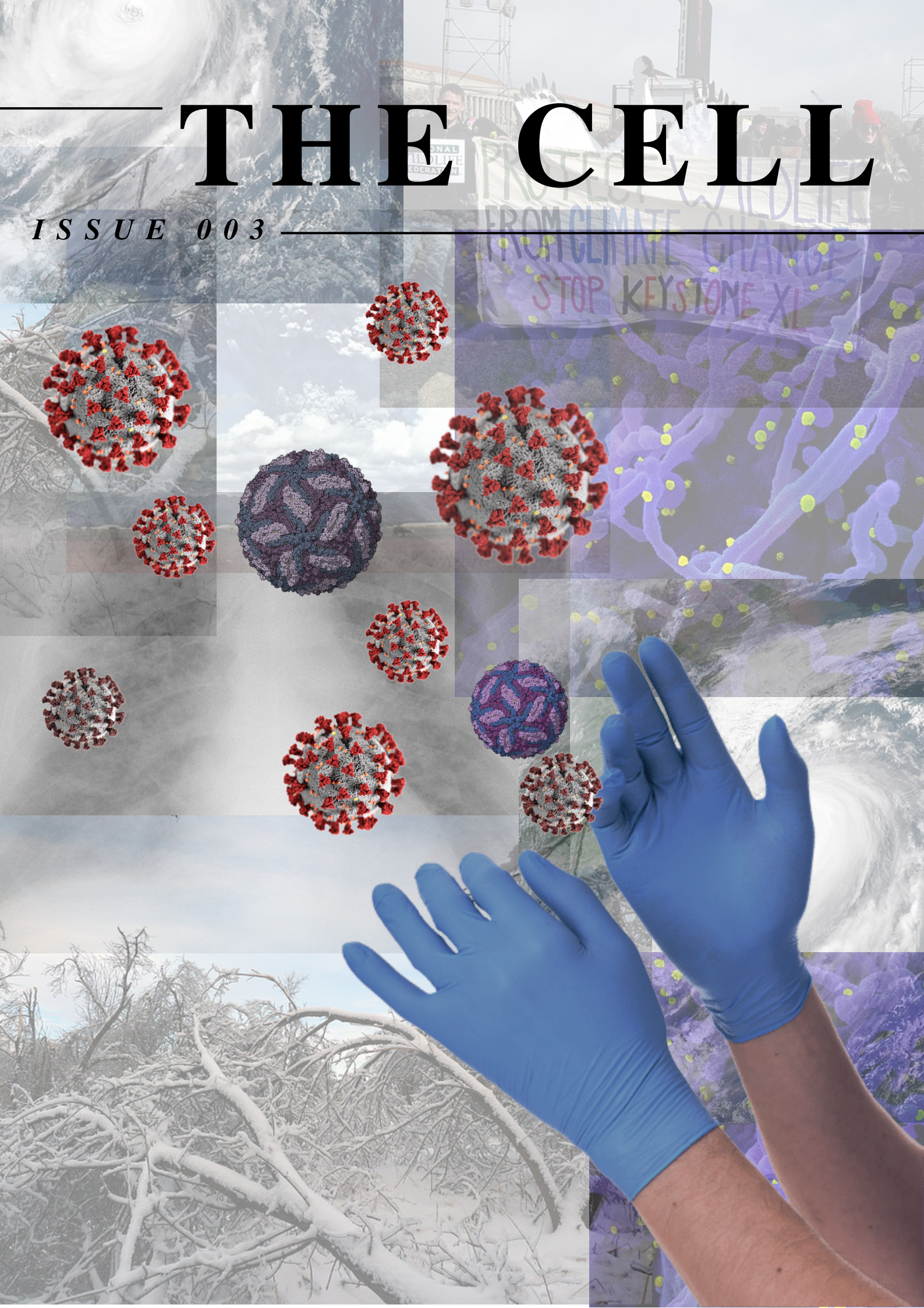


# THE CELL

ISSUE 003





A scanning electron microscope image of Clostridium perfringens bacteria which causes food poisoning

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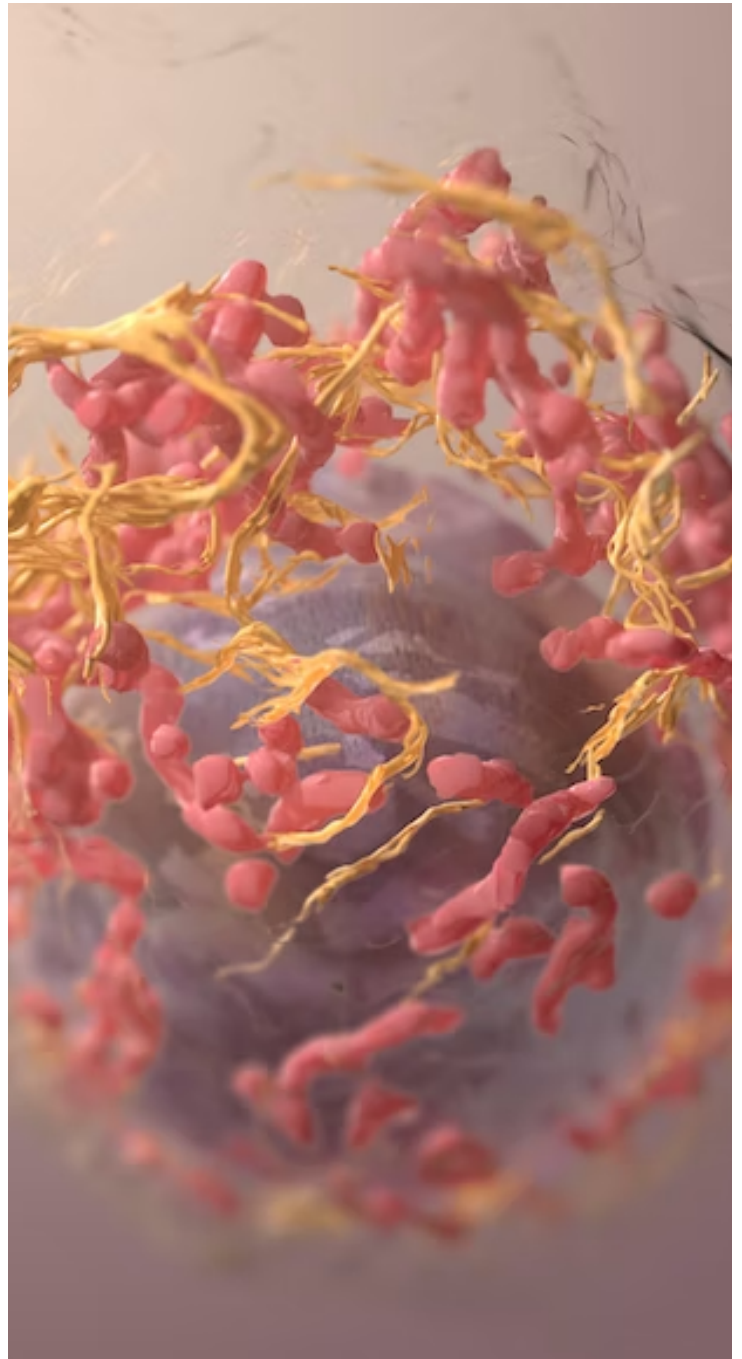
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# THE IMPORTANCE OF SUN PROTECTION

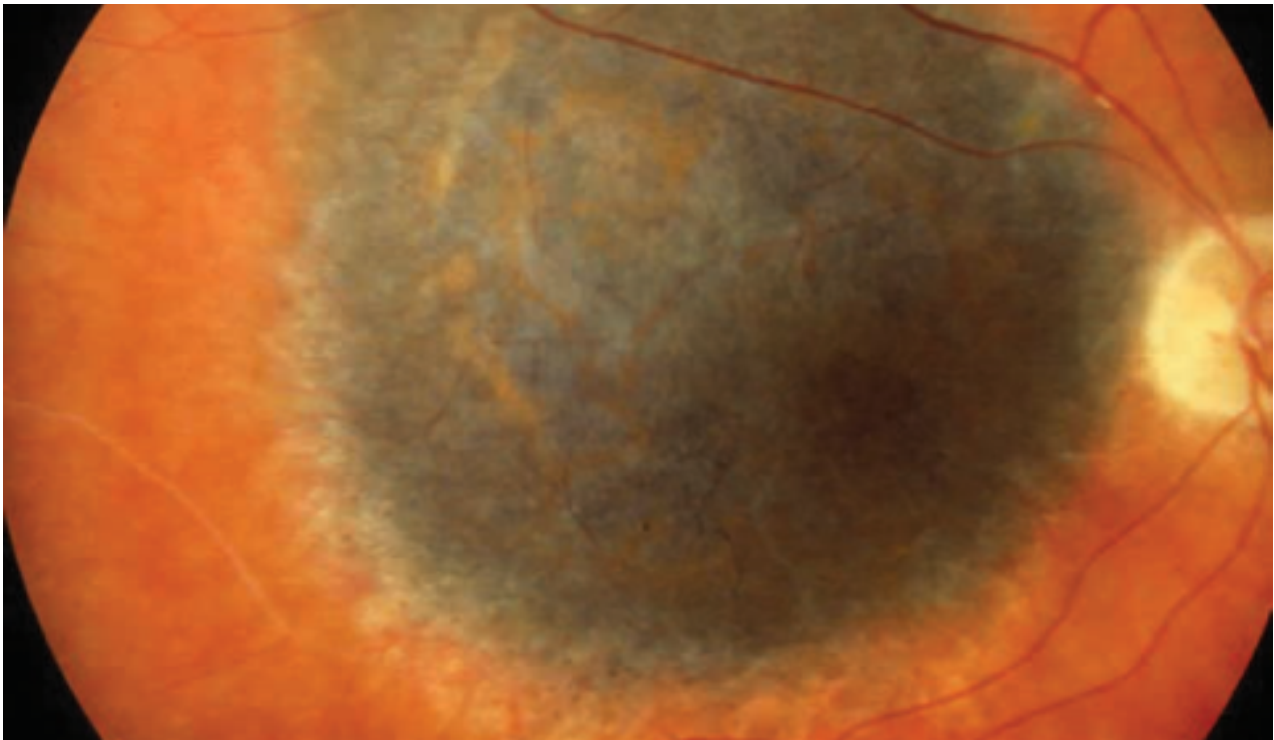
*Written by Tabi Butler*

Climate change is on all of our minds with the thinning of the ozone layer and soaring temperatures: the consequences of which are demonstrably detrimental to the planet and human life. However, few think about the impact on the skin: as the background level of ultraviolet radiation increases, so does the incidence of skin cancer.

Especially in your early life, excess UV exposure has a significant impact on your likelihood of getting subsequent melanoma and non-melanoma skin cancers; be this through enjoying sun outside or tanning beds. Sunburn is an inflammatory response to the excess UV radiation the skin has been exposed to. Blood vessel dilation causes increased blood flow which makes the skin appear a fiery red colour. Ultraviolet radiation causes mutation in DNA within the nucleus of the epidermis cells in the skin. The peeling and blistering we experience is actually due to our bodies trying to get rid of the mutated cells to stop them reproducing and accumulating mutations. To do this, cells undergo apoptosis or programmed cell death where lysosomes help destroy cells which may no longer be needed or in this case be a danger to the body. Some cells inevitably escape this control mechanism with a detrimental consequence for the body; these cells now have a cancer prone genotype and so in the future may facilitate cancerous growth.



*3D structure of a melanoma cell derived by ion abrasion scanning electron microscopy.*



*retinal melanoma*

In addition to the danger of sun burns there are also lesser-known consequences of excess UV exposure. That bronze glow coveted by every teenager and social media star is actually a sign of something far more sinister. As stated on the NHS website, 'there is no safe way to get a tan. A tan does not protect your skin from the sun's harmful effects'. To obtain a tan you still have to expose your skin to that harmful UVB radiation however you do not get the warning afterwards (in the form of a sun burn) that you have put your skin in danger. Whilst it is true that you do obtain some level of protection from a tan it actually causes more harm than good. The SPF value you obtain from a tan is around 2-4 whereas the protection recommended by the NHS is SPF30-50. This means that while you have a tan you are still likely to be obtaining those harmful effects of the UVB radiation, you just can't see that you have, due to the increased melanin which disguises the redness. In addition to the danger to your skin our eyes are equally as vulnerable just often less protected and neglected. Retinal melanomas are caused by the same effect of the UVB radiation as skin cancers however they are often neglected when we look to protect ourselves from the sun. However here you are endangering something far more complex and delicate; our eyes. In addition to cancers, UV exposure also increase your likelihood of getting cataracts (clouding of the lenses) earlier in your life. Whilst this is normally an issue for 30-40 years down the line, it is still important to consider as your retirement may be less enjoyable if you can't see the beautiful colours of your garden or even the letters in the cross word! With the increase in waiting times of the NHS, it is unlikely that you would get them fixed. Even if you will be lucky enough to get them done privately you would still have to live with the consequences of your new more static lenses. The procedure used to restore your vision involves replacing your lenses with artificial ones, which cannot accommodate (change their shape).

There are also some factors which may increase your likelihood of suffering from sun burn. Genetics plays a massive role in this as the more melanin you naturally have in your skin the more protection you have although everyone should still protect themselves with sunscreen. There are some genetic abnormalities which result in increased susceptibility to sun damage. One involves the complete absence of melanin in the skin (albinism) another where the person has mutations in the genes involved in repairing damaged DNA (xeroderma pigmentosum). In both of these conditions the person would have to be extremely careful with the sun even on cloudy days. Much more common however are people with freckles and blue eyes. These are two tell-tale signs that that person has little melanin in their skin so should always be wary of the sun by wearing SPF every day (even a low value in winter) to avoid cancers and burns. In addition to genetic factors immunosuppressed patients are at higher risks of developing cancers as they are less able to undergo apoptosis and destroy the mutated cells as their immune system is compromised. In addition, people who have undergone radiotherapy have already been exposed to radiation so may already have more of those cells with the cancer prone genotype.

However, you shouldn't lock yourself away from the sun, it has many essential functions! We require the sun to convert vitamin D into the active form for our cells to use, without which we would get symptoms such as fatigue, hair loss, bone loss, immunological compromise and difficulty sleeping. According to the national diet and nutrition survey 1 in 6 adults have low levels of vitamin D in their blood so it is extremely important to obtain your dose of vitamin D through being outside and enjoying the sun. In addition to this many doctors believe being outside can decrease the symptoms of depression and anxiety and the likelihood of their onset. Just a short 30 minute walk every day will boost your mood whilst helping your physical health, reducing your risks of obesity and the plethora of associated health problems. Additionally, many skin conditions improve with sun exposure. Psoriasis is a painful skin disease where your body over produces skin cells in specific places. It causes red patches with silvery scales and can be extremely difficult to treat. However, sun exposure can often reduce the symptoms, however it will not cure it completely. Additionally, many people find that sunlight improves their acne reducing the need for teenagers and young adults to go on medications such as Roaccutane or Lymecycline with possible harmful side effects.



So, how can I remain outside without the harmful effects of the UVB radiation? There are many ways to do this including sunscreen and sunglasses. The NHS website suggests a sun cream with an SPF value of around 30 however these days you can even obtain ones with a value of 75 or even 100. In general, the greater this value the better. This value indicates the number of times longer you can stay out in the sun of your burn time i.e., if you would normally burn in 20 minutes, wearing factor 30 would allow you to stay in the sun 600 minutes or 10 hours. However, this is only true if you are applying a very generous quantity, which most of us do not. Sunglasses are often neglected but can filter out the UV B and A rays if they are made for sun protection. In an age where sunglasses are a fashion statement there is no excuse for sacrificing your vision later in life by not rocking those stylish sunnies!

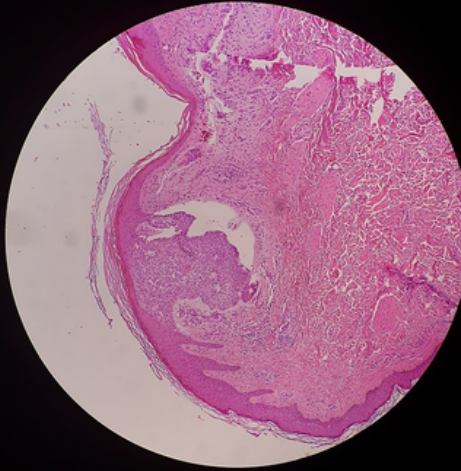


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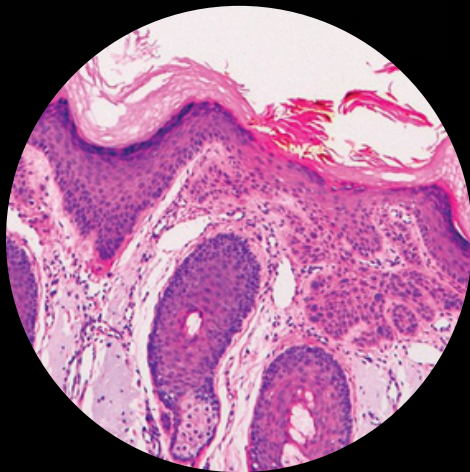
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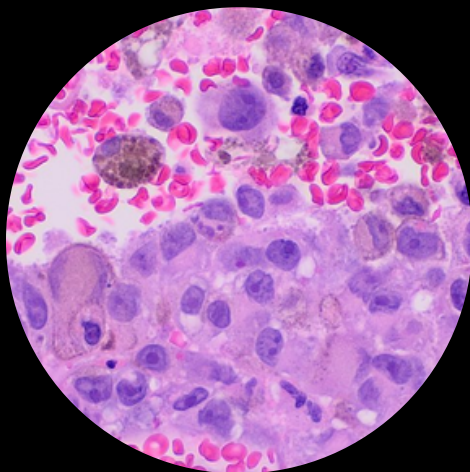
# VIEW: SKIN CANCERS UNDER THE MICROSCOPE



*Stained specimen of a basal cell carcinoma. The cleft seen is a deformity caused by the fixation process.*



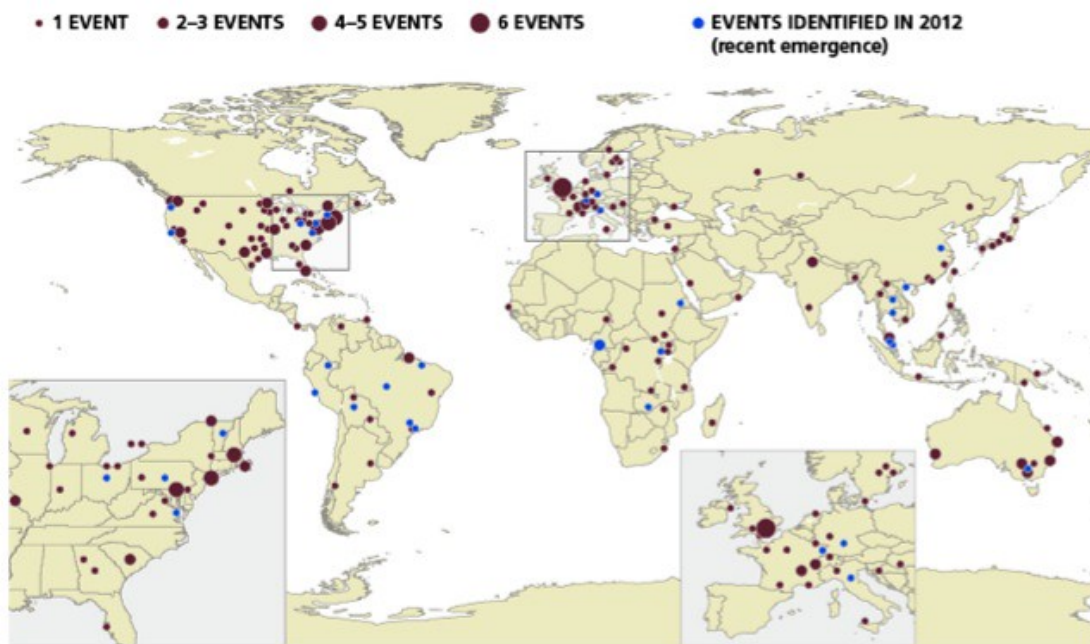
*Stained specimen of a squamous cell carcinoma.*



*Stained specimen of melanoma cells that had metastasized to the brain.*

# THE PANDEMIC PROGNOSIS

Written by Reem Shami



Map by IOZ, published in an ILRI report to DFID: Mapping of Poverty and Likely Zoonoses Hotspots, 2012

## *emerging zoonotic disease events 1940-2012*

It is no secret that our climate is changing. News of melting ice caps, dying species, natural disasters, and the increasingly suffocating atmosphere has been plastered on every conceivable social media platform and bulletin available. In fact, research shows that in certain populations, 98.3% of people have gained their knowledge of our current climate crisis through social media (Ogunjinmi, 2016). As we catapult into this new era of change, the questions we as a society must ask are also evolving.

Disease, tragedy, and death - all ancient markers of mankind - are unfolding in new, unprecedented ways. With a growing death toll approaching seven million, it is quite obvious that COVID-19 inspired this article (Cumulative Deaths, 2022). One does not need to look further than their own city to witness the devastating effects of COVID-19, a zoonotic disease with perceived origins in Wuhan, China, that has pervaded nearly every community around the world (Centers for Disease Control and Prevention, 2021). It is easy to forget, however, that the COVID-19 pandemic that swept our international community into disarray was very much a predictable outcome of our own actions. And the disease is absolutely not the first of its kind.

Only in the past two decades a wide variety of diseases, primarily zoonotic, have emerged. In fact, 60% of all known infectious diseases in humans originated from animals (Woolhouse ME, 2005). Thousands of people around the world have contracted and unfortunately died of such zoonoses such as the MERS, H1N1, SARS CoV-1, Ebola, and Zika viruses (Bhadoria, Gupta, & Agarwal, 2021). There is certainly a grim feeling that despite the invaluable advances in modern medicine the increasing frequency and severity of emerging disease is posing a unique and unsettling threat to our own existence



I would like to briefly revisit the idea that these horrific events are completely consequential. Modern living - industrialization, agricultural revolution, internationalization, and the depletion of natural resources. The argument has been made countless times that these are "inevitable" processes that are required to sustain human life on earth. However, irrefutable evidence is emerging to suggest otherwise. Have our own actions condemned ourselves to a lifetime of masks and distancing? Have our virtues as humanity finally become our vices?



*cattle farm*

The answers to those questions are much more profound than one may initially expect. Each factor of our post-industrial revolution way of living contributes to the disturbing trend in global health crises we are witnessing today. Take, for example, deforestation and the growing encroachment into natural spaces. Often times, the only negative associated with the cutting down of forests is carbon emissions and global warming. However, a compelling link can be made between deforestation and the rise in zoonotic disease.



*battery farming of chickens*

To understand this link, put yourselves in the shoes of a bat carrying an Ebola virus who lives in the forests of Congo, a country which lost 1.25 million hectares of natural forest in 2021 alone (Global forest watch, 2022). You are living quite far from human influence until your favorite trees are cut down. Abruptly, you are presented with two options: either move west further into the remaining forest or move east into human inhabited places. You know that many bats will have moved into the forest, as a result there will be more competition for food and mates, which could mean you die a hungry, lonely death. Therefore, against your better bat judgement, you move east. The Ebola virus still remains within you no matter which direction you choose. Soon you find a nice leafy tree near a lovely flowing river and decide to rest, there you excrete, feed, and drink. Unbeknownst to you and the small children playing under the tree, your feces also contain the Ebola virus. They develop fevers a few days later.

This illustrates that as more disease carrying animals are forced to move into human-inhabited places, more people are exposed to deadly pathogens, and therefore the rate of disease in the human population increases. (illustrated, 2020)



### *deforestation*

Another influential factor is one of the main reasons for deforestation in the first place: agriculture. In 2019 an estimated 5.4 million hectares of forest was cut down for agricultural use, this figure barely deviates from the annual 5.5 million hectares per year a decade ago (Global forest watch, 2019) (Pendrill, 2019). Most modern agricultural practices are anything but sustainable: high concentrations of antibiotics in feed allow for the development of antibiotic resistant “superbugs”; the closely packed animals allow for rapid transmission of pathogens, either through bodily fluids or the equally dense air they breathe; the energy needed to produce 1 pound of beef alone is 107,482 Btu (team, 2022) (Congdon, 2020) (Harrison Wein, 2014). In fact, it could be argued that cattle, poultry, and dairy farms are excellent incubators for novel, devastating diseases.

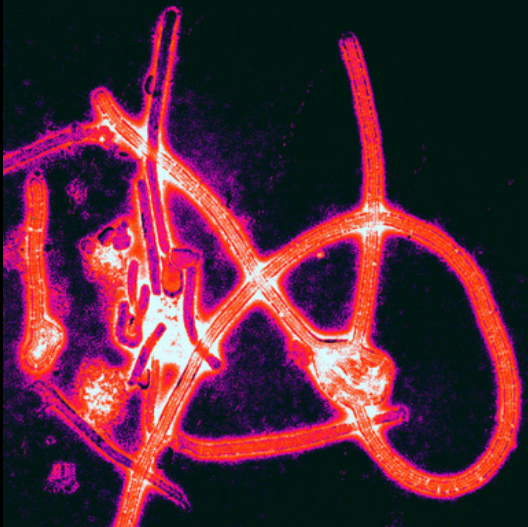
But the effect of our worsening climate on global health does not stop here. There is a clear link between our environment and our prognoses once sick. For example, research shows that prolonged exposure to air pollution may be linked to an 11% increase in mortality from COVID-19 for every 1 microgram of pollution per cubic meter (Wu, Nethery, & Dominici, 2020). This link is also quite intuitive: clearly if one’s lungs are being consistently damaged by the air they breathe, a disease effecting the respiratory system is going to have a devastating effect.

While research in this field is still developing, an alarming association between climate change and pandemics is coming to light. It is important to note that the environment is not a separate entity from ourselves. Earth is not trying to rid itself of us – our unsustainable practices have brought us to where we are today. The trends discussed in this article are merely a symptom of a wider issue that must be treated. Until we have revolutionized farming practices, industrial production, and our relationship with the natural world around us, the prognosis for humanity as we know is truly a dismal affair.

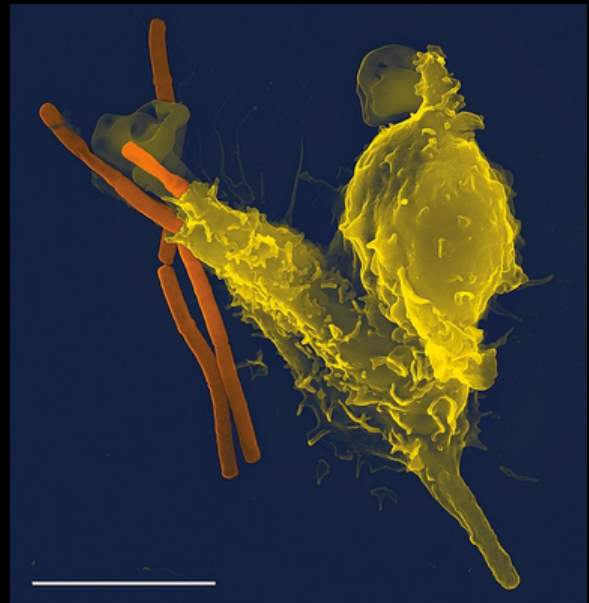
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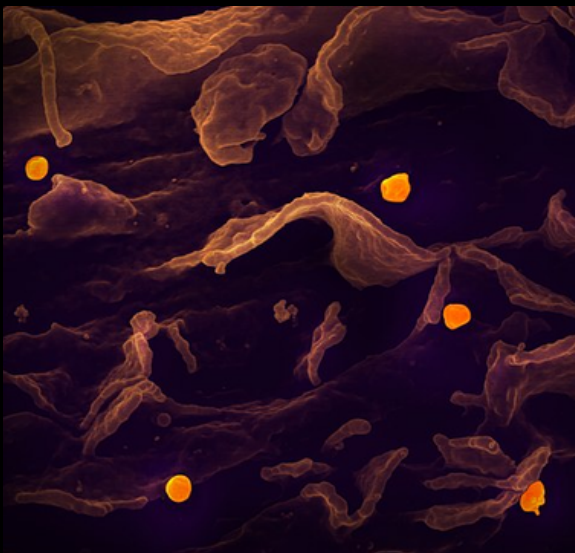
# VIEW: 3D STRUCTURES OF PATHOGENS



*Ebola virus*



*A neutrophil engulfing anthrax*



*Nipah Virus (yellow spots)*



*onchocerca volvulus larva*

# SECRETS OF THE INCAS: THE UNKNOWN STORY OF THE INCA SKULL SURGEONS.

**WRITTEN BY NATASHA LARSEN**

The Inca Period in Peru (1500AD - 1530) is often credited as the largest empire the America's have ever seen. It is a period well known for its unique architecture of geometrical stonework built to meld with the natural landscapes, Machu Picchu being of the New Seven Wonders of the World. However, their brilliance in architecture and agriculture often overshadows some of their surprisingly modern medical innovations: The Ancient Inca Civilisation were for example, exceptional brain surgeons.

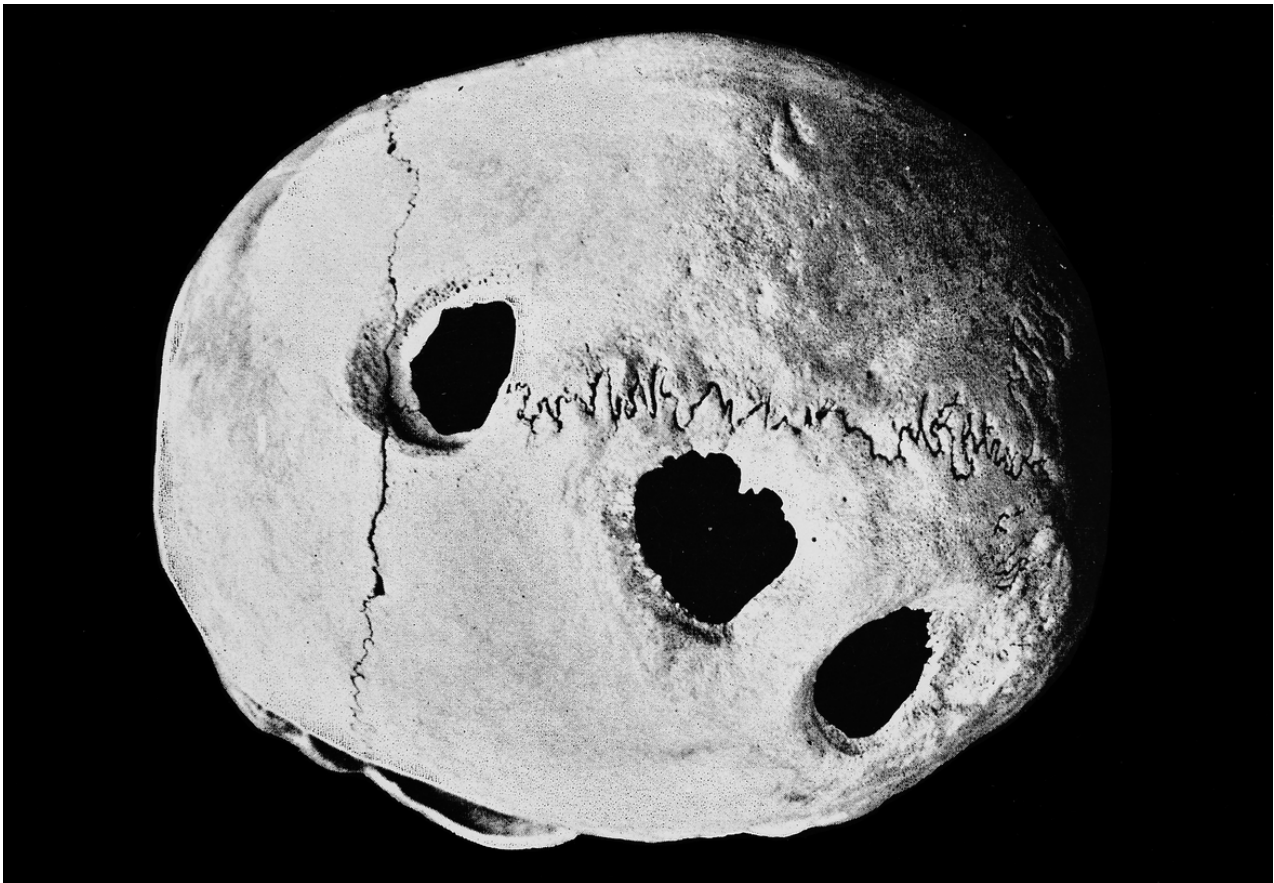


*Incan surgical tools*

Trepanation is a surgical procedure in which a circular piece of bone is drilled and removed, most commonly from the human skull/crania. Signs of trepanation have been found across Polynesia, Ancient Greece, Africa, Russia, the Far East and North and South America. However, thanks to Peru's excellent preservation conditions due to their humid climate, Peru has hundreds of trepanned crania dating back to AD 1000. Several studies have been performed on these crania to investigate the nature and success of trepanation, most notably by David S. Kushner along with John W. Verano and Anne R. Titelbaum (study published in Neurology Magazine 2017).

If the edge of the hole on the studied crania had been 'remodelled' or healed significantly, the surgery was considered a success, whereas if the hole was ragged without signs of healing, it was assumed that the patient did not survive the operation or died soon after. The oldest crania showed no healing around the removed skull area which suggests that the procedure was originally a failure; only 40% of the earliest group survived. However, the success rates increased over time to the point where Inca trepanation could be considered a considerably successful procedure, with success increasing from 74% to 83% in the Inca Period AD 1400s-1500. There was even a 91% success rate in AD 1000-1400 when additional samples of 9 crania from the northern highlands were studied.

This curious rise in success was down to the Inca surgeons who, over time, refined their methods to reduce the risk of puncturing the dura mater (the brain's protective membrane) and causing an infection. The trepanation holes reduced in size over time as smaller holes were more survivable than larger holes; the surgeons drilled and cut less and were more careful when "grooving" making the surgeries shallower. They also learned to avoid areas of the crania that would produce excessive bleeding, suggesting a well-rounded knowledge of the brain's anatomy.



*Incan cranial cutting*

Trepanation during the Inca period was mostly performed on adult men and was likely used to treat trauma injuries during combat, but other possible reasons include to relieve swelling, cure ailments like epilepsy or even as a ritual to let evil spirits out. Medicinal plants were probably used to help relieve pain or other symptoms that occurred because of the surgery, but they had no access to modern anaesthesia or antibiotics used today! Many crania have been found with more than one successful trepanation; as many as 7 successful trepanations performed on one crania was found at an Inca site.

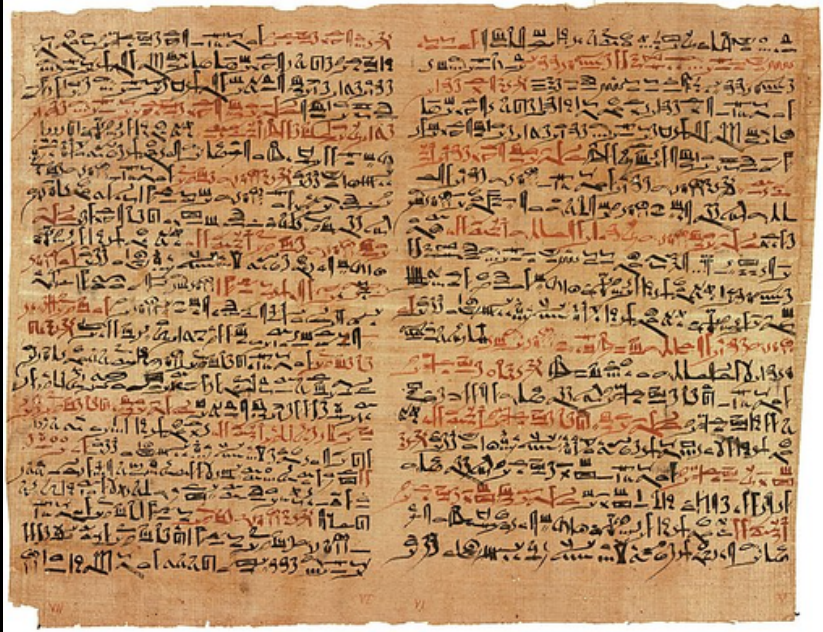
Despite their lack of modern medicine and use of stone tools, trepanation in the Inca Period was surprisingly more successful than those performed during the American Civil War some 400 years later, where only 40% of patients survived! There are many theories as to the big difference in survival rates: The nature of the patient's injuries were probably very different, as trauma in the civil war was very different to trauma in Inca times. The Civil War battlefield hospitals were also incredibly unsanitary, with doctors unable to sterilise their equipment, making the hospitals a breeding ground for infections. In contrast, the Inca surgeons seemed to understand infections and know how to control them, possibly through the use of coca leaves.

However, these factors shouldn't take away merit from the extraordinary achievements of the Ancient Inca Skulls Surgeons. The distinction in success rates highlights the staggering success of trepanation in Peru as a treatment for living patients.

## References:

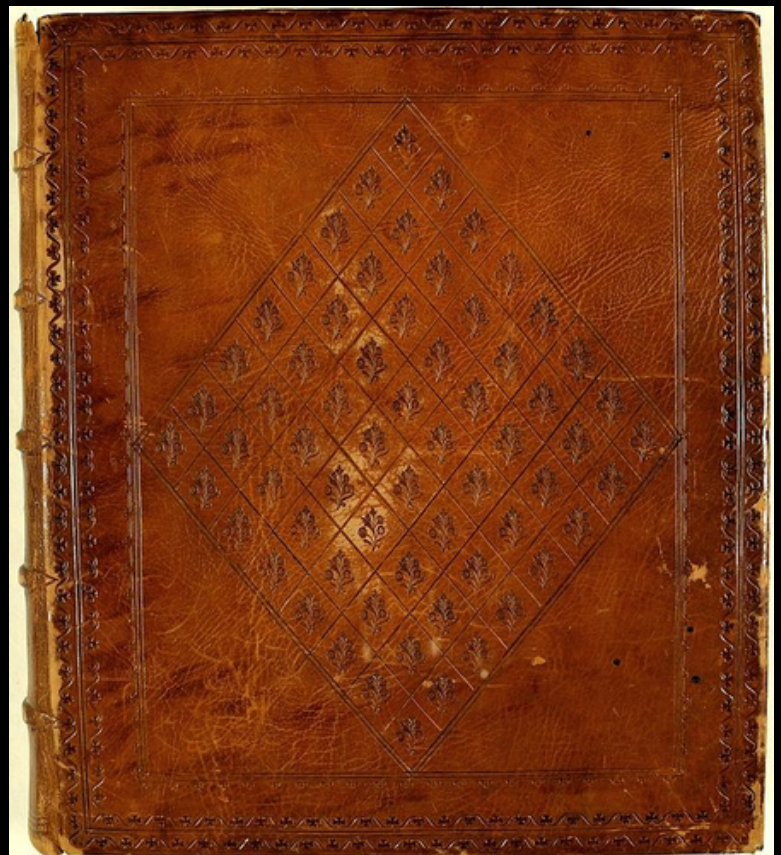
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# VIEW: ANCIENT MEDICAL TEXTS



*Oldest surviving surgical text, the "Edwin Smith" document. The text comes from the ancient Egyptian period.*

*Greek physician's codex  
"known as the Dioscurides  
Neapolitanus, written by  
Pedanius Dioscorides*





# AROUND THE WORLD: MEDICAL ADVICE AND PRACTICES

WRITTEN BY ALICE WONG

How does medical advice vary around the world? From language to practices, medical advice varies from country to country on a vast scale. Floating through the western hemisphere to the Eastern hemisphere, medical advice is influenced by culture as well as religion or even social stereotypes. Are there any practices that are agreed upon universally?



*different medicines used to treat the common cold*

Starting off in the western sector, medical advice ranges in the more scientific practices. Medication is distributed when needed and rest is encouraged. Taking the example of a cold, most will take the recommended dosage of 500-1000mg (two pills) of paracetamol every 4 hours, have a long nap and a warm drink. This would be considered as the conventional approach. This is known as 'western medicine' where the aim is to cure, manage or suppress the ailment which is also sometimes known as the allopathic approach meaning to 'go against the disease', the focus is not on the temperament, attitude or behaviour of the patient but on the diagnoses. This is in great contrast to several countries in East and South-East Asia, where upon catching a cold, you are told to use homemade remedies and controlling one's environment, behaviour and routine, this also means that most patients chose to not take any medication unless absolutely necessary. For those in the East and South-East Asian countries, illnesses are predicted and are avoided at all possible. This is done according to the prediction of illnesses such as colds during the winter months, heatstroke during the summer months, seasonal allergies during both autumn and spring months. Precautions such as; not eating cold foods (fresh or raw foods) and not going to sleep with wet hair, this is based on the theory of preventative care as well as regular tune ups, known as 'Traditional Chinese Medicine'. Methods of treatment as mentioned above does not surround the use of medication/drugs but rather on acupuncture, acupressure, food and herbs. Focusing on nature and knowing one's body, another type of healthcare commonly seen in the South Asian country of India. Ayurveda is about balancing three aspects of your body and mind known as doshas. Similar to TCM, Ayurveda utilises food, herbs and self-knowledge (or as some might think of as a 'gut instinct').

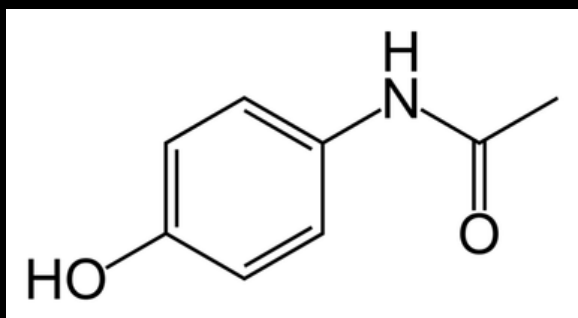
If by taking larger global events into scale. The COVID-19 pandemic provides us with a perspective never seen before. It can be easily seen that early on during the pandemic, Asian countries such as China, Hong Kong, Singapore and India pursued a 'zero covid' strategy which tried to eradicate covid entirely by imposing quarantine laws, lockdowns and mask mandates whereas, countries in the Europe and North/South America abandoned 'zero covid' soon after analysing statistics and understanding that it is nothing more than a cold that must make its way around everyone. This has since created controversy in politics, economics and the healthcare sector with many debates regarding whether it is still true that the world is still entrapped in a pandemic. Countries did what they could to ensure that they were acting in the best interests of the countries' stability and again goes back to the basis of healthcare practices in different countries, where countries that tend to gravitate towards more preventative medicine following more stricter covid laws and countries with gravitation to allopathic medicine following a more relaxed but alert approach towards covid.



*Check for 2019-nCoV in Jishuitan metro station (Beijing)*

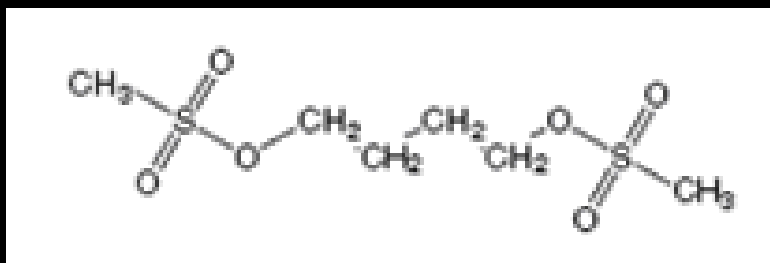
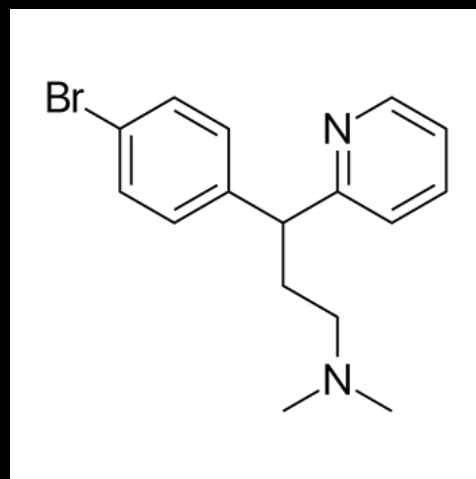
In summary, it is undeniable that medical advice and practices are influenced by many different cultures. From something as simple as interpreting a common cold to larger scale crisis such as the COVID-19 pandemic. Different countries have overtime built a reputation for their own way of ensuring the best provisions in their theory.

# VIEW: CHEMICAL STRUCTURE OF MEDICINES



*Skeletal structure of paracetamol  $C_8H_9NO_2$*

*The chemical structure of Brompheniramine (a type of antihistamine)  $C_{16}H_{19}BrN_2$*



*Chemical structure of 1,4-  
butanediol  
dimethanesulfonate*