA and this allows for non-permanent gene mutations. It can be used to target and degrade mRNA, reducing or silencing the expression of genes. Broadly speaking, Cas13 is used for RNA technologies like RNA interference, RNA detection, and RNA editing in all kinds of organisms. Cas13 has been used in protecting plants from viruses, a potential tool to tackle mitochondrial DNA disorders, and in the detection of SARS-CoV-2 (2,3).

To determine whether SARS-CoV-2 is present, the collateral cleavage activity of Cas13 is measured with the help of a specific gRNA, and the cleavage activity is measured with fluorescence techniques. This method can be advantageous over PCR, since it is cheaper, faster, more specific, and more sensitive. Cas13 can directly target RNA, meaning no reverse transcriptase is needed (4).

Another interesting application I came across is antimicrobials combined with CRISPR-Cas13 that can kill antibiotic resistant bacteria. Scientists encapsulated specifically designed Cas13 into bacteriophage capsids and introduced them to the bacteria. The antimicrobials were able to kill the bacteria drastically, showing that Cas13 is not only a tool for detecting bacteria, but also for killing antibiotic resistant bacteria and killing of a select group of bacteria within a bacteria population (5).

So far, Cas13 has been widely used in various research fields, and in the future, this will only expand. More and more applications keep being developed for all CRISPR Cas types, including Cas13. We don't know yet what the boundaries are, but the sky is the limit.

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MSG REVOLUTION

IN THE FIELD

Image sources: deviantart.com, flickr.com, rawpixel.com

No matter what you do, home cooking does not taste nearly as good as fast food. There may be many reasons as to why this is the case, but many sources agree that a substance known as MSG plays a big role in this. Monosiodium glutamate, commonly referred to as MSG, is an additive that you might not have heard about, but most likely have consumed. It is in almost all fast food, seasoning blends, chips and snacks, condiments, frozen meals, and many more. MSG by itself does not have a specific taste, but rather interferes with your perception of taste by giving you a satisfactory feel in your mouth without letting you realize you have consumed an additive, but surely makes you draw back to that food over and over again.

How does MSG work?

MSG is a white, odorless, crystalline flavor enhancer derived from L-glutamic acid through fermentation of plant-based ingredients such as sugar cane, beets, and corn. Due to its associated umami flavor, it has been found to induce saliva secretion and thus make you more drawn to the food it is found in.

Is MSG safe?

MSG has been around for more than a century and it is particularly popular in Asian cuisine, along with fast food. Although its association with fast food may make its reputation questionable, your body cannot tell the difference between naturally occurring glutamic acid found in foods such as meat, poultry and eggs, and that found in MSG.

In fact, usage of MSG might be a big step towards reducing your sodium intake. It contains only one third of the sodium of regular table salt, without a trade-off of taste. This fact may be taken advantage of by replacing salt in butters by a proportion of MSG in the industrial scale, or by adding MSG to your homemade meals to reduce your salt intake whilst keeping the umami flavor.

Is MSG addictive?

MSG by itself has not been recorded to be addictive, yet you might need to keep in mind that it is an excitatory neurotransmitter. Just like any other excitatory neurotransmitter, it might make you overly dependent on the food it is found in, and might trigger a binge eating response. Many foods that contain MSG are known to cause low satiety and an even greater desire to eat, so it might be a good idea to be aware of its presence, rather than be afraid of it. Even better, it has been proposed that the addition of MSG to homemade and relatively healthier foods might result in an increased appetite for them, making a good use of this additive while helping those looking to reduce their sodium intake.

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A ZOMBIE APOCALYPSE: IS IT ACTUALLY AN IMPOSSIBILITY?

FORESHADOWING

Whether you're playing "Plants vs. Zombies", or watching the "Last of Us" or the "Walking Dead", or listening to Thriller by Michael Jackson, our obsession with zombie apocalypses is on the rise; but is this microgenre really just fiction? In Haitain folklore, a zombie was said to depict a dead individual who was reanimated through necromancy, a practice of magic to communicate with the dead, by a bokor (a sorcerer or witch). Three centuries later, our idea of a zombie consists of a debilitated, gruesome, and raging monster with the sole purpose of biting and making unpleasant noises. We can't blame our entertainment industries for this portrayal, let alone those of zombie apocalypses, as our demand is what causes such renditions to flourish. While these fictitious productions may never come to existence, those of a more subtle nature, antithetic to all the rotting, screaming, and fighting, is indeed not an impossibility.

The characteristics attributed to zombies, such as basic motor function, primitive instincts, and violence are often underlined by damages to brain chemistry. *Toxoplamosa gondii* is a parasitic protozoan that infects the brains of warm-blooded animals, most commonly rodents. An infected rodent exhibits decreased predator aversion, meaning it is more susceptible to being preyed on by felids (cats), the only mammal in which this parasite can sexually reproduce. It causes epigenetic changes in genes in specific locations within the rodent's brain, and once eaten by a cat, the parasite infects the epithelial cells of its small intestine. In humans, this toxin appears to increase the risk of psychiatric disorders such as schizophrenia and bipolar disorder, and shockingly half the world's human population is actually infected. While this parasite is unlike that of a 'zombie virus', all it takes is a mutated version that can do to us what it does to rodents, in which case half the world suddenly loses all instinct for self-preservation or rational thought. Of course, if left to occur naturally, this could take years. However, with the rising technological advancements, it would be unwise to omit the potential of such parasites being weaponized, whether intentionally or not.

In the mid 20th century, a Haitian man, Clairvious Narcisse, proclaimed that he was turned into a zombie by Vodou and forced to work as a slave. The ongoing hypothesis is that he was given tetrodoxin, the paralysing puffer fish venom, and Datura, a strong deliriant. While these neurotoxins can induce zombie-like behaviours, it is very unlikely to induce an apocalypse, as the toxins would have to be regularly administered to each person individually as they're not contagious.

However, diseases like rabies, also known as rage diseases, are far more likely to create an apocalyptic outbreak. Rabies is a viral disease that causes encephalitis, the inflammation of the brain, in humans and other mammals. According to the World Health Organisation, "human-to-human transmission through bites or saliva is theoretically possible but never been confirmed". Even if this is not possible, given that bat-mediated rabies is an emerging public health threat, particularly in Australia and western Europe, if enough bats had rabies, they could render an apocalyptic reality.

Fungi: you might know them as the green species that plagues the corners of your house, or as a food delicacy, but have you ever thought of it as a mastermind? *Ophiocordyceps* is a genus of fungi with more than 200 species that target and infect various insects, particularly *Carpenter* ants. Infected ants exhibit random and convulsive movements, and climb up a plant to 25 cm where they bite the leaf vein. Once bitten, their mandible muscles break down, leading to lockjaw, and fixing the ant victim in place while its legs twitch. After some time, the fungus kills the ant, and resumes growing through the ant's head, eventually sprouting out of it to release its spores and spawning the next generation of fungus. While this prospect may be terrifying, the likelihood of this ever happening to humans is slim given our complex brain chemistry. Our body temperature (37° Celsius) also discourages fungal reproduction. However, with climate change fungal strains can either adapt or die, and this will only propagate the threat of fungi to humans. For example, *Candida auris* is a fungus that is hypothesised to be the first fungus to acclimatise to increasing global temperatures, and if true, forewarns us of far worse things to come, alongside the melting of the Siberian permafrost.

We may never become the zombies we see in fiction but the combination of nature that predates us, the climate crisis, and the accessibility and advancement of technology, makes an apocalyptic outbreak only more imminent, whether it turns us into traditional zombies or not.

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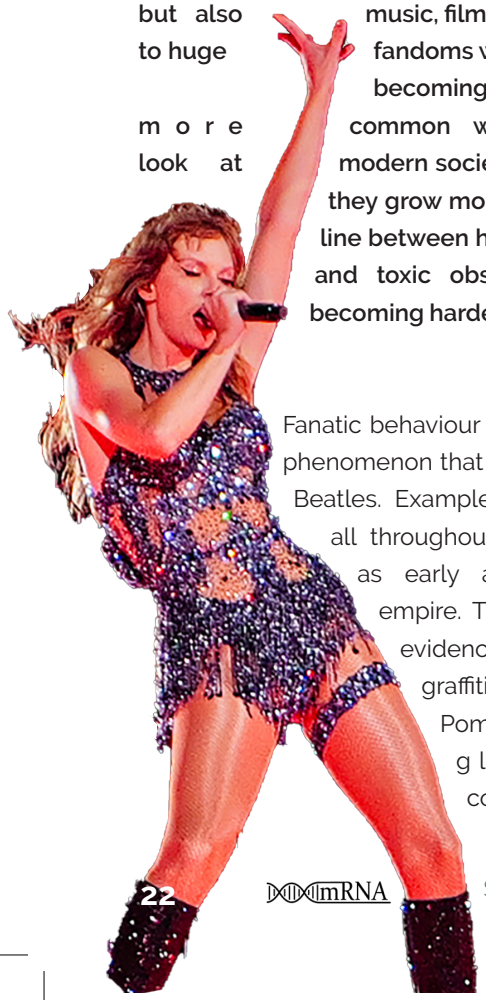
Image sources: Pinterest.com, Openclipart.com

IS BEING A HARDCORE FAN OF ANYTHING NORMAL?

PSYCHOLOGY

You step into a football stadium mid-match. The current score is 1-1, the home team needs one goal to win and gain the crucial points needed to lift the league trophy. All of a sudden, a club legend gains the ball dodging two opposing team defenders and scores a beautiful top left corner goal leading the team to a victory. A unanimous roar erupts from the crowd, people of all ages, ethnicities, and backgrounds losing their voices screaming chants. In this moment the people are observers united by a common interest; they are fans thriving and obsessing over the talent of other individuals. What I've just described is the passion of a fanbase. All kinds of sports but also music, film, and tv give rise to huge fandoms which are slowly becoming more and more common when taking a look at modern society. However, as they grow more common, the line between healthy devotion and toxic obsession is also becoming harder to distinguish.



Fanatic behaviour is not a modern phenomenon that started with the Beatles. Examples can be seen all throughout history dating as early as the Roman empire. There is physical evidence of ancient graffiti on the walls of Pompeii, depicting gladiatorial combat, thought to have been drawn by a devoted fan. The meaning of fanaticism, like most words, has shifted and adapted over time, from being viewed as pejorative due to links with political extremism during the French Revolution, to its current meaning which originates from the scenes in London following the publication of the death of the fictional detective "Sherlock Holmes" in 1893. It has been rumoured that angry readers wore a black armband as a sign of mourning, while 20,000 people unsubscribed from the magazine responsible for the publication of the short stories.

In truth, fandoms have become a new form of normality. Such interests are even being likened to a hobby, which would suggest a recreational aspect separate from work. Creativity has long been an outlet granting entertainment, yet what makes fandoms a subject of interest is the fact that the leisure is being provided through the perspective of a bystander. The intense affiliation with the subject of idolization is driven through the creativity of others rather than one's own creativity, making it distinctively different from having a hobby.

Self-identification and a sense of belonging are two of the most attractive features of being part of a fan community,

Sophie Demicoli

It also provides a feeling of escapism, allowing individuals to live vicariously through the lives of the people they idolise. Fandoms are what could be considered the closest modern alternative to a tribe. Forming part of a community fills the basic human need to belong within a group, which for fans, happens through shared interest. A 2023 Wisconsin survey showed that joining a community is extremely beneficial to psychological health, emotional wellbeing, and stress management, leading individuals within a community to be less likely to report depression and anxiety.

The problem arises when what was once a simple form of leisure becomes intense involvement. Whenever there is worship there are extremes, and in our life of modernity, where social interactions on every corner of the planet are documented, viewed obsession and extremism is becoming more normalised. Just earlier this year one of the most infamous fan groups, that being Taylor Swift fans, crowded the street outside a restaurant in which she was attending a wedding rehearsal. The "Swifties" turned wedding crashers were slammed repeatedly, most sane people agreeing that their actions were out of line, as the hope to catch a glimpse of the artist eventually led to the street swarmed with people being closed off.

Yet a road being closed off is common practice when say, the Pope is coming to town. Just last summer, a visit from the Pope attracted 1.5 million visitors in Lisbon inorder to celebrate "World Youth Day", completely changing the transportational infrastructure of the city, with certain areas being cut from circulation. The same can be said for certain events attended by members of royal family members in countries like the United Kingdom.

The question remains, how far can we go when taking a step back and analysing human behaviour? And what can we truly deem to be out of the norm?

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CILANTRO OR SOAP?
GENETICS

I'll ask you a simple question: what does cilantro taste like? Personally, I have not a single clue. And I'm not alone, as a significant percentage of the human population has been affected by the same issue. Instead of tasting the apparent fresh and vibrant flavour, the cilantro curse puts a soapy taste in our mouths. This has led to a polarising opinion across the entire world, with cilantro being popular in countries like Central America and India, while East Asians try to avoid it. Where did this phenomenon come from and is there a way to rid us of the curse?

Interestingly, there are records of people complaining about cilantro way back in the 1500s and 1600s with records dictating "very stinking herbe" with leaves of "venemous quality". Vilmorin-Andrieux described it quite succinctly as well in his book from 1976: "ome writers say the leaves are used for seasoning, but this statement seems odd, as all the green parts of the plant exhale a very strong odour of the wood-bug".

But there is actually a very simple answer as to why it tastes so "unconventional" for some. It comes down to a genetic predisposition related to your olfactory receptor genes.Your olfactory receptors play a critical role in recognising thousands of odorant molecules, and it's well known your sense of smell plays a big part in how you perceive flavours. The Single-Nucleotide Polymorphism (SNP) responsible would increase the binding of olfactory receptors(OR6A2) to aldehyde compounds.

Cilantro contains such aldehyde compounds, like E-2-decenal and E-2-dodecenal, which are responsible for its distinct aroma. Aldehydes are also present in higher concentrations in soaps and lotions which leads to the association of a "soapy" smell and taste. Given the heightened sensitivity due to the SNP, even a low concentration of aldehydes in cilantro leads to the soapy taste.

The genetic variations also explain the difference in geographical perception of cilantro. According to a study done by 23andMe, a low heritability was found for the SNP, and of the Southern and Northern European respondents, about 13% said cilantro tastes like soap. For the East and South Asian respondents, the numbers vary between 17% and 21%.

Now, studies suggest increasing your exposure to cilantro could lead to a change in perception over time. A rigid cilantro training regiment dedicated to lowering your sensitivity has the possibility to someday diminish the overall soapy taste overall. Or you could just choose to live with the curse, and pluck the damned bastards out of your pho every time.

But the question remains... Why do you know what soap tastes like?

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Image sources:
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'TIS THE SEASON
DUTCH HOLIDAY TRADITIONS

Image sources: freepik.com

As many of you are aware, moving to a different country can feel like entering an alternate reality. This experience is particularly jarring when settling down in the Netherlands. Although your surroundings look similar, you could easily be blindsided by a drunk orange mob, bellowing unintelligibly at the top of their lungs. Fear not, however: one can learn to enjoy the idiosyncrasies of the Dutch.

We're rapidly approaching spring: the beautiful time of year with free days sprinkled throughout. The first will occur on what the Dutch eloquently call "second Easter day": a Monday often spent with family, though students may use it as an opportunity to become one with the couch. The same is true for "second Pentecost day" - the naming originality is staggering - or Whit Monday. Fortunately, supermarkets tend to still be open, so there is no need to stock up in advance.

King's Day, arguably the most interesting celebration, falls on April 27. Dutch people collectively decide to become their most chaotic selves while wearing obnoxiously orange outfits to celebrate the birthday of King Willem-Alexander. This day ranges from wholesome (flea markets) to unhinged (canal day drinking), but it is undeniably a peak example of the word *gezellig*.

On May 4 and 5, we remember those killed during wars or their aftermath, and we celebrate our liberation from Nazi-Germany in 1945, respectively. On Remembrance Day, the country is silent from 20:00 to 20:02 o'clock to commemorate the fallen. On May 5, there are Liberation Festivals organised throughout the Netherlands, which are often free.

A small peculiarity of Dutch holidays can be found on the third Tuesday of September: Prinsjesdag, literally translating to Day of the Little Prince. The King travels in a gold or glass carriage to present governmental policy. Many officials attend the ceremony, and it is tradition for the women to wear outlandish hats. The general public most commonly engages with Prinsjesdag by reading articles about the ugliest headgear.

This list would not be complete without mention of Sinterklaas, a legendary old man who travels from Spain every year to bring gifts to Dutch children. These presents go through the chimney into childrens' shoes. The past few years, Sinterklaas has been embroiled in controversy due to the tradition of Black Pete and associated blackface. Fortunately, the majority of Dutch people adjusted the celebrations accordingly, so my personal favourite dobbelen (dividing gifts by an elaborate game of dice-throwing) can still be enjoyed.

Any Dutchie would be happy to ramble about their personal customs. As these holidays have existed for centuries and continue to evolve, you are not just allowed but invited to put your own spin on them - after all, we're all part of the Netherlands now. As the King's Song (2013) states: "The W of Willem[-Alexander] is the W of We / All of Orange stands side by side."

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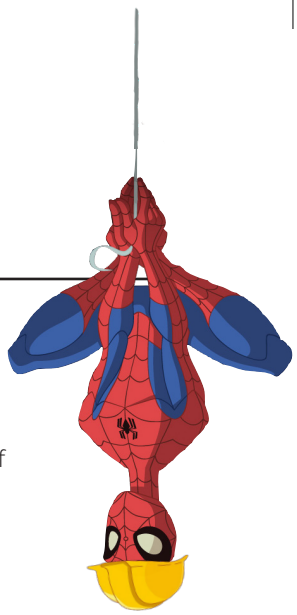
WHAT IF... SPIDER-MAN WAS A CONSTRUCTION WORKER?

SYNTHETIC SPIDER SILK



In the myriad of parallel universes, either our own or from the "spider-verse"... What if there was a Spider-Man who wore a yellow safety hat and used his spiderwebs to help out in construction? He could use his spiderwebs to create temporary support structures or to secure materials in place, and his "spider strength" could lift the same weight it would take a dozen men to carry. As impressive as this is for a single fictional teenager (and technically illegal under child labour laws), what if we could harness some of those same powers and apply them in real life? Spider silk is known to be one of the most powerful fibres in nature, stronger than steel and tougher than kevlar, but why is it so powerful and how could we apply it to today's industries?

Spider silk's secret to unparalleled strength lies in its molecular composition. Comprised of proteins called spidroins (spider + fibroin), spider-silk contains repetitive sequences of poly-alanine blocks and glycine-rich regions. As their liquid form passes through specialised glands in the spider called spinnerets, they undergo rapid solidification in which the spidroins get aligned into beta sheets. The alanine-rich regions link together to form crystalline areas giving spider silk its strength, while the glycine-rich regions form amorphous areas contributing to its elasticity.

However, the spidroin protein is not the sole reason why spider silk is so unique in terms of its properties. Recent research has shown using an atomic force microscope that every strand of spider silk, which is already 1000 times thinner than human hair, is composed of a thousand more nanostrands. 2500 nanofibrils are aligned in parallel, creating a more robust network single mass of silk would be able to provide.

Through using this more accurate structural model, researchers have been exploring ways to harness the potential of spider silk by developing an artificial version: to recreate and amplify the same properties in terms of strength and elasticity in a laboratory.

One lab in particular has come a long way from mimicking spider silk to improving its qualities. The lab of Fuzhong Zhang succeeded in 2018 in synthesising spider silk by implementing the silk gene into bacteria, and were then able to match the naturally occurring silk's properties. Since then, they have been focused on making the process more scalable and economical while increasing its robustness.

In 2023, they reached a breakthrough in its efficiency. By engineering cohesive protein fragments from mussel's feet into the spider-silk sequence, molecular interaction between silk fragments would be improved, and shorter silk proteins could be synthesised. A high yield is critical to render the use of synthetic silk in everyday applications, but the lab achieved an output increase of eightfold. Reaching 8 grams of fibre from 1 litre of bacterial culture, they produced enough fabric to test for use in real products.

Another researcher at the University of Trento is feeding spiders carbon nanotubes and graphene flakes in the hopes that it creates stronger spider silk, and it WORKS! Nicola Pugno has achieved a toughness modulus of 2.1 GPa, Young's modulus of up to 47.8 GPa, and a fracture strength of up to 5.4 GPa, surpassing even synthetic high-performance fibres and the current toughest knotted fibres. Although there hasn't been a way to efficiently harvest this spider's silk, I'd say the potential of modifying silk is as big as our imagination.

The applications of synthetic spider silk in the modern world extend to a lot of different industries, most notably fashion and construction. Considering the fashion industry produces an estimated 100 billion garments and 92 million tons of waste each year, the biodegradability of spider silk is a big factor in replacing some of the more common fabrics such as nylon. On the other hand, spider silk could prove to be useful in the medical field as well. With the ability to suppress inflammation and promote cell adhesion, silk could be used as suture material and be applied to disease detecting biosensors or drug delivery systems.

As researchers continue to unlock the secrets of spider silk and improve existing production methods, someday this biomaterial will transform industries. And Spider-Man, who was already able to synthesise this using high school equipment, does what? He swings around with it...

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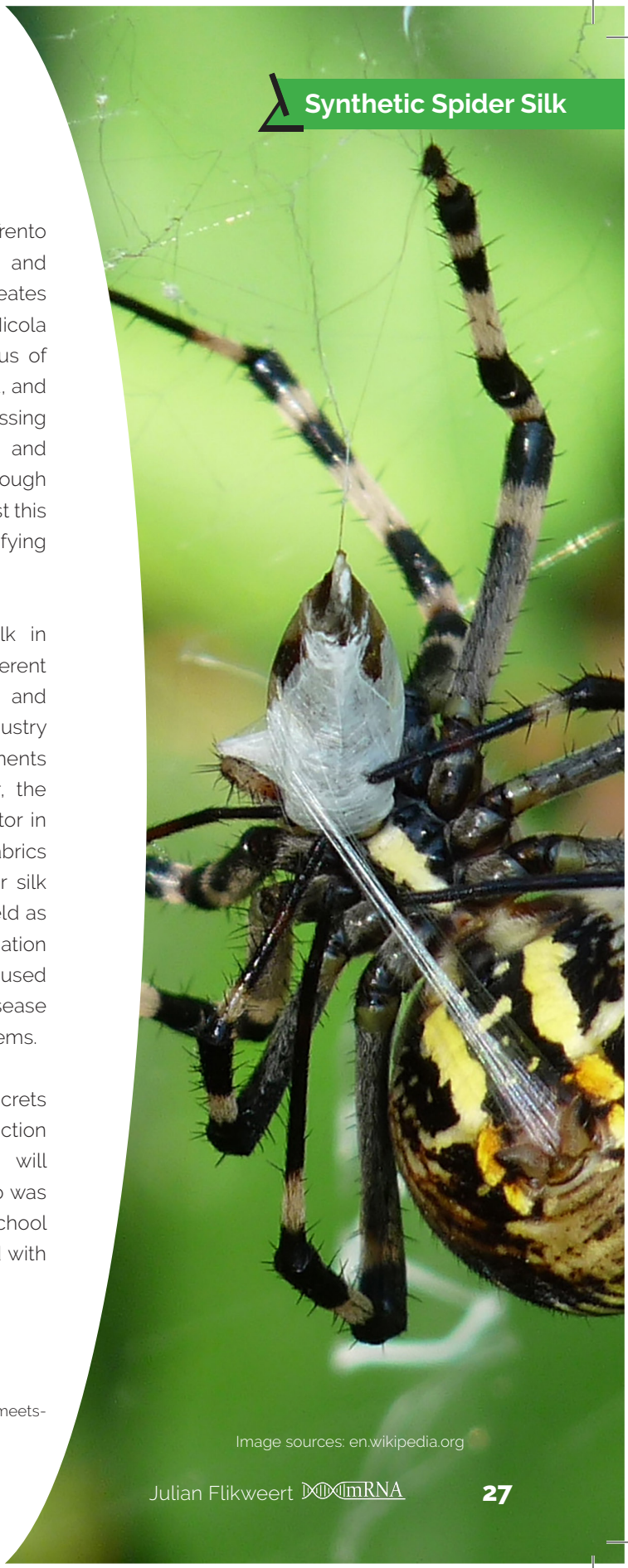

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GEOENGINEERING TO SAVE THE CLIMATE

EXCITING TECHNOLOGY

Humanity has come a long way since the stone age. Never before have we had so much power to do the greatest and most fascinating projects. Right now, we can even change the climate, meaning we perform well controlled changes that change the climate for the better to tackle climate change. Are you convinced of how cool this is? Well don't forget, with everything great in science, you should ask: we can, but should we?

Geoengineering, or climate engineering, is a term used for purposely implementing large-scale changes in our ecosystems on earth. Geoengineering includes several techniques to stop or slow down climate change: carbon dioxide removal, stratospheric aerosol injection, and ocean liming. These can be powerful tools to slow down climate change and help nature to adapt to higher CO_2 levels. Several of them will likely be used within our lifetime. Therefore it is important that we are aware of both the advantages and disadvantages of such projects.

Stratospheric aerosol injection:

The Earth's temperature is rising due to increased CO_2 levels. Stratospheric aerosol injection introduces reflective aerosols into the stratosphere with the aim of reflecting sunlight back into space. This will counteract the climbing effects of CO_2. The effects are comparable with a large volcano eruption, which has decreased the global temperature temporarily on several occasions.This method is cheap and within our technological capabilities. The effects would be temporary, a couple of years maximum, so it will have to be repeated periodically. The main concern of this technique is changed rain patterns, which will affect crop yields and could lead to famine. There are also indications that the sulfur aerosol particles can be damaging for the ozone layer.

Iron fertilization:

Phytoplankton are small autotrophic organisms that grow in iron rich parts of the ocean. They can take CO_2 out of the atmosphere and use it for assimilation. To increase the growth of phytoplankton, it is proposed to seed the oceans with iron. This process can reduce the CO2 levels significantly, and will help slow down the effects of climate change. This can lead to an increased growth of autotrophic life, but also an increased growth of harmful algae. This increased algae growth also leads to decreased oxygen levels in deep sea levels.

So far I have explained a little about two geoengineering techniques. They can help us, but we have to remain cautious. that they will be implemented within our lifetime, particularly stratospheric aerosol injection, so stay alert!

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THE GOOGLE EFFECT

PHENOMENA

Picture this: you turn on your phone to look up the answer to a simple piece of trivia. The Google search loads, you remember you've looked this up already in the past, but the second you turn off your phone again you instantly forget. This common phenomenon is what's being now dubbed the "Google effect" or "digital amnesia".

First observed in 2011, the "Google effect" was coined by Betsy Sparrow, Jenny Liu, and Daniel M. Wegner when collaborating on a four-part study testing recall abilities. The aim of the study was to discover whether the internet had become what they referred to as a "primary form of external or transactive memory", meaning no attempts are made to memorise information if it is already stored in the internet.

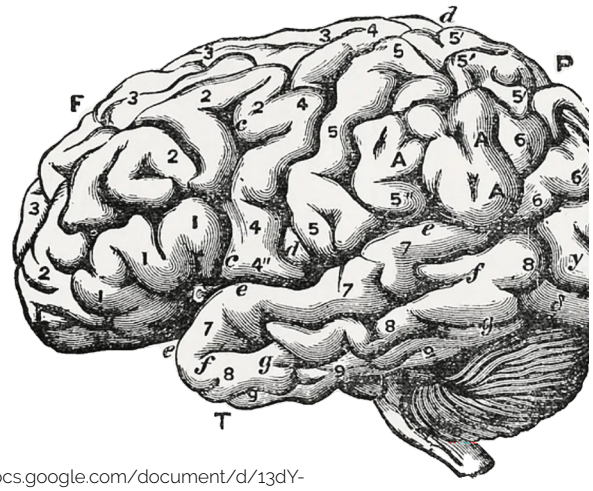
The term "transactive memory" was part of a hypothesis proposed by Wegner in '85 to describe a collective memory, usually formed between families, offices, or in this case the human brain and the internet.

The four different experiments that took place required the volunteers to memorise or answer certain trivia questions. Each experiment had different nuances in which some groups were told the information would be saved and become later accessible while others were told specifically to memorise. The experiments also tested if the location in which the information is stored is subconsciously memorised rather than the information itself.

The study supported the initial claims that human minds have adapted in light of the easily accessible and vast source of knowledge at our fingertips, and as a result become worse at retaining information immediately turning to the internet. So, though we might not know the name of that actor off the top of our head, with a phone in hand we're as close as we'll ever get to knowing it all.

Fun fact: to test recall ability after exposure to certain stimuli, the "Stroop Test" was used which is the same test rumoured to have been used during the Cold War to weed out Russian spies. The Russian word for a colour would be written in different colour. Depending on how quickly the subject could answer what the colour of the writing is in would be useful to determine whether or not they spoke Russian.

Green	Red	Blue
Purple	Red	Purple
Blue	Green	Red



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A GORDON RAMSAY APPROACH TO GEL ELECTROPHORESIS

RECIPES

In the fast-paced world of molecular gastronomy, one technique stands out as a crucial step in unravelling the mysteries of DNA and protein: gel electrophoresis. Renowned chef Gordon Ramsay, famous for his culinary expertise, has taken on the challenge of describing the intricacies of this scientific method with his signature flair. Just as he meticulously orchestrates the perfect dish, Ramsay guides us through the steps of gel electrophoresis, a technique essential for separating biomolecules in the kitchen of molecular biology.

Setting the Stage: "Right, listen up! Gel electrophoresis is like preparing the perfect risotto; it requires precision, timing, and a keen eye for details. You wouldn't want a mushy risotto, and we certainly don't want a messy gel electrophoresis result, do we *eyeroll*? Let's break it down, shall we?"

Ingredients and Preparation: "First, let's talk ingredients. In our scientific kitchen, we'll need an agarose gel – think of it as the base for our dish. We mix this with a buffer solution, creating the gel matrix. Just like salt and pepper in a recipe, this buffer provides the ideal environment for our ingredients – the DNA or proteins – to dance through the gel."

Loading the Ingredients: "Now, the fun part: loading the samples onto the gel. Treat your DNA or proteins like delicate herbs; you want them evenly spread. Use a micropipette – it's your kitchen whisk – to carefully deposit your samples into the wells. Don't be sloppy here, you two eyed cabbage; precision is key, just as it is when plating a delicate dessert."

Applying Voltage: in the heat of the kitchen: "Once your ingredients are in place, it's time to turn up the heat – apply the voltage. Think of this as turning on the stovetop. The electrical current acts like a master chef, guiding your molecules through the gel. The bigger ones move slower, just like a hefty piece of meat in a slow braise, while the smaller ones dash through like a perfectly seared scallop."

Visualisation: The Grand Reveal: "After the electrophoresis dance, it's time for the grand reveal : visualisation. Stain your gel, and suddenly, your separated bands appear, just like a dish beautifully presented on a plate. Now, take a moment and appreciate the results. Are your DNA bands well-defined, or are they as messy as an overcooked pasta dish? Oh gosh, a paperclip could do a better job than this"

Troubleshooting: Rescuing the Recipe: "If your bands are a disaster, don't throw in the towel you donkey! Gel electrophoresis, like cooking, allows room for improvement. Adjust your voltage, check your buffers, and troubleshoot like a pro. Remember, the kitchen is your laboratory, and experimentation is part of the journey."

In the hands of Gordon Ramsay, gel electrophoresis transforms from a scientific procedure into a culinary masterpiece. With precision, attention to detail, and a touch of Ramsay's … unique flair, this technique becomes as accessible as creating a Michelin-starred dish. So, roll up your sleeves, put on your chef's hat, don't have olives for eyes, and let's make gel electrophoresis a culinary adventure in the scientific kitchen!

Image source: Vecteezy.com, Pinterest.com

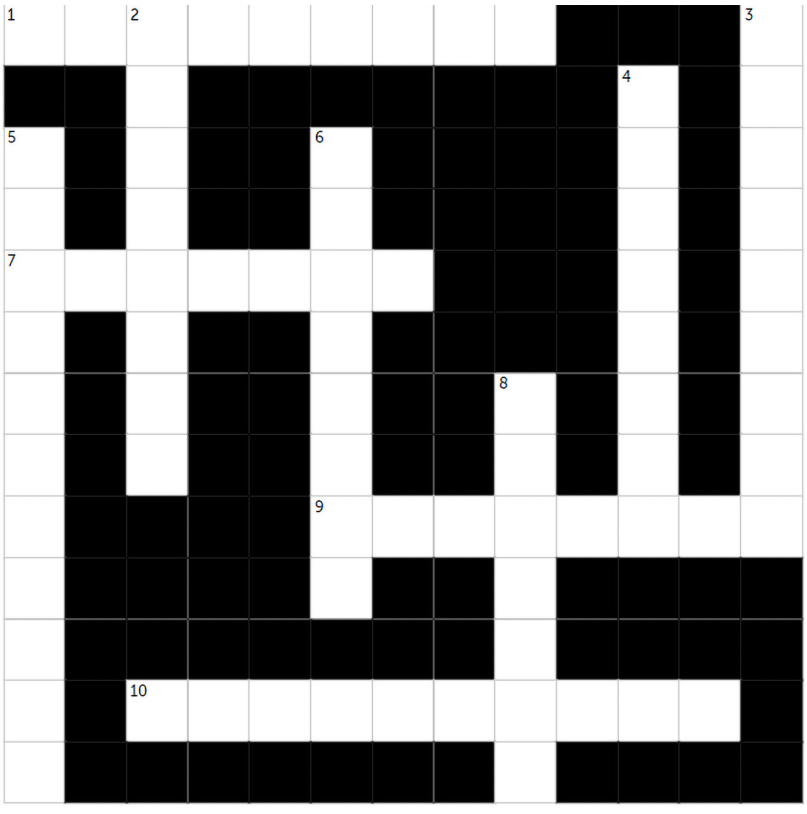
PUZZLE
ALTERNATE REALITIES

Y	T	I	L	I	B	I	S	S	O	P	U
S	G	N	G	E	O	G	R	A	P	H	Y
E	L	O	E	C	I	O	H	C	Y	Y	E
T	D	I	L	S	O	U	T	U	T	N	S
N	I	U	T	O	E	R	S	L	I	O	R
A	S	M	N	E	N	R	A	T	L	I	E
I	C	I	E	I	R	H	P	U	A	T	V
R	O	M	A	L	V	A	C	R	E	U	I
A	V	G	I	N	I	E	T	E	R	L	T
V	E	A	T	I	O	N	R	U	T	O	L
Y	R	O	T	S	I	H	E	S	R	V	U
N	Y	Y	S	A	T	N	A	F	E	E	M

Choice
culture
Discovery
Evolution
Fantasy
Geography
History
Literature
Multiverse
Past
Possibility
Present
Reality
Technology
Timeline
Universe
Variant

Across:
1. Period of time after prehistory
7. Set of customs common to a group of people
9. Inventor of the special theory of relativity
10. Quantum mechanical interpretation of parallel universes

Down:
2. Chronical sequence of historical events
3. The gradual changes in time and space
4. Other name for Einstein-Rosen bridge
5. The study of ancient human history through the examination of artefacts
6. In the multiverse, … parallel universes exist together
8. All human events of humanity together



MICROCHIP