



Issue 3

 **Atomic**



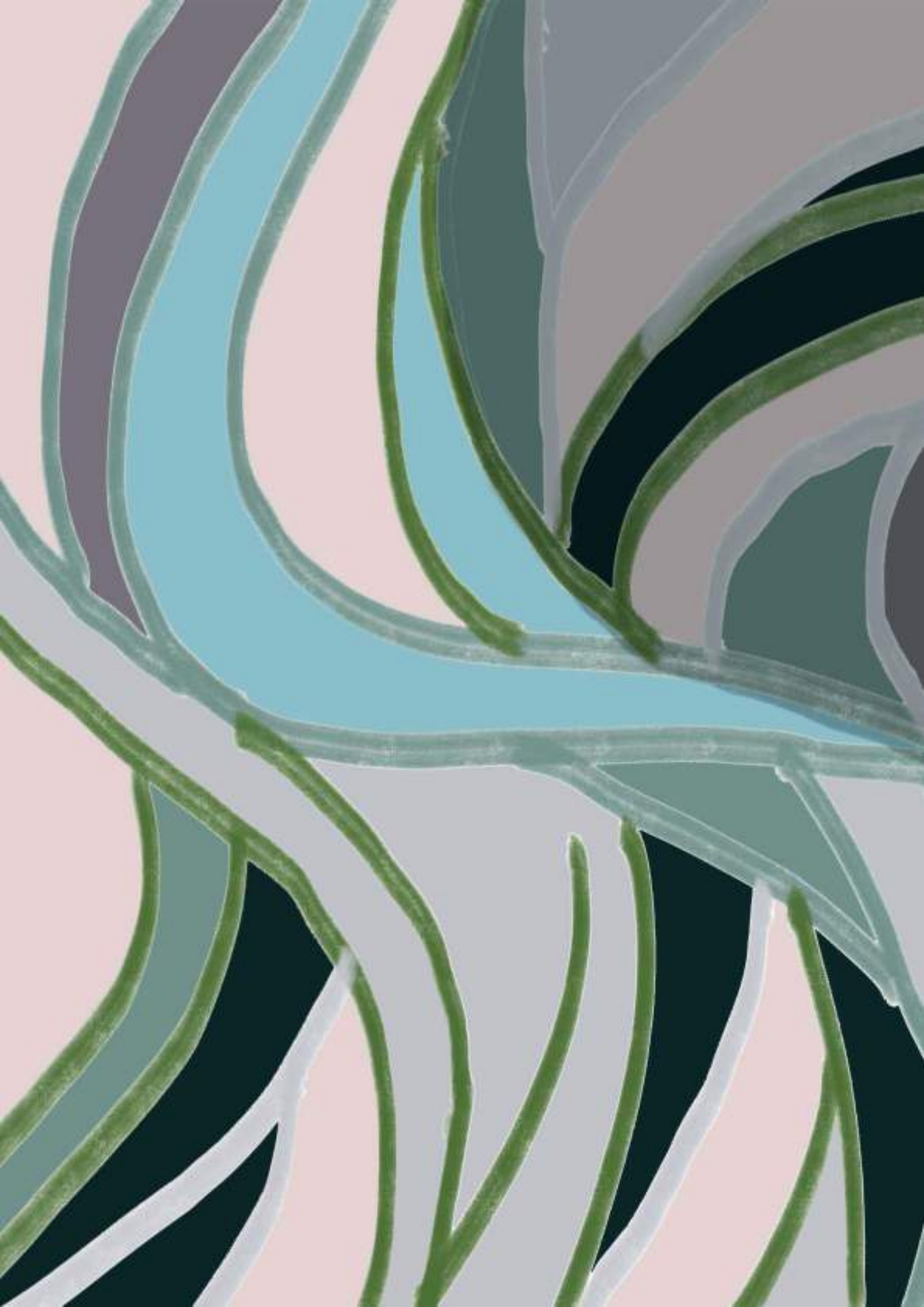
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Physics

Engineering &
Computer Science

*Algorithms: Noise and
the Procedural
Generation of Terrain*

*Arguments for
String Theory*

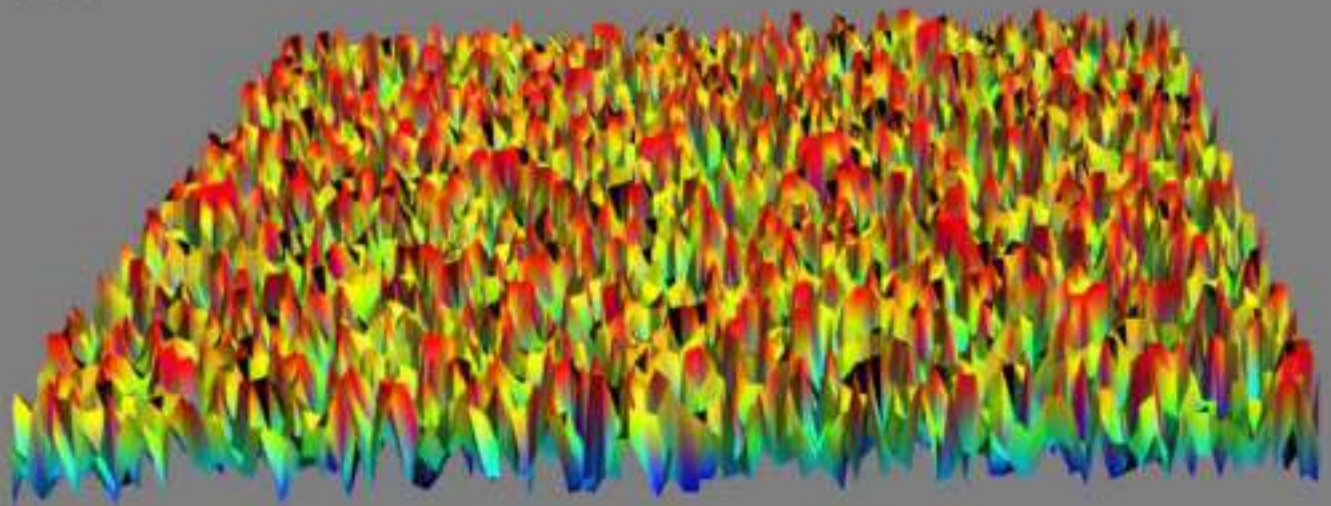
*To what extent do
Aerodynamics have
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*Importance of
Crude Oil*

ALGORITHMS: NOISE AND THE PROCEDURAL GENERATION OF

My inspiration for this issue's article came from the classic voxel sandbox game, Minecraft. As a child, I often poured hours into exploring the blocky expanse of these worlds, and as I did, I would find myself thinking about the mechanisms behind the generation of these impressively natural landscapes. Back then, I chalked it up to nothing more than mathematical magic, an algorithmic blackbox that churned out chunks upon chunks of fresh landmass for me to exploit and explore. However, when I revisited the topic recently, I realized that the processes behind Minecraft's procedural world generation wasn't as complicated as I thought, and that I myself could actually give a pretty good shot at creating something similar.

At its core, procedurally generating terrain is just applying distortions to a plane. For the rest of the article, the horizontal plane will be made up of x and y values, and elevation will be associated with z values.

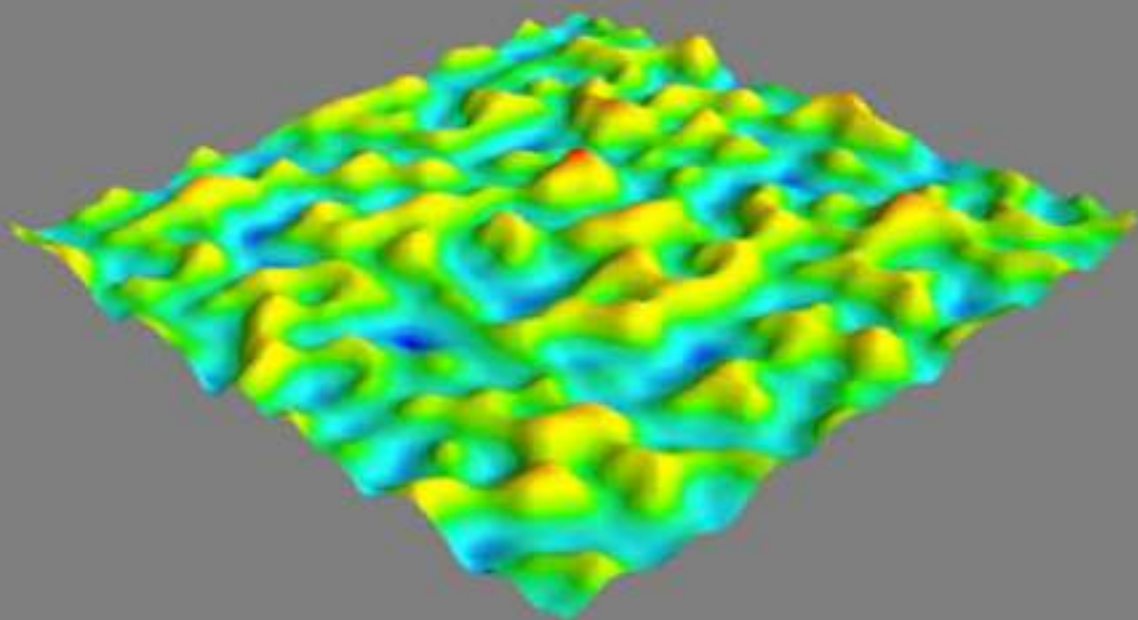


In the above rendering, I've simply applied a random z value distortion to every x and y pair. However, I'd say that most people wouldn't associate this "landscape" with natural terrain. In order to produce a smoother surface, we can apply a distortion using perlin noise.

TERRAIN VINCENT CHANG

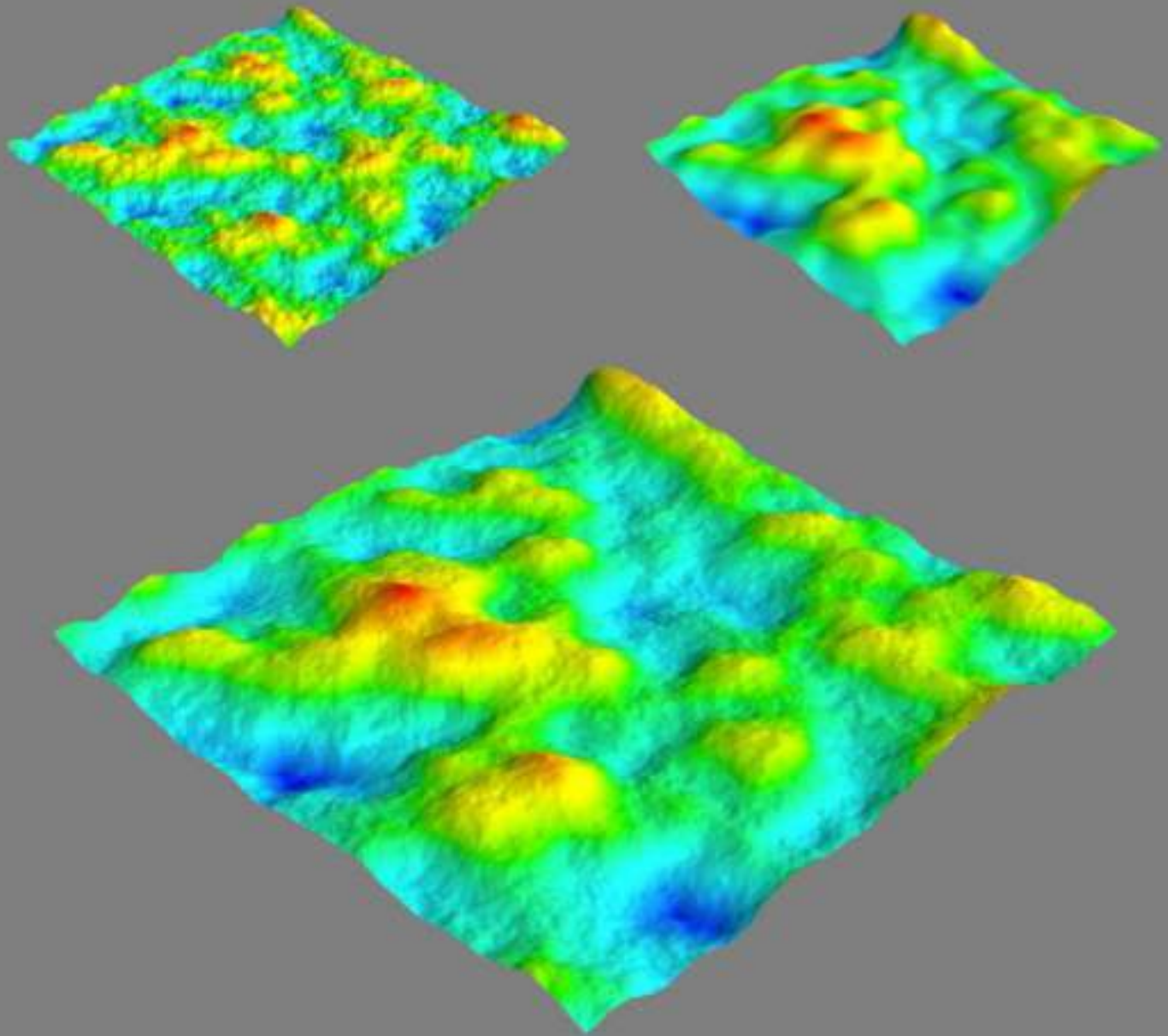
Perlin noise is a type of gradient noise algorithm that is characterized by its smooth, natural looking gradient, and is often used in procedural generation algorithms. The intensity of the pixels in perlin noise can be used to distort the z values of a plane. For every point on the "horizon plane", a z value distortion is applied depending on the intensity (brightness) of the corresponding pixel on the perlin noise image.


After running the plane through a perlin noise map with some arbitrary parameters, the following height map was generated.



Compared to the entirely random height map, we can see that the map is clearly smoother. By definition perlin noise is also deterministic, which means that for any x value, the same y value will always be returned. However, this can be solved pretty easily simply randomising the x value range used in the generation.

Currently, we have a random, hilly swamp like terrain. We introduce smoothness and uniformity to the noise, but with just one layer of perlin noise, it feels rather bland. In this implementation, I simply generated another, different layer of noise with different parameters, and averaged the values to produce a more diverse noise map. For example, the following two layers generate the the image when combined.





By utilizing different types of noise, games like Minecraft are able to generate immense worlds with ease. In this article, We only covered perlin noise and the generation of surface terrain. However, other types of noise may be used to model cave systems, or even the placement of foliage.

Conclusion:

- Perlin noise is a type of deterministic noise, that is characterized by it's natural and smooth shape
- This noise can be applied to a heightmap to procedurally generate terrain
- Different types of noise or manipulations can be utilised for a desired effect.

Citations:

Perlin Noise: A Procedural Generation Algorithm, rtouti.github.io/graphics/perlin-noise-algorithm.

"Adrian's Soapbox." Understanding Perlin Noise, adrianb.io/2014/08/09/perlinnoise.html.

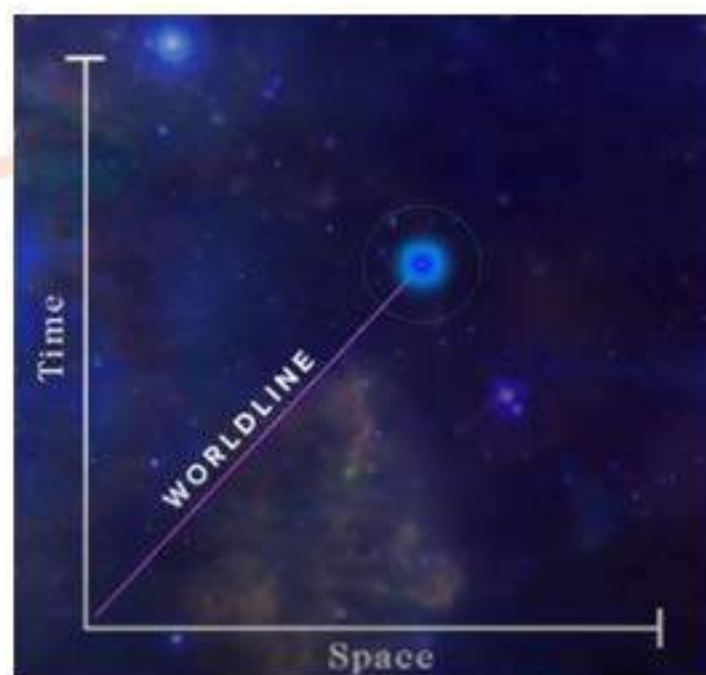
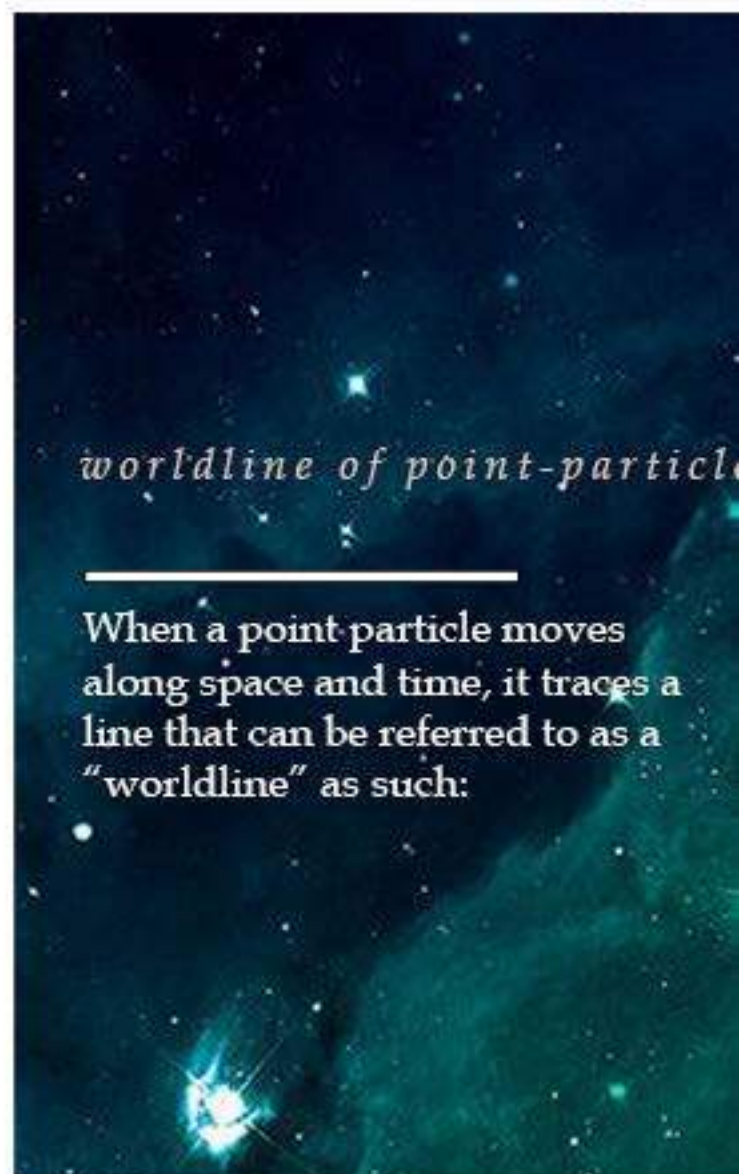


Argument

Previously, we have mentioned that string theory was created in order to unify the theories of general relativity and quantum mechanics. String theory describes particles as "strings" instead of points which enables further mathematical implications. However, the math involving string theory cannot work in our three spatial plus one temporal dimensions and in fact, requires 10 dimensions to work out - this is unachievable at the moment.

Above illustrates the contradiction of this scientific theory. In this article, we will first go through arguments for string theory and in the future, we will discuss the arguments against. The arguments for string theory revolve around the idea of black holes and gravity. The reason why quantum theory and the theory of general relativity could not be unified is due to predictions of blackholes in mathematics involving point-like particles.

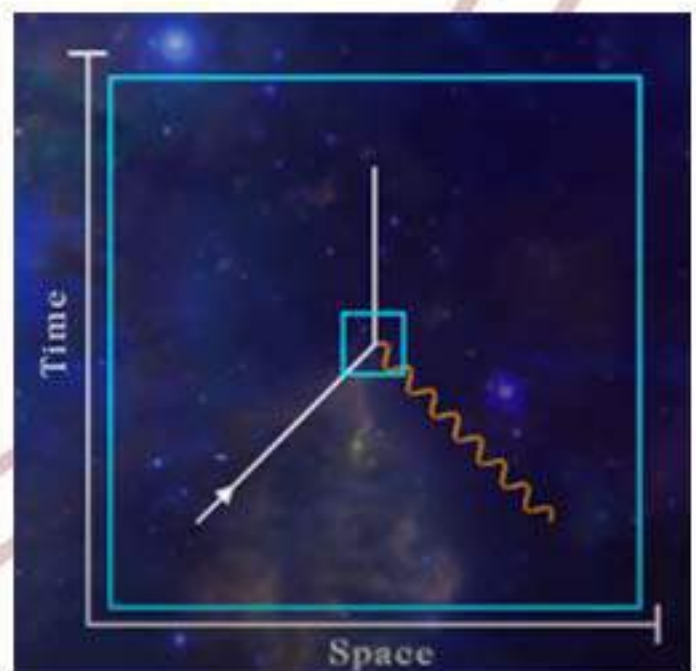
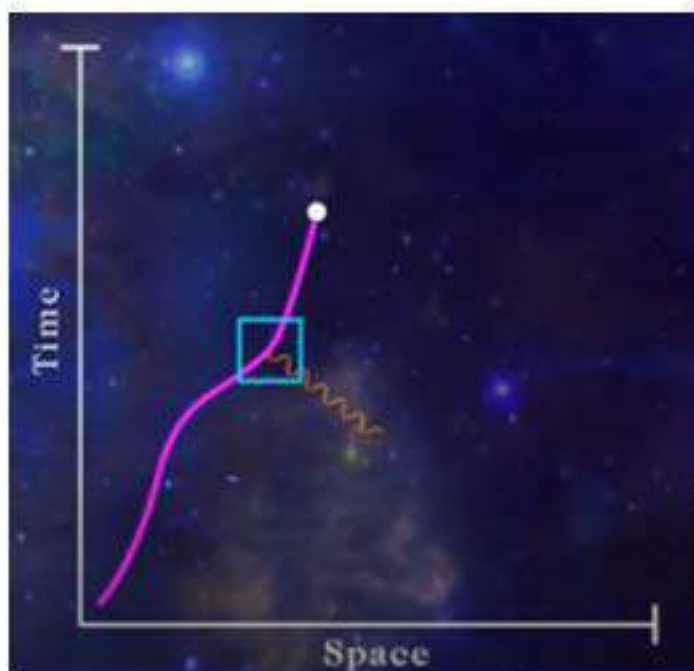
By Anna Wu 12Q2



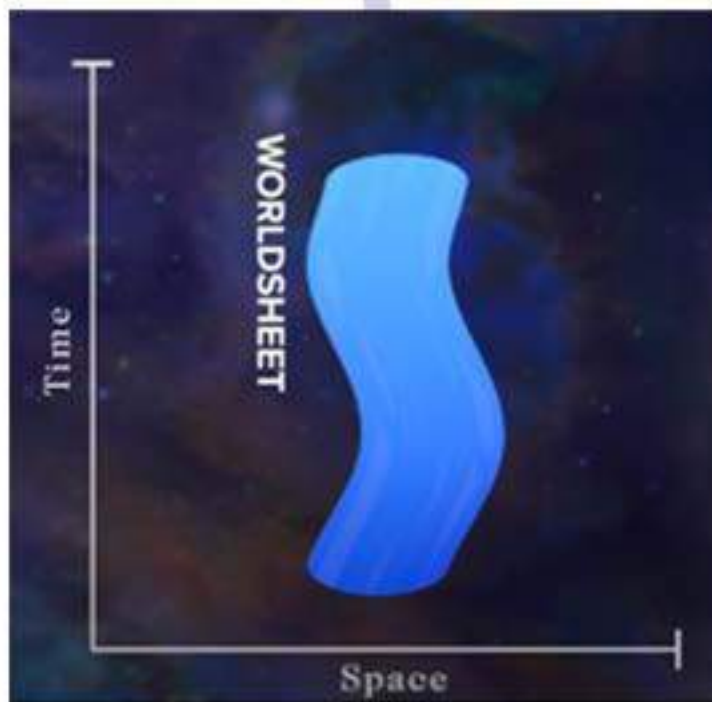
Elements for String Theory

In quantum theories of gravity, gravitational force is said to be caused by a hypothetical elementary particle called graviton. When graviton acts on another particle, it exerts its effect at an intersection to their worldlines over some distance which distorts the worldline of the other particle.

The stronger the gravitational interactions, the intersection becomes more and more defined and point-like due to the stronger force exerted by the graviton. In very strong gravitational interactions, the energy density at such a "point" becomes infinite, creating infinite feedback effects between the graviton and its own field - this is described as blackholes, an oddity in the math of general relativity and quantum mechanics.



String theory, however, avoids the problem of blackholes when mapping out worldlines in situations of strong gravitational interactions. In string theory, particles are either loops or open-ended strands. In this case, graviton is a loop. When strings move on a spacetime diagram, they trace out sheets/ columns - instead of a one dimensional world line, you can refer to these as two dimensional world sheets.



In interactions involving two sheets, the vertex (intersection) can never be pointlike there there won't be predictions of blackholes creating infinities we cannot define using mat



An attempt of this was made by Hermann Weyl right after Einstein's general relativity which he tried to use it to unify general relativity with electromagnetism. Weyl symmetry or Weyl invariance states that changing the scale of space should not affect the physics of the system however his theory was disproven because in 4D spacetime, scaling space does in fact matter. Yet his discoveries showed that there are still geometric situations that respect Weyl invariance such as the world sheet of a quantum string.

Source:

<https://www.youtube.com/watch?v=iTTa9YcTe1>

The elegance of string theory's mathematics extends even further. In addition to string theory's utility in avoiding the contradiction created by blackholes, it also predicts gravity. The tiny vibrating strings automatically reproduce the theory of general relativity and seemingly reproduces all of quantum theory too. Scientists have concluded that the vibrating strings are strangely well suited for quantization.

Quantization means taking a classical large scale motion and forming it into a quantum description, for example: when the act of throwing a ball becomes quantized, we can describe it using classical equations of motion. It is believed that exploring the symmetry of string theory could potentially quantize the theory to portray the gravitational field.

Weyl Symmetry

Weyl Invariance

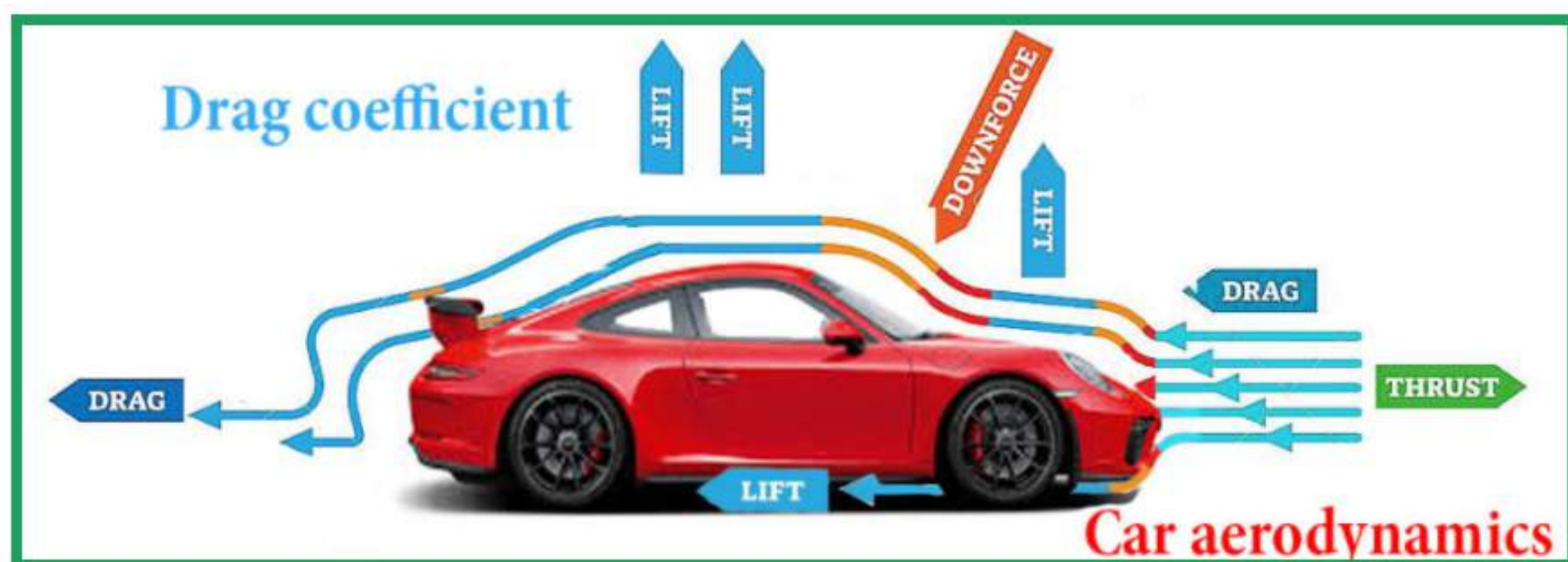
The 2D sheet traced out in spacetime by vibrating a 1d string has symmetry that allows us to redefine the scale on its surface however we like. This goes back to the idea that string theory could give the gravitational field through simple quantum wave equations from equations of motion because strings are quantizable in a way other structures aren't.

The actual mathematics behind this isn't as straightforward as we make it sound because adding Weyl invariances means that we have to account for new fields in the calculations however string theory is worth pursuing because it could hold a key to solving many scientific puzzles and it allows for more convenient methods that yield the same results.

TO WHAT EXTENT DO AERODYNAMICS HAVE ON THE PERFORMANCE OF CARS?

By Arion Hui

Aerodynamics. What's the first thing that came to your mind after seeing this word? Is it an image of an aeroplane soaring through the sky, kept afloat by nothing but air? Or perhaps a Formula 1 car, taking a corner at high speed with no issue whatsoever? Regardless of what you were thinking of, there is no denying that aerodynamics plays a significant part in our everyday lives, especially when it comes to vehicles.



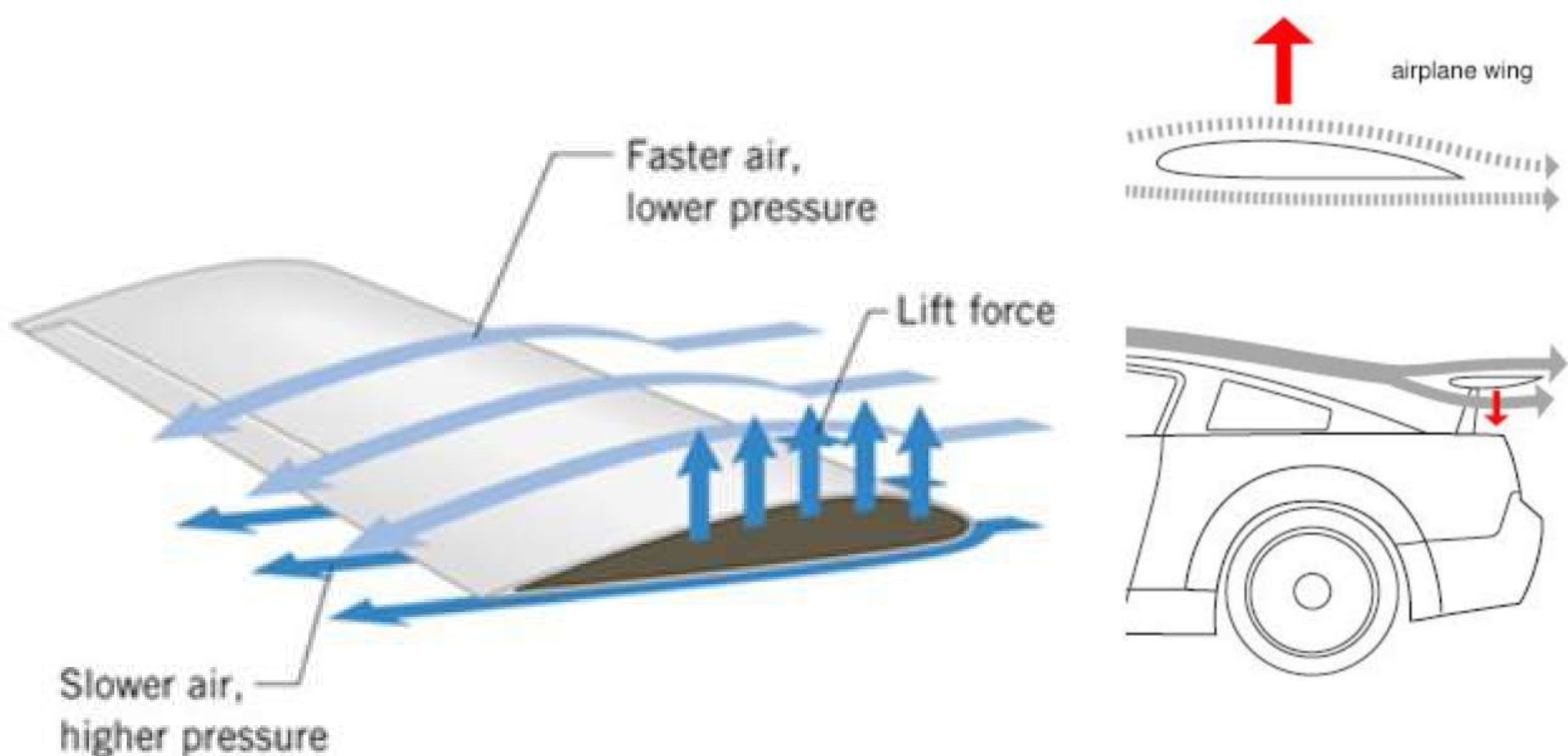
Year by year, the performance of cars has been increasing, and the many innovations that have occurred within the aerodynamic sector in recent times has only added to that. To put it simply, aerodynamics is nothing more than the science of reducing drag. What is drag you might ask? Essentially it is the force that your vehicle will be subject to when it is trying to move through the air. This force always acts against your direction of movement, meaning that in order to go faster, the vehicle must use more fuel and power to overcome that force. Automotive engineers use something called a drag coefficient (C_d) to measure how much drag will act on a certain vehicle. A low drag coefficient means that the vehicle is more aerodynamic than a vehicle with a higher one. Typically, cars nowadays will have a drag coefficient of around 0.4, with some cars like the Tesla Model S reaching 0.24.

This is one of the reasons why the Tesla is able to travel such large distances on battery power alone. A more aerodynamic car will have a more streamlined shape with a smaller surface area at the front, enabling it to cut through the surrounding air easier. This happens because there is less area for the air particles to collide with the car to slow it down, thus reducing the drag force. This will allow it to use less fuel and power when compared to a less aerodynamic car to reach and maintain the same speed. The drag force is also proportional to the velocity of the vehicle squared, meaning that if the vehicle is moving twice as fast, the drag force will be 4 times as large.

By looking at the speeds that an F1 car reaches, you would be forgiven if you thought that they had extremely low drag coefficients, but this is actually not the case. The C_d of F1 cars are relatively high, ranging from 0.7 to 1.1, depending on the setup that is applied to the car. This is a result of the high amounts of downforce required for them to be able to take corners at high speeds. The engineers strive to create a design that maximises the amount of downforce, while also having minimal drag.

Speaking of downforce, this is another area in which good aerodynamics can help immensely. To truly understand what downforce is, we need to look to the skies. The way that cars are stuck towards the ground follows the same principle as how planes are able to stay in the air. Looking closely at the wing of an aeroplane, the top part of the wing is curved more than the bottom part.

FLOW OVER AN AIRPLANE WING



Since the top part is curved more, the air travels a greater distance than the air travelling along the bottom, meaning that the air going over the top of the wing will be travelling at a higher speed. This is according to Bernoulli's principle which states that an increase in the speed of a fluid occurs simultaneously with a decrease in static pressure or a decrease in the fluid's potential energy. This results in there being a lower pressure area above the wing and a higher pressure area beneath it. The pressure difference causes lift and is what keeps planes in the air. To keep cars grounded, a wing is mounted upside down. This creates downforce and will provide the car with better grip, significantly increasing cornering speed and handling. The most common way that this is applied is through the use of a fixed wing.

Evidently, a car that has good aerodynamics will have significantly better performance compared to one that does not. But aside from performance gains, there are also gains in fuel efficiency, a reduction in cabin wind noise, and can even help reduce the temperature in the brakes. The aerodynamic sector continues to make breakthroughs all the time and we've seen the likes of active aero being introduced into more and more vehicles. With electric cars now becoming more and more mainstream, there will be vast amounts of opportunities for manufacturers to make gains in this sector in the transition into this new era in the automotive industry.

WORKS CITED LIST

"3 Reasons Why Aerodynamic Drag is So Important for Automotive Design." Car Throttle, www.carthrottle.com/post/a7952v8/.

Bober, Isaac. "Automotive Aerodynamics Explained." Practical Motoring, 30 Nov. 2020, practicalmotoring.com.au/car-advice/automotive-aerodynamics-explained/.

"Car Aerodynamics." How a Car Works, www.howacarworks.com/technology/car-aerodynamics.

Delfi. "What is Car Aerodynamics." Car Construction, 5 Dec. 2019, www.newkidscar.com/automotive-engineering/what-is-car-aerodynamics/.

Gretton, Matt. "Updates on the RB16: The Rear Wing is Almost Flat!" The Fastest and Most Complete Formula 1 News Blog!, 4 Sept. 2020, www.gpblog.com/en/news/67382/updates-on-the-rb16-the-rear-wing-is-almost-flat-.html.

"How a Faster Air Flow Creates a Lower Air Pressure on an Airplane Wing?" Physics Stack Exchange, physics.stackexchange.com/questions/439683/how-a-faster-air-flow-creates-a-lower-air-pressure-on-an-airplane-wing.

"How Aerodynamic Drag Affects Vehicle Performance?" CarBikeTech, 11 Apr. 2019, carbiketech.com/aerodynamic-drag/.

Hulley, Leai. "Aerodynamics of Rear Wing - Google Search | Aerodynamics, Wings." Pinterest, www.pinterest.nz/pin/423056958720504606/.

McIntosh, Jil. "How It Works: Aerodynamics." Driving, 24 Jan. 2018, driving.ca/auto-news/news/how-it-works-aerodynamics.

Santos, Rodrigo. "Race Car Aerodynamics: How Air Improves Lap Times." Racing Car Dynamics - Your Uncomplicated Resource to Race Engineering, 5 Oct. 2014, racingcardynamics.com/race-car-aerodynamics-air-lap-times/.

"Tesla Model S 2021." Driving, driving.ca/tesla/model-s.

Trochalidis, Constantinos. "The Effects of Aerodynamics On Cars." DriveTribe, 29 Sept. 2019, drivetribe.com/p/the-effects-of-aerodynamics-on-S5nweq-XQASk_m9ebAmeBw?iid=cGnJIH_CT66YsLPg_wkaeQ.

Whiteley, Michael. "The Benefits of Aerodynamics." Automobile Magazine, 15 July 2017, www.automobilemag.com/news/benefits-of-aerodynamics/.



WHY IS

CRUDE OIL SO IMPORTANT?

By Meenakshi Narayanan [11H2]

Crude oil, a thick, sticky, black liquid that is found under the ground and in the sea is an important source of fuel and accounts for a third of global energy demand. It is used for everything from transport to cooking to heating and thus is an integral part of everyday life. There is only a finite amount of proven crude oil reserves and some estimate it can run out by 2067. While renewable energy is replacing crude oil at a fast clip, the question is, is it fast enough?

Crude oil is made up of the remains of organisms that lived and died millions of years ago - mainly plankton which was buried in mud. Crude oil is also a complex mixture of hydrocarbons and an important source of fuel. Other useful substances made from compounds found in crude oil include: solvents, lubricants and detergents.

Hydrocarbons are organic molecules that consist of entirely carbon and hydrogen. We often use hydrocarbons in our daily lives: for instance, the propane in a gas grill and the butane in a lighter are both examples of hydrocarbons. They are good sources of fuel because their covalent bonds store a large amount of energy, which is released when the molecules are burned (when they react with oxygen to form carbon dioxide and water). Hydrocarbons can be obtained when crude oil undergoes fractional distillation.



Fractional distillation separates a mixture into a number of different parts, called fractions. A tall fractionating column will be fitted above the mixture, with several condensers coming off at different heights. The column is hot at the bottom and cool at the top. Substances with high boiling points condense at the bottom and substances with lower boiling points condense near the top. Longer chains of hydrocarbons with very high boiling points will immediately turn into liquid and are condensed at the bottom of the column. Shorter chains of hydrocarbons with low boiling points will rise up the column and will be condensed near the top. The different fractions will condense at different heights according to their chemical properties (viscosity, volatile, colour, melting/boiling points) and will be condensed into liquids.



The different liquids that are collected are known as fossil fuels. There are six types of fuels produced, refinery gases, gasoline, kerosene, diesel, fuel oil and bitumen. Refinery gases are used for domestic heating and cooking. Gasoline is a very integral part of our lives as we need it for our cars. Kerosene was once also a crucial fuel, but since the airline industry has taken a huge toll over the past two years, due to the coronavirus pandemic, major fuel companies are now converting it into gasoline. They do this because gasoline is more in demand. Diesel is used as a fuel for some cars, lorries and buses. Fuel oil is used in ships and power stations. Bitumen is a thick substance that is used in some countries for roofs and roads.



As we progress into the future, supplies will tighten and fuel prices will increase further. We've already felt the ripples from the recent rises of commodity pricing. And as demand from developing nations combines with an ever dwindling supply - the global economy will soon begin to feel the squeeze. So what does the future hold, no one knows. Obviously, we must find renewable energy solutions, but for them to become our major energy supply is a long time away and crude oil will remain an intricate part of our society.



We can wish for it, we can dream of it, but it will never be, crude oil is not renewable, and therefore in time it must be realized that there will be no crude oil.



Biology

*What chemicals
cause allergies?*

*What is the
Immune System?*

*Enzyme
Deficiency*

*How do Mimosa Pudica
plants close their leaves
when you touch them?*



WHAT CHEMICALS CAUSE

ALLERGIES?

MEENAKSHI NARAYANAN 10H2

No matter what time of the year it is, it always seems that someone is always sneezing, has eyes that are watering, or are all stuffed up due to allergies, may it be pollen, dust, fur, grass or one of the hundreds of triggers.

IMMUNE SYSTEM

Allergies usually occur when the immune system reacts to a foreign substance such as pollen, venom or food. These substances usually don't cause a reaction in most people but the immune system may recognise the substance as harmful, even though it isn't.



Allergic reactions range from the relatively minor, such as itching and redness of the skin, to the severe, such as life-threatening anaphylactic reactions, depending on how potent the allergen is. However, humans don't all react in the same way to a specific allergen.



CAUSES

Ever since industrialisation, there has been an increase in allergic diseases such as asthma and contact dermatitis. There are various reasons for this, one possible cause is that we are exposed to more chemicals than before. Some

people assume that artificial scents are responsible, but the problem might actually be the hidden chemical ingredients found in common household products.

In order to prevent allergic reactions, chemicals may be eliminated or restricted, by chemists, when substances are known to cause allergies among a large group, in order to protect consumers and workers.



CHEMICALS

Some common chemicals that cause allergies include triclosan, ammonia, hydrochloric acid and formaldehyde.



Triclosan is a type of polyhalogenated compound or PHC, found in soap, deodorant, laundry detergents, in addition to toxic buildup in humans. As an allergen, triclosan has been linked to hay fever and skin infections.



A naturally occurring chemical, ammonia, is made up of hydrogen and nitrogen. It's harmless in trace amounts, but in more concentrated amounts, such as those used in glass cleaners, it can be dangerous. Ammonia produces strong fumes and a pungent odour that can cause eye irritation, respiratory problems and headaches.

Hydrochloric acid is another naturally occurring dilute compound made up of hydrogen and chloride. It is most common in toilet bowl cleaners, but hydrochloric acid also finds its way into lime-scale removers, tile cleaners and other bathroom disinfectants. This chemical comes with some serious side effects. If fumes are inhaled, it can result in severe respiratory problems.

There is no way to prevent or cure an allergy, but it is possible to prevent a reaction or manage the symptoms if it occurs. This is why it's good to know types of chemicals that cause allergies.

IMAGES

(n.d.). Johns Hopkins Medicine, based in Baltimore, Maryland. https://www.hopkinsmedicine.org/-/media/images/health/-conditions/allergy/dandelioncloseupstock_

Alex Raths M. (2005, April 13). Chemicals and allergies [Photograph]. https://chemicalsinourlife.echa.europa.eu/documents/23718410/23806762/c_allergies_lg.jpg/8d7cc258-f80c-2508-ce0e-327f6103d7c1?t=1560172029671.

Rakib A. (2015, February 3). CHEMICAL PRODUCTS PURPOSES [Photograph]. <https://www.bettellaprodotti.com/wp-content/uploads/2018/09/pvt.png>.

Buckner A. (2019). Technology Advice [Photograph]. https://cdn.technologyadvice.com/wp-content/uploads/2014/07/Fotolia_142087350_Subscription_Monthly_M-700x408.jpg.

Megazyme, S. E. (2020). Ammonia [Photograph]. https://prod-media.megazyme.com/media/image/01/64/5b/K-AMiAR-2019_600x600.jpg.

RESOURCES

Allergies and the immune system - Health encyclopedia - University of Rochester Medical Center. (n.d.). Rochester, NY - University of Rochester Medical Center. <https://www.urmc.rochester.edu/encyclopedia/content.aspx?contenttypeid=85&contentid=P00039>

How are allergies linked to your immune system. (2019, April 30). Augusta Health | Virginia Healthcare. <https://www.augustahealth.com/health-focused/how-are-allergies-linked-to-your-immune-system>

Chemical allergies: Shampoo, cleaners, detergents, and more. (2010, April 5). WebMD. <https://www.webmd.com/allergies/chemical-allergies>

Allergy levels are increasing, so how can pharmacists help? (n.d.). Chemist+Druggist | Community pharmacy news, analysis and CPD | Est. 1859. <https://www.chemistanddruggist.co.uk/feature/how-can-pharmacists-help-manage-rise-allergic-disease>

Allergy prevention | AAFA.org (n.d.). Asthma and Allergy Foundation of America | AAFA. <https://www.aafa.org/prevent-allergies/>

The Immune System

Alba Br...

What is the immune system?

The immune system protects you against diseases, infections, and helps you recover after an injury. A person with a weak immune system may be more prone to frequent infections. The immune system is a fighting system that is powered by five liters of blood and lymph. Lymph is a clear and colorless liquid that passes throughout the tissues of the body.

White Blood Cells:

White blood cells charge into battle at any sign of trouble. Your immune system can adapt, which is why human beings have been around for so long. Once your body comes in contact with a foreign substance, it attacks it and remembers it. If it comes back, your body knows what to do. This is most obvious with measles and chickenpox: one infection is usually enough to protect you for the rest of your life.

Allergies:

Allergies don't affect everyone. They're caused when your body mistakes something harmless, such as pollen or a type of food, as a pathogen. Your body launches an immune response against it, causing you to experience allergy symptoms (eg. rashes, itchiness, swelling etc.).

Signs of a weak immune system

A person with a weakened immune system is more likely to get infections more often than other people, and these infections may be more severe or harder to treat. One of the things that can weaken your immune system is stress. Nadia H. Delancey, Internal Medicine, says that stress decreases the body's production of white blood cells that help fight infections. This can lower your lymphocyte count, which increases your risk for viruses like the common cold. Some of the signs that people with a weak immune system may get include:

- Pneumonia
- Meningitis
- Bronchitis
- Skin infections

These infections may recur.

People with a weak immune system are more likely to experience:

- Autoimmune disorders
- Inflammation of the intestines
- Blood disorders or abnormalities (like anemia)
- Digestive issues (like lactose intolerance and abdominal cramping)
- Developmental delays, in children

To find out if you have a weak immune system, your doctor can do a blood test to see if you have antibodies in the blood.

Immune System

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What can you do to help your immune system?

Get a good night's sleep
Your body can't function correctly if you aren't sleeping well.

Practice good hygiene
Washing your hands regularly can prevent infections.

Eat a balanced diet and get plenty of exercise
Eating nutritious food and staying active will help your body fight off infections.

Disinfect household objects
Germs can live on household objects such as doorknobs and remote controls

Why is your immune system important?

Without an immune system, our bodies would be open to attack from bacteria, viruses, parasites, and more. Our immune system keeps us healthy and without it we would constantly be ill or sick, things as minor as a paper cut or a cold could become fatal. Signs like high temperature and swelling are designed to aid your immune system. A warmer body makes it harder for bacteria and viruses to reproduce and spread because they are temperature sensitive. When body cells are damaged they release chemicals that make fluid leak into the surrounding tissues causing swelling, that attracts phagocytes which consume the invaders and the damaged cells.

Enzyme Production

Cecily Lei 11M1

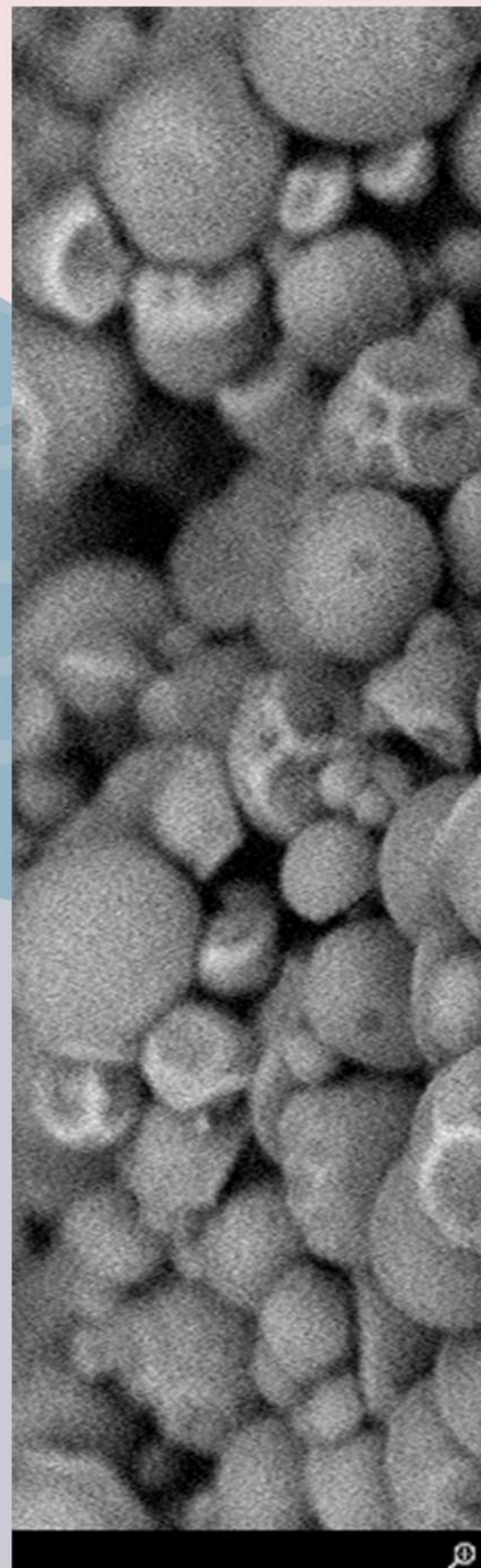
What is an enzyme?

The enzyme, a substance that works as a biological catalyst in organisms, regulates the chemical reaction rates. Nearly all the biological processes that occur within the human body need enzymes to regulate. Enzymes are a special type of protein needed to break down food molecules into fuel in the process of metabolism.

There are thousands of enzymes in our body, for example, amylase, which helps to break down starches into sugars. Maltase which is found in saliva breaks the sugar maltose into glucose. Also, Maltose is found in foods such as potatoes, pasta, and beer.

In the digestive system, enzymes help the body to break down the big molecules into smaller molecules, such as glucose, amino acids, and glycerol. Enzymes also function in DNA replication, when a cell divides, the DNA needs to be copied, enzymes help this process by unraveling the DNA coil and copying information.

The “lock and key” model was first proposed in 1894. The substrate binds to the active site of the enzyme's trusted source and is converted into a product. Once the product leaves the active site, the enzyme is ready to attach to a new substrate and repeat the process.



What affects

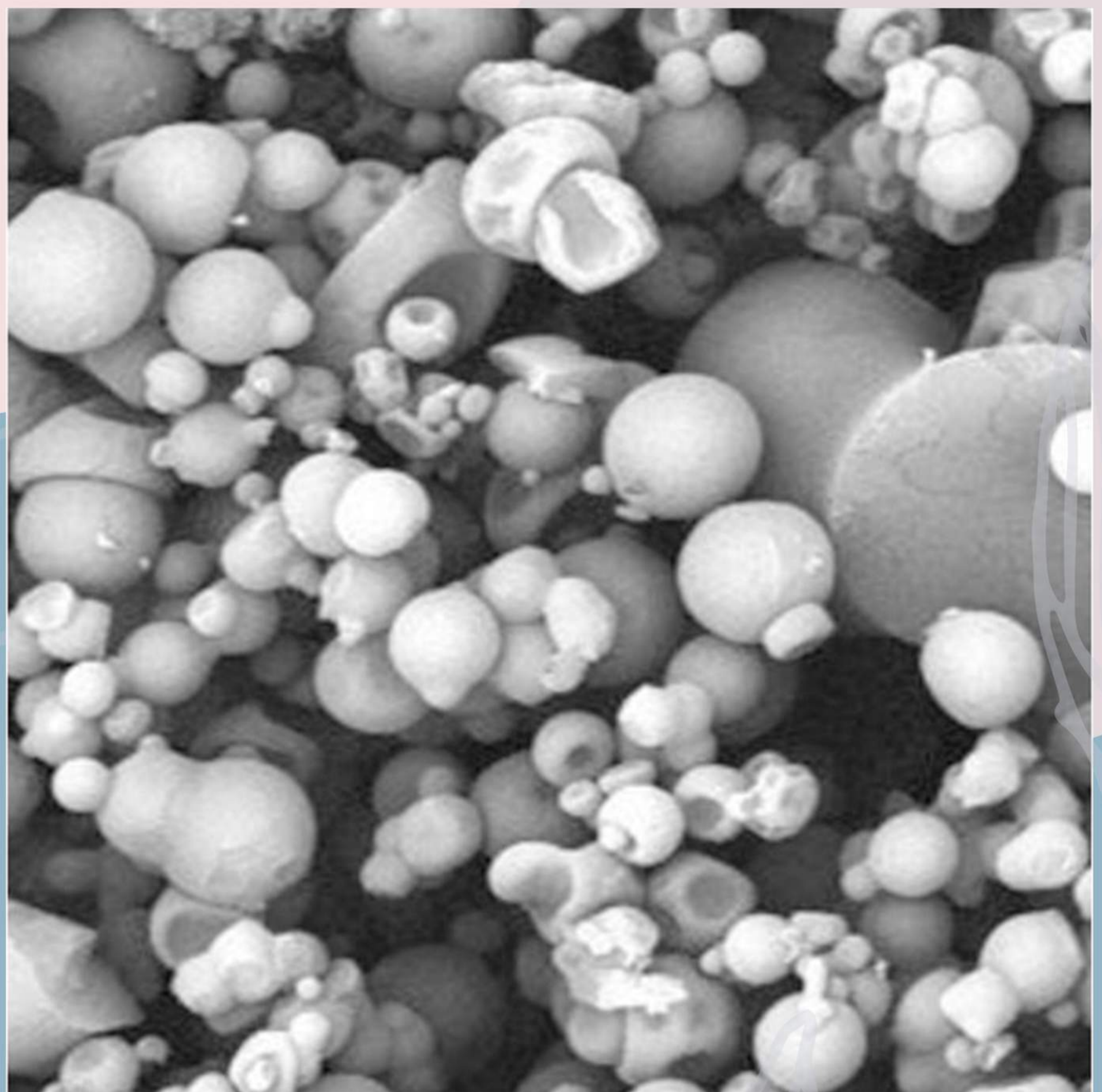
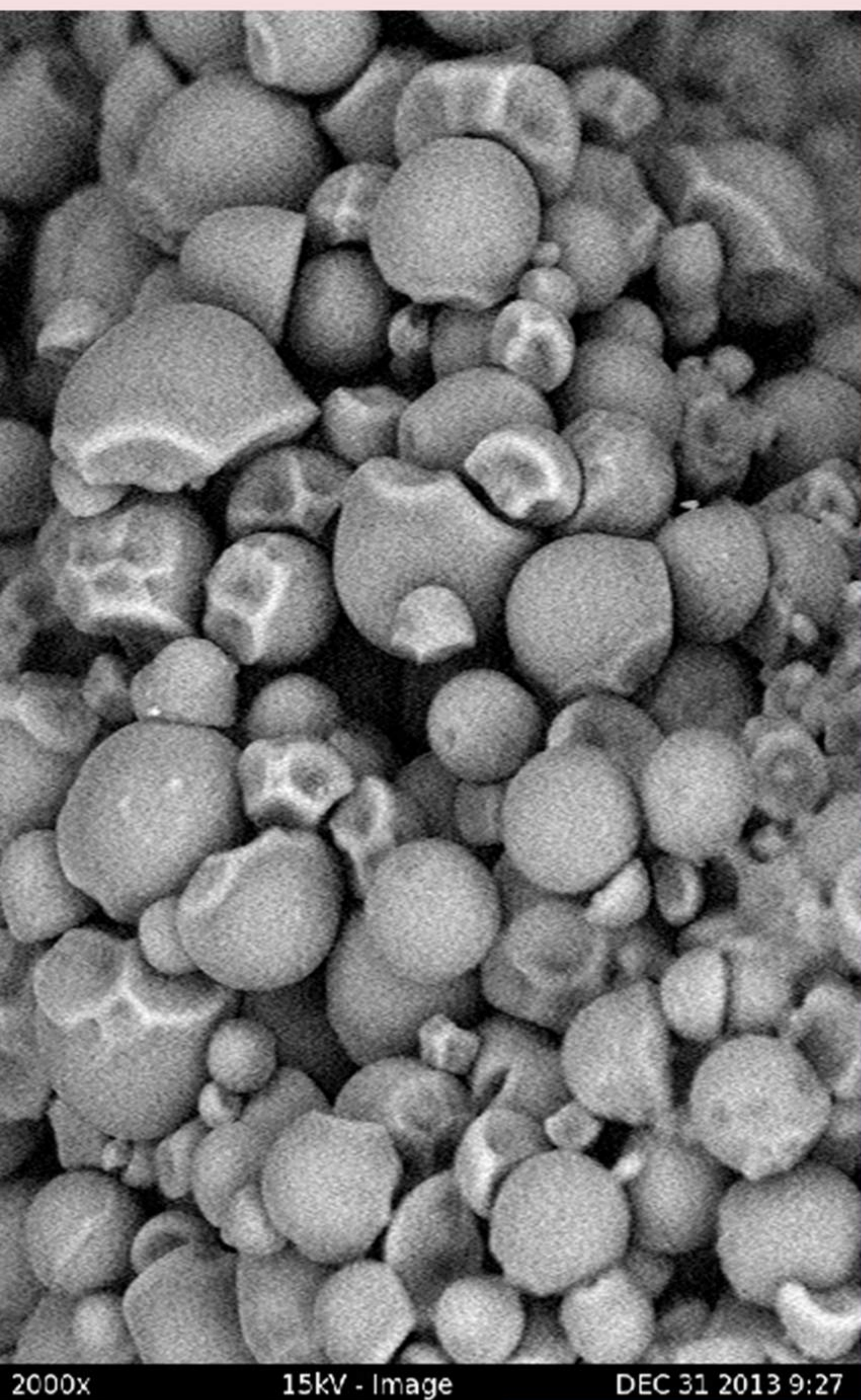
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What are enzymes?

Enzymes are proteins that act as catalysts under a perfect condition to work properly.

Enzymes are only able to work at a certain PH range, and it depends on the places they work. For example, the enzymes in the stomach work best at PH 1 to 2 while the best work condition in the small intestine for maltase is from PH 6 to PH 7.4.

Enzymes can only function under certain conditions. Most enzymes in the human body work best at around 37°C (body temperature). At lower temperatures, they can still work, but at a slower speed.

If the environment is too acidic or alkaline, or the temperature is too high, the enzyme will change its shape. If the shape of the enzyme, especially the active site, can no longer fit the substrate, the enzyme will be denatured.

Another important factor that will influence the work of the enzyme is a cofactor. A cofactor is a non-protein chemical compound or metallic ion that is required for the enzyme's activity as a catalyst. Some enzymes cannot function unless they have a cofactor. Some cofactors are chemical compounds attached to them. For instance, vitamins, many vitamins are cofactors to help enzymes to catalyze properly.

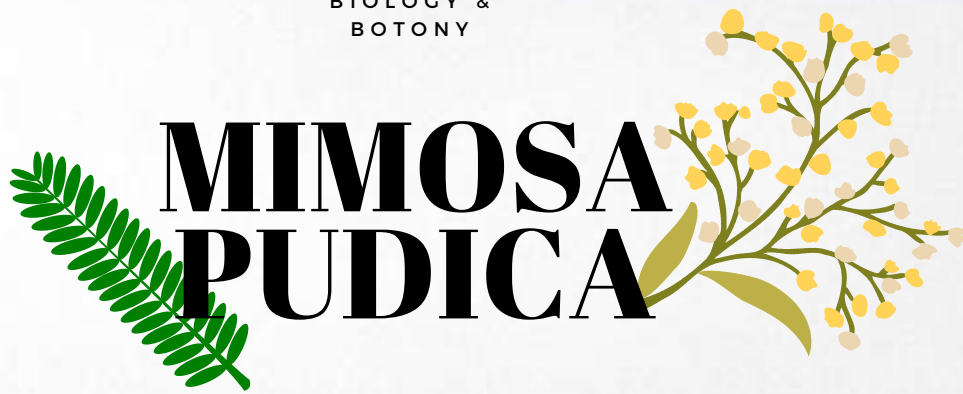
What will happen if enzymes do not work properly?

In 1995, professor Wolfenden from the University of North Carolina reported that without a particular enzyme, a biological transformation in creating building blocks of DNA and RNA would take 78 million years. In the absence of an enzyme - which is almost 30 times slower than that, the reaction's half life-the time it takes for half of the substances to be consumed -is 2.3 billion years, about half the age of the Earth.

So, without catalysts, there would be no life at all, from microbes to humans. Enzyme lets us know how natural selection operated in a way as to produce a protein that got off the ground as a primitive catalyst for such an extraordinary reaction.

Enzyme deficiency or lack of these enzymes are genetic defects that can cause many life-altering or life-threatening diseases. For example, MPS, Mucopolysaccharidosis is a group of genetic diseases in which defective or missing enzymes cause complex sugar molecules to accumulate in cells. As a consequence, it causes progressive damage to the heart, bones, joints, respiratory system, and central nervous system. Although this disease may not be obvious at birth, as more and more cells are damaged, signs and symptoms will develop with age. It is estimated that one out of every 25,000 babies born in the United States has some form of MPS.

MIMOSA PUDICA

An illustration of Mimosa pudica. On the left, a single green leaf with many small leaflets is shown. On the right, a branch with several small yellow flowers and green leaves is shown. The title 'MIMOSA PUDICA' is written in large, bold, black letters across the center, with the green leaf on the left and the flowering branch on the right.

How do Mimosa Pudica plants close (and open back up again) their leaves when you touch them?

By Vivienne Lee [08T2]

What is the Mimosa Pudica plant?

The Mimosa Pudica is a plant that thrives in tropical conditions with a special ability: it can MOVE.

When an animal tries to eat the plant, its leaves fold up and its branches droop. This is to make hungry herbivores think that the plant is dead or in the process of dying, or it will think that the plant is another animal or insect in disguise so that it will find a different, tastier plant to eat.

How does this happen?

When the plant is stimulated, a sort of electric signal is created, similar to the ones nerve cells receive, and passed on to other parts of the plant.

Mimosa Pudica store water in special cells in their leaves called vacuoles. When it 'feels' something touching it, special motor cells called mechanoreceptors at the base of each leaf move first all of the potassium, then all of the water out from itself.

This is because when there is a lot of water pressing on the walls of the cell, the cell is rigid and hard. When there is not a lot of water in the cell, then it is soft and droopy. Since these cells are on the base of the leaf, the *entire* leaf droops. Then the signal branches to other parts of the plant, therefore losing the rigidity of the other leaves and branches, causing them to droop as well.

However, the Mimosa Pudica needs a lot of energy to open and close up their leaves when they are touched, so if they are touched constantly, that means that they will learn to not open and close up because at that point, opening and closing up is a waste of energy.

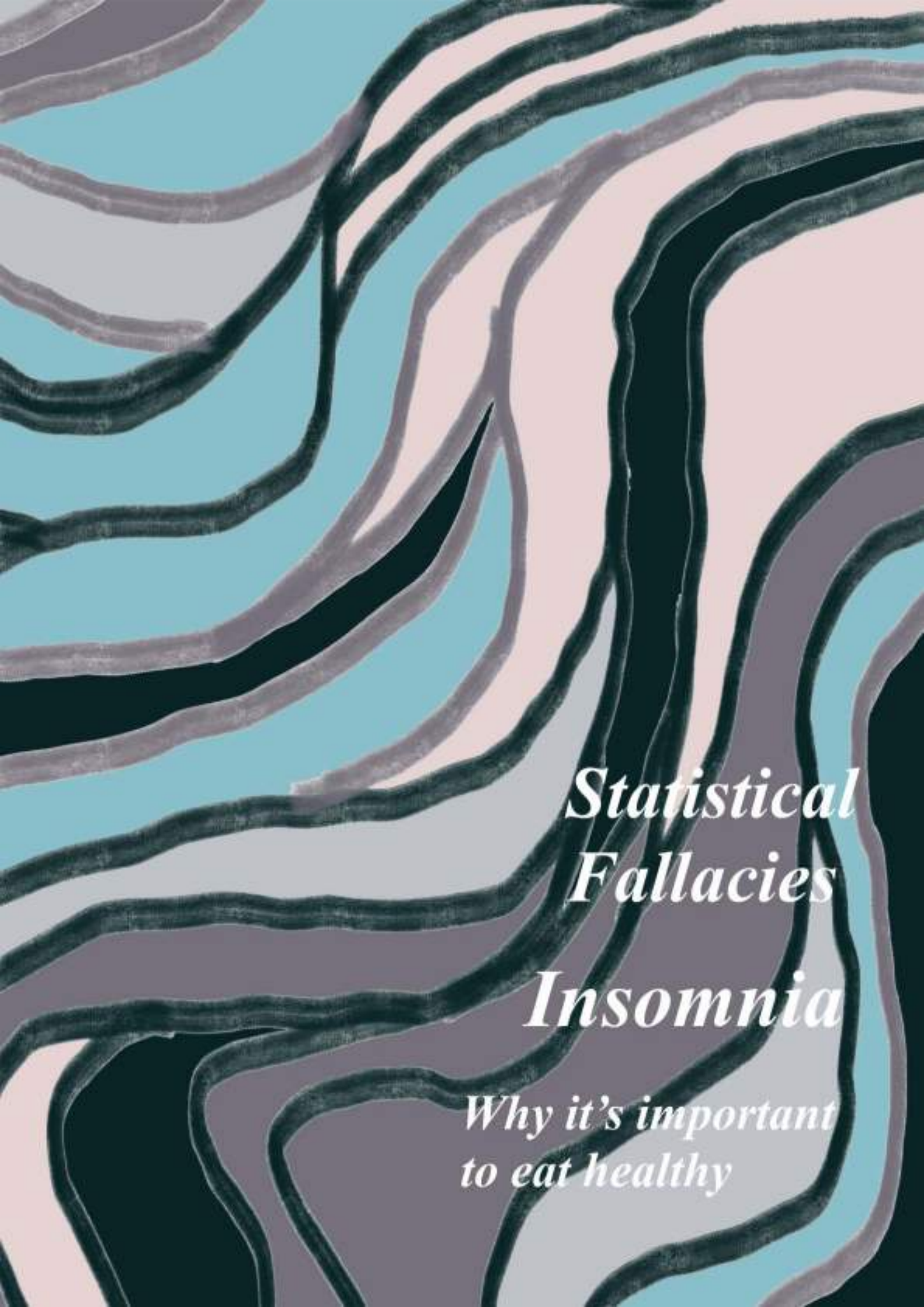
Sources:

1. <https://plantsinmotion.bio.indiana.edu/plantmotion/movements/nastic/mimosa/mimosa.html#:~:text=In%20the%20sensitive%20plant%2C%20the,shaken%2C%20heated%20or%20rapidly%20cooled.&text=In%20Mimosa%2C%20the%20mechanical%20or,cell%20at%20a%20high%20rate>
2. <https://asknature.org/strategy/leaves-fold-in-response-to-touch/>

Psychology & Well-being

*How does Depression
affect your brain?*

*Animal Rights
and Welfare*



*Statistical
Fallacies*

Insomnia

*Why it's important
to eat healthy*



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How Does Depression Affect Your Brain?

What IS depression?

Symptoms of depression can include too much or too little sleep, appetite changes, losing the ability to love, losing concentration, a low mood, no interest in things you like and so on.

Depression is really complex

You can get depression from many different things such as, unbalanced chemicals in the brain, traumatic experiences, medical conditions and even genes. Depression is linked with some parts of the brain. Such as in the amygdala the hippocampus and the thalamus.

But seriously, what is going on inside the brain?

Well, if you look at the brain of a depressed person, the hippocampus is much smaller than usual. Other parts of the brain could be affected, but the hippocampus controls the memory and emotion. The longer a person is depressed, the smaller the hippocampus becomes.

Is there any way to get rid of depression?

While there is medication you can take there are actually other ways. If you make the right decisions, like eating healthier and getting therapy. And coming back to medication you can take. Interestingly, some depression medicine help stimulate serotonin, but serotonin is not what does it. There are chemicals in serotonin that regrow the neurons in the hippocampus.



ANIMAL RIGHTS AND WELFARE

BY ARIANE CRANE AND KAITLYN MALBY

Animal rights are rights that animals have about their basic wants and needs as well as their existence. Such as the need to avoid suffering and hunting, these rights should be considered as much as the rights for human beings. There shouldn't be any inequalities between various organisms, we all have the right to live.

Animal welfare is the wellbeing of non-human organisms, various studies have indicated that animals are complex beings, and are able to experience emotions, communicate with each other, learn and feel pain, in this way similar to humans. Animal welfare also includes animal health, furthermore the physical and emotional state of an animal.

WHY SHOULD ANIMAL RIGHTS AND WELFARE EXIST?

Animal rights exist to prevent unfair suffering and misery. I believe these rights should apply to all living things. They should exist because if they didn't then a lot of animals would probably be abused by bad people, and animals are still treated badly even to this day! An example of the consequences without animal rights are animal testing, animals should not be used to test new substances for the benefits of human kind, over 115 million animals are killed in experiments worldwide for chemical, drug, food and cosmetics testing every year!

We believe that animal welfare should exist because not only does the wellbeing of humans matter, the wellbeing of all animals should matter too. They should not be forced to suffer physically or mentally. All animals including humans big and small should be treated with equality and have access to basic wants and needs and should not suffer mental or physical abuse.

Would you believe that 900 to 2,000 new cases of animal hoarding each year in the United States of America? With 250,000 animals as victims? Did you know that more than 50% of the fur in the US comes from China, where millions of cats and dogs suffer from bleeding to death and being skinned alive?!

In conclusion, animal rights and animal welfare should exist to prevent unjust suffering, harm and cruelty toward animals. As well as the preservation of good health and well-being of animals that may be suffering from mental or physical abuse, [them here.](#)



TRUE STORIES



OWNER SEVERELY INJURES HIS DOG INTENTIONALLY



MAN ATTEMPTS TO KILL A PIGEON USING A WATER BOTTLE



WOMAN CAUSES UNNECESSARY SUFFERING, RESULTING IN 175 ANIMALS DEAD



MAN CHOOSES PROFIT OVER ANIMAL NEEDS

There are many stories out there regarding animal cruelty, however here are 4 shocking true stories about animal cruelty.

This man who fractured his own dog's spine and left him with extensive bruising was disqualified from keeping animals for a lifetime. This reliable proof that animal welfare and rights are relevant and should always be kept in mind.

A social media video shows proof of a man attempting to injure and kill a pigeon using a full bottle of water. This deliberately shows that this man disregards animal rights and welfare, because he did not care about the pigeon most probably just entertainment for himself. *

A woman was sentenced to disqualification for a lifetime of owning any animals after she admitted that she caused unnecessary suffering and failing to meet the needs of a large number of animals in her care, this resulted in 175 animals dead.

A man who completely ignores animal welfare to make profit from puppy farming was disqualified from keeping dogs for a lifetime. A result of disregarding animal welfare can be end disastrous, so respect the needs and wants of any kind of organism, and never think that you have the right to injure or kill any animal.

The RSPCA (royal society for the prevention of cruelty to animals) is an organisation that aims to end animal cruelty, they have been trying to do so since 1824. Their mission is to improve the lives of all animals and their main focus is to end cruelty that animals suffer, it is their vision to live in a world where all animals are respected and treated with compassion.

*this is just a probability, do not assume that this is a fact.

Ultimately, animal welfare and animal rights are extremely important and we must do our best to protect animals from abuse, neglect and cruelty. Animal welfare and animal rights should underpin exist to prevent unjust cruelty to animals.



*What action
can you take
as a
responsible
global
citizen?*

You can take action by donating money to charities and adopting a pet instead of buying one. If you have a pet already then take good care of it, it is your responsibility after all, and make sure it's wants and needs are fulfilled, you can also spread the word throughout your community about animal rights and welfare.

Other things you can do are to prevent animals from being mistreated, if you see someone abusing or mistreating an animal. Another thing you can do is teach people such as your children, family members or friends to have respect for animals and to always treat them with kindness. In addition, if you see someone treating an animal badly and you feel that you are not the one to stop this, alert suitable authorities such as organisations like the RSPCA and SPCA. Other ways to take action are to help animals in need by giving them a home by adopting them. Another way to raise awareness for animal rights is that you can educate people about the importance of the issue and teach them to respect animals. If you are willing to go as far as protest against animal cruelty or demand for more laws against it then you are truly aware of this issue.

CITAT

SOURCES

Wikipedia:

https://en.wikipedia.org/wiki/Animal_rights_idea,similar%20interests%20of%20humans

Wikipedia: https://en.wikipedia.org/wiki/Animal_rights

SPCA: <https://www.sPCA.org/hk/en/animal-rights>

SOURCES

Wikipedia: https://en.wikipedia.org/wiki/Animal_rights

Thoughtco: <https://www.thoughtco.com/why-should-animal-rights-127603#:~:text=The%20reason%20that%20people%20are%20opposed%20to%20animal%20rights%20is%20because%20of%20the%20fact%20that%20animals%20are%20sentient%20and%20can%20feel%20pain%20and%20suffering.>

Naia: <http://www.naiaonline.org/articles/article/what-is-animal-rights#:~:text=Freedom%20from%20pain%20and%20suffering.>

Do something: <https://www.dosomething.org/us/facts>

Wikipedia: https://en.wikipedia.org/wiki/Animal_hoarding

Wild Welfare: <http://www.wildwelfare.org/can-a-zoo-visit-a-zoo-welfare/>

SOURCE

RSPCA:

<https://www.rspca.org.uk/whatwedo/ending-animal-exploitation>

RSPCA:

<https://www.rspca.org.uk/whatwedo/ending-animal-exploitation/whoweare#:~:text=We're%20the%20largest%20animal%20welfare%20organisation%20in%20the%20UK%20since%201824.>

SOURCE

Four-paws: <https://www.four-paws.org/campaigns/ending-animal-exploitation/ways-to-prevent-cruelty-to-animals>

Naturewatch foundation: <https://naturewatch.org/animal-welfare>

START TO CHANGE

STOP UNJUST CRUELTY

By Ariane Cran

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cruelty/prosecution/crueltystories

crueltyRSPCA:<https://www.rspca.org.uk/wh>
%20Royal%20Society,out%20of%20animals%

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o-prevent-cruelty-to-animals

atch.org/blog/article/feeling-like-a-caged-

AN ANIMAL'S WORLD

ELTY AND SUFFERING

e & Kaitlyn Malby

In our modern, digital age, we find the vast majority of our news online from a dizzying array of sources. These include—but are not limited to—news sites like The Guardian, Telegraph or Apple Daily, as well as social media sites like Instagram or Reddit. An increase of the ease and speed of global communication has its boons, but also brings certain troubles. Now more than ever before it is easy for misinformation to spread around the global community, which is why it is so important for us to exercise our critical thinking and consider sources from a variety of different perspectives.

One area where critical thinking can be applied is statistics. Using graphs, percentages and the like in a persuasive piece can make it seem a lot more convincing—after all, those numbers represent the ethos of the scientific community! When presented with any sort of apparently scientific material, we tend to be rather trusting. In reality, bad statistics and misinformation are everywhere. In fact, a 2016 study by Cambridge Analytica found that 83.7% of all statistics you see in the media are false! *That's a lie, by the way. That said, in this article we will discuss some common statistical fallacies, or ways in which statistics can be altered to deceive readers, using sample data gathered from West Island students. Have a look at these graphs (see if you can spot the problems with them yourself).

Statistics

Examples Us

ID Event Placements in Rank-Order by

How well did each Dynasty do in ID events from 2019-3

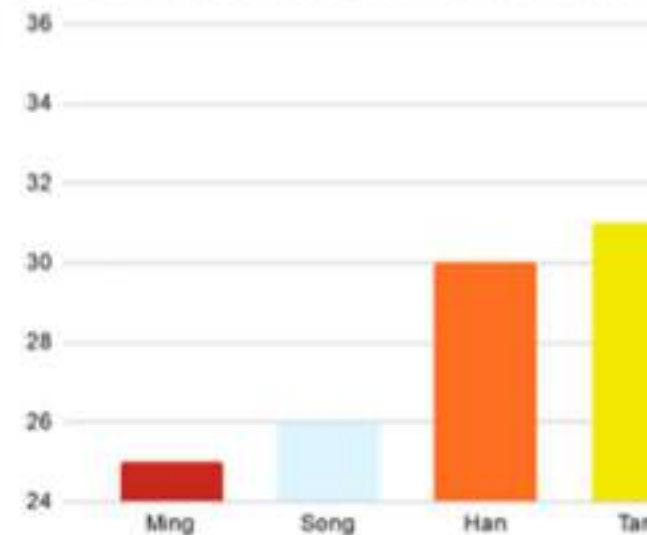
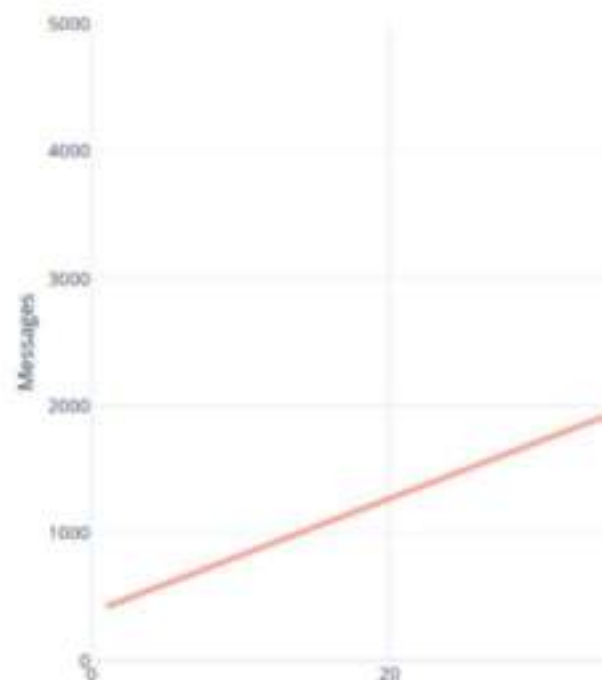


Fig. 1

Number of Messages Sent in Group Chat



tical Fallacies:

ing Responses from West Island School

y Dynasty
0207

Which IB Programme do West Island Students Prefer?

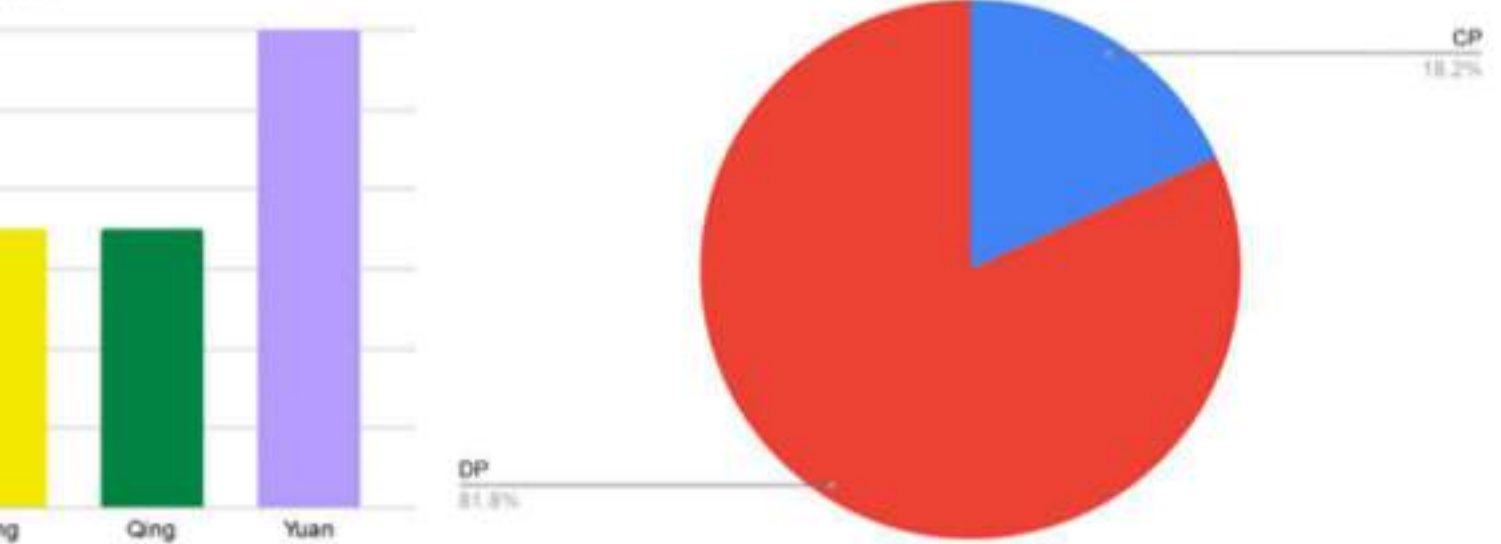


Fig. 2

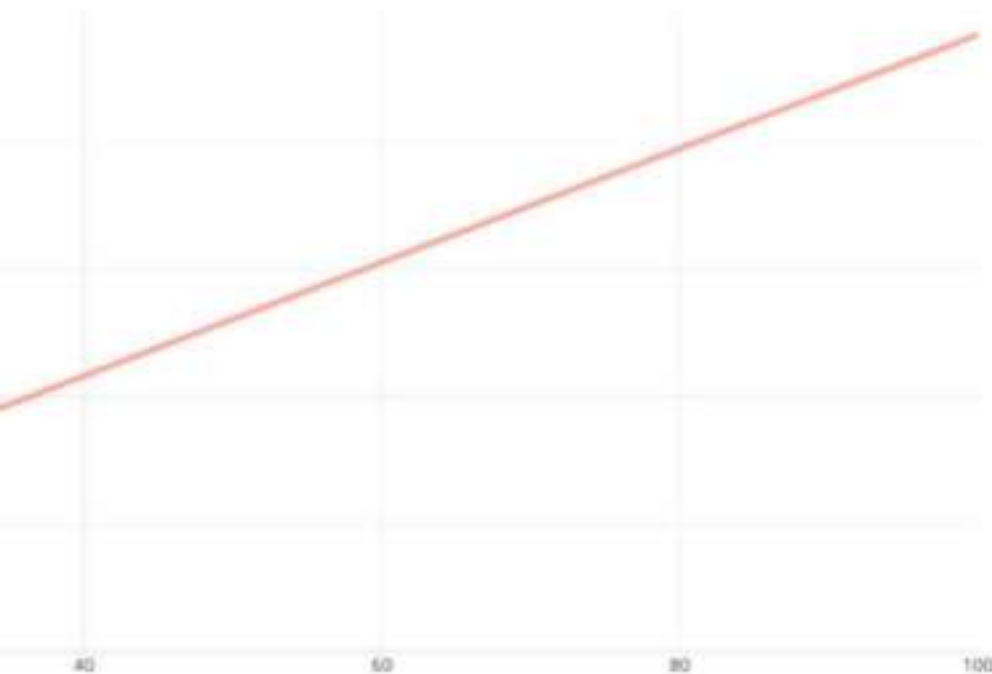


Fig. 3

Uoyo Huang 12M2

Let's analyse these graphs in order.

Fig 1: Misleading Data Visualization

First off, Fig. 1 takes advantage of an assumption/preconception which West Island students may or may not suffer from. At West Island, we associate each Dynasty with a certain color. Han is red, Ming is blue and so on. To that end, the bars are colored (in dynasty order). However, what might not be so obvious is that while the coloring of the bars is in the normal order, the actual bars are not. A person who does not read the labels on the x-axis carefully may assume that the Dynasty which did the worst is Han, when in fact it is Ming.

Furthermore, if one looks carefully at the scale on the y-axis, they may notice that only values from 24-36 are displayed. This may seem like an innocent enough stylistic choice at first, but is in fact rather deceptive. The fact that the majority of the bars are hidden makes the comparison between the Dynasties, especially the lowest and highest, seem a lot starker than they actually are. Based off the visualisation in Fig. 1, one might be led to assume that Ming did several times worse than Yuan! While Ming did actually do worse than Yuan, the competition was a lot closer than it appears on Fig. 1, as illustrated below in Fig. 1 (Revised).

ID Event Placements in Rank-Order by Dynasty (Revised)

How well did each Dynasty do in ID events from 2019-2020?

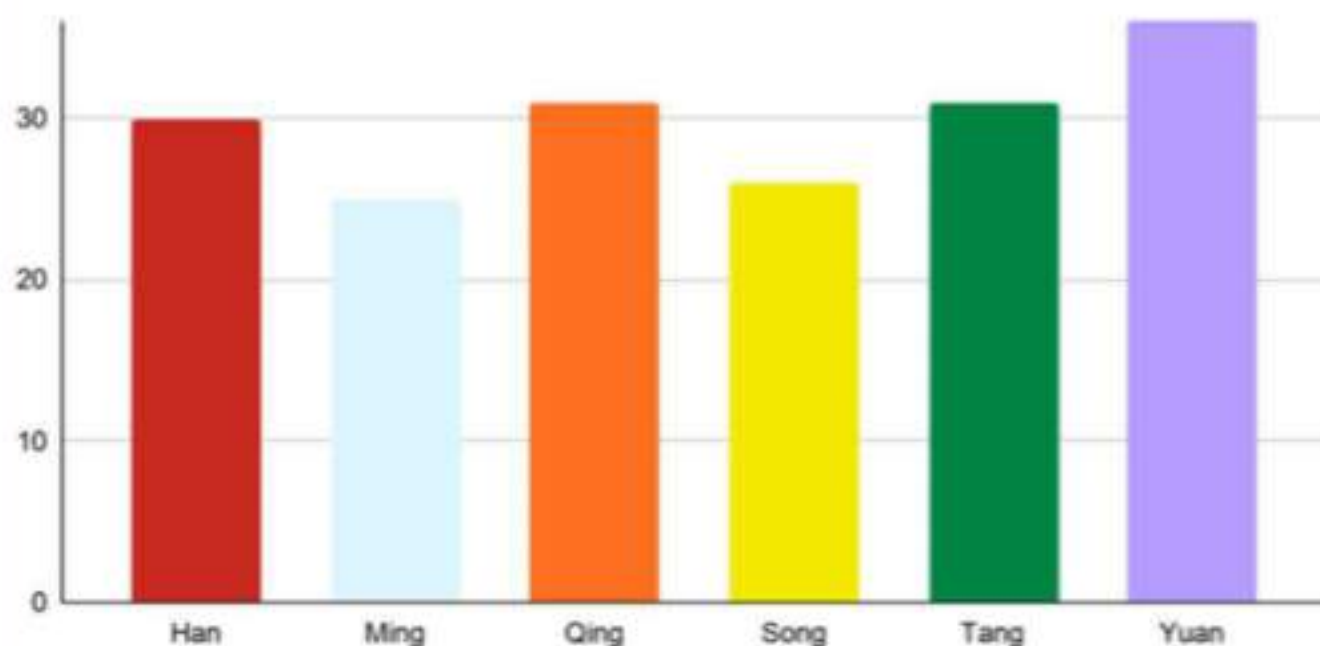


Fig. 1 Revised

As you can see, in the revised version of the chart, the colors correspond to the correct dynasties, and the y-axis is much more representative of the data, creating a much more accurate depiction of said data.

Fig 2: Purposeful Bias, Use of Percentages Alongside a Small Sample Size

Now, the deception of Fig. 2 is a little bit more subtle. There are no obviously misleading aspects to the chart, or hidden meanings behind the coloring or labels. To spot the problems with it, you would have to have a look at the data used to create the chart:

1	Name	Yeargroup	Preference	Current Course
2		12	CP	CP
3		12	DP	DP
4		12	DP	DP
5		12	DP	DP
6		12	DP	DP
7		12	DP	DP
8		12	DP	DP
9		12	DP	DP
10		12	DP	DP
11		12	DP	DP
12		12	CP	CP

Fig. 2 Revised (names blacked out for privacy reasons)

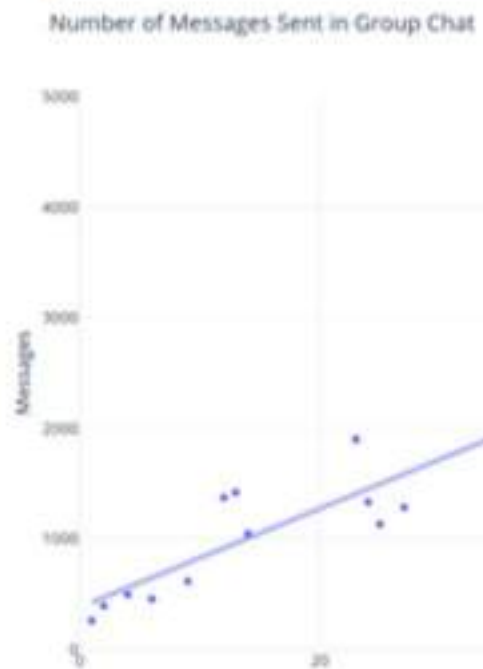
The data reveals a few important facts about the poll. Firstly, you may see that participants have been polled on three separate points (year group, preference and the current course they are taking), although only one of these is relevant to our chart. The other two variables, though, are still important. What they tell us is that this sample is heavily biased. Consider that all of the survey respondents are in Year 12, and that the majority of them take the IBDP course. This is an obviously biased sample—of course the students who take the DP course are going to say they prefer the DP course. In fact, the only respondents who said otherwise were those taking the CP course. This is known as purposeful bias, when the participants in a study are specifically chosen to induce a desired result. A less biased sample might include a greater variation of participants in terms of age, profession, nationality and so on.

Additionally, the choice made to use percentages instead of hard numbers in the visualised pie chart can also deceive the reader. 81.8% appears to be a rather astounding percentage, and so readers may be led to believe that the DP course is an overwhelmingly popular choice amongst IB students at West Island. The reason that this claim would be incorrect, of course, is because of the extremely small sample size of the poll—only 11 students have given responses! Overall, the selectiveness and small size of this sample mean that there is basically no possibility it is in any way representative of the thousand plus students in West Island, most of whom are probably not yet considering what IB course they think is better anyways.

Fig 3: Extrapolation, More Misleading Data Visualization

Fig. 3, like Fig. 2, may require a more in-depth examination of its corresponding data in order for one to discern exactly the problems with it. There are things you can spot just from the graph, though. In Fig. 1, we talked about misleading data visualization. Fig. 3 is also guilty of this error. You may notice that neither of the graphs have a properly labelled y-axis, and Fig. 3 does not have a proper x-axis either. This is not a problem for Fig. 1, as it is measured in rank-order, but it is for Fig. 3, particularly for the x-axis. Time? Time in what? Minutes, hours, days, months? The graph only implies a correlation between the number of messages sent and time, without revealing specifics (the actual unit is days, by the way). When we display the data points onto the graph, this claim starts to look a bit more shaky:

Now, an important concept in data analysis to remember is extrapolation (as exposed to interpolation). When we make estimates or claims about data outside of the examined dataset, we are extrapolating. Extrapolation is unreliable because we cannot be certain whether a correlation will continue outside of our range of data. For some variables extrapolation is less of an issue (e.g. a recurring periodic trend in weather patterns is to be expected), but for something as unpredictable as the number of messages sent in a group chat, it is clearly an egregious oversight. The trend continues for approximately two more times the length of our data range, so the majority of it is extrapolated and therefore, in fact, extrapolated. Of minor concern is the fact that the sample for this graph is also quite terrible. In fact, data was collected from only one group chat between West Island School students. The sample is too small to be truly representative of group chats between West Island School students.



Lastly, I reveal my greatest lie: the sample. While this is technically not really a statistical analysis, it is a common mistake in the scientific community that researchers like very much. Although this is something I highlight the importance of checking the like. In this dataset, I have removed the graph looks like with all the data points.

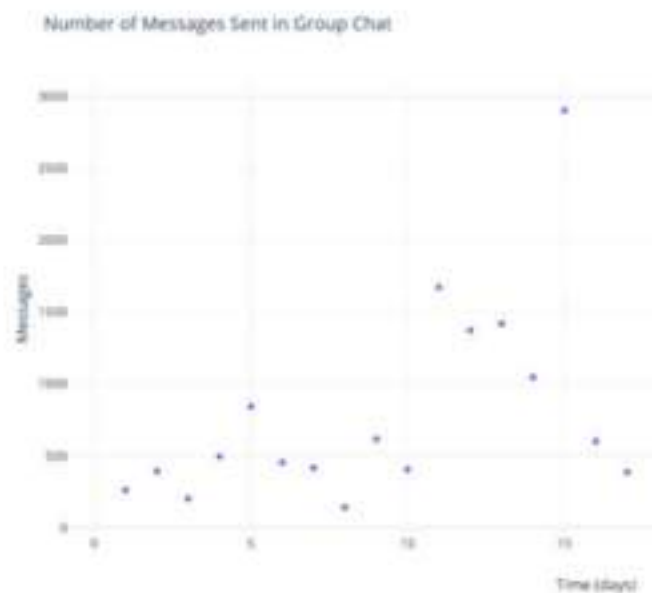
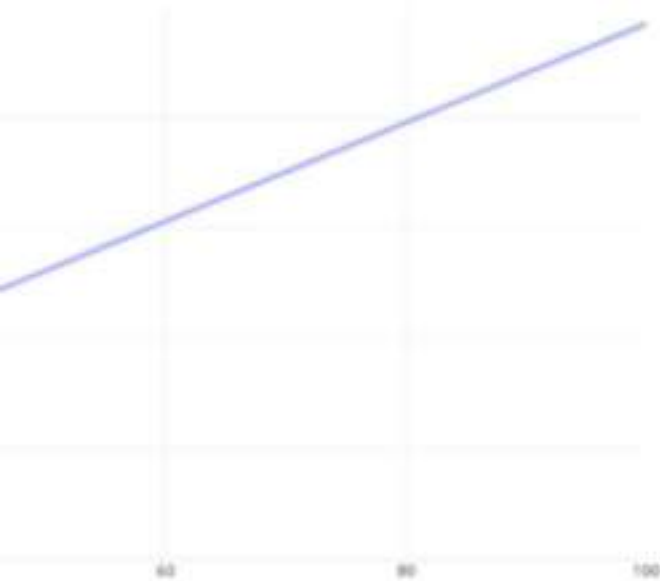
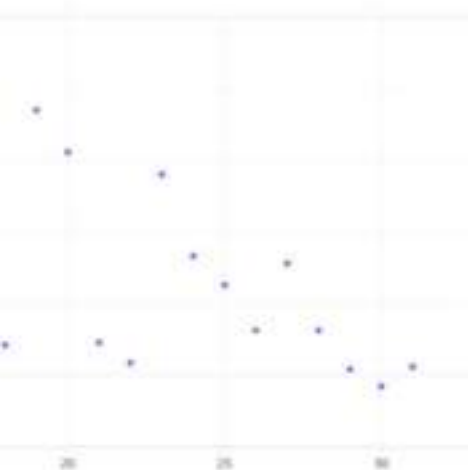


Fig. 3.3 (all data points, better analysis)
Using the complete dataset, we can infer a strong positive correlation between the two variables, and

Fig. 3.2 (Revised)



The data has been altered to better fit the trend!
Statistical 'fallacy', it is true that it occurs sometimes in
graphs will discretely exclude data points they don't
showing that is fairly out of a reader's control, it does
undermine the validity of studies, including peer reviews and
removes over half of the original data points. Here's what
the graphs present, and better labeled axes:



regression
Remember that there is either a very weak
correlation or there is no correlation.

Lebied, Mona. "Misleading Statistics & Data – News Examples For Misuse of Statistics." BI Blog | Data Visualization & Analytics Blog | Datapine, 15 July 2020, www.datapine.com/blog/misleading-statistics-and-data/.
Leetaru, Kalev. Forbes, www.forbes.com/sites/kalevleetaru/2017/02/02/lies-damned-lies-and-statistics-how-bad-statistics-are-feeding-fake-news/?sh=5fd1e8aa50ca.

In this article, I have drawn attention to just a few of the ways in which statistics can deceive readers, including misleading data visualizations, biased samples and data fishing. It's important to note that these are not purely theoretical ideas either, as misuse of statistics has reared its ugly head time and time again, particularly in recent history. Take Ancel Keys' "Seven Countries Study", for example, which selectively utilised data from six countries when the full dataset contained data from over twenty. The point is, statistics are very useful, but also easily manipulated. Hopefully, next time you're reading an article and some fancy graphs pop up, you'll have been inspired to look more deeply into their origin.

INSOMNIA

by Ariyaana Doss [07s2]



Insomnia is trouble having the chance to sleep or staying asleep for enough time to feel invigorated the following morning. It affects plenty of individuals on a daily basis. Insomnia is seldom an isolated medical or mental illness but instead a side effect of another disease to be examined by an individual and their medical doctors.

What is Insomnia ?

Insomnia is a common sleep disorder that can make it hard to fall asleep, difficult to stay asleep and / or cause you to get up too soon and not have the option to return to sleep. You may still feel tired when you awaken

What are the causes of insomnia?

Insomnia may be the primary problem, or it may be associated with other conditions. Chronic insomnia is normally an aftereffect of stress, life events or habits that disrupt sleep.

Some of the main causes are :

- i) **Stress :** Worries about work, school, health, finances or family can keep your mind up and active at night, making a difficult task to fall asleep.
- ii) **Travel or work schedule :** Your circadian rhythms act as an internal clock, guiding such things as your sleep-wake cycle, metabolism and body temperature.
- iii) **Poor sleep habits :** Poor sleep habits include an irregular and unmonitored bedtime schedule, naps, stimulating activities before bed, an uncomfortable sleep environment, and using your bed for work, eating or watching TV.
- iv) **Eating too much late in the evening :** Having a small or light bite before bedtime is manageable, but eating too much may cause you to feel physically uncomfortable while lying down.



Additional causes of insomnia are :

- i) **Mental health disorders** : Anxiety disorders, such as post-traumatic stress disorder, may interrupt your sleep. Waking too early can be a symptom of depression. Insomnia often occurs with other mental health disorders as well.
 - ii) **Medications** : Many prescription drugs can disrupt sleep, such as specific antidepressants and medications for asthma or blood pressure.
 - iii) **Caffeine, nicotine and alcohol** : Coffee, tea, cola and other caffeinated drinks are stimulants. Drinking them later in the afternoon or sometime in the evening can keep you from falling asleep at night.
 - iv) **Medical conditions** : Examples of conditions linked with insomnia include chronic pain, cancer, diabetes, heart disease, asthma, gastroesophageal reflux disease (GERD), overactive thyroid, Parkinson's disease and Alzheimer's disease.
-

Insomnia has been very much normalised, overlooked and not seen as a real, dangerous topic as it is. The brain needs sleep without it, we would not be able to function. This is because sleep is vital to a variety of brain functions, including how nerve cells (neurons) communicate with one another . In fact, your brain and body stay remarkably active while you sleep. Recent findings suggest that sleep plays a housekeeping role that removes toxins in your brain that build up while you're awake.

Insomnia can be very damaging to the brain so if we don't bring back the seriousness of this mental illness, people won't be aware of it, the effects and how severe it can be.

Ways to reduce insomnia

There are several tips and tricks you could carry out with to help with your insomnia. The most effective tips are :

1. Stick to a sleep schedule. Ensure that your bedtime and wake time stays consistent from day to day, even on weekends.
2. Stay active. Regular activity helps promote a good night's sleep. Timetable exercise a couple of hours before sleep time and try to avoid stimulating activities before your bedtime.
3. Avoid or limit naps. Naps can make it harder to fall asleep at night. If you can't get by without one, try to limit a nap to no more than 30 minutes and don't nap after 3 p.m.
4. Avoid or limit caffeine and alcohol and don't use nicotine. These can make it harder to sleep and after effects can keep going for a few hours.
5. Avoid large meals and beverages before bed. A light snack is fine and may help avoid heartburn. Drink less liquid before bedtime so that you won't have to urinate as often.

Insomnia can affect many parts of your lifestyle leading into present and future problems. Getting sleep is very important, if you're struggling with sleep make sure to get help and follow tips found online about it. We have to understand the severity of insomnia and everything that causes it. I hope this article helped you with learning more about it.

Sources

"Insomnia - Symptoms and Causes." Mayo Clinic, 15 Oct. 2016, www.mayoclinic.org/diseases-conditions/insomnia/symptoms-causes/syc-20355167#.

THE IMPORTANCE OF HEALTHY EATING

By Riley Wong

- Eating a healthy balanced diet is one of the most important things you need to do to protect your health.
- By keeping a healthy diet you can prevent yourself from:

- Improving your cholesterol levels
- reducing your blood pressure
- Helping you manage your body weight
- controlling your blood sugar

What your diet should include

- Whole grain foods
- A lot of vegetables and fruits
- Protein
- Dairy products
- 70% of water
- Avoid anything with too much sugar in it

Food groups in your diet

- Eat a least 5 portions of a variety of fruit and vegetables everyday
- Base meals on higher fibre such as food like potatoes, bread, rice or pasta
- Have some diary or some diary alternatives likes soy milk
- Eat proteins such as beans, pulses, fish, eggs and meat
- Choose unsaturated oils and spreads and eat them in very small amounts



