KINESIS

Issue 14

TABLE OF

CONTENTS

LETTER FROM THE EDITOR

The warmest of introductions to Kinesis Magazine's 14th Issue! A media ballad of what makes student-led science communication what it is today. The artworks that adorn these articles combine the tenacity of our talented authors, editors, and artists. It was a delight to work with the team this past term and, as always, it is entirely rewarding to see the successful outcome of our dedication.

This year, we started with a slight difference. Launching the year off with a special issue that married the work of two dedicated committees. The former which took our publication back to the SPA stage with a duo of shortlistings. The latter delivered our first regional win in the publications' history. Not content with the gourmet masterclass we prepared last term, we have come together to produce our art piece for this term.

Our issue aims to infatuate you, the reader, with a plethora of different topics. Whether you have ever wished to understand how the so-called "love hormone" works or, why the world can seem a little darker if you are struggling. Our desire to stand up always takes precedence in our daily lives, whether it is the pressure placed on us, the environment or scientific research to deliver when others are not prepared to do so.

It is our articles and artworks that act as a voice piece. Whether it is a way for us to get our point across or a stepping stone for those pursuing a career in journalism or research. I have been asked multiple times across the course of the past term, why should you, the reader, be inspired to write? The simple answer is that you inspire, provoke thought and challenge previously held views. The power of the knowledge you hold ensures our students, across our storied university, remain engaged in the joy of scientific curiosity and discovery.

To the awesome committee I have the privilege of being a part of, thank you, from the bottom of my heart. And to all of our contributors on this issue, all of this would not be possible without you. It is my privilege to work with all of you.

Happy reading!

Attay Shaw

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SPECIAL THANKS TO SUZIE MISHIMA FOR THE COVER ART

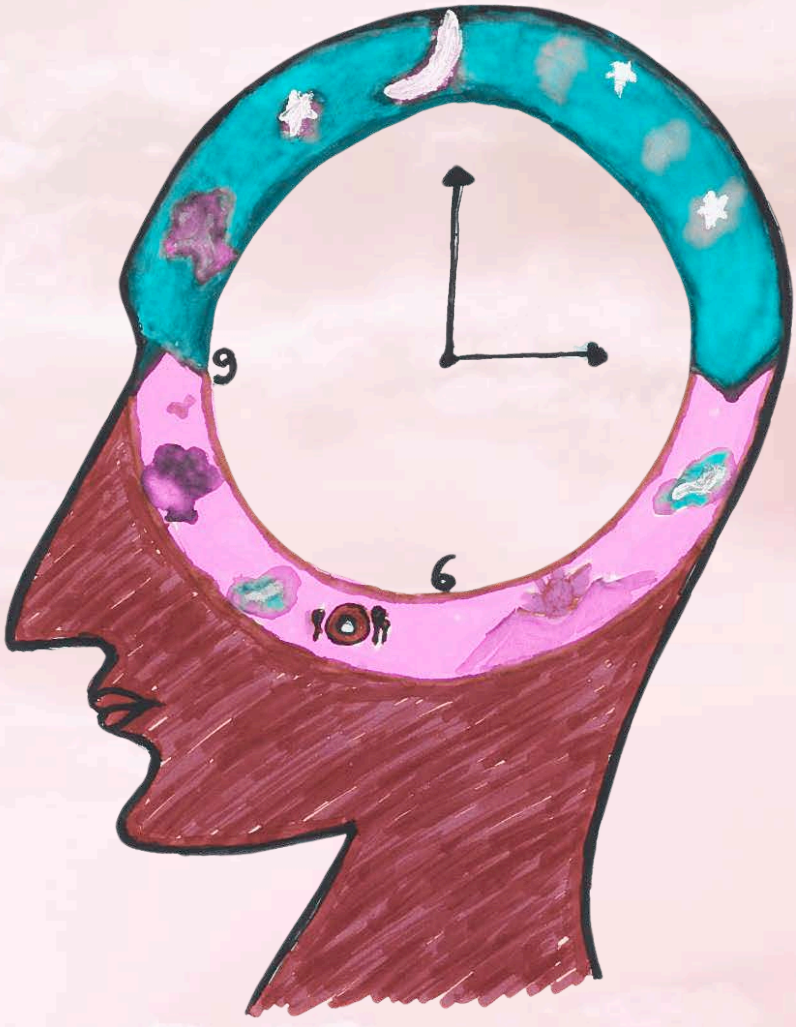
what's your Chronotype sign?

Patrick Toh
Artist: Subhasri Mazumdar

The effects of our *circadian rhythm* on our health

Introduction

Have you ever wondered why some people prefer to sleep early, and some prefer to stay up in the late hours before heading to bed? Scientists have an answer for this, and it is called **chronotypes**. In simple terms, it can be described as similar to an astrology sign or zodiac sign, but the scientific definition is an individual's preference for sleeping and wakefulness, highly dependent on our circadian rhythm, in layman's terms is the natural inclination of your body to sleep at a certain time according to the Sleep Foundation.



However, **our social life and work/school schedule can cause a severe misalignment in our sleep schedule** and internal biological clock, hitting those with the evening chronotype the hardest. This

phenomenon is called **social jetlag,** and it can lead to many mental health issues and, in the long term, sleep disorders.

Chronotype: Biological Basis and Classification

Our chronotype is largely determined by our circadian rhythm, controlled by oscillators found on the suprachiasmatic nucleus (SCN) in the hypothalamus. The circadian rhythm is our body's 24-hour internal clock, regulated by our genes and external factors like light and dark. It can influence many parts of our body, like sleep, activity, and appetite.

Chronotypes are classified into roughly three types: **Morning (lark), evening (owl), and intermediate/neither chronotypes.** Morning chronotypes prefer to wake up and sleep early and do activities early in the morning, while evening types wake up and sleep late and perform activities late in the evening/night. Finally, most of the population falls between the middle of the two extremes. Interestingly, unlike the zodiac or astrology signs, **we do not have a fixed chronotype.** When we are adolescents, we initially lean more towards the evening chronotype, but once we enter our early twenties, we become more morning-orientated the older we get.

Impact of chronotypes on mood disorders and mental health

Numerous chronotype studies have found a link between evening chronotype and mood dysregulation. Because of work/school schedules, individuals would have to wake up early and return home extremely late. **Those with evening chronotypes will especially struggle with the misalignment of their circadian rhythm.** Night shift workers will also experience extreme misalignment, particularly affecting those with morning chronotypes. This misalignment can lead to individuals adjusting their sleep schedule during the weekends compared to weekdays. This phenomenon was introduced by Wittman et al. who term it social jetlag, and it can have a profound effect on individuals if this misalignment occurs in the long term. A study looking at undergraduates found that those with evening chrono-types had a significant difference in rise time and total nocturnal sleep between weekends and school days.

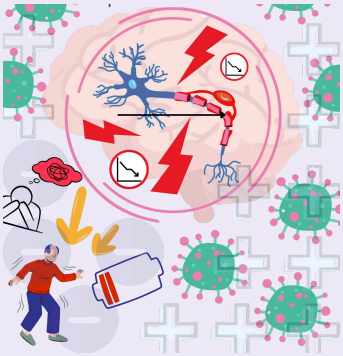
Consequently, they correlated **higher rates of sleep-related problems in evening types** compared to the morning types, reporting more day-time sleepiness due to the misalignment between their biological circadian rhythm and school schedule. Additional factors, such as adolescence, social demands, relaxed parental restrictions, and increased independence, can contribute to the misalignment. Further studies on university students have also found that **this lack of synchronisation can worsen their academic achievement and complicate their relationships with family** members and school friends.

Furthermore, **chronotypes have also been associated with multiple mental disorders.** Those with evening chronotypes were more likely diagnosed with bipolar disorder and associated with more frequent bipolar episode recurrences. However, the literature about this connection is mixed; two recent studies did not find any risk for bipolar. Researchers have also investigated the relationship between ADHD, anxiety, and psychotic disorders with chronotypes.

Conclusion

We all know sleep is essential to our health. But research into chronotypes — our preference for sleeping and waking up — can give insights into our biological circadian rhythm and associations with mental health disorders. In turn, clinicians can help combat the growing rise in mood disorders in individuals due to the pressure of social and work demands.

IMMUNE CELLS REVOLUTIONISING PARKINSON'S TREATMENT



A POTENTIAL TREATMENT WITH STEM CELL THERAPY

WRITER: *NAOMI CHOI* ARTIST: *AHMAD BILAL*

Think dopamine just brings happiness? In fact, this brain chemical does much more. Dopamine is a crucial neurotransmitter in the brain, and there are specific nerve cells that produce dopamine — dopaminergic neurones. Although dopaminergic neurones make up less than 1% of all brain neurones, they play a vital role in brain function, controlling aspects such as motivation, habit learning, and motor control. However, dopaminergic neurones are especially vulnerable to degeneration since they require a lot of energy to send nerve signals along their extensive branching networks, and this degeneration is thought to play a role in the development of Parkinson's disease, an incurable neurodegenerative disorder characterised by the progressive loss of dopaminergic neurones. Parkinson's is the fastest-growing neurological condition, affecting around 10 million individuals worldwide and estimated to double by 2050.

Current treatments for Parkinson's focus on managing and minimising symptoms, but researchers are exploring approaches to slow, stop, or even reverse the disease's progression. One potential solution is via stem cell therapy, where stem-cell-derived dopaminergic neurones are transplanted into the brains of patients as a treatment for the disorder.

Regulatory T cells: The Body's Immune Peacekeepers

In order for this treatment to be effective, dopaminergic neurones must survive the implantation process. However, research conducted by Park and his colleagues, a research team at Harvard Medical School, has shown that over 90% of these neurones die within two weeks of implantation in animal trials, mostly due to inflammatory responses triggered by the surgery itself. More importantly, this inflammatory cascade also makes the grafted foreign cells more visible to the immune system, leading to rejection. Thus, for stem-cell therapy to work, the main challenge for scientists is finding a way to protect and shield these dopaminergic neurones from the body's immune defences.

To tackle this problem, researchers have turned to regulatory T cells, or Tregs — a unique and specialised subpopulation of helper T-cells known for their role in maintaining immune equilibrium. These immune cells help prevent autoimmune attacks by suppressing immune responses, constraining immune activation, and promoting tissue repair. It is also shown that when Tregs are co-transplanted with stem-cell-derived dopaminergic neurones, Tregs significantly enhance neurone survival.

To make things simpler, let us compare the traditional implantation method with the co-transplantation method. In the traditional method, where only stem-cell-derived dopaminergic neurones are implanted, the process of injecting the neurones into the body causes a local immune response. Immune cells like myeloid and natural killer (NK) cells flood the transplant site, secreting proinflammatory molecules such as tumour necrosis factors (TNFs), interleukin-1 (IL-1), and interferon gamma (IFN-γ), which can kill neurones.

This inflammatory environment also induces the spread of progenitor cells — immature implanted cells that have not fully differentiated yet. This proliferation is undesirable, since progenitor cells could unpredictably differentiate into various types of cells including tumour cells, leading to more inflammatory response and disrupting the implantation process. However, if Tregs are implemented, the outcome is far more promising, as they have successfully reduced inflammation and proliferation of progenitor cells.

Why the Environment Matters: Oxygen and Nutrient Challenges

However, immune rejection is not the only challenge, since dopaminergic neurones face environmental stress as well. These neurones are typically produced and cultured in an environment with an oxygen concentration of ~21%, whereas the oxygen level inside brain tissue is only around 1-5%. This steep drop in oxygen availability, along with the sudden reduction of nutrients, causes cellular stress, triggering inflammation and rapid cell death. In fact, a study by Park et al. has shown that 90% of transplanted neurones are lost even with minimal immune rejection; thus, poor cell survival remains a major obstacle.

One intuitive approach might be to simply transplant more cells to account for the loss. However, increasing cell numbers leads to greater competition for the already limited resources, ultimately worsening the problem rather than resolving it.

This is why regulatory T cells play a dual role here; not only do they reduce immune response, but they also create a more hospitable microenvironment, helping the transplanted neurones withstand the harsh conditions.

Unlike conventional anti-inflammatory drugs, Tregs adapt to the changing environment caused by inflammatory molecules post-surgery, allowing Tregs to utilise various mechanisms and making them especially effective in protecting the implanted cells. Another additional benefit of Tregs is their ability to act locally and work precisely where they are needed, helping to prevent generalised immuno-suppression occurring in other parts of the body. Although co-transplanting Tregs would make the process more complex, only a small number of Tregs are needed since it is location-specific and highly targeted, making this technique more efficient.

The Future of Treg–Enhanced Stem–Cell Therapy

Treg-enhanced stem cell therapy is promising as a potential treatment for Parkinson's due to Tregs' anti-inflammatory, adaptive, and highly targeted nature. This pioneering discovery by Park et al. is undoubtedly a breakthrough for Parkinson's, but it has also opened up possibilities to treating other neurodegenerative disorders.

While Treg-enhanced stem cell therapy is still in experimental stages, its utilisation could be transformative in improving the viability of stem-cell therapies. As science continues to unlock the potential of Tregs, we move closer to realising more regenerative therapies that could one day profoundly impact and save the lives of millions.

COFFEE

Is actually good for you

ALTAY SHAW

ARTIST: AHMAD BILAL

If you have ever been a student, someone has invariably told you that coffee is bad for you. Whether it is the strong smell it leaves on your breath or the effect it could have on your heart, negatives are drawn with the consumption of coffee. Yet, in recent years, the messaging has been mixed, with more recent studies able to track the consumption patterns of thousands. **So, is there a benefit for you?**

Coffee is known for containing caffeine, a well-recognised central nervous system stimulant that is generally found in coffee beans. It provides the bitter taste that we have grown accustomed to within caffeinated drinks, whose evolutionary purpose served as a pesticide to prevent insects and mammals from consuming the flowers. In modern diets, we can find caffeine in a variety of beverages, such as energy drinks and sweet teas.

The irritability that comes with coffee is well understood. The typical amount of caffeine in a cup of coffee will be absorbed by the circulatory system within 45 minutes. From this point, it crosses the

blood-brain barrier and reaches the brain. Caffeine can then bind to adenosine receptors, disabling them. By competitively binding to the receptors, adenosine cannot bond with its own receptors, preventing reduced nerve fibre activity and increased fatigue as the day progresses. **Caffeine allows us to stave off the sleepiness that would otherwise occur, allowing us to stay energetic throughout the day.**

It not only helps those trying to get through a long day at the office or a long day of lectures. Being able to stay awake and focused on the task at hand ensures people remain sharp, especially for those of us on placements. In conjunction, research would also suggest that those who have an increased caffeine intake are less likely to score highly on scoring surveys, resulting in those being **less likely to suffer from serious bouts of depression.**

The benefits are not solely seen in terms of mental health either. Studies since the beginning of the century have suggested that individuals who consume a morning cup of coffee are **less at risk of developing heart failure or atrial fibrillation**. Most of the studies emphasise a **limit of around 3 cups of coffee consumed in the morning**, with limited benefits in increased consumption. Past this point, some have speculated that caffeine is not the sole element at play. Whilst effects have been seen to be beneficial at lower doses, **increased caffeine consumption has been correlated with increased amounts of LDL cholesterol**, with the BMJ noting a potential public health concern if rates continue to rise.

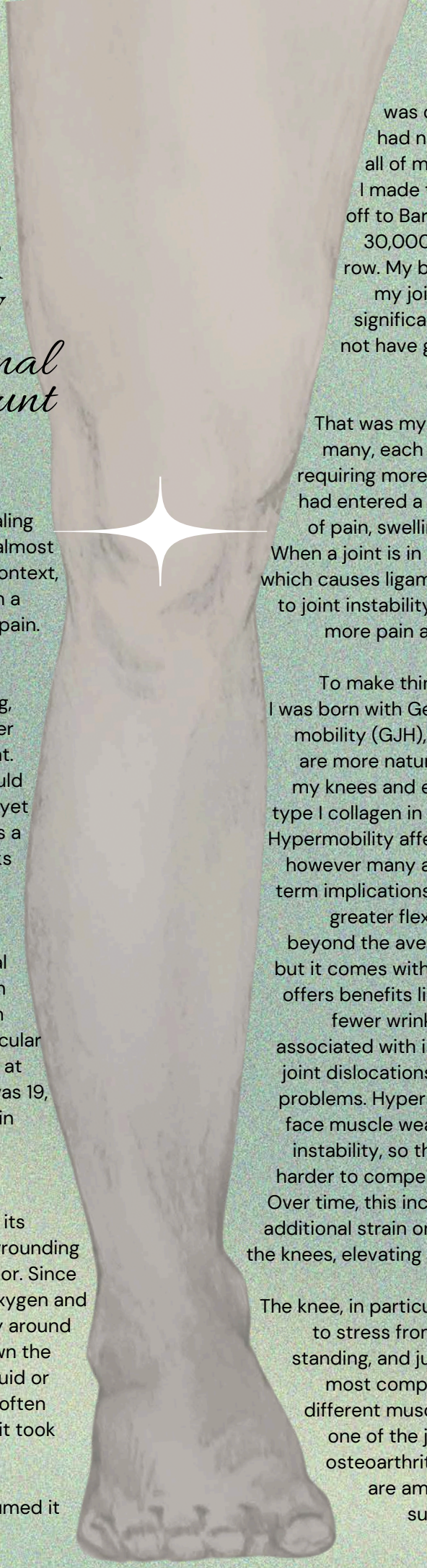
It should be noted that there are some caveats. **Everybody is genetically different in some way,** resulting in the absorption of caffeine and its effects on the body being different. Some people may be at a greater risk of anxiety when consuming increased amounts of caffeinated coffee. This has been observed in both observational and patient response studies. Limitations in methodology mean we are unable to organise larger-scale randomised controlled trials to review the true impact on an individual, and a large amount of trust is placed on trial participants when responding to questionnaires. Additionally, though caffeine may be consumed in the early stages of pregnancy, it is recommended that lower doses be taken. Increased caffeine intake in the later stages of pregnancy can result in stunted foetal growth and weight gain.

Thus, is coffee truly good for you? Like any reasonable healthcare worker would say, it depends entirely upon your circumstances. As long as you are comfortable with the amount you drink, it should be enough to give you the desired effect. Fuel your workday, passions, or just a Groundhog Day of lectures with coffee. Just balance it all out in a safe manner.

WHY THE KNEE IS POORLY DESIGNED FOR INJURY RECOVERY

A Personal Account

MADELEINE HJELT



I am currently on crutches, still dealing with a knee injury that happened almost two years ago. To give you some context, I was walking nearly normally within a month of the injury, with only mild pain. So, what went wrong?

Back in February 2023, I went skiing, returning with a fractured knee after a fall and a sudden twist to the joint. I walked with a painful limp and could not fully extend my leg for a week, yet I kept walking on it, assuming it was a bruise that would fade. Three weeks later I had an MRI, showing bone bruising to the lateral femoral condyleand posterior lateral tibial plateau and an impact subchondral fracture at the peripheral margin. In layman's terms, my knee had taken quite a beating, resulting in spectacular bone bruising and a small fracture at the point of impact. At the time I was 19, with no previous knee injuries and in good physical health. Seems like a simple recovery, right?

Well, bone bruising is notorious for its lengthy healing time, especially surrounding the knee, where blood supply is poor. Since healing requires a steady flow of oxygen and immune cells, the low blood supply around the knee can significantly slow down the process. When the bone bruises, fluid or blood accumulates in the marrow, often taking months to clear up. For me, it took over six months.

Four months post-injury I had assumed it was completely healed, as I had no pain and was back to all of my regular activities. So, I made the wise decision to jet off to Barcelona, where I walked 30,000 steps, three days in a row. My bone bruising flared up, my joint swelled and I was in significant pain. Maybe I should not have gone clubbing that final day.

That was my first re-aggravation of many, each time taking longer and requiring more effort to heal. My knee had entered a positive feedback loop of pain, swelling, and ligament laxity. When a joint is in pain, it causes swelling, which causes ligaments to loosen, leading to joint instability. Unstable joints cause more pain and, therefore, swelling.

To make things more complicated, I was born with Generalised Joint Hypermobility (GJH), meaning my ligaments are more naturally loose, especially in my knees and elbows, due a defect in type I collagen in my connective tissues. Hypermobility affects one in four people, however many are unaware of its long-term implications. The main symptom is greater flexibility - my joints bend beyond the average range of motion - but it comes with downsides. While GJH offers benefits like softer skin and even fewer wrinkles as we age, it is also associated with issues such as frequent joint dislocations, fatigue, and digestive problems. Hypermobile individuals also face muscle weaknesses linked to joint instability, so their muscles must work harder to compensate for weaker joints. Over time, this increased demand places additional strain on the joints, particularly the knees, elevating the risk of osteoarthritis

The knee, in particular, is highly vulnerable to stress from activities like walking, standing, and jumping. It is the body's most complex joint, relying on ten different muscles for support, and is one of the joints most affected by osteoarthritis. Knee replacements are among the most common surgeries in the U.S., with

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approximately 850,000 performed annually.

From an evolutionary perspective, the human knee had to adapt rapidly to our ancestors became bipedal around 2-2.5 million years ago (Mya). This transition, which took only about 0.5 million years, required our knees to quickly adjust to carrying greater weight on two limbs instead of four.

Adaptations like aligning the knees closer to the body's centre and increasing joint surface area for muscle attachment helped manage the increased load. Despite these changes, knee issues are very common today, likely because our ancestors - who had shorter lifespans - rarely lived long enough to experience age-related joint problems like osteoarthritis. In modern life, therefore, it is essential to adopt strategies that preserve knee joint health and delay the onset of degenerative conditions like osteoarthritis.

For people with hypermobile knees, maintaining joint stability requires even more muscle engagement from the quadriceps, hamstrings, and calves. This increased demand can lead to muscle fatigue and weakness, making hypermobile joints more prone to injury. Low-impact exercises like cycling and swimming are ideal for building strength without stressing the knee joint. In particular, treading water is fantastic for strengthening all leg muscles, including the gluteus maximus. A story from my physiotherapist convinced me to give it a go when she told me one of her patients, a pole dancer, relied on it to increase leg muscle strength.

Keeping your joints healthy is crucial - especially in your younger years - to set yourself up for a long and active life. Despite the adaptations that evolved with bipedalism, the joints' complex structure and their role in supporting body weight make them especially vulnerable. Hypermobility, a commonly overlooked condition, can lead to debilitating injuries and an increased risk of osteoarthritis if not managed properly. Recovery from these injuries can be long and challenging, so take it from me: do your physio and let your injuries recover fully, especially if you are young and hypermobile!

Artist:

Bella Marwick

Everything seems grey

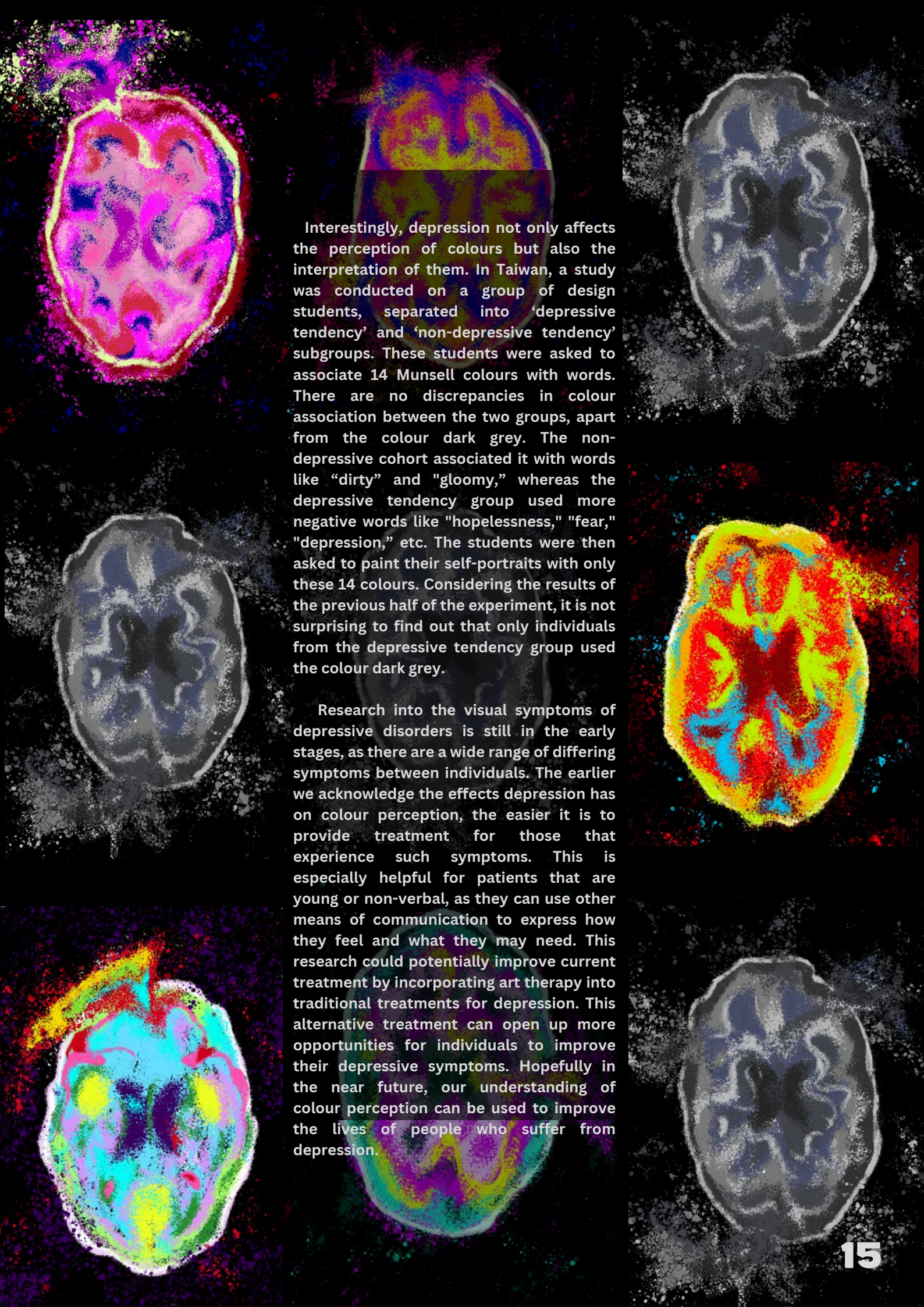
– literal or metaphorical?

Author & Artist : Naomi Chung

Emotions are often associated with colour both in the media and in our daily lives. We often hear and use phrases such as “seeing red” for anger, “getting the blues” for melancholy, and for depressive feelings “everything seems grey." These comparisons tend to be taken metaphorically, but what if the world does look greyer for those suffering from depression?

Depressive disorders come in many different forms, but the general diagnostic criteria includes low mood, loss of interest in pleasurable activities, disruptive patterns in eating and sleeping, etc., according to the International Classification of Diseases (v. 11) published by the World Health Organisation. However, despite frequent mention of altered visual perception by moderate to severe clinically depressed patients, there is very little focus on these symptoms. Depressive disorders affect the hippocampus in the brain, which neighbours the area of the brain corresponding to colour perception, including the V1 and V4 areas of the occipital cortex, the lingual gyrus.

A study in 2021 has found that people with moderate to severe levels of depression find it harder to distinguish between similar colours than people without depression. This study was conducted using the Farnsworth-Munsell 100 Hue test to allow colours to be quantified, which is important due to the subjective element of the categorisation of colours. The results of this study correspond to research from the past decade, discovering that depressive patients see colours in lower luminance and lower contrast, meaning they see colours as less saturated and are therefore less able to see the difference between similar shades.



Interestingly, depression not only affects the perception of colours but also the interpretation of them. In Taiwan, a study was conducted on a group of design students, separated into ‘depressive tendency’ and ‘non-depressive tendency’ subgroups. These students were asked to associate 14 Munsell colours with words. There are no discrepancies in colour association between the two groups, apart from the colour dark grey. The non-depressive cohort associated it with words like “dirty” and "gloomy,” whereas the depressive tendency group used more negative words like "hopelessness," "fear," "depression,” etc. The students were then asked to paint their self-portraits with only these 14 colours. Considering the results of the previous half of the experiment, it is not surprising to find out that only individuals from the depressive tendency group used the colour dark grey.

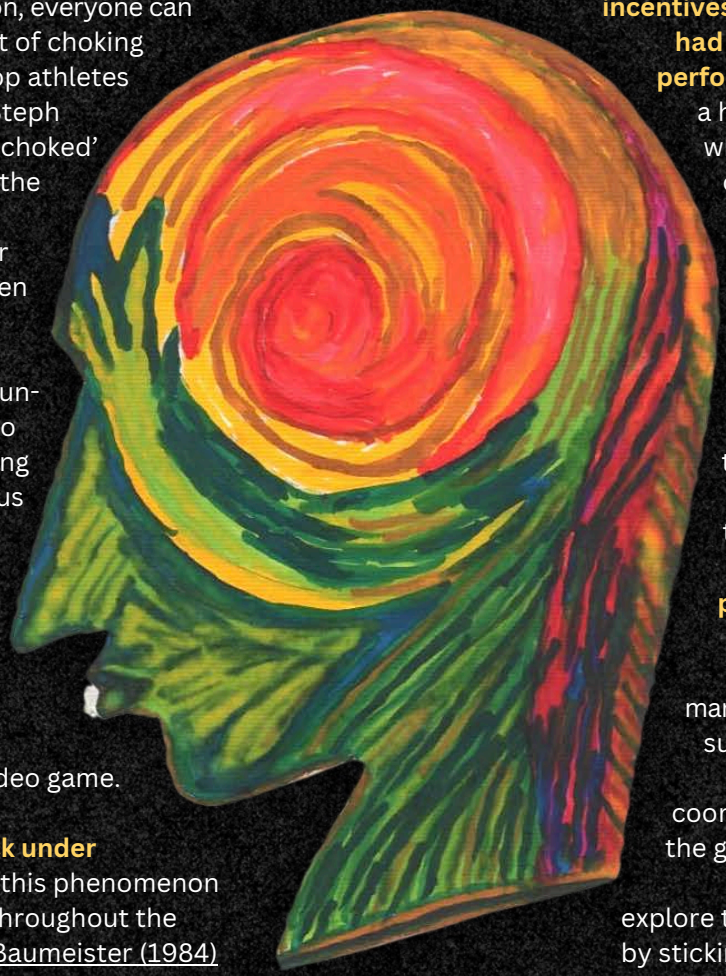
Research into the visual symptoms of depressive disorders is still in the early stages, as there are a wide range of differing symptoms between individuals. The earlier we acknowledge the effects depression has on colour perception, the easier it is to provide treatment for those that experience such symptoms. This is especially helpful for patients that are young or non-verbal, as they can use other means of communication to express how they feel and what they may need. This research could potentially improve current treatment by incorporating art therapy into traditional treatments for depression. This alternative treatment can open up more opportunities for individuals to improve their depressive symptoms. Hopefully in the near future, our understanding of colour perception can be used to improve the lives of people who suffer from depression.

JUNG WOO KIM

UNDER PRESSURE

WHY WE CRACK UNDER EXTREME STRESS

There is nothing worse than the feeling of fumbling at a decisive moment. Be it a sports match, a video game, or even a business negotiation, everyone can relate to a moment of choking under pressure. Top athletes do it all the time. Steph Curry 'completely choked' in the 7th game of the 2016 NBA finals, losing the game for the favoured Golden State Warriors. Magnus Carlsen 'made a historic blunder' at the 2023 Pro Chess League, failing to notice an obvious winning move. In fact, this phenomenon is so prevalent that it has its own meme in the community of the DOTA 2 Esports video game.



So why do we crack under pressure? Though this phenomenon has likely existed throughout the history of sports, Baumeister (1984) was the first to try and rigorously elucidate the factors that contribute to choking. Namely, he found that **increasing amounts of both incentives and self-consciousness had a paradoxical effect on performance.** Indeed, there is a huge pressure to perform when one is faced with the chance to win big (as well as the possibility of losing it all). Baumeister's work has since sparked a trend of psychological research on the choking phenomenon, each with their own theories on the mechanisms that govern this behaviour. **However, the neural basis for this phenomenon has always been elusive,** given that sports games involve so many interconnected factors, such as the presence of an audience and the team coordination required to play the game. Recently, Smoulder et al. (2024) were able to explore the choking phenomenon by sticking multi-electrode arrays

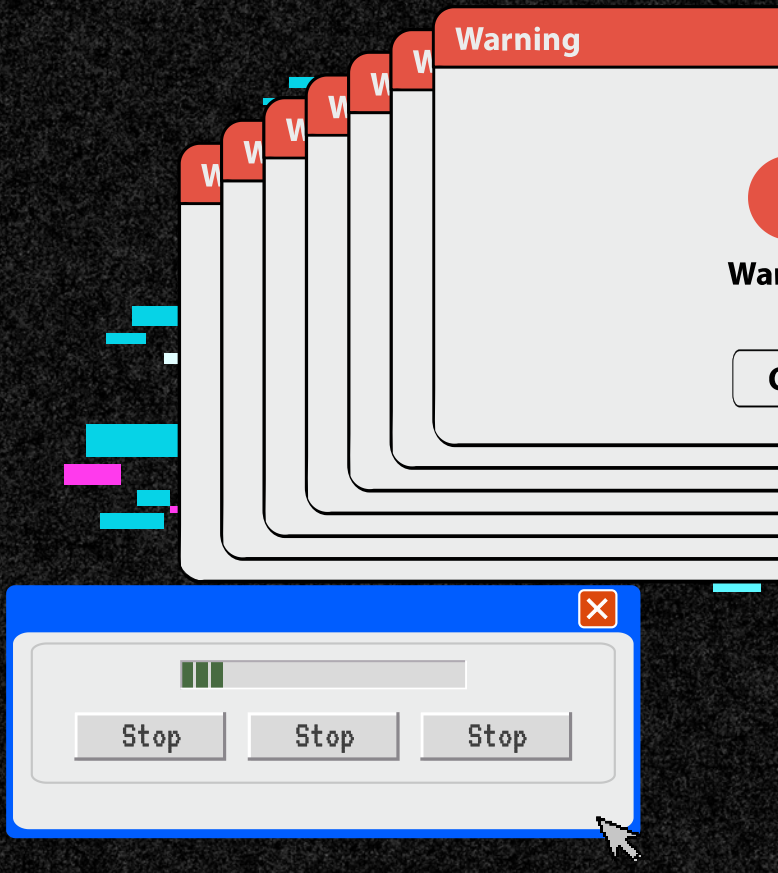
ARTIST: SUBHASRI MAZUMDAR

onto their participants as they engaged in a motor skills task. **Just one thing: their participants were rhesus monkeys.**

Smoulder and his team had a simple goal, which was to determine if non-human animals also choked under pressure, and if they did, what neural mechanisms underlie this behaviour. **If successful, this would be the first step toward linking the psychological and the neurological aspects of this phenomenon together**. They trained three rhesus monkeys to perform a challenging reaching task in which they had to guide a cursor onto a circular area on a screen quickly and accurately after a short delay. The monkeys were also trained to understand what was up for grabs; the experimenters cued them prior to each task by showing what the potential reward was (small, medium, and large), as well as a rare 'jackpot' prize worth 10 times the medium reward. As they had hypothesised, the monkeys' performance would improve based on reward, due to bigger rewards evoking stronger motivation than smaller ones, but only up to a point. **During the more difficult, rare, and high-stakes jackpot tasks, success rates plummeted,** with the monkeys often performing worse than in small reward tasks.

Armed with this knowledge, the scientists then analysed the neuronal firing patterns of electrodes placed over the motor cortex of the monkeys. The motor cortex is the part of the brain that coordinates many different muscle groups to produce smooth and intentional motion. They believed that by charting the neural activity during tasks involving different-sized rewards, they would be able to find the relationship between the size of the reward and the neural drive produced in the motor cortex. They found that **increasing sizes of rewards directly increases the amount of neural drive**, but the sheer size of the jackpot reward **pushes the drive further past the optimal 'sweet spot'** of motivation. This was also linked with a failure in preparing to reach for a target in jackpot rewards, causing more undershooting errors.

Of course, this study is far from being a definitive proof of the neural mechanism of choking. For one, we aren't monkeys. Also, there are a multitude of other brain regions and other factors, such as social pressure to perform, that are much harder to simulate in a laboratory environment. Nevertheless, Smoulder et al.'s use of **multi-electrode arrays allowed for an extremely precise measurement of neural activity that is ethically impossible to achieve in humans**, giving us an idea of the role played by our motor cortex in preparing motion in the presence of rewards. Ultimately, these findings reinforce the idea that choking under pressure is a phenomenon across species and invite further research into this very intriguing paradox. **As for the rest of us, our takeaway is clear: if placed in a high-stakes situation, don't monkey around.**



Lecanemab?

The medication that fails female Alzheimer's patients

Katie Kavanagh

Artist: Yasmin Yong

Lecanemab is the most recent treatment targeting the root cause of Alzheimer's disease, aiming to prevent amyloid-β buildup, therefore decreasing cognitive decline. This treatment boasts a 27% reduction in cognitive decline after 18 months, a result that appears to be significant; however, upon closer inspection of the statistics, it is evident that lecanemab only results in a 9.3% reduction of cognitive decline in women, despite constituting two-thirds of the Alzheimer's population. This blatant neglect of the majority group at risk of the disease makes it evident that we should be looking into specific and personalised treatments for Alzheimer's to ensure everyone affected, especially those most at risk, receive appropriate care.

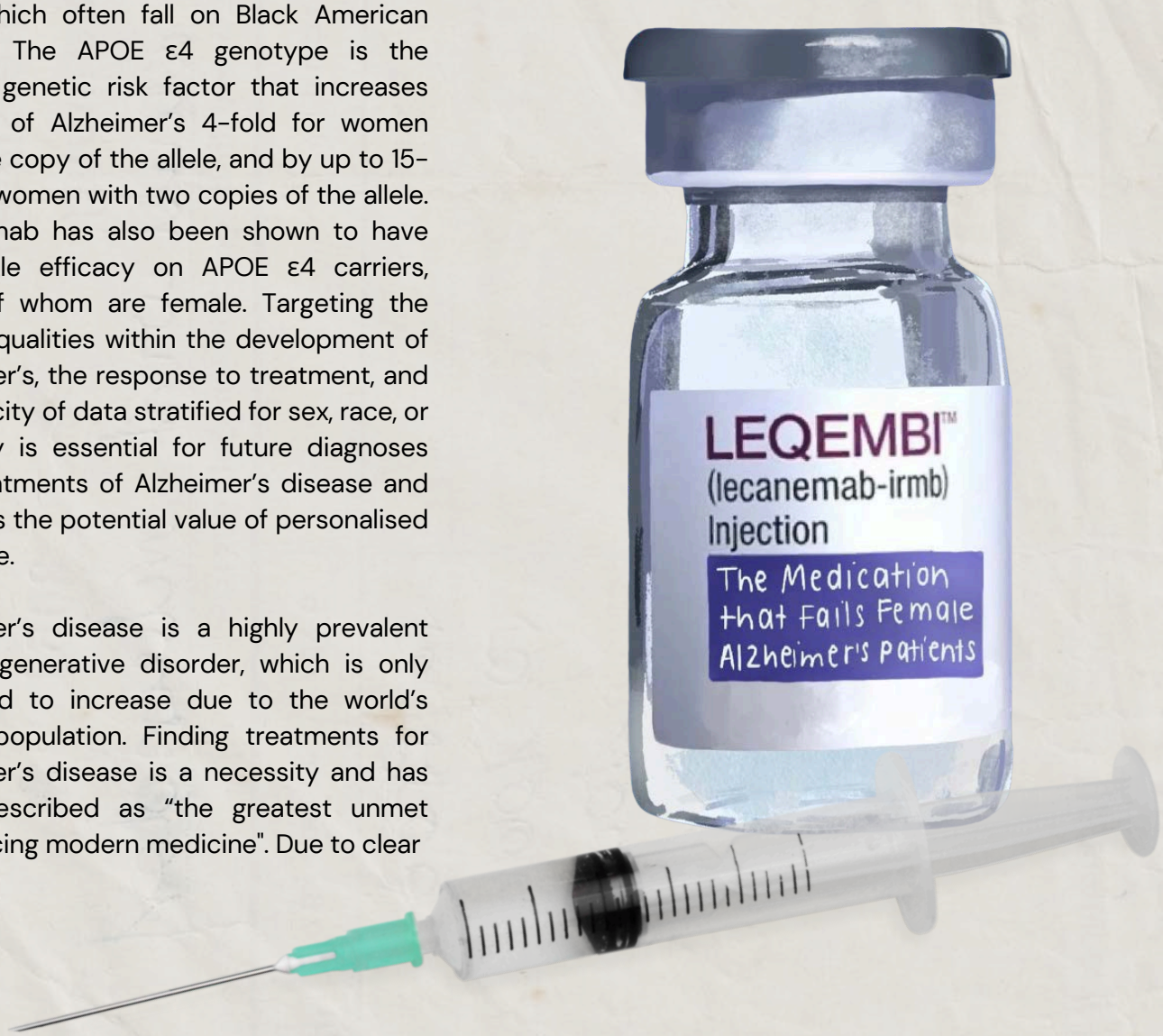
Lecanemab is a monoclonal antibody that targets oligomeric b-amyloid peptides to prevent the formation of the β-amyloid plaques that are characteristic of Alzheimer's disease. This treatment is based on the amyloid cascade hypothesis theorising that Alzheimer's pathology begins with the formation of β-amyloid plaques, which then cause intracellular neurofibrillary tau tangles to form, furthering cognitive decline. Lecanemab is administered via infusion once every two weeks at a dose of 10 mg/kg body weight. The original report of the CLARITY-AD trial claims that the treatment was effective, leading to a 27% decrease in cognitive decline. However, upon stratifying the data by gender, it is revealed that lecanemab only reduces cognitive decline by 9.3% in women, a figure that is negligible in daily life.

Alzheimer's disease impacts 55 million people worldwide, a number that is expected to almost double every 20 years. Increasing age is the biggest risk factor for developing this disease; however, it does not impact all people equally, as women are 2 times more likely to develop Alzheimer's disease than men. It is well established that women live longer than men; although, this longevity alone is not sufficient to account for this drastic inequality, and it is hypothesised that this bias is due to a combination of social and biological factors. Social factors such as increased years of education, physical activity, and social engagement are believed to play a protective role in late-life dementia; however, due to the historical absence of women from these roles, they are excluded from this protection. Biological factors such as pregnancy and menopause exclusively impact females, and both increase the risk of mild cognitive impairment. Oestrogen is believed to play a protective role in the brain, preventing the formation of β-amyloid plaques but during menopause, oestrogen levels rapidly decrease, removing this

protective feature.

The imbalance of risk of Alzheimer's is even more prevalent when the race, ethnicity, or genotype of these women are considered. Black American women, Hispanic women, and female APOE ε4 carriers are especially susceptible to developing Alzheimer's disease compared to non-Hispanic White women and non-APOE ε4 carriers. This risk according to race and ethnicity is largely due to the aforementioned social factors, such as fewer years of formal education and increased oxidative stress due to carer roles, which often fall on Black American women. The APOE ε4 genotype is the biggest genetic risk factor that increases the risk of Alzheimer's 4-fold for women with one copy of the allele, and by up to 15-fold for women with two copies of the allele. Lecanemab has also been shown to have very little efficacy on APOE ε4 carriers, many of whom are female. Targeting the vast inequalities within the development of Alzheimer's, the response to treatment, and the paucity of data stratified for sex, race, or ethnicity is essential for future diagnoses and treatments of Alzheimer's disease and suggests the potential value of personalised medicine.

Alzheimer's disease is a highly prevalent neurodegenerative disorder, which is only expected to increase due to the world's ageing population. Finding treatments for Alzheimer's disease is a necessity and has been described as "the greatest unmet need facing modern medicine". Due to clear discrepancies in risk, progression, and response to treatment of Alzheimer's disease resulting from sex, race, and genotype, personalised treatments and medicines should be prioritised to protect those who need them most.



CUTENESS OVERLOAD

HOW OUR BRAINS DEAL WITH EXTREME ADORABLENESS

Chloe Lum Sum Yi

Artist: Yasmin Yong

What Determines Cuteness?

The term Kindchenschema, or baby schema, was first coined by ethologist Konrad Lorenz, who observed that some characteristics of infants—such as big, round eyes, a small mouth and nose, a relatively large head, and soft, rounded body shapes—are universally regarded as "cute". This depiction is not limited to human infants; animals, cartoon characters, and even inanimate objects like plush toys and figurines are bred and designed with these “cute” features to elicit the same attraction.

Cuteness is a multisensory experience that can be evoked by touch, sound, and smell, in addition to visual beauty. Take the Australian king penguin, Pesto, for example. Pesto, who weighs 22 kg and is 9 months old, has large eyes compared to his head. The fun, relatable charm that makes him unquestionably "cute" is a result of his fluffy, spherical form and adorable, infantile actions, such as tilting his head curiously and chirping while attentively following his carers.

Furthermore, as the adored Grumpy Cat (also known as Tardar Sauce) demonstrates, cuteness may transcend conventional indicators. Due to feline dwarfism and an underbite, she had a scowling face that was different from the conventional feline proportions. Her huge eyes, downturned lips, and prominent brows caused a constant frown. Instead, we are able to project human emotional expressions onto her because of her peculiarly cranky manner, which makes her sympathetic and simple to anthropomorphise.

Grumpy Cat’s appeal highlights how adaptable our sense of "cute" is, drawn to both conventional traits and unusual qualities that evoke affection—cuteness is ultimately in the eye of the beholder!

How Cuteness Engages Our Minds

Our brains experience rapid and intense activity when we come across something that is unquestionably cute. In areas such as the orbitofrontal cortex, dopamine and oxytocin - neurotransmitters associated with pleasure and emotional connection - are released as a result of this reaction. According to neuroimaging research, **when we view a baby-like face, the orbitofrontal cortex activates in 140 milliseconds, or a split second.**

Yet cuteness does more than simply grab our attention; it holds it. This initial response leads to more sustained processing across larger brain networks, including the fusiform face area, which specialises in face recognition. Professor Kringelbach, a neuroscience expert at the University of Oxford, points out that when we gaze at babies or anything with baby-like features, we see synchronised activity in both the orbitofrontal cortex and the fusiform face area. These areas work together to make sure that **cuteness grabs our interest and emotions,** which results in a lasting reaction that strengthens our natural need to care for and protect.

Interestingly, **this phenomenon is not limited to parents**; studies show that men and women

react similarly to adorable features, and even children reciprocate. Therefore, **cuteness is also an evolutionary adaptation:** it evokes a sense of smallness and vulnerability, triggering innate caregiving, nurturing, and protective behaviour to improve the likelihood of species survival.

But have you ever felt the urge to squeeze something adorable almost too tightly? Known as **"cuteness aggression,"** this odd behaviour may seem counterintuitive, but it is a typical reaction to intense affection. Cute aggression is a prime example of dimorphous expression, in which someone feels one emotion but outwardly expresses another. Dr. Aragón, psychologist and accomplished researcher in neuroscience, claims that this might occur during a range of emotional experiences, such as crying during good times or laughing during sad ones. Our responses, however, can become even more nuanced and conflicting when presented with adorable stimuli. She suggests that dimorphous aggression serves as an evolutionary mechanism to regulate overwhelming positive emotions and maintain functional caregiving.

Cuteness Crusade: Every Species Deserves Love!

Because cuteness is a strong emotional catalyst for compassion and empathy, it is **gaining traction as a potential tool in conservation science,** effectively fostering public interest and support for endangered species by appealing to our natural instincts to nurture and protect.

Moo Deng (Thai for “bouncy pig”), a baby pygmy hippo, illustrates how cuteness can drive conservation efforts. Her spirited antics—swimming in water and nibbling on her zookeeper—have made her an online sensation, doubling visitor numbers at Thailand’s Khao Kheow Open Zoo. Zookeeper Atthapon Nundee's social media posts about Moo Deng have sparked a strong emotional connection with audiences, raising awareness for the endangered pygmy hippo, of which only 2,000 to 2,500 mature individuals remain, according to the IUCN Red List.

However, as aesthetics play an increasingly crucial role in attracting the attention of conservationists and researchers, **often only a limited number of endangered mammals—usually the more visually appealing ones—receive funding and support.** How do we protect creatures that are viewed as unsightly, frightening, or “ugly”?

In the same way that films like Ratatouille (2007) and Zootopia (2016) have made animals who are frequently viewed as pests into endearing characters, direct exposure to these species can aid in altering perceptions. Similarly, groups like the Ugly Animal Preservation Society (UAPS) combat this prejudice by utilising comedy and humour to increase public awareness of endangered and fragile species that are frequently disregarded because of their looks. Additionally, they frequently elect "ugly" mascots through public voting.

From 1970 to 2020, the number of 5,495 vertebrate species fell by an astounding 73%, according to the Living Planet Report 2024. Human activity is also responsible for extinction rates that are tens to hundreds of times higher. This pressing issue, which is fuelled by hunting, pollution, habitat loss, and climate change, emphasises the need for more financing and outreach for conservation. Conservation research can engage the public and create support for endangered species across the aesthetic spectrum by appealing to the deep empathy and compassion that cuteness evokes, ultimately resulting in more impactful conservation efforts.

How can soldiers carry out atrocities and sleep easy? How can people blindly follow internet personalities and do their bidding? How can those we consider thoughtful friends and kind colleagues demonise and hurt vulnerable communities AND truly believe that what they are doing is right? The term brainwashing comes to mind, a word that is casually thrown around but complex in nature and implication, as it operates at the intersection of political authority and religious doctrine.

Taylor (2016), in her book "Brainwashing: The Science of Thought Control" describes brainwashing as:

"The dream of controlling other people's beliefs and behaviour so effectively that they do not feel manipulated – as if the imposed beliefs were their own".

When brainwashing an individual, the aim is to: Isolate victims from their previous environment; Control what they perceive, think, and do; Increase uncertainty about previous beliefs; Instil new beliefs through repetition; Use emotion to weaken former beliefs and strengthen new ones. In today's current political climate, where there is ever growing distrust in political structures and leaders, more and more people are angry and frustrated. Thus, they find themselves more susceptible to extreme beliefs "presented by someone they feel is on their side" – someone they trust.

Belief and Behaviour

A schema is a set of beliefs, attitudes, and behaviours; patterns of thinking that allow people to interpret the world. In this context, schemas can be considered personas we adopt in different situations. Different schemas can contain opposing beliefs, but this incompatibility will not be noticed by the individual unless a situation activates two schemas simultaneously, meaning the individual will not notice the hypocrisy in their own behaviour.

Different schemas are represented by different patterns of connections between neurons. In the brain, different aspects of the world are encoded by individual neurons (this is known as abstraction), hence it is the activation of a group of neurons that encodes for the entirety of an experience, object or belief.

These connections are strengthened when neurons are activated at the same time and more frequently (repetition). Taylor explains, the stronger (better learned) a schema, the more it defines self-identity and resists change. They are used more frequently and without conscious thought, and when these schemas are altered an identity shift may be perceived. Furthermore, when altered by external influences the individual may be perceived as "brainwashed".

Misinformation and Memory

Another aspect to consider is the effect of misinformation on memory and beliefs. Memory of events can be distorted by misleading post-event information resulting in individuals claiming to remember events and news stories that are inauthentic. The latter is aided by the inclusion of deepfake videos with the presentation of the fake news.

However, memories of an event cannot be completely overwritten and are resistant to complete unlearning. When individuals are warned about the unreliability of information they have digested, they are less likely to fall prey to the effect of misinformation on memory and contrived beliefs. But they are not completely safe! The Continued Influence Effect indicates that misinformation can still influence beliefs and judgements even after being corrected, with belief in the misinformation persisting, despite remembering the correction. This effect can be applied in the context of political orientation, where individuals are more likely to believe misinformation that already aligns with their political beliefs.

Artist: Meera Maniar

Reducing Susceptibility

Individuals most at risk of brainwashing are those struggling with a sense of identity and belonging. A person seeking to radicalise these individuals will pose as a friend and provide an environment where extreme beliefs are reinforced and not challenged, leading to changes in a person's schema. But the effects of brainwashing are reversed once the "new identity" stops being reinforced.

Throughout this article brainwashing has revealed itself more so to be intense social coercion than "mind control". In order to combat this, we must simply "Stop and Think". Taylor explains, people must employ critical thinking, scepticism and humour when analysing messaging. Is the logic sound? How is emotive language being used? How accurate are the facts being presented? What is the motive of the message's source?

Ultimately, brainwashing is a social and political phenomenon. In order to prevent it at a societal level, people must support political stances that value individual human life above select societal groups.

WHAT IS LOVE?

a short intro to why we love

Artist: Yasmin Yong | ALEXIA RASNOVEANU

Love is less a mystery than a biochemical symphony. Romantic love? Thank dopamine for the euphoria and the sleepless nights. Platonic love? Oxytocin is at play, cultivating trust and empathy. Familial love? It is hardwired. Love is not just an emotion; it is a survival strategy built into our neural circuitry. Free will or biology? Perhaps love is both, and that is what makes it so captivating.

The science of love is a relatively new discipline with almost 90% of neuroscience literature being published in the last 30 years. Therefore, it is no surprise that the scientific basis of love is often sensationalised, as anthropologists, psychologists, and the general public have attempted to define it for centuries. What we have found is that love is a cocktail of feel-good chemicals that allow us to derive pleasure from this experience. **But is love solely a bombardment of neuromodulators and an innate part of our neural composition, or is it something metaphysical?**

What happens in our brain when we experience love is dependent on the type of love we feel. We do not hold the same love for a romantic partner as we do for our pet; we do not hold the same love for humanity as we do for our friends and family. Love is multifaceted yet the chemical patterns of it are often overlapping.

Dopamine – produced in the hypothalamus – is widely known as the "love hormone", and is mainly associated with romantic love. Linked closely to the brain's reward system, heightened dopamine makes us feel giddy, energetic, and euphoric, even leading to decreased appetite and insomnia, and is triggered by activities we find pleasurable (like the thrill of new love). When someone feels a strong sense of love for a community or even for humanity, oxytocin is typically the most prominent neurotransmitter involved. **Oxytocin acts centrally within the brain to control behaviour, especially social behaviours such as altruism and empathy**. Oxytocin also triggers the release of serotonin and dopamine when experiencing positive emotions associated with friendship. The combination of these two neurochemicals leads to a more stable mood, creating a long-lasting feeling of happiness and well-being. **Innocent love, such as the love for a pet has been shown to lower the stress hormone cortisol**, and increase endorphins which instil a sense of comfort and long-term attachment in mammals. Interestingly, in early love, levels of serotonin plunge, explaining the intrusive and overly occurring thoughts associated with infatuation.

Unlike romantic, platonic, or innocent love, love for and from our family is more permanent and unshakeable. It is the one love we cannot quite outgrow, the one bond that is practically programmed to hold on. Unlike friends, who we can exchange like trading cards when our ideals shift, or the fleeting goodwill we might feel toward our communities when convenient, our attachment to family just... persists. **So we cannot help but wonder: what makes love for our family so special?**

Research from University of Wisconsin shows that neurons found in the central medial preoptic area (cMPOA) are essential for maternal behaviours in mice. In particular, those rich in the calcitonin receptor, which influence behaviours like aggression, anxiety, and sexual drives. From nest building to looking after pups, this receptor plays a unique role in the motivation of motherhood in females, even in situations that evoke fear or disgust. By hyperactivating these neuronal pathways, researchers found that female mice who do not have offspring began taking care of other pups and building a nest with the same care and intensity as if they were their own children. With the flip of a switch, when inhibiting the calcitonin receptor in these neurons, female mice started showing hesitation in retrieving their own pups, even in mildly stressful conditions. **So, to what extent is motherhood an expression of free will, and how much is it driven by neurological wiring?**

When it comes to paternal love, vasopressin is the key neurochemical secreted in a father's brain. This neuromodulator is strongly associated with the hypothalamus and the amygdala – areas involved with emotional processing and the fight-or-flight response. Male prairie voles, one of the few mammalian species that exhibit increased paternal involvement, have significantly higher levels of vasopressin. This hormone does not simply make a father "love" his child, it rather imbues them with vigilance, territoriality, and active caregiving behaviours. Similarly, in human fathers, vasopressin strengthens both attachment and protective instincts, becoming an evolutionarily wired imperative to ensure the survival and safety of his child.

On the other side of the equation is the love a child holds for their parents. However, in more scientifically accurate terms, **much of what we call familial love is actually described as attachment**. In the early stages of life, secure attachment ensures that a child is in proximity to their caregiver and that their brain develops accordingly. This is why custodial care is crucial in early life growth: a child whose parents offer consistent care is neurologically primed for healthy emotional growth. Without parental love in a person's childhood, the likelihood of adolescent mental health issues is increased; and it all comes down to constant neural stimulation.

Neurons with little neural activity will die, while neurons that are "used" will survive and forge stronger neural connections with each other. As much as certain brain areas can boom with activity, other functions could be lacking from early on if improper care from a child's caregiver is shown. For example, Romanian orphans reared in physical and social isolation have smaller brains and a larger amygdala than their non-adopted counterparts. The amygdala is a brain area concerned with emotion and fear, thus a larger amygdala would suggest altered emotion and fear processing due to overstimulation and distress. This enormity of brain growth in early life is incomparable to later growth which makes this time crucial.

So what does it mean to love our family? Are we creatures simply a fatality of the primal circuitry of our brains, or are we actually carving out genuine, intentional connections? Even if our loved ones are scripted by proteins and receptors rather than us, what makes the love we hold for our family alluring is its deep roots. We do not love our families despite our biology; we love them because of it, and maybe that is as close to free will as we are ever going to get.

UNMASKING THE 'LOVE HORMONE'

Does oxytocin truly make us more loving?

Artist:
Ayotenu Dosumu

Haruna Kajimoto

When you hear the word 'oxytocin', what is the first thing that comes to mind? Hormones have garnered a wide variety of reputations. Perhaps you've previously blamed testosterone for that one time you suddenly snapped at your friend, or attributed your hours of doomscrolling to dopamine. Among hormones, one of the most well-known is oxytocin affectionately dubbed 'love hormone'. **But does oxytocin truly make us more loving?** Or does this connotation only tell one side of the story?

Over the years, there have been numerous findings regarding the effects of oxytocin on love and bonding, which reveal that **the primary function of oxytocin is to facilitate childbirth.** Secretion of oxytocin triggers the

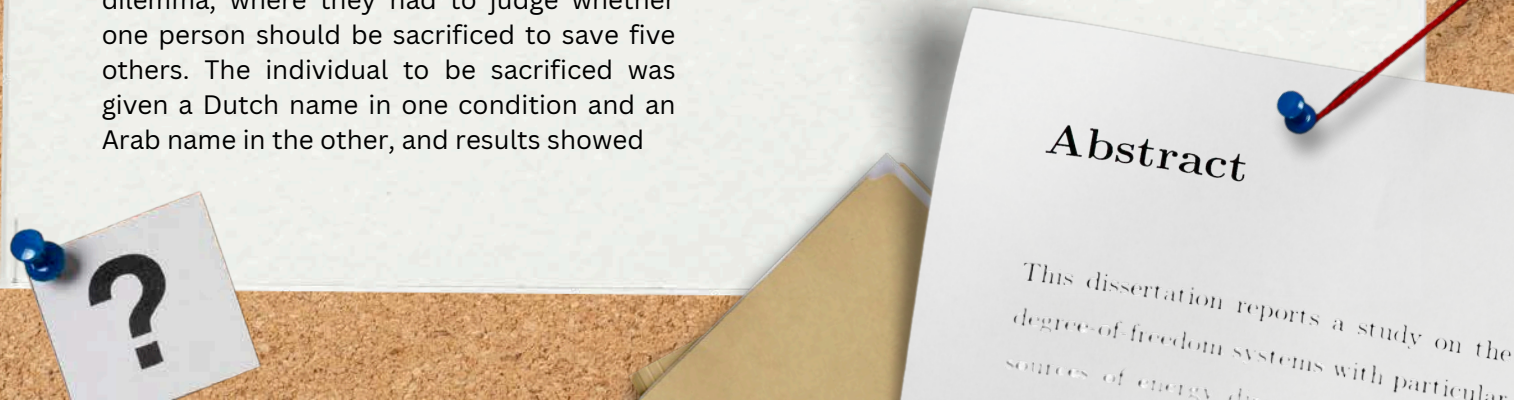
contraction of the uterine muscles during labour, and stimulates lactation after birth. The calming effect oxytocin brings to a mother also contributes to deepening the bond between her and her child. But the role of oxytocin does not end here.

Research has shown that **oxytocin also plays a part in fostering social bonds and interpersonal relationships.** This occurs by inhibition of the central amygdala, a region in the limbic system of the brain that plays an important role in emotional responses, including fear. In other words, increased levels of oxytocin secretion could suppress anxiety and thus have a comforting effect.For instance, studies have found that our bodies produce more oxytocin when we hug our loved ones, or when we fall in love. Interestingly, even pets are involved, as the brains of both a dog and its owner secrete more oxytocin when they interact. Thus, the warm feeling of a pat on the shoulder, a first crush or seeing your dog after a long day of work could all be attributed to the effects of the 'love hormone'.

However, there are often two sides to the same coin and **research has discovered a darker side to the story.** De Dreu et al. conducted a study in 2012 investigating the links between oxytocin and co-operation. Male participants were placed into groups of 3, and asked to play an economic game involving real money against a stranger from an opposing team. The study found that compared to those who had received a placebo, men who had been administered a nasal spray of oxytocin were less willing to cooperate with other players.

Another study, conducted by De Dreu et al. in 2011 provided even more insight into the darker side of oxytocin. In this study, Dutch participants were presented with the trolley dilemma, where they had to judge whether one person should be sacrificed to save five others. The individual to be sacrificed was given a Dutch name in one condition and an Arab name in the other, and results showed that participants that had been administered oxytocin were less willing to sacrifice a person with a Dutch name. This indicates that oxytocin increases our bonding and sense of belonging to groups that we personally identify with, however, **it is important not to overstate the implications of these findings**. De Dreu et al. concluded that oxytocin does not directly drive outright discrimination towards out-groups. Instead, this is a side effect of in-group favouritism. From an evolutionary perspective, this makes sense – we are more likely to survive if we are part of a group. It has thus been proposed that oxytocin's effect was initially observed during childbirth and parenthood, but eventually evolved to become co-opted for social bonding among members of in-groups. In addition, we adopt our worldviews and values from the groups that we belong to. As such, oxytocin's role in social bonding helps to form a core part of our identities.

Although it makes us more susceptible to bias, and in extreme cases, prejudice, it is undeniable that oxytocin plays a central role in our lives and relationships. So what is the bottom line? Does oxytocin cause love or hate? As evidenced by oxytocin's complex role in social bonding, hormones do not strictly lead to one behaviour or the other. Saying that oxytocin makes us more loving, or that testosterone makes us more aggressive is not entirely inaccurate, but it also does not reflect the full picture, as how we respond to fluctuations in hormone levels largely depends on context and environment. **The same molecule could play a part in both affection and discrimination** depending on who we are with and what the occasion is. Therefore, oxytocin is not only responsible for one aspect of love, but all facets of it – from strong belonging to intense segregation, and everything in between.



METHODOLOGICAL AND ETHICAL FAILURES OF THE CASS REVIEW

Why It Falls Short as A Guideline for Trans Healthcare

In 2020, the NHS initiated the Cass Review, an independent assessment of the UK's gender identity development services. The goal was to produce recommendations for enhancing children's gender care, yet the final report, published in April 2024, has drawn extensive criticism from healthcare professionals and advocacy organisations. The report's findings, which deviate markedly from internationally accepted standards of care as set by the World Professional Association for Transgender Health (WPATH), have been influential in policy shifts that greatly risk harming trans youth. This article critically examines key issues with the Cass Review, including serious methodological weaknesses, misguided medical recommendations, and a pervasive cisnormative bias that impacts its conclusions and recommendations.

Methodological Flaws of the York Reviews

The Cass Review's conclusions are largely based on seven internal systematic reviews, called the York Reviews (YRs), supplemented by additional quantitative and qualitative studies. Systematic reviews require evaluation and summary of all studies relevant to a research question. However, an analysis conducted by Noone et al. using the ROBIS tool found significant bias and cherry-picking of studies in all seven YRs, undermining the reliability of the findings.

The York Reviews were expected to be guided by a so-called protocol document detailing eligibility criteria for study inclusion. However, ambiguities in this protocol, combined with inconsistencies in its application, rendered the YRs irreproducible. For instance, although the protocol called for the Mixed Methods Appraisal Tool (MMAT) to evaluate studies, three of the reviews instead used an adapted Newcastle-Ottawa Scale (NOS), which has faced substantial criticism as unsuitable for medical research. This shift in evaluation method led to the exclusion of 48% of relevant studies on puberty blockers and 36% of studies on hormone therapy. A key reason for excluding these studies was the lack of blind control groups—a standard that is ethically and practically unattainable given the noticeable physical effects of puberty blockers and hormones. Insisting on such controls suggests deliberate cherry-picking of evidence to fit a predetermined narrative, ultimately compromising the report's credibility.

Poorly Informed Medical Recommendations

One major consequence of the Cass Review was the NHS's effective restriction on prescribing puberty blockers to minors outside of clinical trials, a decision implemented in March 2024.

This recommendation to restrict puberty blockers for young people arose from narrow analysis and a distorted interpretation of evidence. McNamara et al. highlight that the widely accepted GRADE framework, typically used for evaluating healthcare recommendations, includes considerations of evidence quality, benefit-harm balance, patient values, and resource utilisation. The Cass Review prioritised the first criteria while largely ignoring the remaining three.

This restrictive approach to evidence evaluation led the Cass Review to deem only 2 of 103 papers on puberty blockers as "high quality." Such extreme standards are not seen in other areas of medicine like anaesthesia, breast cancer, and stroke care, where evidence which does not meet the highest levels of methodological rigour are included. The disproportionate application of these criteria in trans healthcare suggests a selective, potentially punitive standard not applied in other fields.

Furthermore, while some trans youth were consulted for the review, their input was often dismissed, with recommendations ultimately diverging from their expressed needs. The review also largely overlooked the psychological and physical repercussions of denying treatment to trans youth, who may develop permanent, incongruent physical traits if denied puberty blockers. While purported treatment risks were discussed, the serious consequences of withholding care were downplayed, reflecting a skewed view of risk.

Cisnormative Bias and Lack of Expertise

There is significant evidence of cisnormative bias—the assumption that everyone is or should be cisgender, leading to transness being viewed as a problem—and a general lack of knowledge basic trans healthcare within the research group. This bias was evident in the composition of the research team. Experts in trans healthcare were deliberately excluded under the guise of reducing bias, an approach not paralleled in other medical or scientific fields where expertise is valued.

Furthermore, in an environment where trans prejudice has doubled since 2019 and hate crimes have peaked, the research group's composition raises concerns about impartiality, with no explicit exclusion of prejudiced members. Notably, Tilly Langton, an advocate of "gender exploratory therapy" (a modern form of conversion practice), was involved in designing the YR methodology.
Additionally, 32% of healthcare professionals interviewed for the report stated they "do not believe in the existence of trans children", a view incompatible with providing informed, compassionate care. The review's language choices further underscored this bias by referring to trans children as merely "gender-questioning", a term that questions the permanence of their identities. Such framing contributes to the marginalisation and pathologization of trans youth.

The report's conclusions are also undermined by a lack of understanding of fundamental aspects of trans healthcare. It incorrectly argued that puberty blockers are ineffective for alleviating gender dysphoria or body dissatisfaction, ignoring that these medications aim to prevent unwanted physical developments rather than alter current characteristics. The report cited stable mental health scores as a "failure," when in reality, stability is a beneficial and desired outcome for trans youth undergoing puberty blockers.

The Cass Review, despite being promoted as an authoritative document, suffers from serious methodological and ethical flaws. Its selective evidence review, unrealistic study criteria, and underlying cisnormative bias have contributed to recommendations with harmful outcomes for trans youth. These recommendations have already influenced NHS policy, restricting access to puberty blockers and closing some gender services, placing vulnerable children at risk.

Trans youth deserve informed, compassionate healthcare rooted in scientific understanding and respect for their identities, which the review sorely lacks.

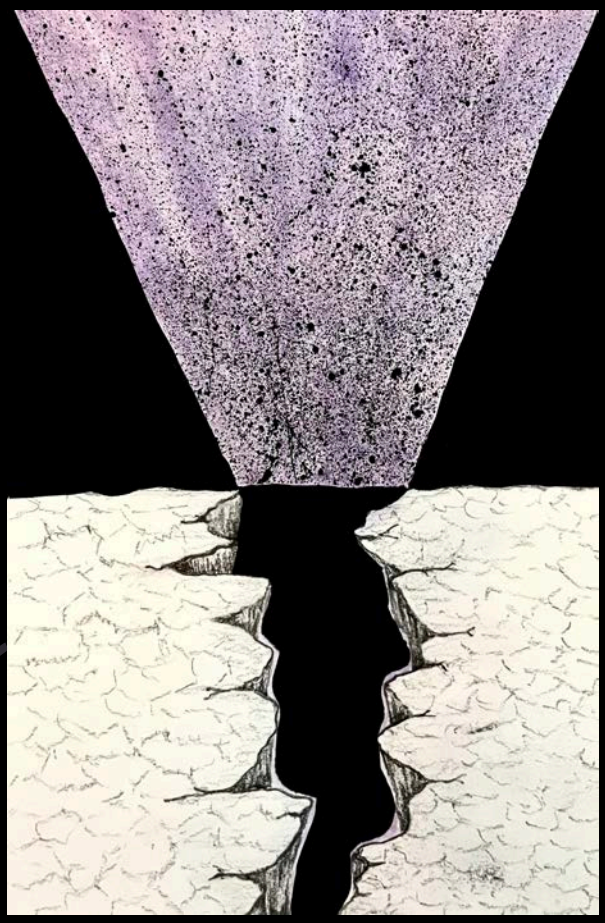
ANTHRAX

The Deadly Disease Rising from the Past

Lying dormant for decades, a deadly bacteria frozen in the ground is waiting to be awakened. Anthrax, a deadly disease, is reemerging as environmental conditions shift due to consequences of climate change. But what is behind this deadly revival?

Anthrax, one of humanity's oldest diseases, dates back to Hippocrates in the fifth century BC. It is caused by the resilient, rod-shaped bacterium, Bacillus anthracis, which is found in soil. Due to its resistant characteristics, such as being both aerobic and anaerobic, it has successfully adapted to both cold and warm environments. One particular trait that has allowed for this is its robust spores, which allow the bacteria to be activated when the right conditions strike. Although the bacterium usually targets animals, recent environmental and social shifts have exposed it to humans, posing a threat. Anthrax has previously been used as a bioweapon in the U.S. military programs in 2001 and has been labelled as a Category A priority pathogen - highlighting the very real risk it poses.

Once anthrax is on the surface, transmission to humans occurs in three ways. Firstly, and most commonly, cutaneous anthrax enters the body through open skin and causes black ulcers and swelling. This is the mildest form of anthrax but can spread rapidly if not treated on time. Another form is gastrointestinal anthrax, residing in contaminated meat which, when consumed, causes abdominal pain, abdominal bleeding, and intestinal ulcers. However, the last and the most severe transmission is inhalational anthrax, which enters the body when spores are inhaled, and subsequently enters the lungs and the lymph nodes.



Artist: Ayotenu Dosumu

At that point, they germinate and multiply, unleashing deadly toxins. This causes the respiratory system to collapse, often culminating in septic shock. The only way to treat this is through antibiotics prescribed shortly after the event.

Until recently, the disease was restricted to Asia, Sub-Saharan Africa and the Americas but climate change has driven it to northern altitudes mainly in the region of the cryosphere (regions of the earth surface consisting of solid water). Climate change, causing global warming, has increased the thickness of the active layer in permafrost (frozen soil) by thawing at increasing rates. The thawing of the active layer starts off a series of processes such as soil cracking and solifluction. These occur particularly in warmer years as they facilitate the exposure of the Bacillus anthracis spores through pathways in the soil. As the bacteria is exposed to oxygen from its surroundings, it enters a dormant stage until favourable conditions arrive such as thawing of permafrost deep active layer.

In August of 2016, the Yamalo-Nenets region of Siberia faced an anthrax outbreak, 8 confirmed cases and 90 people hospitalised and causing the death of one baby. Cryologists researching this unexpected event believed that it was triggered by a heatwave, causing the active layer thickness to be increased by 26%, and snow depth to be increased by 43% between 2010 to 2016. This increased snow contributed to the permafrost thaw by insulating the soil, preventing it from fully refreezing. The anthrax was then exposed to herbivores - particularly, reindeers who fed on it. After their death, their carcasses released anthrax spores, posing a public health problem etc.. Over 2,300 reindeer died in the outbreak, primarily affecting reindeer-herding families who were subsequently relocated for safety.

As global warming intensifies, it remains clear that the understanding of this reemerging pathogen is key to safeguarding certain environments - as well as animal and human populations. Its targeting of herbivores not only leads to their death, but also to severe sanitary challenges- especially in areas with limited veterinary infrastructure. Therefore, there is ongoing cryology research which aims to improve outbreak prediction, as well as prevention strategies for communities to tackle outbreaks. Anthrax's return is a powerful reminder that climate change could revive more than we expect. Will we be ready to face the diseases of the past?

Arielle Shina

Urban Renewal

Restoring Nature in City Centres

Nicole Bowen
Artist: Meera Maniar

When most people picture the average city, the image of bustling, overcrowded streets comes to mind. Think Oxford Circus, but with slightly less Christmas lights. Cities do not often inspire thoughts of greenery, let alone a picturesque walk in nature. But the reality is very different.

Cities have built themselves around the natural landscape, whose ecological features have fought to remain; the presence of the River Thames can attest to this. In fact, some estimates trace its history back to over 30 million years ago.

However, natural geographical features are not the only green spaces in cities. **Increasingly, man-made ecological structures have appeared in urban centres over the past few decades.** These range from vertical forests that climb high-rise buildings to local parks and forests. Even something as small as a community garden can have a huge impact. For example, in New York City, there are over 760 community gardens alone, which means that around half of New Yorkers can walk to a community garden within 15 minutes or less. These gardens do not just provide a source of organic

ood but also give residents a sense of pride and belonging. In crowded cities where it is all too easy to feel isolated, these spaces offer educational opportunities and facilitate important social networks.

Similarly, Rio de Janeiro is a city that has witnessed some of the largest urban community gardens in Latin America. On an economic level, this has improved the lives of residents by providing gardening jobs, selling vegetables at reduced prices, or donating profits to vulnerable groups. However, the real benefit is observed in the community. **The gardens have brought people closer together and helped countless residents leave the world of drug trafficking.** Once known as "cracolândia" or "crackland", the Manguinhos area has transformed into an agricultural oasis.

Other green spaces, such as parks, also offer areas for community networks and social cohesion. Despite this, parks are often underappreciated, particularly in lower income neighbourhoods. This is crucial, since lower income residents already experience reduced levels of physical activity, which in turn affects mental health. In the Netherlands, it was found that **citizens who lived closest to green spaces had over a 40% reduced risk of anxiety disorders** compared to those who were furthest away. This statistic showcases just how dire the consequences are when the link between nature and humanity is severed.

It is therefore clear that **community gardens and local parks are integral to green cities.** However, these are often seen as the limit to incorporating nature into urban areas. Office buildings and concrete car parks are usually considered dead zones for wildlife. Poor government planning has created a perception that cycle lanes are impossible to implement, let alone rooftop wind turbines. Yet innovative solutions from companies have proved otherwise. Office buildings do not have to contribute to the drab atmosphere of a city but can offer an important source of greenery themselves.

For example, the infamous Vertical Forest in Milan boasts 15,000 perennials and over 800 trees. Not only does this staggering 367ft high structure create a beautiful backdrop, but it **converts 44,000 pounds of C02 per year.**

Closer to home, the Living Wall in Liverpool One's Chavasse Park houses approximately 8000 plants. But the architectural biodiversity does not stop there. As part of Liverpool ONE's green strategy, two beehives were added to the roof of a Barclays Bank in 2019. Just two years later **more than 160,000 worker bees were seen thriving here.**

An earlier example of green technology has been the use of permeable pavements. These are pavements that allow water to trickle directly through pores embedded in their surface, instead of going through drains. This both decreases flooding risk and cools down pavements, which is useful for cities suffering from heat island effects.

This foray into green spaces has only scratched the surface of nature within urban centres. Both traditional scenery such as parks, as well as innovative designs like living walls have huge potential to transform cityscapes. They are not only a pop of colour in a sea of grey streets, but are the underappreciated lifeblood of a city.

When Nature's Janitors Disappear:

India's Vulture Collapse and Its Human Toll

Julian Jun An Tan
Artist: Marya Cao

We are living through Earth's sixth mass extinction—the first to be driven by humans. Nearly 500 vertebrate species have vanished in the last century. While the impacts of biodiversity loss are well-documented, one of the toughest challenges facing policymakers is deciding which species to protect and which to let go.

Quantifying the costs of losing individual species is difficult, which means conservation decisions often rely on emotion. Take the panda —the iconic species of the World Wide Fund for Nature (WWF)—its appeal has captured public affection and support. But what about species that aren't so charismatic, like vultures?

Vultures as Sanitation Workers: The Unseen Role

In India, vultures are a keystone species. This means they play a critical role in the ecosystem, and their removal leads to devastating consequences. Before 1990, there were over 50 million vultures serving as natural sanitation workers across India. Today, three common vulture species are critically endangered, with only around 2,000 birds remaining—a collapse caused by a single chemical: diclofenac.

The patent for diclofenac, one of the most widely used painkillers in the world, expired in 1994, allowing cheap, generic versions to flood the market. Farmers began using the low-cost drug to treat their livestock, especially cattle. When these cattle died, trace amounts of diclofenac lingered in their carcasses, and vultures feeding on them suffered fatal kidney failure.

Cows carry a unique cultural status in India, where their slaughter is illegal. As a result, ageing dairy cows are often set free, left to live out the rest of their lives without easy access to food or healthcare, leading to premature deaths. Traditionally, scavengers such as vultures would clean up these carcasses. With their highly acidic stomachs, vultures can consume an entire cow carcass in under an hour, leaving only bones behind. Their efficiency in carrion disposal enabled them to outcompete other scavengers like dogs and rats.

But with vultures gone, carcasses left out in the open began to attract these less effective scavengers. Dogs and rats not only leave flesh behind to rot but are also carriers of diseases like rabies. As the number of exposed carcasses increased, so did the population of rats and feral dogs.

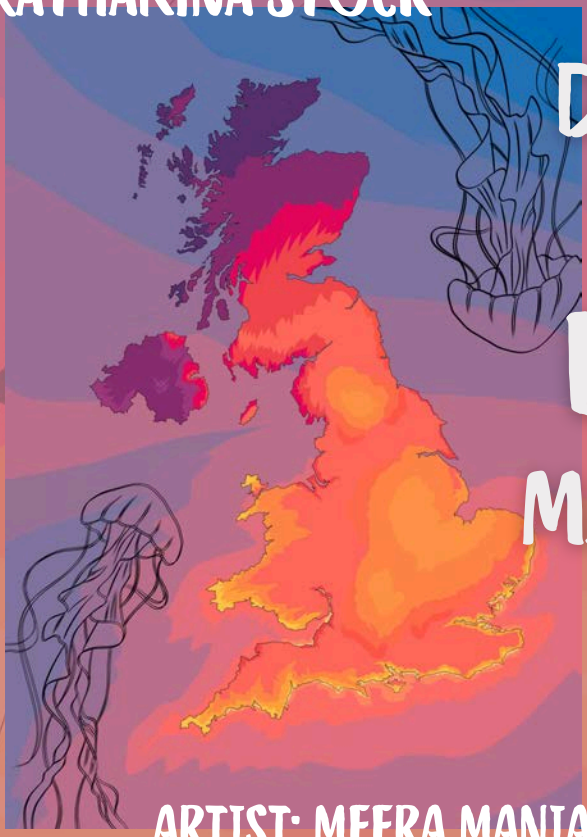
This also worsened another problem: water pollution. Carcasses, now left unconsumed, are often dumped into rivers like the Ganges. This contaminated water supplies and introduced harmful pathogens into the environment, resulting in cascading public health impacts.

The Cost of Collapse: Health and Economic Impact

The consequences of this vulture collapse are significant. The loss of vultures has led to a 4.7% increase in human mortality in areas where these birds once thrived. In a sample population of 430 million, this equates to an additional 104,000 human deaths annually. The total economic toll on India has been estimated at $69.4 billion per year, highlighting the immense, unseen value of keystone species like vultures.
With rising demand for dairy products, this crisis will only worsen. Vultures have a slow reproductive cycle, laying a maximum of two eggs per year, which makes population recovery difficult.
Their story is a reminder of the need for strategic conservation efforts that prioritise species with critical ecological roles—not just those that capture public sympathy. While it may be impossible to quantify the cost of every extinction, more attention is needed for the organisms that uphold the delicate balance of our ecosystems.

KATHARINA STOCK

In Hot Water: DOES THE UK NEED TO PREPARE FOR DEVASTATING MARINE HEATWAVES?



ARTIST: MEERA MANIAR

Few thought that marine heatwaves would pose a serious concern in the UK's cool waters quite so soon. However, in June 2023, scientists sounded alarm bells as sea surface temperatures off the UK and Irish coast rose to unprecedented levels. That month, the Met Office reported temperatures up to 5°C higher than normal.

"Marine heatwaves can cause devastation to marine ecosystems," says Zoe Jacobs, Senior Research Scientist at the National Oceanography Centre, "They can cause coral bleaching, wipe out seagrass meadows, and severely impact fisheries."

Marine heatwaves are periods of high ocean temperature that can last days or months.

Typically, a period must last five days or more and fall into the 90th percentile in deviation from the seasonal temperature average to qualify as a heatwave. Much like major storms, Jacobs explains, marine heatwaves are natural phenomena, but due to climate change, their frequency and intensity have increased. Since 1982, the number of extreme heat events recorded has doubled.

While the UK does not yet stand out globally in marine heatwave activity compared to more turbulent areas like the North Atlantic, in a recently published study, Jacobs and her team identified regional hot spots. In particular, the southern North Sea, off the UK's south-eastern coast, seems to exhibit frequent and intense heat events.

Jacobs explains that the region may be more susceptible to marine heatwaves driven by temperature extremes in the atmosphere. Due to the shallowness of the waters in the southern North Sea and the English Channel, heat absorbed by the sea has little room to dissipate allowing the ocean to retain its temperature for longer periods.

Because of the unique geography of the British Isles, this relationship also works in reverse, with marine heatwaves impacting both atmospheric temperature and rainfall in return. Under the right conditions, slow-moving air can accumulate heat and moisture from the sea. The wind then carries this warm and moist air to land, resulting in higher land temperatures and more precipitation. “Because the island is so narrow, you're never far from the ocean.” Met Office climate scientist Ségolène Berthou explains, “That means that there's almost always enough wind to bring an anomaly from the sea to land.”

“Our projections show that the temperatures we recorded during the June [2023] marine heatwave will be the average in 2050, so we will likely see more marine heatwaves and ones that are more intense.”

Globally, marine heatwaves have already ravaged ecosystems and caused losses of crucial foundation species such as algae, seagrass, and corals. These species form the basis of the ecosystem with many others relying on them for food and shelter. Losing them, we risk a reduction in fish abundance and an altered species composition, threatening local economies.

However, impacts in temperate regions like the UK are difficult to predict. Kathryn Smith, Marine Ecologist at the Marine Biological Association says, “in the UK we're only just starting to be impacted by these marine heatwaves.”

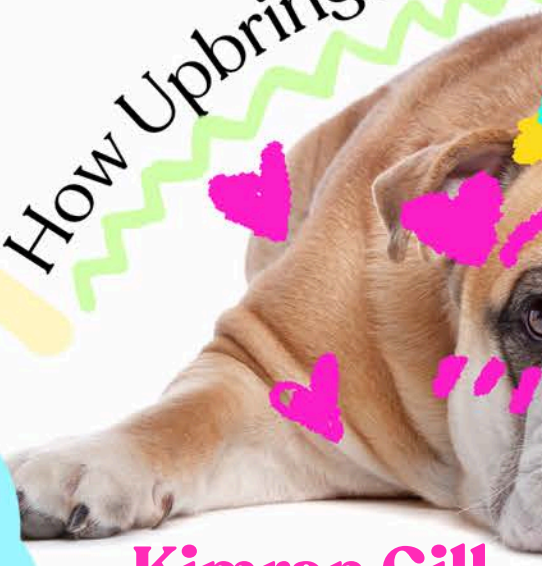
Although marine heatwaves typically lead to losses in foundation species, in some cases, they can promote growth instead. Every species has a thermal range in which they can survive comfortably. Smith explains that some species, living in more temperate climate regions, in temperatures on the lower end of what they can tolerate, might benefit from warmer conditions. While this may sound like good news, such events are still likely to impact ecosystem composition more broadly, letting some species thrive as others decline, altering the ecological balance.

Experts were surprised when a paper published in Nature last year reported no impact of marine heatwaves on species like cod and haddock that live near the bottom of the sea in temperate climates. It is possible that fish living in areas like the UK that experience dramatic seasonal temperature differences are more adaptable than others. However, the scale could quickly tip if heatwaves in these regions become more frequent and intense.

For climate scientists, the next step is now to build forecasts which will allow for a more accurate prediction of marine heatwave occurrence. As global sea temperatures continue to rise, extreme heat events are more likely to become precarious. It is important for the UK to prepare for this inevitability and look to other countries, already experiencing more severe conditions, for solutions.

BEYOND THE BREED

How Upbringing Sh



Kimran Gill
Artist: Suzie Mishima

Following a series of fatal attacks on the public, the UK government banned the XL Bully breed in England and Wales. This decision has sparked debate about whether a dog's breed is the primary factor influencing its behaviour, or if other factors, such as upbringing and environment, play a more significant role. In this article, I will explore the factors that determine a dog's behaviour, and examine whether breed is truly the major influencing factor.

The recent ban on the XL Bully in the UK has raised questions about breed-specific aggression. Is the XL Bully inherently dangerous, or is irresponsible ownership and inadequate training more to blame? Originally bred for bull and bear baiting and later for fighting, the XL Bully has since become a beloved household pet. Being a crossbreed, XL Bullies lack established Kennel Club breed standards, prompting the government to create its own criteria based on factors like head size, muzzle shape, and body proportions. This approach is problematic, as dogs with only slight differences from the designated XL Bully profile may be unfairly targeted, creating ambiguity in breed identification. Many large, powerful breeds possess similar traits, including strength and guarding instincts, but are not subject to the same scrutiny. Under the ban, XL Bullies must be neutered, and owners have been offered financial incentives to put down their pets. Animal shelters are now unable to rehome XL Bullies, leading to increased abandonment. These consequences highlight the importance of responsible ownership and proper training, highlighting that breed alone should not be blamed for negative behaviours such as aggression.

The nature vs. nurture debate in dog behaviour explores how both genetics and the environment help to mould a dog's behaviour. While certain breeds, like Rottweilers, are often associated with traits such as aggression, it is unfair to stereotype dogs by breed alone, as breed is not the sole predictor of behaviour. Among the 155 most differentiated loci, the genes CDH9, DRD5, and HTR2A strongly influence behaviour that varies among breeds. Additionally, artificial selection has led to certain breeds being chosen for specific tasks by enhancing traits that help them excel in these roles. For example, Border Collies have been selectively bred for generations to herd livestock, resulting in instinctual behaviours such as controlling animal movement and heel-nipping. Though certain breed-based behaviours can be beneficial, breed alone does not define a dog's behaviour. Many dogs within these "stereotyped" breeds exhibit friendly behaviour and are unfairly labelled with negative reputations.

hapes Canine Behaviour

Ultimately, while genetics may predispose a dog to certain behaviours, a dog's upbringing and socialisation both play a much larger role in determining whether it becomes a loyal companion or displays aggressive behaviour . Understanding both genetic and environmental influences enables owners to address their pets' behaviours early on, helping dogs lead healthier, happier lives.

However, the COVID-19 pandemic significantly limited owners' ability to socialise their puppies, as lockdowns prevented many from introducing their dogs to new people or attending training sessions, putting the long-term welfare of these 'pandemic puppies' at risk. Without adequate socialisation, dogs are more likely to react aggressively toward unfamiliar people or animals. The pandemic has shown how vital early socialisation is for puppies to grow into confident adult dogs, which is especially important for dogs training as guide or therapy dogs.

The period between three and twelve weeks of age, known as the sensitive socialisation period, is crucial for shaping a puppy's behaviour, as this is when they are most receptive to learning. Early socialisation helps puppies build confidence as well as reduce their aggression and anxiety, since their reactivity and fear responses are highly adaptable during this time. Positive interactions with people, other animals, and exposure to various environments are essential for healthy development and building the trust that makes dogs "man's best friend."

In conclusion, both genetics and the environment influence the behaviour of dogs. Although genetics may have a role in predisposing a dog to certain traits, socialisation and training are much more important in determining whether the dog becomes a threat or a friend. As a result of the XL Bully ban, we are reminded of the complexity of breed-specific behaviour, as well as the importance of responsible ownership and care, so that dogs do not have to suffer the consequences of human mismanagement.

AMBER STRATION

THE POINTING ORANGUTAN

ART BY: NAOMI CHUNG

An orangutan, by the name of Amber, has captured the attention of millions over the past few months. An 18-year-old armed with an iPhone and a selection of household objects has created a viral series on TikTok under the username @pointingorangutan, where she visits Amber at the zoo and displays items to her through the glass enclosure. It feels like you're watching a hairier version of your grandad, staring at the Greggs counter as he decides which corned beef pasty he wants, aloofly pointing out 'that one'. With the dispassionate gaze of a veteran pointer, she gestures, as if to say 'next', at every object offered. Still, her curiosity is undeniable, and her TikTok audience is left with enough videos of her inspecting items to fill an afternoon.

Each new object revealed to Amber also sparks curiosity among the eager commenters who suggest what to bring next. In a sense, these TikToks and the responses from viewers echo the early days of scientific discovery. Before rigid methodologies were established, pioneers like Charles Darwin, Alexander von Humboldt, and other naturalists relied heavily on observation and a trial-and-error approach. In striking contrast to the rigidity, impenetrability and exclusivity of contemporary research, the public's engagement and participation is encouraged; they watch closely and offer up suggestions of the next object to be introduced. The potential of interactions like these should not be dismissed, as we see a rise in citizen science projects, such as online camera trapping, playing a role in research.

Aside from entertainment value, these videos prompt fundamental questions about primate behaviour. By turning to research on primate cognition and communication, we can start to answer the questions viewers have been asking.

Is Amber an exceptional case? Amber's behaviour, while remarkable, is not not an isolated case. Pointing and similar gestures are seen in orangutans and other great apes. However, it is certainly rare in the animal kingdom, as using gestures to communicate desires is typically understood to be a sign of complex thought. Complex thought involves forming abstract connections, anticipating outcomes, and intentionally communicating desires. When an animal points, expecting another to understand and act, it demonstrates more than a simple reaction—it shows an understanding of cause and effect and the ability to use symbolic communication.

Is she just imitating human behaviour? While Amber's pointing could be seen as a result of her emulating human behaviours from frequent interactions, it is not purely a case of imitation. In the wild, orangutans and other great apes use gestures, including pointing, to communicate with each other. This suggests that while Amber may have refined her gesturing in response to human behaviour, the ability to use gestures like pointing is an innate aspect of orangutan communication.

Many of these gestures have "tight" meanings—that is, they are used consistently within specific contexts to convey particular intentions. One study found that orangutans in captivity could use up to 29 different gestures, each associated with a single, clear meaning, such as requesting food, initiating play, or signalling a desire to move together. This clear and purposeful use of gestures shows they strategically choose signals to achieve desired outcomes, reflecting their sophisticated cognitive and social skills.

What is Amber actually trying to communicate? Research suggests that orangutans will modify their signalling if their needs are not met, using different gestures until their goals are achieved. Since Amber .consistently uses the same gestures without variation, it is likely that she is successfully communicating her needs and getting what she wants from those interactions.

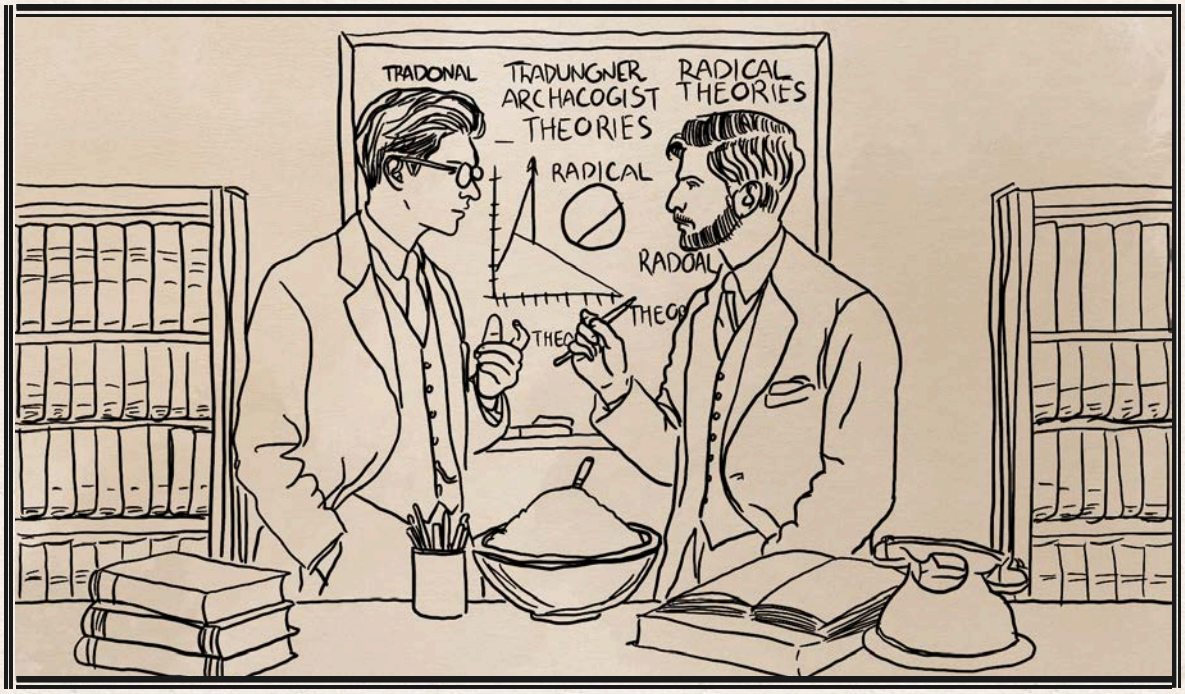
What does Amber understand about the person on the other side of the glass? Amber's behaviour indicates an understanding that the person recording her is an independent being with intentions and actions that affect her environment. Studies on great ape cognition, including orangutans, indicate that these animals are capable of understanding that other beings have their own thoughts and intentions, a cognitive ability known as "theory of mind." Her targeted pointing and adjustments based on the human's responses imply that she recognises the recorder as another being with the capacity to understand and respond to her signals.

Does she recognise herself in the mirror? One of @pointingorangutans' most captivating videos is when Amber is presented with a mirror. She stares at her reflection with such intensity that viewers are prompted to wonder if she recognises the image as herself. In the animal world, self-recognition is rare and considered an indicator of high cognitive abilities. Studies have shown that only a few animals, including certain primates, elephants, and dolphins, pass the "mirror test" of self-awareness. It is hard to say what is happening here, but the fact that she engages with her reflection suggests she may possess an understanding of her own identity.

Whilst Amber the orangutan may initially appear to be just another set of TikTok videos to provide you with a 100-second dopamine burst, they are undoubtedly sparking interesting discussions on how we think about animal curiosity and communication. TikTok users may unknowingly be prompted to ask deeper questions about animal intelligence, personality, and our relationship with them. These videos serve as accessible and engaging examples of primate cognition, capturing public imagination in a way that textbooks or research papers rarely do. Observing Amber stimulates discussion on topics like self-awareness, theory of mind, and the evolution of communication. While Amber may not know the extent of her viral fame, her subtle gestures and bemused expressions are inspiring people to think more deeply about what it means to share this planet with such extraordinary beings.

An Untold ACADEMIC FIGHT

HOW THE SCHISM BETWEEN THE ARCHAEOLOGISTS OF THE 60'S AND 70'S IMPACTS OUR UNDERSTANDING OF THE PAST AND WHERE WE GO FORWARD



Katharina Stock

Artist: Marya Cao

In November 2024, the world feels more fragmented and uncertain than ever. President-elect Trump waves to crowds of adoring fans in America after his electoral win, while promising to evict refugees and other minorities. Closer to home, Starmer treads a delicate political balance between asserting British identity and refuting the ethnonationalist claims of the far right. As political entanglements increase, war brews and people clamour for a unifying identity, making the questions of the past more necessary to answer. Our collective understanding of the past hangs by a tight thread, and if we are not careful, the winds of history will blow and the whole edifice will come down with it. In this article, I would like to explore identity—one composed, nurtured, and sustained through our relationship with objects.

In November 2023, Greek Prime Minister Kyriakos Mitsotakis sat down with BBC host Laura Kuenssberg to discuss the possible return of the Elgin Marbles from the British Museum, a digitised screen displaying the Acropolis behind them. When questioned about where the sculptures “look better”, the PM claimed that “the answer is very clear”. The following day a media frenzy ensues, reporting a political spat between Mr. Mitsotakis and the British PM at the time, Rishi Sunak, who took the position that we own these sculptures as a nation and that this debate is therefore null and void. As expected in our current politically hostile environment, the country suddenly forgot all about it, however, I remained fascinated. Several weeks before, I had visited the British Museum myself with a cohort of international university friends. Every room we entered

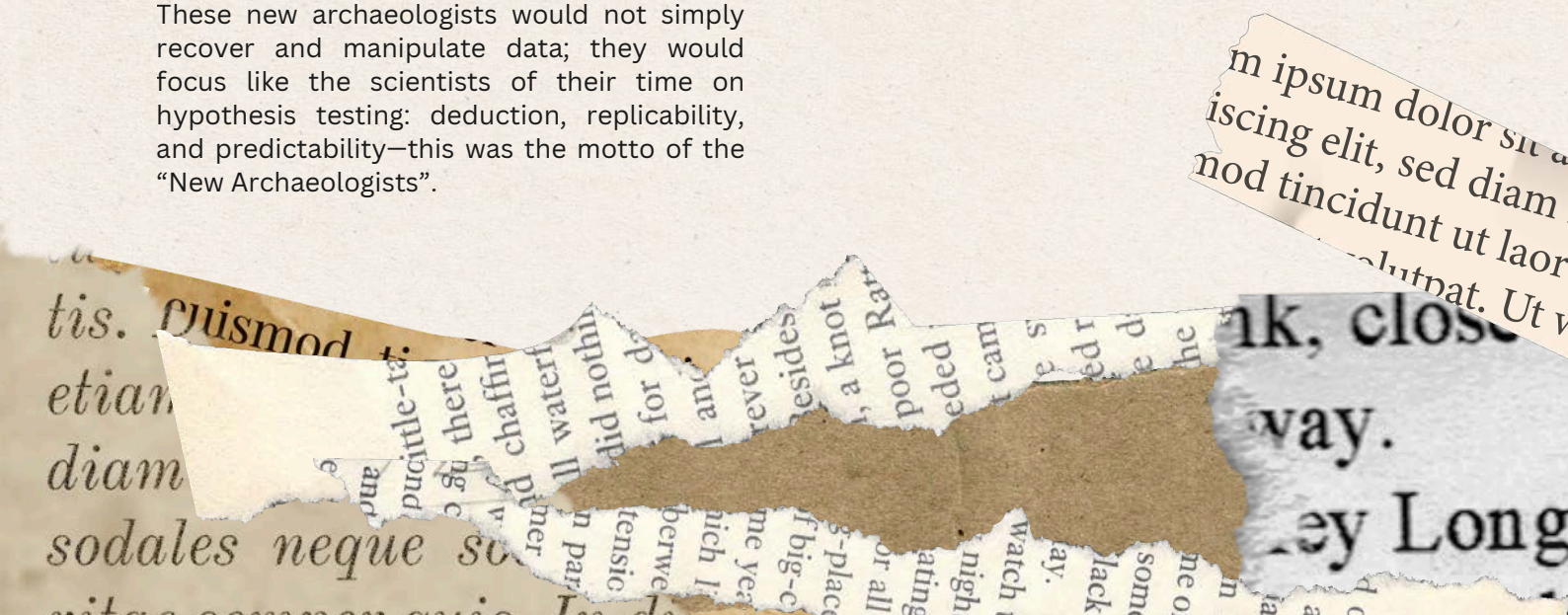
had contested objects—objects that spoke to a history, a collective understanding of a world, a shared interpretation of nature, stories, and communities outside the context that they were born into. Conversations ensued about the objects and what they meant to my friends, which made me think this was something worth exploring.

In the beginning, archaeologists believed that their role was to establish a true narration of history. In other words, to compare objects in order to establish a historical chronological order. They believed that this would lead to a correct analysis of historical events, a timeline of the creation of objects, and a comparative tool to understand the growth and decay of societies. However well-meaning these archaeologists were, they were fundamentally misguided, and their narrow-minded interpretation led to a hyper-diffusionist worldview. Hyper-diffusionists believe that two or more similar constructions or objects cannot have been made without inspiration or contact with another social group. The issue with this viewpoint is its correlation with the racist eugenics' movement of the time—that is, hyper-diffusionists believed that it would be impossible for societies that they thought of as being "primitive", to come up with an innovative technique without inspiration or contact with other more "enlightened" societal groups.

Along come the 1960s, the end of the great World Wars, and the entire planet clamours for freedom. The outdated interpretations of archaeologists could not provide a wide enough frame of knowledge, so a multifaceted approach was required to differentiate between sound and valid scientific interpretations and those that were biased. These new archaeologists would not simply recover and manipulate data; they would focus like the scientists of their time on hypothesis testing: deduction, replicability, and predictability—this was the motto of the "New Archaeologists".

Why has this not been applied to the political sphere where politicians still use old-fashioned archaeological interpretations to form their identities? When the spat between the Greek and the British PM ensued, I realised that this was due to a lack of understanding of the historical process that archaeology itself has been through. Archaeologists today know that a singular frame of reference has no hope in providing a grand overview of a society. Yet, politicians, and even the general public perhaps, use modes of interpretation that do not accurately assess the life stories of objects in the manner that they deserve. As the world turns and national arguments over object possessions continue to ensue, I hope we can all take the time to ask ourselves: what do these objects mean to us, and to what end will we refuse to accept the full breadth of context in which they deserve to be viewed?

For all the confidence and optimism of the 1960s, the 1970s came with a more apprehensive view on the possibilities of science as an applied method in archaeology. Archaeologists realised that the scientific method, in spite of its benefit of evolving the previously inadequate references of cultural historians, could not provide a full picture of the society they studied. And so, archaeology splintered—some used science, others aligned more with anthropology, and others used economic and sociological frameworks, like Marxism, to study their respective society and object histories. Now we have arrived at a moment in history where archaeology is a broad discipline—its academics engaged in a serious moral endeavour to uncover truths about the past, both so we can benefit from a greater appreciation for our ancestors, but also so we can learn from them.



A SCIENCE FOR SOCIALISTS?

What the history of eugenics can tell us about contemporary political division

A brief google search for ‘eugenics at UCL’ will yield a plethora of apologetic articles on the university’s official website addressing their “historical links with the eugenics movement.” ‘Historical links’ is putting it lightly; the history of eugenics is not one where UCL appears as a footnote, rather UCL was the home of eugenic research in Britain. Francis Galton, cousin of Charles Darwin, and founding father of the movement, left his financial estate to UCL in 1907. This enabled the establishment of a eugenics laboratory, including a permanent Chair of Eugenics, bequeathed to his protégé Karl Pearson. UCL’s grounds welcomed meetings of the Eugenics Education Society and its academic journal, The Annals of Eugenics, was published by the university.

But what is eugenics and why is UCL so ashamed of its association with the movement? Eugenics is a pseudoscience stemming from turn-of-the-century anxieties surrounding population control, immigration, and empire. Eugenicists sought to reckon with this seismic social upheaval by positing that humans have the ability to manufacture social progress, to manage the quality of their populations, using policies to control reproduction. Policies existed on a spectrum of marriage prohibitions to forced segregation and sterilisation of those deemed mentally or physically ‘undesirable’. All policies - however draconian their means - rested on a superficial understanding of human genetics that assumed abstract qualities like talent, morality, and intelligence, were heritable.

For the likes of Galton and Pearson, society was considered, 'as plastic as clay, under the control of the breeder's will.' This sinister language may sound unsettling to the 21st century reader, conjuring images of dystopian science-fiction and Nazi-experimentation. Such was not the case less than 100 years ago. From its inception, eugenics was considered a cutting-edge science, embraced by those who professed to be modern, and primarily the preserve of Britain's leftist elite. UCL's Karl Pearson was a committed socialist, authoring The Moral Basis of Socialism and advocating for the logical and moral necessity of nationalisation of land and capital.

Pearson's vision of a socialistic-eugenic Britain was not a paradoxical anomaly either. Many of Britain's most beloved progressives (including John Maynard Keynes, Bertrand Russell, William Beveridge) accepted invitations to speak at the Eugenics Society and became official members of the body. Rather than being an unfortunate blemish on the history of the British left, eugenics was understood by many as an essential appendage to socialism. The ideological intersection lay in the belief that individual reproductive freedoms should be made subservient to the welfare of the social body. British leftist Eden Paul affirmed that 'unless the socialist is a eugenicist as well, the socialist state will speedily perish from racial degradation.' The revered liberal economist, John Maynard Keynes, was director of the Eugenics Society from 1937 to 1944. He wrote of the necessity of birth control provision among working classes as their supposed 'drunkenness' and 'ignorance' threatened the possibility of them outbreeding Britain's middling sorts.

Socialists saw conservatives as the enemies of progress. Commitments to planning, scientific research and technical efficiency were the order of the day for the British left which created fertile ground for eugenic and socialist ideas to flourish and coalesce. In part, this unsavoury association was a consequence of the left's perception of science as a neutral instrument to bring about 'progress'. These British socialists of the early 20th century failed to understand science as a fundamentally social phenomenon.

Science possesses an unquestioned authority and argumentative power, it's supposed impartiality, objectivity, and pursuit of capital-T 'Truths' blinds us from the fact that it is so often a projection of our hopes and anxieties, a desperate quest for meaning in the face of the world's messiness and chaos.

For eugenicists, selective breeding was understood as a compassionate means to control human evolution. Galton prophesied in 1904, 'what nature does blindly, slowly and ruthlessly, man may do providently, quickly and kindly.' An uncritical embrace of Social Darwinist thinking led eugenicists to the conclusion that their science was a humane alternative to letting natural selection run its course; clearly failing to situate their arguments for the prosperity of future generations into a larger framework of human rights and freedoms. By striving for a future of absolute equality (a classless nation made up of only the fittest human stock) they were necessarily claiming that their current society was inherently unequal, and that this inequality was biologically fixed and determined.

Today, eugenics is a dirty word, forever tainted by its realisation in the genocidal practices of the Nazi party. But prior to 1945 it was largely the preserve of elite leftist intellectuals who saw themselves as the pioneers of progress. Our current conceptualisation of politics, which has been fuelled by the expansion of mass media and internet echo-chambers, manifests in overly simplistic section divisions. Left vs Right. Progressive vs Conservative. While eugenics clearly eschews expected political boundaries, the same can be said for so many contemporary social and political issues. A timely example would be the remarkably high number of Americans who opted to vote for both Donald Trump and avowed democratic socialist Alexandria Ocasio-Cortez on the same ticket in the recent US presidential election. The two couldn't be on further ends of the political spectrum but united voters because of their 'anti-establishment' convictions. The 'political spectrum' as a metaphor then doesn't allow us to speak adequately about what politics actually looks like in practice. Perhaps a more refined understanding of politics as a messy web of competing interests and ideological affiliations would benefit us greatly in both our scientific research and political pursuits.

WRITER: RHIANNON EVANS

ARTIST: MARYA CAO

Have you ever wanted to watch life evolve? Have you ever speculated on how different certain species might look or behave had conditions varied even a little bit somewhere in their evolutionary past? The Sapling is an indie video game that attempts to do just that: simulate life and how it evolves. I interviewed its developer, Wessel Stoop, to find out more.

Artist: Suzie Mishima

The game currently has four groups of organisms: algae, plants, animals, and, after the most recent update, fungi. "

"You create them yourself, and you can create your own ecosystems," Wessel tells me. "Or you can hit the random mutations button, let the game run for itself, and see what happens."

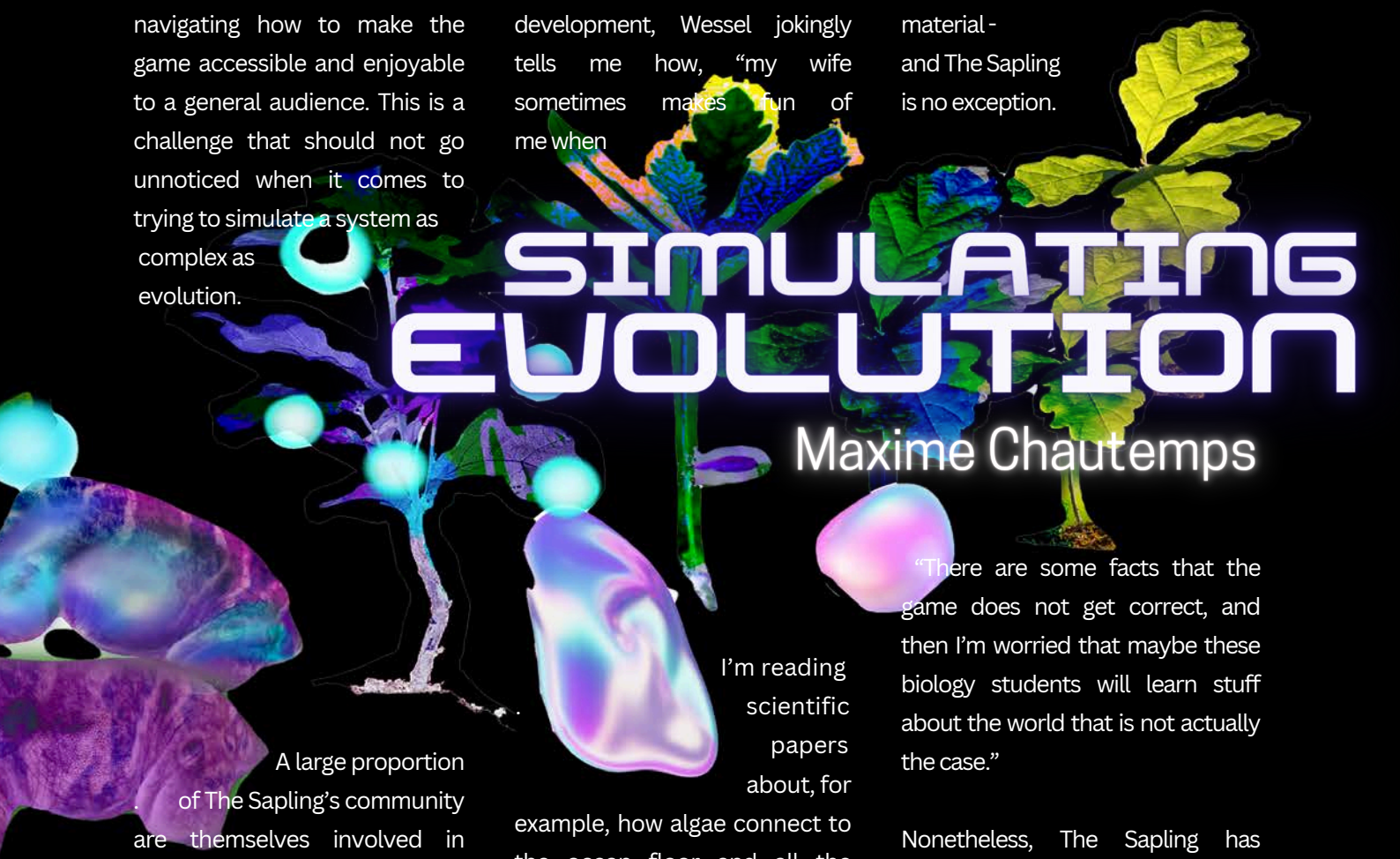
Wessel first had the idea for a game like The Sapling when he was around eleven years old. For as long as he can remember, he's been playing simulation games and fantasising about making his own. "If you're in that mindset—you like simulation games and you want to make simulation games—everything around you, any system that you see, you think, oh wow, cool! Somebody should make a cool simulation game about this!". I am a little bit shocked when he tells me that his interest in nature is relatively new by comparison. but once he explains why, it all makes sense. "Evolution was always the starting point of my interest," he elaborates, "and only from there I've also grown interested in nature." For Wessel then, "the core interest is this mechanic - evolution mechanic."

So how does evolution work in the game? And how accurate has Wessel managed to make it? "It's not that complicated at all, actually", Wessel says. He points out that there are similar games that use a system much closer to DNA than his own. The Sapling doesn't work like that, and the reason why comes down to a question that Wessel is constantly asking himself: how much can be simplified?

Organisms are divided into body parts, each of which has a chance of randomly mutating inoffspring depending on what mutation rate the player chooses. The computer then rolls some die to decide which body part will change and how it will change, with mutations affecting colour, size, morphology, and more.

Animals can even develop instincts allowing them to respond to stimuli or randomised hormones that affect their behaviours.

Wessel's approach to The Sapling has been shaped by years of playtesting and direct feedback from the game's passionate fanbase. "One of my design principles is that whatever I'm building,



SIMULATING EVOLUTION

Maxime Chautemps

it should be something I can visualise, something I can show to the users." This became especially clear to Wessel in the early days, when a lacklustre launch left the future of the project uncertain. Four years later, it is clear Wessel has found his confidence in navigating how to make the game accessible and enjoyable to a general audience. This is a challenge that should not go unnoticed when it comes to trying to simulate a system as complex as evolution.

A large proportion of The Sapling's community are themselves involved in biology, whether through academia, work, or as a hobby. Despite having to often sacrifice realism and accuracy in favour of playability, this group in the community seem to be the most devoted and understanding of the limits the game has to work within. "It seems like everybody understands that you can't get everything right, because then your computer would explode."

Still, feedback from players is vital for The Sapling, and ensuring as much realism makes it through is always a top priority. "It's important to get all these details right, because I've noticed that the audience appreciates it when I do." To do so, Wessel reads through a bombardment of daily suggestions, coupled with dense research. Due to his background in linguistics and game development, Wessel jokingly tells me how, "my wife sometimes makes fun of me when I'm reading scientific papers about, for example, how algae connect to the ocean floor and all the details around that; that's something she never expected me to read."

With the increasing role of video games in education, the potential for simulators of biological systems as learning resources has never been greater. The Sapling itself has apparently been recognised as such, with Wessel explaining how teachers have reached out in the past. "Almost by accident, it's something that teaches stuff to people. That was not my intention at all - it was just my geeky interest that I turned into a video game."

All learning resources have their limitations—video games are particularly vulnerable to distracting from potential learning material - and The Sapling is no exception. "There are some facts that the game does not get correct, and then I'm worried that maybe these biology students will learn stuff about the world that is not actually the case."

Nonetheless, The Sapling has evolved dramatically over the past four years. It is one of many games attempting to simulate evolution and ecosystems - all inheritors of a legacy stretching back thirty years to projects like PolyWorld and Creatures.

With a new update on the horizon that promises to add features ranging from fungi to sexual selection, The Sapling shows no sign of stopping yet. "For now, as long as I remain excited about this project and the audience remains excited about this project, I'm going to keep going."

KINESIS
MAGAZINE

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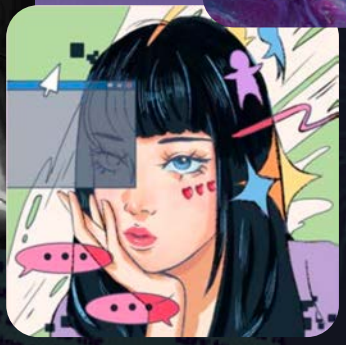

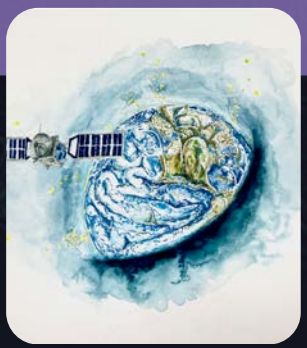

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We welcome everyone to join us in exploring fascinating topics in science and how they intersect with each other and society!

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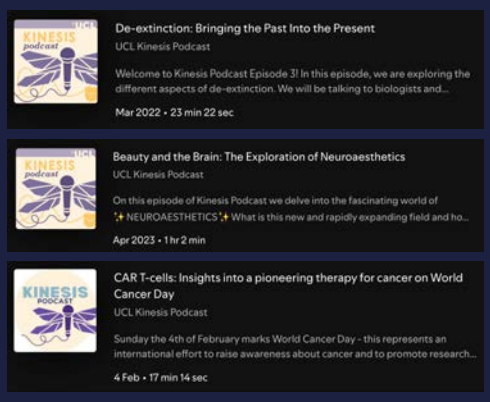

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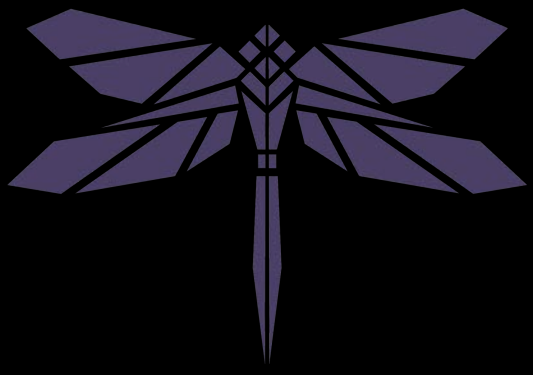

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