PULSE

North London Collegiate School Science Magazine

Edition 2

FOOT BINDING

BY: JANAINE HO

Foot binding, a symbol of beauty and wealth, was the Chinese custom of breaking the bones within and tightly binding it in order to alter the shape. It was popular among the elite class during the Song Dynasty, and it spread to the lower social classes during the Qing Dynasty. It was estimated that by the 19th century, at least 40% of women had bound feet, and wore lotus shoes (shows that kept the feet in shape). The practice only began to die out in the 20th century when Christian missionaries and Chinese reformers challenged the idea. The idea of foot binding came from the story of Pan Yunu, a consort known for having delicate feet, who usually performed dances on golden lotus decorated floors.

The process of foot binding starts before the arch in the foot is fully developed, around the age of 4 to 9 during winter as it is colder, hence making the feet numb and reducing the pain experienced by the individual. The feet were first soaked in a mixture of herbs and animal blood in order to soften the foot. The toe nails were then cut as far back as possible to prevent ingrown toenails. Following that, the toes on each foot were curled under the arc with great force until the bones broke. It is then immediately wrapped with cloth till the point where the girl can no longer move their toes.

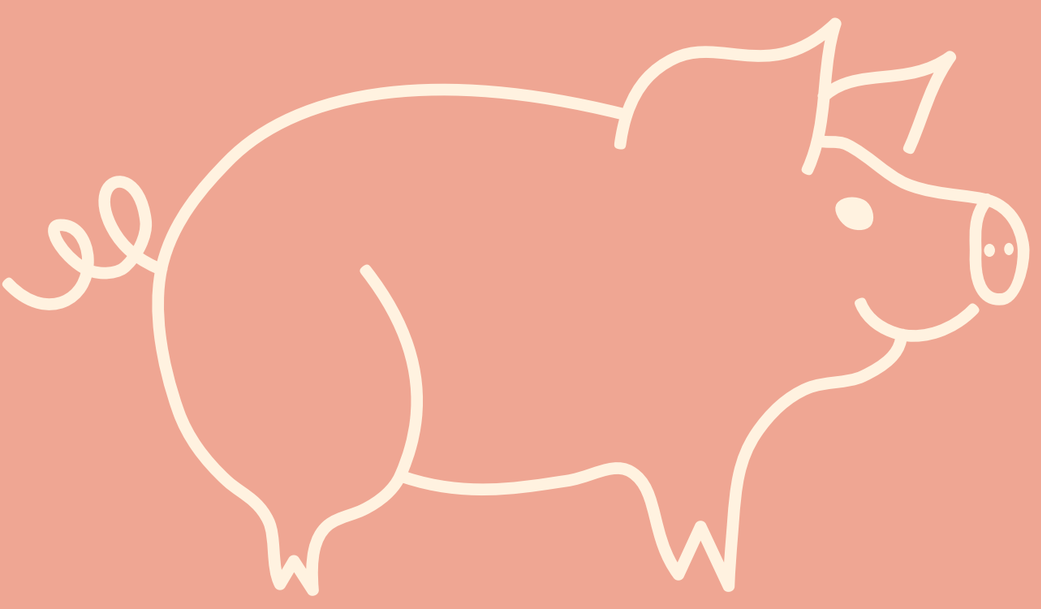
Green Flashes

BY: JANAINE HO

The Green Flash is a meteorological optical phenomena where the rising or setting sun appears green for an instant. It is a combination of the dispersion of light and a mirage. This usually happens over a warm ocean, when only the upper edge of the sun is visible over a distant horizon with a clear sky.

This occurs as the Earth's atmosphere gets thicker when you look lower in the sky. The water vapour in the air will scatter violet light, and absorb yellow and orange in white light. This leaves the red and blue light, allowing the sun to appear green. As the sun lowers into the horizon, the sun's light becomes highly refracted, appearing to have 2 suns, one red one that is closer to the horizon and one blue-green one that is further. Hence, the green flash can only be observed when the sun is only slightly above the horizon.

Click here for link to video



Ethical Discussion in social science:

KALBI THE PIGLET

By: Janaine Ho

Let me introduce you to Kalbi. Adorable isn't she? A Japanese Youtuber adopted Kalbi just when she was 75 days old (born 27.02.2021) in May of 2021, explaining that Kalbi was the newest addition to his household. Many netizens fell in love with the piglet, and tuned in to watch the owner’s videos of them going on walks and playing together. However, here’s the catch: The owner will eat the pig after 100 days.

Many of you might be thinking that what he is doing is appalling and inhumane, which no one can blame you for. How could you adopt a piglet as a pet, build a relationship with it, with the intention of eating it 100 days later? The owner chose a symbolic name for the piglet, ‘Kalbi’ or ‘galbi’ means ‘ribs’ in korean. Many people commented online, pleading with him to let the pig live, calling him a cruel man. Sadly, the Youtuber kept his morbid promise.

The Japanese Youtuber, under the channel name ‘Eaten Pig after 100 days’, did this experiment to prove a point, that we care so much about this one pig simply because of the fact that it has a name. He was trying to show the irony when society consumes meat on a daily basis and feels no remorse, but when they have only known a pig for a 100 days, they suddenly act completely differently. This links to the debate about animal cruelty, that many chose to ignore such issues because they have not personally witnessed it.

If I told you that the Youtuber faked Kalbi's death, and that the pig he cooked was another random pig, would you feel relieved? Many people online suspected that this was all a ruse, and it was simply a social experiment, and that the owner never cooked Kalbi. However, the point here is that, either way, a pig's life ended, regardless of whether it was Kalbi's or a nameless pig's, so why is it that some people feel relieved when they find out Kalbi isn't the one that was cooked? Does this show that we don't care about other life until we build a connection with it? Can the Youtuber really be considered a cruel man for killing his pet pig, when we consume meat on a daily basis? Just because we didn't kill nameless pigs with our bare hands, doesn't mean we did not indirectly cause it's death. Does that mean we are all cruel?

To make it clear, I am not writing this article to convince you to give up meat and go vegetarian. My intention today is to show how we as a society can start to care more about issues that are not directly related to us, that there is cruelty all around us that we should stop ignoring, and start taking action.

To end off, I leave you with this: Does an animal with a name matter more than a nameless one?

Click here for link to Youtube Channel
Click here for link to Youtube video introducing Kalbi
Click here for Youtube video cooking Kalbi

NOTE: there may be content that viewers find disturbing, please view at your own discretion.

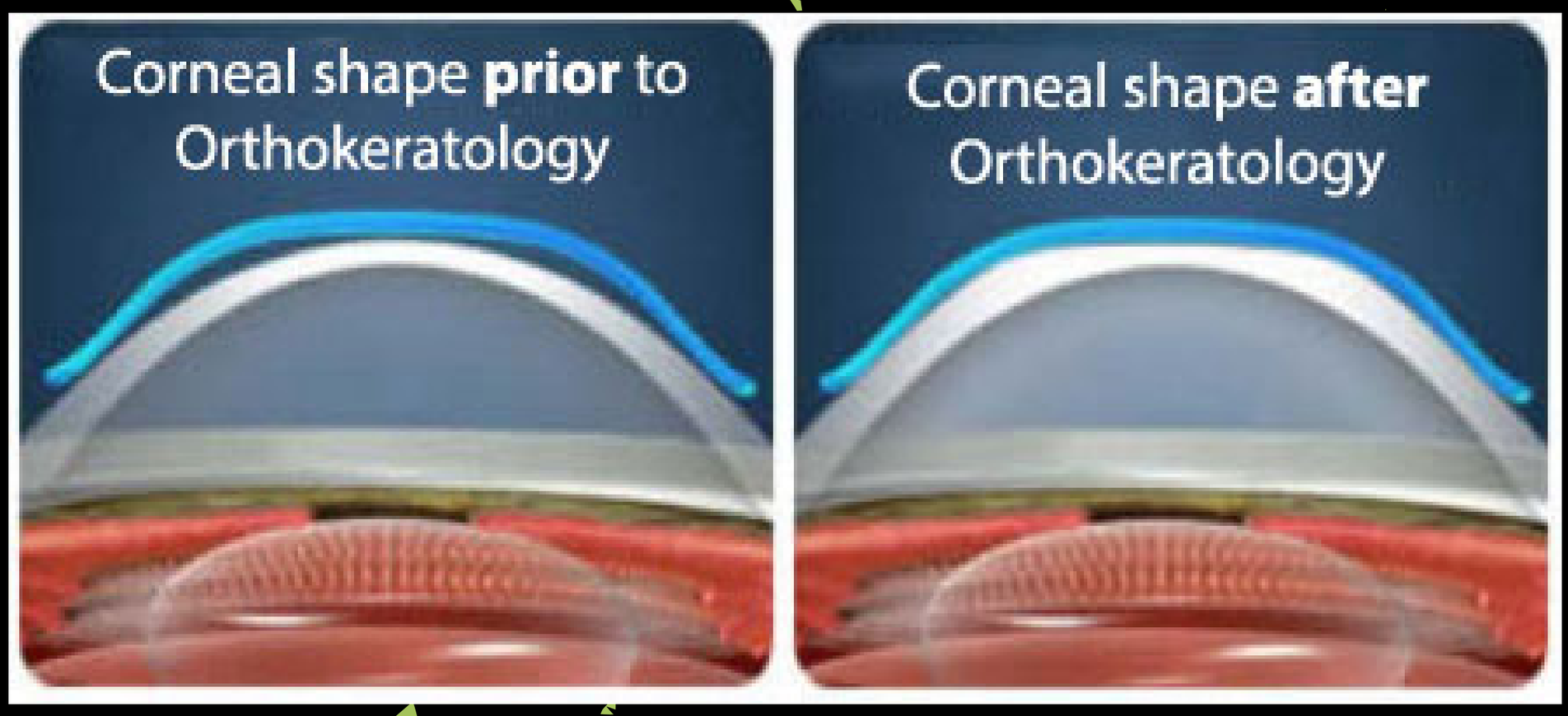
NIGHT LENSES

BY JIEUN YUM

Orthokeratology is a non-surgical procedure that helps improve vision, allowing those with nearsightedness, farsightedness, astigmatism and presbyopia to see clearly during the day. It involves the use of specially-designed gas permeable contact lenses that reshape your cornea while you are asleep.

The cornea is the clear, dome-shaped outer layer of your eye responsible for refracting and focusing light into your eye. Using a computerised corneal topography (CCT), the ophthalmologist is able to map corneal contour to determine its shape and curvature. This will allow them to design a specific lens for you.

When the lenses are worn, the base curve of the lens flattens the centre of the cornea and changes how light is bent as it enters the eye. This change in shape is maintained even when the lenses are removed in the morning, thus correcting vision for the day. However, the cornea will return to its original shape if the lenses are not worn regularly at night.



NEUROMARKETING

BY JIEUN YUM

Neuromarketing, also known as consumer neuroscience, is an evolving field that provides firms with valuable insight into consumer behaviour and decision making. It involves the study of our brains' response to marketing stimuli, usually by utilising either medical scanners like fMRI (functional magnetic resonance imaging) and EEGs (electroencephalogram) to directly measure brain activity, or other less costly tools like eye tracking and facial coding to measure our physiological responses (mainly arousal and attention). The employment of these neuromarketing techniques can illustrate the pervasive influence of marketing actions on us at a neural level.

In one study, researchers demonstrated the effect of external properties like price on consumers' experienced pleasantness (EP) from consuming a good. Participants' brains were scanned while they tasted what they thought were 5 different wines at different retail prices. Unbeknown to them, 2 of the wines were actually the same, their only difference being the prices they were presented with. Interestingly, results demonstrated increased activation in the medial orbitofrontal cortex - the region of the brain believed to encode for pleasantness - when they were drinking the more 'expensive' wine.

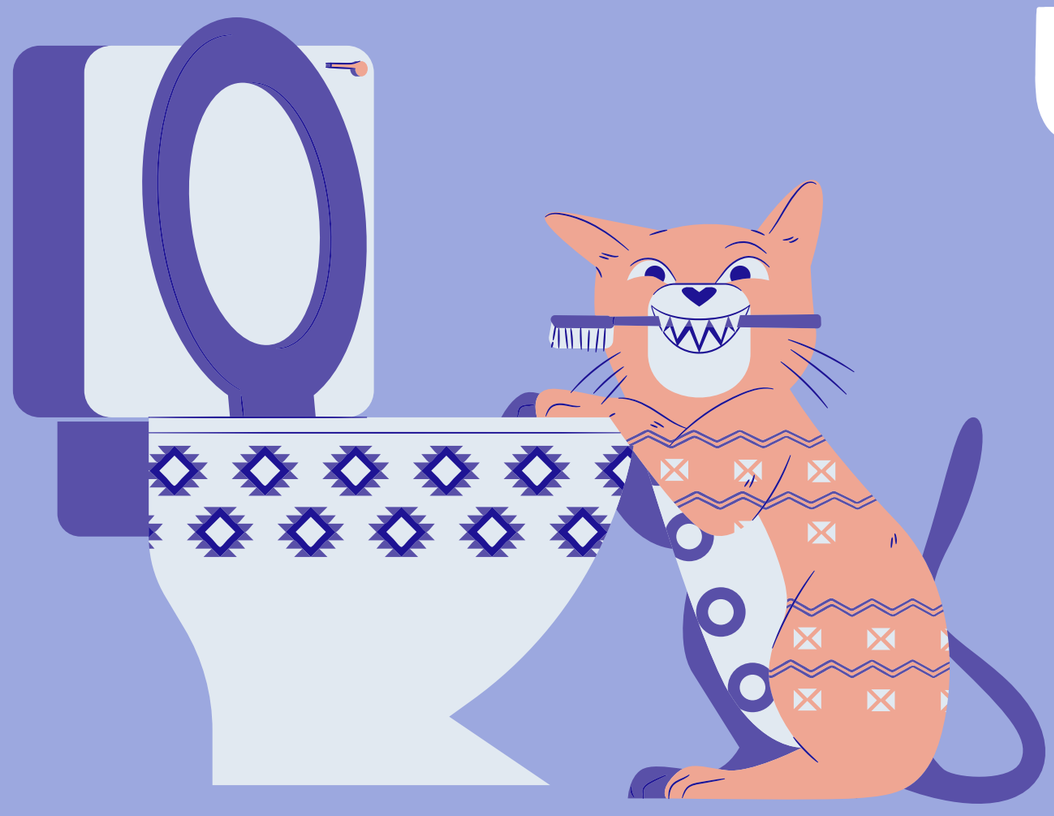
Neuromarketing techniques can also help inform firms' choices in advertisement, and in the case of the following example, package design. Chips ahoy utilised an EEG to measure participants' responses to different parts of their packaging. The data revealed that the word 'resealable' drove negative responses, while the image of the cookie 'only drew neutral reactions'. These insights gave the company a window into consumers' minds, and allowed them to make the necessary refinements to their package design to appeal to a wider audience.

Another fascinating concept is ‘neuroforecasting’, which neuroscientist Brian Knutson has dubbed for the predictive power of brain data. Him and his colleagues conducted a research study to investigate whether brain data of individuals can forecast the behaviour of other, unrelated people. As participants watched videos online, their brains were scanned using an fMRI and their behaviour analysed. Questions were also asked after each video - whether or not they thought the video would be popular, etc. They found that only brain activity, and not behaviour or the questionnaire, could forecast a video’s popularity on the internet (number of views per day). Videos with increased popularity showed heightened activity in the reward-sensitive region of the brain, while videos with decreased popularity showed heightened activity in the region associated with anticipating punishment. This and other related research suggest neuroimaging to be better predictors of product successes than traditional market research tools like surveys and focus groups.

Unfortunately, neuromarketing does not end with the simple measuring of consumer preferences. Researchers are growing more and more fascinated with the idea of neural manipulation - utilising tools to physically manipulate our decisions and preferences. The concern thereby lies in the lack of transparency around neuroscience research being conducted at companies, particularly tech giants like Faecbook and Google. The neuroscientist Morgan Cerf once said, ‘I’m only half joking when I tell people that the moment a tech company introduces an EEG to connect with their home-assistant device— that’s when we should all panic.’

BY: JANAINE HO

URINE THERAPY



Urine Therapy is an alternative medicine where it involves one drinking their own urine, or using their urine to massage their skin or gums in order to treat diseases. It was popularised by British naturopath (people who study alternative medicines) John W. Armstrong in the early 20th century, and he was inspired by a bible verse, Proverbs 5:15. It states: "Drink waters out of thine own cistern, and running waters out of thine own well". There also has been research done on urinating on jellyfish stings, which can neutralise the alkaline sting due to urine's acidic nature, however it is better to seek medical attention immediately.

However, according to the American Cancer Society, there is no scientific evidence to support the claims of the therapeutic use of urine. Additionally. The urine of Nigerian children were tested, and multiple pathogens were detected, such as E.coli, Shigella, and Salmonella. These pathogens can be introduced to the body through urine consumption, hence, it would not help at all.

Disclaimer: There is no scientific evidence to prove the claims, Do NOT try this at home

CAN THE SHAPE OF YOUR HEAD DETERMINE PERSONALITY?

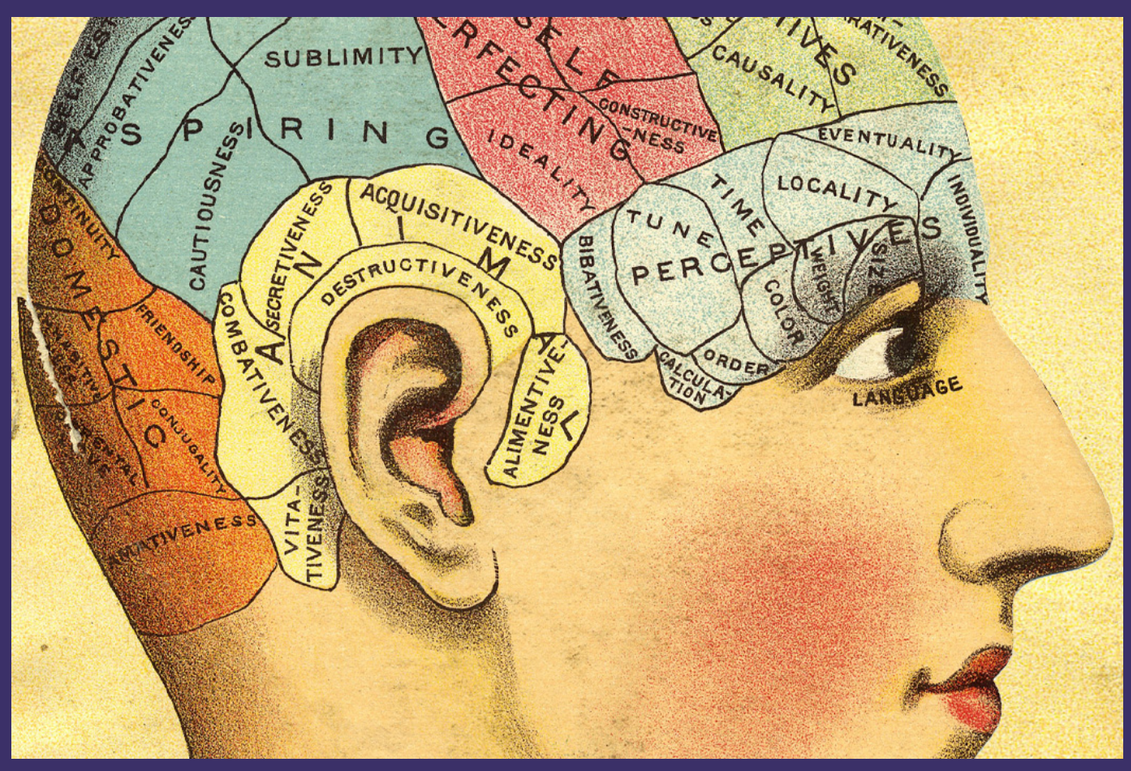
BY JIEUN YUM

If only it were that simple...

Phrenology is a pseudoscience first popularised by the physician Franz Joseph Gall in 1796. He believed that the conformation of the skull could act as determinants of an individual's character and ability. It was based on the belief that the brain was an aggregate of 27 separate 'organs', each attributed to a distinct function. A person's capacity for a certain mental trait was thereby correlated to the size of the portion it represented on the skull. This postulation was hugely popular in the 19th century amongst the middle and working classes, due to its simplified principles and applicability to a myriad of social constructs.

Though the 'science' which formed the basis of this theory was doubtful and has long been discredited, the core ideas of this phenomenon still proved useful for the historical advancement of neuroscience. In particular, Gall's idea of localisation of function within brain areas contributed important scientific progress in the understanding of our brain. For one, it played a role in the discovery of aphasia - a disorder resulting from damage to a region of the brain that produces and processes language.

However, this seemingly harmless theory also contributed to the solidification of discriminatory notions. Some used phrenology as a means of highlighting gender stereotypes, with the claim that women had underdeveloped regions necessary for success and larger and larger mental organs relating to 'devotion to offspring'. Not only this, some also utilised this 'science' to uphold 'scientific racism', and affirm European superiority over other races. Bear in mind, all this was solely based on the shape of our skulls - patterns which were subject to confirmation bias from the very start.



THE CHEMISTRY WITHIN BAKING

BY INEZ WANG

Have you ever wondered what is happening inside your cookie dough? What turns it into delicious cookies? The truth is, every time you bake, you are triggering a series of chemical reactions!

The moment you slide your baking pan into the oven, Chemistry kicks in. To begin this process, when the oven reaches around 33 degrees celsius, the butter inside the dough melts, causing your dough to flatten out. Butter is an emulsion or a mixture of two substances that don't stay together - in this case water and fat- but daily solids hold them together. As butter melts and the temperature increases, water escapes from the dough and turns into steam, pushing the surface of the cookie dough outwards unevenly. When the dough eventually reaches around 57 degrees, salmonella, a bacteria that can be found in eggs, die off (so remember not to eat raw dough:) As the temperature increases to 62 degrees, proteins, which were coiled up, unfold and get tangled up with other neighbouring proteins instead. When it reaches 100 degree, water dried out, giving your cookies a stiffed texture. As the steam evaporates and sodium bicarbonate or baking soda reacts with the acid inside the dough, creating carbon dioxide, airy pockets are left on the surface and inside the cookies.

The two final stages are the Maillard reactions and carmalisation. The Maillard reactions, happening when proteins and sugars rearrange, give your cookies a rich brown color. Lastly, carmalisation occurs as the sugar compounds break down, which explains why cookies have a slightly caramel taste. After all these stages, you have unconsciously carry out numerous chemical reactions and it's time for you to enjoy the cookies!

Empathy & psychopathy

BY JIEUN YUM

Empathy is often associated with the idea of ‘putting yourself in somebody else’s shoes’, being able to feel what another person is feeling. This simple concept affects not only our social behaviour, but our moral compass - its importance is indisputable. The question thereby lies less in its significance, and more in its underlying mechanism - the neural underpinnings of empathic processing. How does one feel empathy? Why are some more empathetic than others?

Empathy is a complex process that is believed to include both cognitive, and affective aspects. Affective empathy refers to emotional contagion - our ‘automatic’ ability to share or mimic the feelings of another person. Cognitive empathy on the other hand, is the capacity to infer the mental states of another person. It is viewed more as a skill of recognising and understanding another person’s emotional state. As such, empathy can be explained as a constitution of both the experience of emotion in self, and the perception of emotions in others.

A fascinating concept to consider when thinking about empathy is the mirror neuron system which, as the name suggests, refers to a group of neurons that enable us to ‘mirror’ the behaviour of others. This mechanism was first discovered in the brains of monkeys, as researchers found neurons responding not only when the monkey picked up food, but also as it watched someone else picking up the food. Since this discovery, there is now evidence that found mirror neurons to be present throughout the motor system in humans, which can to a certain extent explain our action observation and execution.

Can mirror neurons be applied to our emotional experiences as well? There is evidence that suggests the presence of ‘mirroring’ in the perception and expression of emotions such as fear, pain and disgust. For one, studies found that inflicting pain on the participants and then having them watch as pain was inflicted on others, resulted in increased activation of similar neural mechanisms, in particular the anterior cingulate cortex and anterior insula. However, whether or not mirror neurons are actually involved in these cognitive functions still remains a highly debated area of interest.

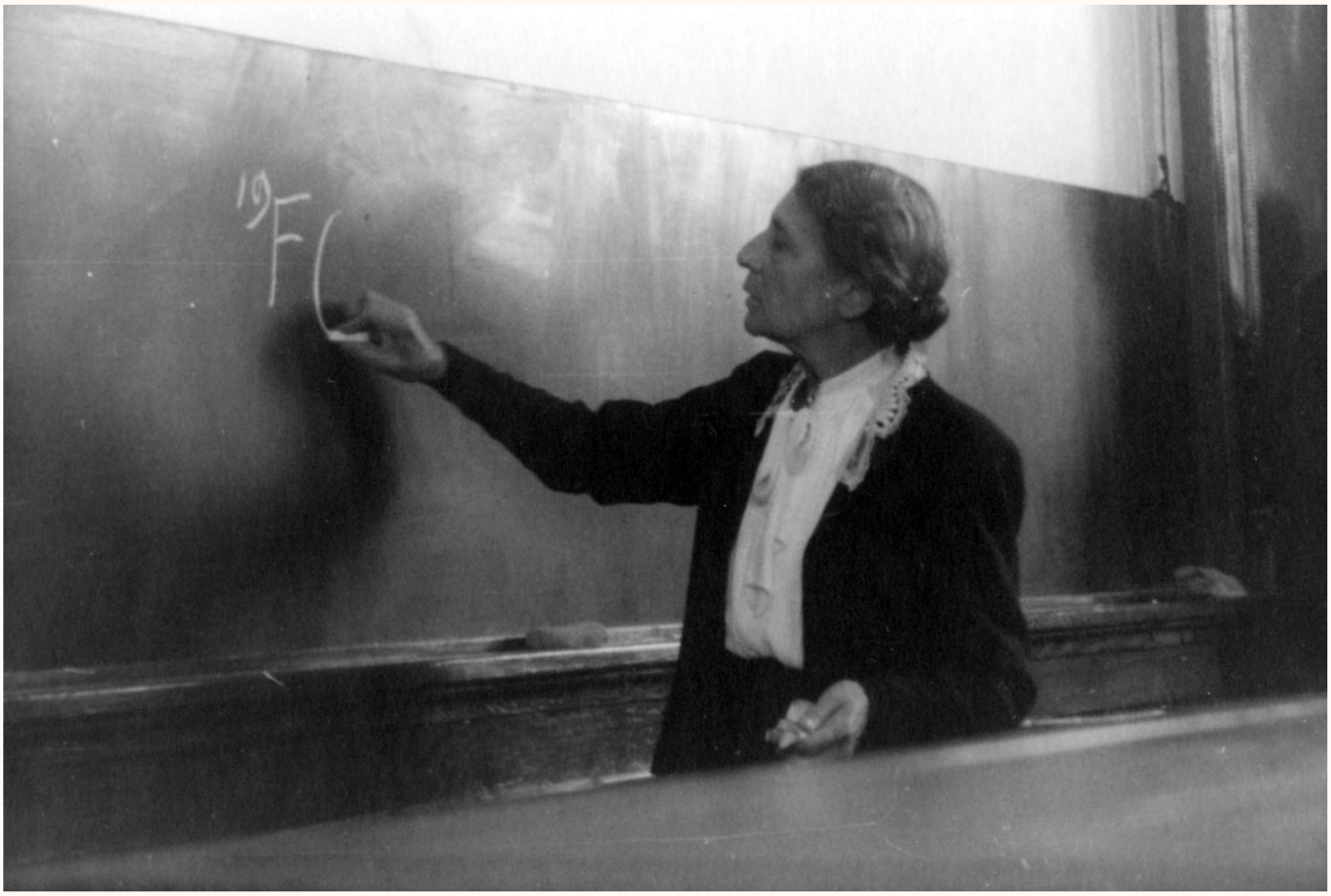
The empathic brain of pscyhopaths

Psychopathy is a personality disorder characterised by the lack of empathy; the lack of this essential component of healthy human social interactions. Several studies found the neural circuits relevant for empathy to be dysfunctional in the psychopathic brain, including the ventromedial prefrontal cortex, orbital frontal cortex and amygdala.

In one study, the brains of inmates were assessed as they were asked to imagine pain inflicted on themselves, and then somebody else. Results demonstrated that in those deemed 'highly psychopathic' on the hare psychopathy checklist (PCR-L), activation of brain areas linked to emotion processing and empathy only occurred during the imagine-self perspective, and not the imagine-other perspective. Moreover, another study found that instructing psychopathic individuals to empathise resulted in a partial 'normalisation' (reduced group differences) of their brain activity. This led researchers to suggest a 'reconceptualisation of psychopathy more as a reduced propensity, rather than an incapacity, to generate vicarious activations.'

Another interesting thing to note is that most research points to psychopaths lacking affective empathy, and not cognitive empathy. This could explain the manipulative nature of psychopathic individuals - they are perfectly capable of understanding other people's emotions; the problem is it does not register emotionally with them.

Despite the seemingly elusive research, developments in technology are bringing experts one step closer to understanding the vibrant life of the empathic brain. Insight in the complex neurological underpinnings of empathy will ultimately lead to a better understanding of psychopathic personality, which will aid in the development of better treatments for the dysfunctional social and cognitive behaviour of these individuals.



IDOL OF THE MONTH

LISE MEITNER

Lise Meitner is an Austrian-Swedish physicist that discovered nuclear fission and the element protactinium. Nuclear fission is an efficient way of producing nuclear energy. She did eventually win the Noble prize for her discovery.

7 NOVEMBER 1878 – 27 OCTOBER 1968

DID YOU KNOW

A tuberculosis vaccine is being currently studied for coronavirus protection.

SCIENCE RIDDLES

1. Many have heard it, but nobody has ever seen it. It will not speak back unless spoken to. What is it?

2. What chemical element doesn't like to follow?

3. I am needed for flight but cannot fly on my own. What am I?

Answers at the bottom of the next page

References

Foreman, A. (2015). Why Footbinding Persisted in China for a Millennium. [online] Smithsonian. Available at: https://www.smithsonianmag.com/history/why-footbinding-persisted-china-millennium-180953971/.

www.aaas.org. (n.d.). Catching the elusive “green flash” | American Association for the Advancement of Science. [online] Available at: https://www.aaas.org/catching-elusive-green-flash#:~:text=The%20green%20flash%20is%20a [Accessed 12 Nov. 2021].

Corinne O'Keefe Osborn (2018). What Are the Risks and Benefits of Drinking Urine? [online] Healthline. Available at: https://www.healthline.com/health/drinking-urine.

ec.europa.eu. (n.d.). Twenty surprising scientific facts we learned in 2020 | Research and Innovation. [online] Available at: https://ec.europa.eu/research-and-innovation/en/horizon-magazine/twenty-surprising-scientific-facts-we-learned-2020 [Accessed 12 Nov. 2021].

Business Insider Australia. 2021. Is Neuromarketing The Future Of Marketing?. [online] Available at: <https://www.businessinsider.com.au/is-neuromarketing-the-future-of-marketing-2011-9> [Accessed 12 November 2021].

Harvard Business Review. 2021. Neuromarketing: What You Need to Know. [online] Available at: <https://hbr.org/2019/01/neuromarketing-what-you-need-to-know> [Accessed 12 November 2021].

Plassmann, H., O'Doherty, J., Shiv, B. and Rangel, A., 2008. Marketing actions can modulate neural representations of experienced pleasantness. Proceedings of the National Academy of Sciences, 105(3), pp.1050-1054.

Stanford University. 2021. Price changes way people experience wine, study finds. [online] Available at: <https://news.stanford.edu/news/2008/january16/wine-011608.html> [Accessed 12 November 2021].

Tong, L., Acikalin, M., Genevsky, A., Shiv, B. and Knutson, B., 2020. Brain activity forecasts video engagement in an internet attention market. Proceedings of the National Academy of Sciences, 117(12), pp.6936-6941.

Greater Good. 2021. *Empathy Definition | What Is Empathy*. [online] Available at: <https://greatergood.berkeley.edu/topic/empathy/definition> [Accessed 27 November 2021].

Inc.com. 2021. *There Are Actually 3 Types of Empathy. Here's How They Differ--and How You Can Develop Them All*. [online] Available at: <https://www.inc.com/justin-bariso/there-are-actually-3-types-of-empathy-heres-how-they-differ-and-how-you-can-develop-them-all.html> [Accessed 27 November 2021].

Kilner, J. and Lemon, R., 2013. What We Know Currently about Mirror Neurons. *Current Biology*, 23(23), pp.R1057-R1062.

Luo, J., 2018. The Neural Basis of and a Common Neural Circuitry in Different Types of Pro-social Behavior. *Frontiers in Psychology*, 9.

Medicalnewstoday.com. 2021. *We look at what happens in the brain of a psychopath*. [online] Available at: <https://www.medicalnewstoday.com/articles/321839#_noHeaderPrefixedContent> [Accessed 27 November 2021].

Meffert, H., Gazzola, V., den Boer, J., Bartels, A. and Keysers, C., 2013. Reduced spontaneous but relatively normal deliberate vicarious representations in psychopathy. *Brain*, 136(8), pp.2550-2562.

Psychology Today. 2021. *Empathy 101*. [online] Available at: <https://www.psychologytoday.com/sg/blog/our-social-brains/201007/empathy-101> [Accessed 27 November 2021].

Rajmohan, V. and Mohandas, E., 2007. Mirror neuron system. *Indian Journal of Psychiatry*, 49(1), p.66.

van Dongen, J., 2020. The Empathic Brain of Psychopaths: From Social Science to Neuroscience in Empathy. *Frontiers in Psychology*, 11.

Lee, Y., Wang, J. and Chiu, C., 2017. Effect of Orthokeratology on myopia progression: twelve-year results of a retrospective cohort study. *BMC Ophthalmology*, 17(1).

American Academy of Ophthalmology. 2021. *What Is Orthokeratology?*. [online] Available at: <https://www.aao.org/eye-health/glasses-contacts/what-is-orthokeratology> [Accessed 27 November 2021].

Medicalnewstoday.com. 2021. *Phrenology: What is it, and how did it contribute to neuroscience?*. [online] Available at: <https://www.medicalnewstoday.com/articles/phrenology-the-pseudoscience-of-skull-shapes> [Accessed 27 November 2021].

The Conversation. 2021. *Neuroscientists put the dubious theory of 'phrenology' through rigorous testing for the first time*. [online] Available at: <https://theconversation.com/neuroscientists-put-the-dubious-theory-of-phrenology-through-rigorous-testing-for-the-first-time-88291> [Accessed 27 November 2021].

Encyclopedia Britannica. 2021. *phrenology | History, Theory, & Pseudoscience*. [online] Available at: <https://www.britannica.com/topic/phrenology> [Accessed 27 November 2021].

Helmenstine, A. M. Ph.D. ThoughtCo. 2019. The Chemistry of Baking Cookies [Online]. Available from: <https://www.thoughtco.com/chemistry-baking-cookies-4140220 > [Accessed: 24/11/2021].

Warren, S. TED. 2013. The Chemistry of Cookies [Online]. Available from: < https://www.ted.com/talks/stephanie_warren_the_chemistry_of_cookies#t-240776> [Accessed: 24/11/2021].

IMAGES

AnOther (2015). The Last Women with Bound Feet. [online] AnOther. Available at: https://www.anothermag.com/art-photography/7497/the-last-women-with-bound-feet [Accessed 12 Nov. 2021].

www.cinemaonline.sg. (n.d.). cinemaonline.sg: Pirate legends and myths. [online] Available at: https://www.cinemaonline.sg/articles/features_details.aspx?search=2010.f_piratemyth_4425 [Accessed 12 Nov. 2021].

Answers to the riddles

1. An Echo
2. Lead
3. Feathers