

An acrylic painting of a kitchen table set with various fresh produce. The table is covered with a white cloth and features several plates and bowls. A central plate holds a large bunch of green asparagus. To the right, a white bowl contains sliced avocados and green olives. Other items include a watermelon slice, green beans, and various other vegetables. The background is a mix of light blue and white tones, suggesting a bright, airy kitchen setting.

THE IB TIMES

HEALTH

&

FOOD

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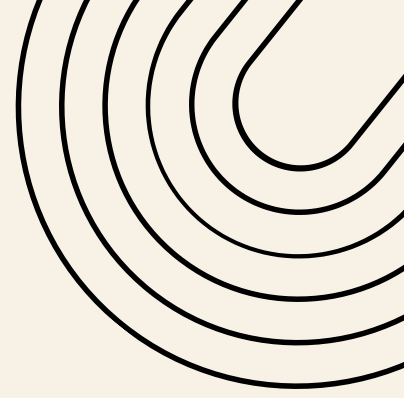
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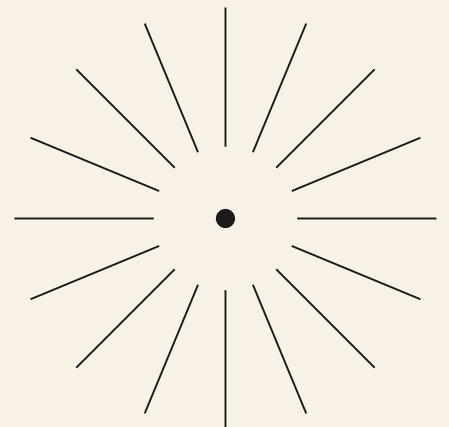
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What is antibiotic resistance, and how can we prevent it?



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Accessed 14 Dec. 2024

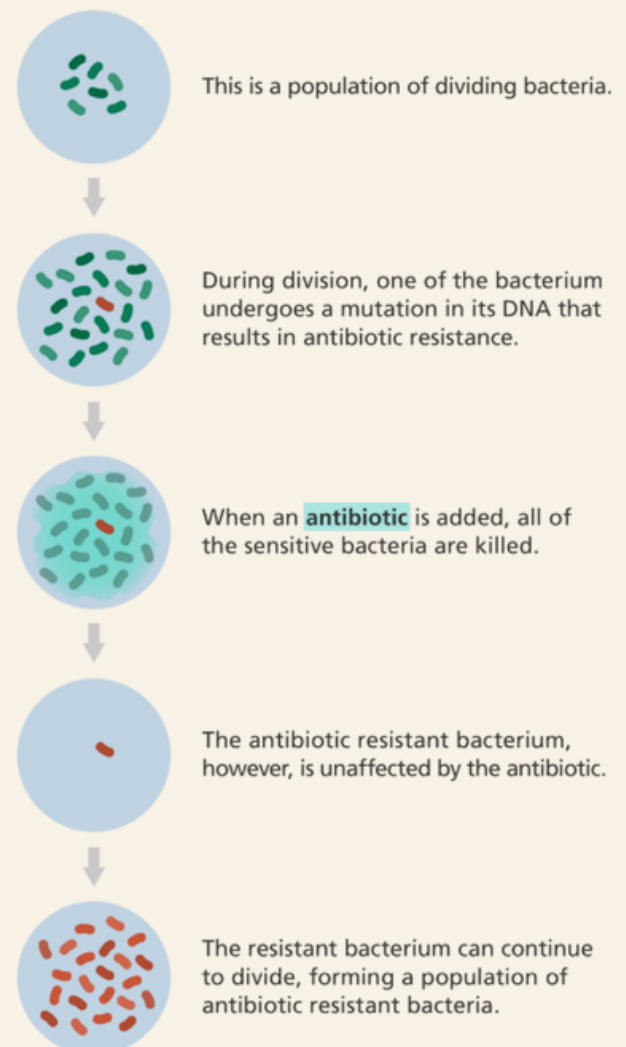
Antibiotics — we've all heard of them; we've all used them. A universally used drug that revolutionised public health as we know it only a hundred years ago. Now we use it for many things, from curing a simple sore throat to facilitating a heart transplant. Without antibiotics, routine medical procedures would be tremendously harder to perform. They seem so effective, so where is the catch? Antibiotic resistance—a challenge to modern science.

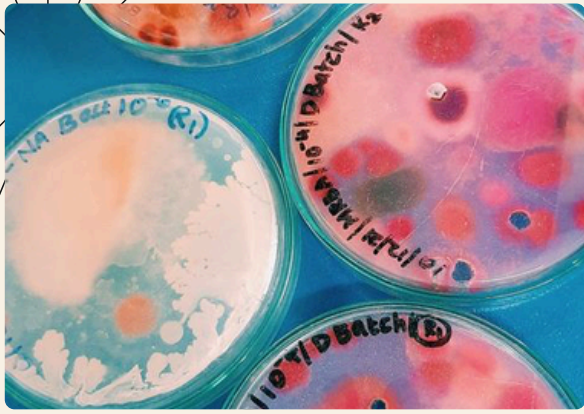
Firstly, what is an antibiotic?

It is a chemical substance that acts against bacteria, as simple as that. However, in nature, nothing exists on its own. The 'original' antibiotic, penicillin, comes from mold, but most modern antibiotics come from soil bacteria, which is not accidental. Soil bacteria produce certain molecules that eliminate other bacteria not resistant to it. For medical use, these bacteria are purified, and then we calculate what concentration of them is strong enough to fight the infection in our body.

And here's the loophole in antibiotic treatment....

The problem lies in the bacteria that we are fighting against, or, to be precise, in its genetics. So, when trying to eliminate the target bacteria, we can actually trigger mutations in their DNA, making them resistant to the antibiotic meant to kill them. The bacteria can also share the DNA with each other, with resistant bacteria passing the said resistance to others. This makes treating bacterial infections harder and harder. At first, it just requires a higher dosage, but with time, the drug will become completely ineffective.





Bharti Prajapati. "Microbiology." Pinterest.com, pin.it/7mbfCknCv.
Accessed 15 Dec. 2024.

Antibiotic resistance...

Antibiotic resistance has become a huge problem in the 21st century. A lot of recently discovered antibiotics are already met with resistant bacteria. The food we eat also influences antibiotic resistance due to the heavy use of antibiotics in agriculture. They are used not only to treat infections in animals and fish but also to make them grow larger.

To resolve ABR...

To resolve ABR, scientists are developing new antibiotics and searching for alternative ways to treat bacterial infections. To help minimise this problem, we, as average people, can also contribute. One of the reasons for such high resistance to antibiotics is simply the misuse of them. Here are some tips to decrease your own bacterial resistance:

- Do not treat viral infections (such as the common cold) with antibiotics; they have no effect on viruses.
- Take your medication according to prescription, even if you feel better — your bacteria are just adapting instead of dying.
- Never take antibiotics prescribed to someone else.
- The studies do not say explicitly, but some sources state that diets high in fibre and low in animal protein promote less antibiotic resistance.

Antibiotic resistance is a serious issue, but with the development of new technology and social awareness, we should still remain hopeful.



Ganzhinsky, Anatoly Lvovich. In a Rural Laboratory. Novosibirsk State Art Museum.



Why won't the scale budge?!

That is how bad habits affect your mental and physical wellbeing.

Have you ever been in a situation where you look at yourself in a mirror and only notice flaws? Like “I’m so fat, maybe I should work out more?” or “I’m eating too much lately, my cheeks have gotten chubbier...”. During the era of the internet, we hear a lot of tips on how to lose weight, build our muscles, pick up a healthy diet etc.

On the second thought, how can we be sure of authenticity of influencers we see on media? Many can be posting videos just to gain popularity on view-gaining trends like the latest focus on medicaments like Ozempic that help lose weight but have many unsaid side effects. Afterall, it’s not really mainstream media we should trust!



Johnson, Richard S. “A Woman Sitting and Contemplating.” Pinterest, pl.pinterest.com/pin/231161393349386875/. Accessed 24 Dec. 2024.



Backhaus, Kenn Erroll. “Balestra.” Kenn Erroll Backhaus, www.kennbackhaus.com/fresh-paint/. Accessed 14 Dec. 2024.

Let’s be real, have you actually ever considered that what these wellbuilt trainers suggest on social media is made for THEIR physique, not YOURS? This is the thing - not adjusting the level of exercises to your own physique and capabilities. The second thing is doing the actual exercises wrong. You can attend the gym every day for 12 hours and not see the expected results only because your technique is wrong. Don't get me stated on how it can cause injuries... I know it may seem silly but when doing exercise, speed is not the most important thing. It’s actually advised to slow down and consciously control your body, make sure you’re using the proper technique and most importantly be aware of what muscles need to partake in a distinct movement as this is the way that will boost your dopamine, muscle gain and weight loss.

Exercising incorrectly

I became interested in this topic as I noticed that close people around me started losing motivation, having their self-esteem drop and finding themselves talking negatively about their appearance when in reality almost no one found them “fat” or “ugly”. With such people around me I developed a need to address this issue as many stereotypes such as “eating little will help” or “following influencers’ routine on TikTok will help me live healthier” are wrong.

You have probably seen many influencers, personal trainers etc. talk about what YOU should do to look and feel fit. But have you actually realized that the audience behind the screen, including you, WHO most likely DOESN'T WORK out 7 times a week for 6 hours each session, isn't capable of immediately switching to salads and a high-protein-low-calories diet and keeping it up for the rest of their lives... psychically it's impossible.



“Three People Playing Volleyball.” Pinterest, pl.pinterest.com/pin/29906785019279246/. Accessed 14 Dec. 2024.

Not getting enough sleep

It may sound trivial, and you probably know about it already but are you AWARE as to why not getting enough sleep affects your mood and fat gain? If you sleep less than 7-9 hours, your brain tends to make bad decisions as well as perk up your reward center significantly. That's why you might find yourself looking for a snack that is not particularly healthy and usually packed with sugar, fats and carbs, which, let's be real, might be one of the main reasons why the numbers on a scale don't drop. When you don't sleep enough, your body starts to conserve fat for the waking hours, but since it wants to go back to your natural cycle where the energy stored isn't mainly used to wake you up, you keep on craving food for more energy and feeling less satisfaction from it. The researchers of the University of Chicago also conducted an experiment to test how our insulin sensitivity changes with the lack of sleep. Insulin is a hormone that helps you exchange sugar, carbs and other foods into energy and if your body stops responding to insulin, fats will be harder to break down hence stored in your body as fat making you gain kilograms.



"A Woman Sleeping Soundly." Pinterest, pl.pinterest.com/pin/147844800262461078/. Accessed 14 Dec. 2024.



Danielson-Gambogi, Elin Kleopatra. "After Breakfast." Wordpress, 1890, bloudjinnzesblog.wordpress.com/2017/09/21/day-dreamer/. Accessed 14 Dec. 2024.

Eating too much... or too little?

I will say it once - STOP EATING TOO LITTLE! Not eating enough doesn't contribute to fat burning but WEIGHT GAIN! There's this thing called *metabolic adaptation*, and it happens when your daily calory income is less than the energy you use daily. It is a defensive response from our organism since way, way back in time when many people were at risk of starving. Your body sees that you're not eating enough so it wants to increase your chances of survival by storing fats and calories just in case. It means that even if you have a diet rich in nutrients and protein, if reducing your calories by too much, you will not lose but gain weight. Of course, it's not like in order to lose weight you should keep your calories income like before, just remember NOT TO decrease it too much, around 500 calories less than your normal takings should be sufficient to start seeing progress (considering you work out regularly). I know it may be hard to incorporate healthy eating with your daily life and maybe you're afraid that you'll feel bad that for a week or two you don't notice progress and your organism will feel guilty about it, but believe me, it IS possible to eat the same amount of food but with ~500 calories less; just ask a dietitian or find good blogs about healthy eating and I assure you it won't be as hard as you think!

PLEASE! Remember!

Whereas there are many more subjects to cover, like self-judging, lack of motivation, improper hydration etc., The 3 main points I HAVE described above are in my opinion the most important ones. Without enough sleep, calory income and proper exercising you won't see progress on your physique or mental acceptance no matter what else you do... I mean, you can take Ozempic but that would just be straight giving up on yourself, wouldn't it? 😊

Sport and health

Author: Laura Rogowska

How to incorporate more movement into a busy schedule

Sport and physical activity play a key role in a healthy lifestyle, providing both physical and mental benefits. Regular exercise strengthens muscles, improves heart and lung function, and helps maintain a healthy weight. Moreover, physical activity has a positive impact on our well-being by reducing stress and improving sleep quality.



Art. Saatchi - Alessandro Piras, Sept. 2024, pin.it/4Zuks66im. Accessed 14 Dec. 2024.



Pletts, Nicole. Cyclist - Detail Nicole Pletts, Sept. 2024, pin.it/6Rtnkq3qm. Accessed 14 Dec. 2024.

According to the latest MultiSport Index 2023 survey, walking is the most popular form of physical activity in Poland – 56% of Poles regularly engage in it. Cycling comes in second place (40%), and running is third (19%). Walking, although simple and accessible, is an excellent form of movement that can be easily incorporated into daily routines without requiring special preparation. Just 30 minutes of brisk walking a day can significantly improve your health and well-being. For those with limited time who want to maximize health benefits, one of the best solutions is High-Intensity Interval Training (HIIT). Short, intense sessions lasting just 20 to 30 minutes several times a week can deliver comparable health benefits to longer, moderate exercises. It is also important to remember that physical activity directly impacts mental health studies show that as many as 84% of Poles agree that regular exercise reduces stress.

How to increase activity levels?

If time constraints are an issue, there are a few simple ways to incorporate more movement into your daily routine:

- 1. Utilize walking – daily walking instead of driving or taking public transport can significantly increase your level of physical activity.*
- 2. Short bursts of exercise – introduce short, 10-minute sessions of activity, like a morning warm-up or quick exercises during work breaks.*
- 3. Use a pedometer – set a goal of 8-10 thousand steps a day and track your progress.*
- 4. Take the stairs – opt for stairs instead of the elevator.*
- 5. Exercise at home – simple exercises like squats, push-ups, or planks can be done at any time.*

Even though walking is the most popular form of movement, it may not always meet the World Health Organization (WHO) recommendations.

WHO advises adults to engage in at least 150 minutes of moderate or 75 minutes of intense physical activity per week.

To fully benefit, it's worth combining walking with more intense forms of exercise.

In conclusion, sport is an essential element of a healthy lifestyle. Whether it's a simple or more intense activity, regular exercise brings benefits to both physical and mental health. Even short intense activities like HIIT can be a great option for those with little time but who want to take care of their well-being. It's worth incorporating more movement into your daily routine and enjoying its positive impact on your mood.

Trend for obsessive unhealthy chase for perfect body

Author: Maria Grochowska

Nowadays we can see a lot of trends about our bodies, features, and appearance going through celebrities' and influencers' profiles in social media. There has been such a trend recently. Even though plus-size is starting to be a totally normal thing even in modeling, we can see more and more recurring trends for super skinny figures as well as more and more people chasing them.

We observe young girls getting obsessed about 90's and 00's models like Kate Moss who have this super skinny type of body. Kate Moss, acclaimed by many as "heroic Queen" was accused of being a drug addict even though she has never been one. The only thing she was addicted to were cigarettes, Red Marlboro, exactly. Thanks to this she could refrain herself from eating while spending lots of time on fittings, rehearsals and runways. At the peak of her career her BMI was about 15 which is considered as anorexia, but the model never claimed she had it.



Kate Moss for GQ Magazine, 1992

Kate Moss. Nov. 2024. pin.it/ljXRGBVZT. Access(Kate Moss) 14 Dec. 2024.

What about teenagers?

Unfortunately, this mindset is very often taken as an example and a goal to follow by teenage girls. Lots of them start to starve themselves dreaming about becoming one of the supermodels or famous actresses.

Kids inspired by their idols start to eat less or they don't eat anything. Their only meals are low calorie food or, in worst cases, just water and chewing gums. They start to work out extremely hard and isolate themselves because they don't feel confident with their own bodies. That's why pretty often their grades start to go down.



Nowadays, many teenagers are burdened by numerous problems, and very often, they begin to feel weak. They start to think negatively about themselves, sometimes even with disgust. They believe that if they become more attractive, they will find friends and love, and through this, they will manage to become better people. They are struggling with various health and mental issues because of this. There are some common problems, especially among young women, such as bulimia, body dysmorphia, and eating disorders. In my opinion, our society is poorly informed about these types of disorders, which also have connections with psychology. The majority of people who struggle with eating problems do not want to talk about it, and no one knows what they are going through. As a result, they miss the chance to receive specialized help, and that is why many of them end up dead. This problem is very serious and is often ignored by parents, teachers, and even peers. If we see that something is going on with someone, we should report it. In addition, everyone should remember that we are all beautiful and that the size of our clothes does not define us or our worth. It is just a number or a letter. Everyone is different, and that is what makes us beautiful.

Let's take care of it!

I think that we should educate about this problem at schools. However, huge institutions should also get interested in the problem, especially the fashion, music and movie industry. One of the best examples of companies that could help is the most popular fashion magazine called, "Vogue". They could organize a huge sale where people could buy clothes from the best designers at really cheap prices and all the money were transferred to people's education about eating problems. Because if we don't know anything about the rating disorders we can do nothing to remove and prevent them. They should also start to write more about these problems with lack of acceptance of their own body on their page because they have a really huge influence on young people, especially those interested in fashion. Anyway problems with obsessively chasing a perfect body is just the beginning of huge problems with health.

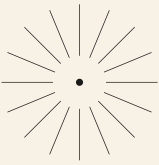
WE SHOULD REMEMBER THAT EVERYBODY IS BEAUTIFUL NO MATTER WHAT SIZE WE WEAR!



ray. Fashion, 12 Dec. 2024, pin.it/630VXUyLm. Accessed 14 Dec. 2024.

Kate Moss Vogue. Sept. 2024, pin.it/57y0ooGP8. Accessed 14 Dec. 2024.

Blush, Never. British Vogue September 2010 Cover, 20 Nov. 2024, ray. Fashion, 12 Dec. 2024, pin.it/630VXUyLm. Accessed 14 Dec. 2024. Accessed 14 Dec. 2024.



Blue Zones Wisdom: How to Apply It Amidst the Controversies

It is undeniable that recent years have seen a considerable surge in health-conscious (or seemingly health-conscious) content permeating nearly every realm of media we consume. This recently increased level of interest in the topic combined with the sensationalized nature of the information presented on the internet leads to the tremendous popularity of surefire lifestyle and dietary methods for weight loss, muscle gain, improvement of skin and hair condition, sufficient energy levels, brain function, hormone balancing, and, most importantly to this article, longevity.

The Blue Zones

While navigating the media climate fraught with charismatic figures recommending various solutions to their audiences, one might stumble upon an idea called "Blue Zones". Its central message states that in order to extend our lifespans we should look to the lifestyle choices of the inhabitants of selected regions characterized by a high relative number of exceptionally long-living people, including centenarians – people who live to be 100 or more years old. Recent discoveries, however, suggest that these extraordinary areas may not truly be what they seem at first sight.

In 2008, American author Dan Buettner published "The Blue Zone: Lessons for Living Longer From the People Who've Lived the Longest" in partnership with National Geographic. The book, which was an almost immediate success, claimed that there exist specific areas in the world, from which we can extrapolate certain lifestyle choices and habits which contribute to a life expectancy higher than that of the general population.

The book has recently been adapted into a 3 time Emmy Award winning mini-series titled "Live to 100: Secrets of the Blue Zones", which broadened the reach of its key themes. The selected sub-regions are Okinawa (Japan), Ikaria (Greece), Nicoya (Costa Rica), Loma Linda (USA), and Sardinia (Italy). The inhabitants of these towns supposedly exhibit a few key factors determining their longevity, namely:

- daily exercise based on natural movement,
- a largely plant-based diet,
- low levels of stress,
- a sense of purpose carried into later stages of life,
- a stable network of social connections.

Both critically and publicly acclaimed for voicing an inspiring message, the documentary would later indirectly lead to the growth in popularity of the Mediterranean diet on platforms like TikTok and Instagram due to the similarity in latitude and climate across most of the Blue Zones.



Colla, Gianluca, and National Geographics. A 98-Year-Old Man and His Wife on Greece's Ikaria Island. 29 Dec. 2012. www.nationalgeographic.com/culture/article/121227-dan-buettner-health-longevity-100-centenarians-science-blue-zones. Accessed 15 Dec. 2024.



Blue Zones Map. 8 July 2024, safety4sea.com/cm-want-to-live-a-long-life-learn-how-from-the-words-blue-zones/. Accessed 15 Dec. 2024.

Too good to be true...

Dubiously enough, a preprint research paper by Saul Justin Newman posted on March 14, 2024, pointed to a much less optimistic reason for the commonness of centenarians and supercentenarians in towns marketed as the Blue Zones. The article titled "Supercentenarian and remarkable age records exhibit patterns indicative of clerical errors and pension fraud" investigates inconsistencies in census data which seem to suggest that a significant portion of records of people who live to over 100 or over 110 years old may not actually be of that age. The ideas explored in the paper have recently been gaining traction among the scientific community and the article, even though it is yet to be peer-reviewed, has been reported on by notable figures such as the well-known science communicator Sabine Hossenfelder. A cynical approach may therefore dictate that the conclusions of various Blue Zone Theory based media are at best misleading and at worst manipulative. Combined with other controversies accusing the book and documentary of faulty research methods and malformed confusion, the aforementioned possible clerical errors and fraud led to an almost adversarial attitude towards even the briefest mention of the Blue Zones in some circles.



Paella, an example of the Mediterranean cuisine, Pedro M. Martínez Corada, <https://martinezcorada.es> Accessed 15 Dec. 2024.

In the end...

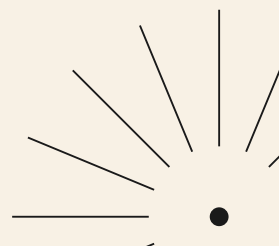
Nevertheless, there still might be something to gain from following the examples of even "fraudulent" centenarians. After all, most of the listed beneficial factors are, in fact, supported by research and statistics. The WHO lists cardiovascular diseases as a leading cause of death in the modern world. Methods of prevention of these diseases have indeed been described as congruent with the Blue Zones' habit of daily movement and low-cholesterol diets.

Furthermore, high levels of stress and loneliness contribute to not only a reduced lifespan but also a drastically lowered quality of life. Even some specific dietary habits find scientific ground thanks to papers like "Mediterranean diet and life expectancy; beyond olive oil, fruits and vegetables" or "Mediterranean diet and longevity" filling research gaps present in the Blue Zones conclusion. The Mediterranean argument is further supported by the fact that another one of Europe's top longevity regions is Comunidad de Madrid (Spain) within reach of said climate. Therefore, what now appears to be a highly sustainable way of living is one that is organized around a balanced approach, which takes into account both the verifiable scientific claims and the generational wisdom of inhabitants of the Blue Zones, even though it may not lead to a satisfying, round number of years of life.



Sustainable School Gardens Festival in Madrid, 2017, Diario de Madrid, <https://diario.madrid.es/blog/notas-de-prensa/la-alcaldesa-participa-en-la-fiesta-de-los-huertos-escolares-sostenibles>. Accessed 15 Dec. 2024.

Ultimately, it may prove more holistically positive to focus on quality of life, with longevity as its welcome consequence. Moreover, researchers should not take a superficial approach to lifestyles in regions with the longest life expectancy. Measurable factors such as diet and physical activity are significant. However, caring for the local community and strong social relationships may prove crucial to disease prevention and longevity.



Can anything be healthy?

Health is a topic brought up so often that it can seem repetitive, even exhausting — especially for us, young people, who don't experience as many health problems. It's the other way round for older people.

Generally, interest in health grows with age

As a young adult, you might start going to the gym or stick to a meticulously planned diet. Then, if you don't let your job fully consume your time and thoughts, you might start reading books on how to stay young or live a long life. But the main audience for medication commercials or any health-related products tends to be the elderly.



Bhutinat Supin from Getty Images, licensed under Canva , Accessed 14 Dec. 2024

They often turn to articles promoting miracle cures, supposedly invented by "American scientists", or other questionable solutions for the effects of ageing. It might seem terrifying to think about losing the ability to do basic things and experiencing pain just from functioning daily. But that's part of being human. We have to accept that, no matter how hard we try, time will eventually have its way.

The key is to maintain balance



Sebastian Voortman from Pexels, licensed under Canva , Accessed 14 Dec. 2024

I'm not saying that regular exercise or eating healthy won't have a positive effect on you — the key is to maintain balance. It's easy to fixate on one aspect of health while neglecting others, but that can be just as harmful as ignoring health altogether. You need to stay aware of your actions and their influence on your well-being because anything, when overdone, can be harmful. Even activities commonly associated with health, like running or reading, can leave their mark. Running stresses your joints, and reading strains your eyes. That's true for everything you do - it has both positive and negative effects.

Take care of yourself

But that doesn't mean there's no point in taking care of yourself. It's mostly about how you feel in the present. Life consists of moments where you get to decide what to do with yourself. Do what makes you happy. You're going to die anyway.* So choose what you really love, and let it be the thing that takes you down.

*Don't worry though, this applies to everyone ;))))



Stokpic from Pexels, licensed under Canva , Accessed 14 Dec. 2024

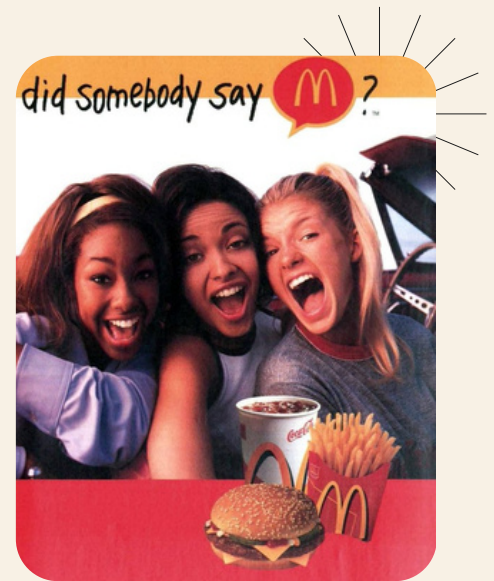
How can I fix my relationship with food?! The side effects of how Fast Food interferes in our daily lives

Have you ever wondered how deeply food can affect our mental but also physical health? We all know that food is a source of life, providing energy which is beneficial for us to function. However, the majority of food we consume can also lead to the development of various diseases. Therefore, we should pay attention to the food we digest in order to live a good, peaceful life.

In today's world, fast food has been normalized worldwide. Its unchallenging accessibility as well as delectable flavors come with negative consequences, affecting both our health and relationship with food. In this article, we will focus on the impact of fast food, including its contribution to obesity occurring throughout the world, its promotion through various commercials, how it may eventually lead up to food obsessions, and how we can introduce healthy eating habits into our daily routines. Let's look at the pros and cons of consuming processed food and its effects on our bodies.

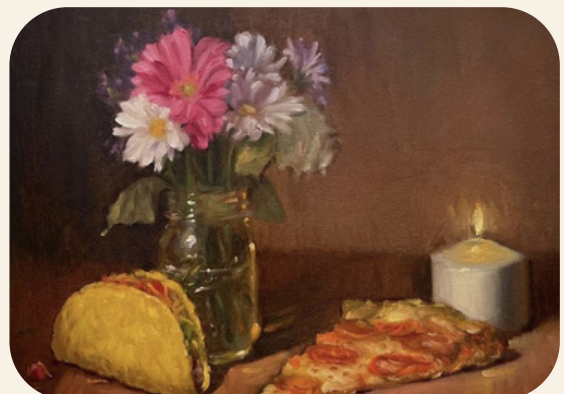
Popularity of Fast Food and its impact, food commercials

First of all, what is the definition of fast food? It is easily prepared processed food served in snack bars and restaurants as a quick meal or to be taken away, causing it to increase in popularity by its simplicity. It is no accident that junk food is well-known across the world. Companies spend a huge amount of money each year on marketing, hoping to target us with advertisements that make fast food the key to living our lives to the fullest. They often tend to be vibrant, energetic, giving fast food a positive image to recipients, who are tempted to try this type of meal. However, it is far from the truth. In reality, it does not always look how they picture it on the Internet. There was at least one time we experienced a specific kind of sorrow when we went to a trendy fast-food restaurant we had seen our favorite influencer giving the best reviews on, whereas the meals were not decent at all like we expected.



"McDonald's Quarter Pounder Meal Ad." Pinterest, 1997, pl.pinterest.com/pin/678002918936893579/. Accessed 15 Dec. 2024.

Due to all these promotions, a considerable part of the society often turns to this type of food under the pretext of a quick and straightforward option for filling up their hunger, but does this really work? All of this exposure makes it more difficult for us to say 'no' to fast food, especially when it's normalized as a pleasure in today's world.



Verrier, Noah. Instagram, 4 Aug. 2022, pl.pinterest.com/pin/678002918936893653/. Accessed 15 Dec. 2024.

Various obsessions and diseases caused by processed food



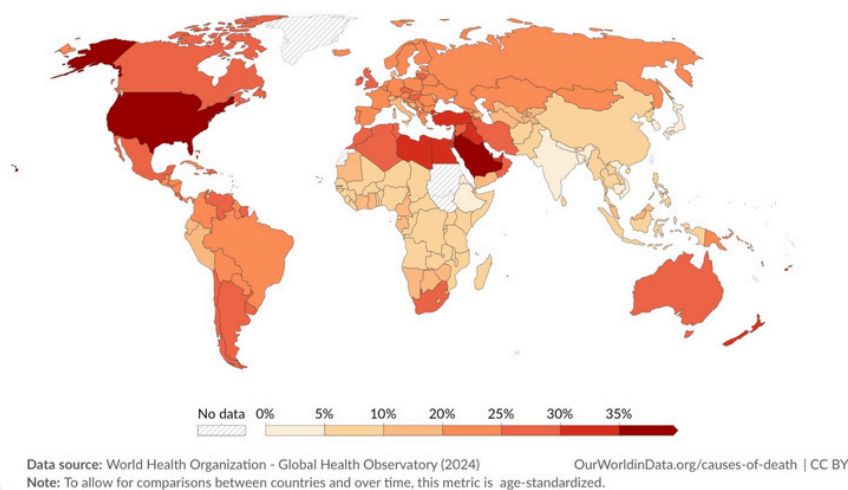
Casas, Ramon . A Decadent Girl, 1899, Pinterest, pin.it/aVuRsUI5T. Accessed 15 Dec. 2024.

‘Too much of a good thing’, they say. This has a deep but crucial meaning when it comes to food consumption. After some time, we start to emotionally rely on Fast Food which can lead up to a cycle where we ‘need’ it to satisfy our cravings. We usually crave it due to it being severely high in saturated fats, sugar and salt. Not only does it affect our physical health, but also mental. We may start obsessing over it, eventually leading up to unhealthy relationships with food, like eating disorders. These include, for instance, Binge Eating Disorder (BED) - this occurs by overeating in a short period of time, often until you feel uncomfortably full. It usually develops by emotional eating to cope with various feelings as well as stress we may experience; anorexia and bulimia. These examples tend to be damaging both our bodies and mess up our minds, as they may lead up to cycles of guilt or shame.

Another serious prospect which is dealt with globally is obesity. The percentage of people suffering from obesity (BMI ≥ 30) is rapidly increasing, whereas based on the data from the World Health Organisation, as of 2024, around 70% of the population in Tonga is obese. Nevertheless from the statistics of WHO in 2022, 1 in 8 people in the world live in obesity. This states that worldwide obesity has more than doubled since 1990, whereas adolescent obesity has unfortunately quadrupled.

Prevalence rate of obesity in adults, 2016

Estimated prevalence of obesity in adults, based on general population surveys and statistical modeling. Obesity is a risk factor for chronic complications, including cardiovascular disease, and premature death.



Ourworldindata.org, 2016, assets.ourworldindata.org/grapher/exports/obesity-prevalence-adults-who-gho.svg. Accessed 15 Dec. 2024.

Healthy eating habits and how to introduce them to our routines

As we have mentioned before, because of the rise in Fast Food consumption followed by its health risks, it is fundamental to focus on building healthy eating habits, even though processed meals are so readily available basically anywhere. We do not have to be on a diet in order to be fit. Going on an unreal ‘diet’ and not being able to follow it up can lead up to disappointment along with lowercase self-esteem, and in a long run it may provoke development of numerous diseases. However, introducing new habits to our lives should not occur rapidly, applying them step by step prevents resumption of previous ones.

Simple changes regarding healthy eating are the ones that make an enormous difference on your overall wellness. For instance, getting your ‘five a day’ (5 fruits and vegetables everyday), cutting down on saturated fat and sugar or even drinking minimally 2 liters of water daily are the first steps when it comes to changing your perspective around food. Moreover, reducing salt intake may help avoid heart diseases as well as a stroke by almost a fifth! Regardless, we should not cut down on sweet treats and other cravings entirely, it is completely normal to eat something unhealthy from time to time but not too often.



Grethen, Donna . www.donnagrethen.com/rmfzoxqtdb95v2rki59b753vau3w2. Accessed 15 Dec. 2024.

Author: Asya Chub



Frichi and Rao family, "Bao Dumplings," Instagram, 29 Jan. 2023. www.instagram.com/p/Cn_4F4ITXU?utm_source=ig_web_button_share_sheet

History of dumplings

Dumplings are a universally loved dish existing in various shapes and forms across multiple cultures—pierogi, wonton, khinkali, manti, and much more. How come the delicious snack is so widespread, and what are its origins?

What is a dumpling?

A dish that can bear the name of dumpling is quite the topic of discussion. According to the Cambridge Dictionary, a dumpling is "a small ball of dough that is cooked and served with meat dishes or in soup or a filling of fruit, meat, or vegetables covered with dough and steamed, baked, or fried." While the definition is quite broad, there is no ultimate consensus whether a given dish is a dumpling. The English word for the dish emerged in the 17th century, which defined it as a small part of dough that was either boiled or steamed. Later, the definition expanded to include fillings and other cooking methods. No matter how we define the dish, it is prevalent in almost all cultures and is enjoyed all around the globe.



Emperor Huizong of Song, *Literary Gathering*, Silk, upload.wikimedia.org/wikipedia/commons/6/Song_Dynasty_Elegant_Party.JPG. Taipei Palace Museum, Taipei, Taiwan. Accessed 14 Dec. 2024.

The Chinese legend

One of the ancient mentions of dumplings is present in a Chinese Han dynasty (206 B.C. to 220 A.D.) legend. The story follows a man returning to his home village after a long time and finds the villagers cold and stricken with frostbite.

In a rush, the man chops lamb and medicinal spices, then wraps them in the scraps of dough to then fold into an ear-like shape and boils them in a pot to cure people's frostbite ("The History of Dumplings"). This story may revoke some associations with traditional Eastern European dumplings added to borshch, called ushka, meaning "small ears."

Ancient Roman recipe

The first written evidence for a dumpling recipe was found in an Ancient Roman "cookbook" called Apicius dating around 400 A.D. The book actually includes two dishes: "Dumplings of Pheasant Isicia plena" and "Dumplings and Hydrogarum Hydrogarata isicia" (Thayer 65).



Bompiani, Roberto. *A Roman Feast*. Oil on Canvas, www.getty.edu/art/collection/object/103RCA. Getty Center. Accessed 14 Dec. 2024.

A dumpling from different parts of the world

Pastéis: thin dough that can be stuffed with a variety of meat or vegetable fillings, Brazil



Chitruga, Diana. Brazilian Pastéis with Chicken. 13 Dec. 2023. www.theprocess.com/brazilian-pastel-with-chicken-3029689. Accessed 14 Dec. 2024.

Tihlo, prepared from roasted barley flour, Ethiopia



Queen of Sheba. Tihlo. 10 May 2021. www.opentable.com.au/queen-of-sheba-footery. Accessed 14 Dec. 2024.

Dango: sweet dumpling made from rice flour, Japan



Lawrie, Sarah. "Dango." Wanderoos.com. 21 Jan. 2021. www.wanderoos.com/red-bean-paste-with-rice-flour-dumplings/. Accessed 14 Dec. 2024.

Khinkali: twisted knobs of dough filled with meat, fish, or vegetables, Georgia



Arts Bakery Glendale. "Khinkali Rice Dumplings." Artsbakeryglendale.com. www.artsbakeryglendale.com/products/khinkali-beef-dumplings?srsltid=AfmBO0ooAG-mchyAOCjnyVWKZ5hBqLLeVhaMeZy_gZ0P6cheBkMj. Accessed 14 Dec. 2024.

Manti: steamed dumpling with lamb or beef filling, Central Asia



Sierigastierlein. Manti. 2009. commons.wikimedia.org/wiki/File:Manti_20100213_001.JPG. Accessed 14 Dec. 2024.

Jiaozi: minced meat and vegetables wrapped in thin dough, China



Gauley, Heather. "Chinese Dumplings (Jiaozi)." www.vibrantfoodvibrant.com/recipes/chinese-dumplings-jiaozi. Accessed 15 Dec. 2024.



"Gefüllte Knödel." Das Pflanz-Magazin. www.das-pflanzmagazin.de/ausgaben/rezept/italienische-kaeche/gefueellte-kaese-gruete-knaepf?L=0. Accessed 14 Dec. 2024.

Raviole du Dauphiné: two layers of pasta surrounding a cottage cheese filling, France



Saint Jean. Raviole Du Dauphiné. www.saint-jean.fr/les-recettes-creatives/fiche-produit/ravioles-du-dauphine-traditionnelles. Accessed 14 Dec. 2024.

Knödel: made from flour, bread, or potatoes, Central and Eastern Europe

Ravioli: pockets of pasta enclosing various fillings, Italy



Molloy, Rosemary. "Homemade Creamy Mushroom Ravioli." 7 Sept. 2022. antiallammykitchen.com/mushroom-ravioli/. Accessed 14 Dec. 2024.

Pierogi: sweet or savoury fillings wrapped in a thin dough, Poland



Kreplaj. cookidoo.pl/recipes/recipe/p1603817. Accessed 14 Dec. 2024.

Yomari: steamed dumpling with an external covering of rice flour, with sweet filling, Nepal



Yomari. Steamed Rice Dumplings. 1 Aug. 2024. www.goya.in/blog/yomari-steamed-nepalese-delicacy. Accessed 14 Dec. 2024.

Kreplach: filled with ground meat or mashed potatoes, Ashkenazi Jewish cuisine

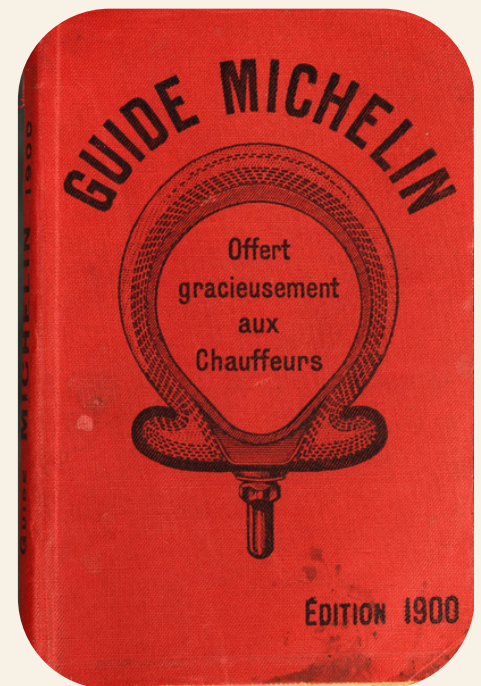


z2000. Christmas Dumplings Stuffed with Mushroom and Cabbage on a White Plate. www.shutterstock.com/image-photo/christmas-dumplings-stuffed-mushroom-cabbage-on-747860074. Accessed 14 Dec. 2024.

A (Michelin) Star Is Born

The legendary Michelin star is possibly the most highly valued honour in the culinary world. A restaurant being awarded even a single star of the possible three means it has achieved a mastery of cooking technique, inventiveness, quality of used products as well as level of service and overall dining experience. However, one fact related to this subject may raise a perfectly valid question – why should such a prestigious, sought-after award be given out by a company principally known for tyre manufacturing? It may seem simply preposterous to think that such a corporation is capable of accurately gauging the proficiency of chefs. There is, fortunately, a very reasonable explanation for this phenomenon, and it is one that reveals a story of travel, tyres, and businesses enduring in the face of hardship.

Following the acceptance of the patent for Carl Benz's automobile, the revolutionary invention started gaining traction and transforming the perception of travelling. Demand for the, then luxury, commodity was particularly visible among the affluent class of France. Noticing the eagerness of early car adopters, the Michelin company decided to capitalize on this newfound market and boost its sales of rubber tyres. In 1900, the first Michelin Guide was published in France and started being distributed to car owners free of charge. Designed by brothers André and Édouard Michelin, the guide consisted of a small booklet containing any information motorists might need on their travels. This included roadmaps, tyre replacement instructions as well as directions to hotels, gas stations, and mechanics. All of these features of the guide, soon to be published with adjustments in other countries, proved useful for users, but what they were most impressed with was the included list of recommended restaurants placed along popular travel routes. Subsequent editions of the guide would include an expanded rating system for restaurants assigned by secret inspectors hired by Michelin. The food critics were required to judge restaurants based on five key factors: quality of products, personality represented in the dish, value for money, consistency and mastery of flavour, and cooking technique.



The first Michelin Guide, published in 1900, Unknown Author, <https://crystalclearcomms.com/117-years-content-marketing-teaches-us/>

Over time, inspectors devised a standardized system for appraising and rating the cuisine they tried. Initially, in the 1926 edition, the publication included only a single-star classification. However, five years later it took the form of a three-star system with distinct levels of recommendations for each commendation. The explanations (revealed in 1936) were, needless to say, kept within the theme of road travel and went as such:



1 star – "Une très bonne table dans sa catégorie"

A very good restaurant in its category (later known as "worth a stop");



2 stars – "Table excellente, mérite un détour"

Excellent restaurant, worth a detour;



3 stars – "Une des meilleures tables, vaut le voyage"

Exceptional restaurant, worth a special journey.

What started as a clever way to promote particular tyres eventually went on to become the most widely acclaimed system of rating culinary establishments in the world. Receiving a Michelin Star has become a motivating factor for many of the world's most skilled chefs. The most highly decorated people on this list include Gordon Ramsay, Enrico Bartolini, Yoshihiro Murata, and Joël Robuchon, the last mentioned being the top award recipient with a staggering 32 stars across his restaurants. Despite the general enthusiasm surrounding this award system, it has not been immune to controversies. For instance, it has been reasonably accused of a Eurocentric view of cuisine as there are virtually no Michelin-starred restaurants in Africa or Central and South America. Furthermore, the most commonly awarded type of restaurant is one that serves French cuisine. This puts chefs whose cultural background extends beyond these bounds at a disadvantage in the rankings. Moreover, the pressure associated with working towards a Michelin star may create a toxic and competitive working environment in restaurants led by chefs with lofty aspirations. While the current method Michelin employs when selecting inspectors (anonymity) is seemingly the least biased, it instills doubt as to whether the critics responsible for such influential rankings are truly qualified.

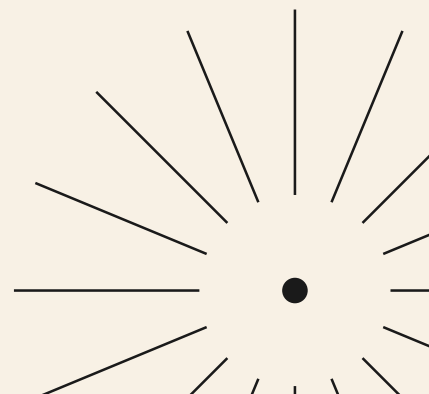
Recent studies and reports have begun to shine a light on the matter of restaurant workers' mental health. The data presented in such content suggests that chefs frequently suffer from high stress levels and burnout. In their endeavours towards earning a star, head chefs have been known to put their subordinates under tremendous pressure. Moreover, many interviewed chefs have stated their conviction that more creative freedom in the kitchen would, at least partly, remedy the well-being problems. This resembles the attitude of one of the most famous Michelin-starred chefs Marco Pierre White. Because of the dissatisfaction with his career's effect on his personal life, and a desire for creative development, he gave up all three of his Michelin stars. Both of these stories perfectly exemplify, that as with all art forms, the culinary arts are incompatible with strict guidelines and boundaries.



Marco Pierre White, Harry Murphy / RISE via Sportsfile

It is noteworthy that along with the popularisation of Michelin stars and the increase in professional recognition of Michelin's rankings, their original meaning has mostly been distorted and blurred. During the early years of the culinary section of the *Michelin Guide*, there was a clear delineation between each number of stars. These unique ranks would suggest distinct approaches to visiting recognized restaurants. Today, however, the price point and exclusivity of even one-starred restaurants would warrant a "special journey" previously reserved only for three-starred establishments. In quite an ironic turn of events, along with cars becoming more common, the average car owner's access to Michelin-starred cuisine has gradually decreased. The entire process of dining at one of these restaurants has gained an intensified level of elitism – a far cry from its origins in a motorist's handbook. Another negative aspect of the current state of Michelin recognition is that it mostly focuses on catering to, often international, culinary tourism, and disregards the local community. This also aligns with criticism aimed at restaurants and chefs seemingly detached from their reality in the self-imposed pursuit of critical acclaim.

The Michelin star system lives on in our collective consciousness through its irreversible impact on societal outlook on the culinary arts. The ranking has been mentioned or heavily emphasized in such hits as "Burnt", "Hell's Kitchen", "Emily in Paris" or "The Bear". In recent years, efforts have also been made to make the awards more accessible to restaurants outside of the mold of fine dining. In 2018, "Jay Fai" became the world's first street food stall to receive a Michelin star, marking a significant shift in the company's approach. It could potentially signify the start of a previously exclusive system's appreciation of food from diverse cultural and class backgrounds, or perhaps even, along with the widely announced hotel rating system, a renaissance of its days as an impactful tool for travelers of all economic statuses.



Food from around the world - pleasure or danger while travelling?

As we all know, exploring cuisine is one of the key points when discovering a given country. So the real question is how to enjoy it without getting ill or gaining lots of weight and then feeling too full. Let me tell you something about it.



Tampopo. Directed by Jūzō Itami, Itami Productions, New Century Producers, 1985. film-grab.com/2022/01/18/tampopo.

Getting sick...

At first I want to mention getting sick after eating unknown food. Each country has a different bacterial flora which can cause tourists to suffer from serious stomach problems. How to avoid it? The simplest thing to do is to do a decent research on the cuisine of the country you are travelling to. It doesn't take that long and can save lots of trouble. You should also take medicine that is known to help you while suffering from nausea or while having stomach problems. My other advice is to try food in small portions so that even if it is something completely new, eating it won't cause serious consequences.



Wincoff, Stuart. "Vogue Kyiv Fall/ Winter Collection." *vogue* no. 22 Aug. 2019. [vogue.ua/article/fashion/brend/nespyashchie-4-kieve-cover-story-sentyabrskogo-nomera-37425.html](https://www.vogue.ua/article/fashion/brend/nespyashchie-4-kieve-cover-story-sentyabrskogo-nomera-37425.html).

Feeling full, but unwell?

The second significant problem is usually with getting full and feeling unwell after that. Why does that happen so often? The answer is pretty simple. The desire to experience and discover something new grows in us when we travel. New environment stimulates our brain to try and explore. Also we keep in mind that we may never come back so the need to taste as much as possible is even more irresistible. So what is my advice? To definitely eat only as much as you can and not to push yourself any further. Surely different cuisines are extremely interesting but there is no point in overeating.



"Food Market in Seoul." <https://www.thenonmad.com/2018/01/05/food-markets-in-seoul/>, 5 Jan. 2018. www.thenonmad.com/2018/01/05/food-markets-in-seoul.

To summarise everything, I just want to say that everyone should be careful when eating food from around the world. That doesn't mean we can't enjoy it but it's better to be safe than sorry. Also take your time to try different options and don't rush it.

“This is the closest humanity can get to completing this problem without solving it”

that is why no one can prove the Collatz conjecture.

What is Collatz conjecture about?

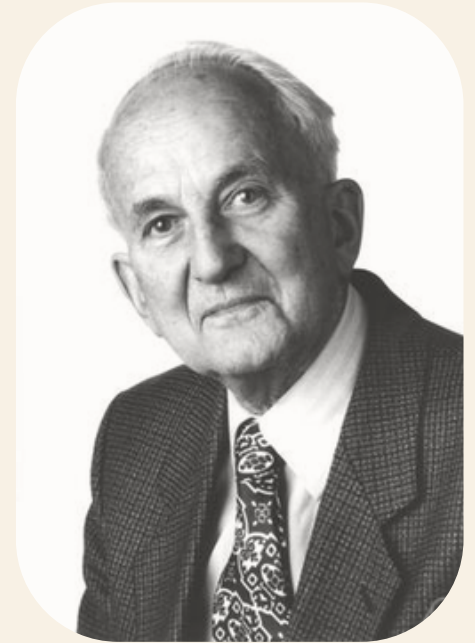
The Collatz conjecture, Ulam conjecture, Kakutani’s problem, Thwaites conjecture, Hasse’s algorithm etc. In short known as $3n+1$ or the hailstone numbers. This mathematical question was most likely created by the German mathematician Lothar Collatz in 1937 or facetiously- by the soviets to keep the US geniuses busy from real problems. This riddle has yet to be solved and probably will never be. As the famous mathematician Paul Erdős stated:

“Mathematics is not yet ripe enough for such questions.”
- Paul Erdős, 1985

The idea of it goes like this:

Choose any natural number you want. If it’s odd, then multiply it by 3 and add 1; if it’s even, divide by 2. That way a recurrence formula for this sequence can be stated as:

$$c_{n+1} = \begin{cases} \frac{1}{2}c_n & \text{if } c_n \text{ is even} \\ 3c_n + 1 & \text{if } c_n \text{ is odd} \end{cases}$$



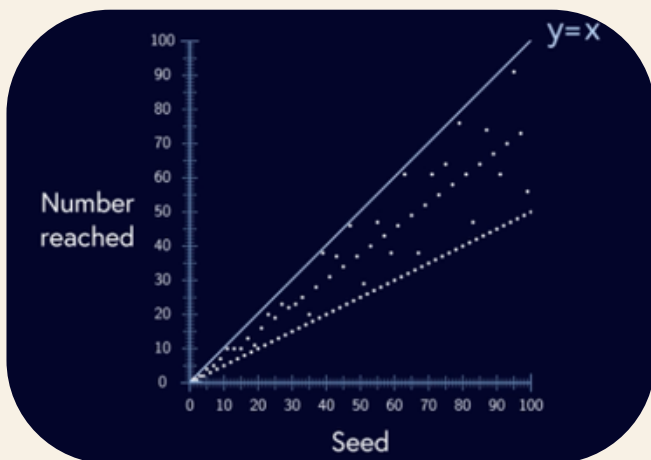
Liebenow, Elfriede. “Photo of Lothar Collatz.” Oberwolfach Photo Collection, 1990, opc.mfo.de/detail?photo_id=8301. Accessed 14 Dec. 2024.

Why cannot we solve it?

Let’s take the number 7, it’s odd so we do $7 \times 3 + 1$ is 22. It’s even, so we divide by 2, get 11 etc. By doing that we acquire a sequence:

$7 \rightarrow 22 \rightarrow 11 \rightarrow 34 \rightarrow 17 \rightarrow 52 \rightarrow 26 \rightarrow 13 \rightarrow 40 \rightarrow 20 \rightarrow 10 \rightarrow 5 \rightarrow 16 \rightarrow 8 \rightarrow 4 \rightarrow 2 \rightarrow 1$

We finish with a 1 where if multiplied by 3 and 1 added to, we get a 4 then 2 and back to 1. Once a 1 is achieved, we enter the 4,2,1 loop thus end of the sequence, at least for numbers smaller than $5,764 \cdot 10^{18}$ it’s true as humans have tested all numbers thus far. However, trying to prove that every single number in this sequence ends in a 1,2,4 loop, mathematicians created a scatter plot showing the seed numbers on x axis and highest reached numbers in the sequence on the y axis [e.g. for number 48 the points coordinates (x,y) would be (48, the highest number reached in this sequence)]

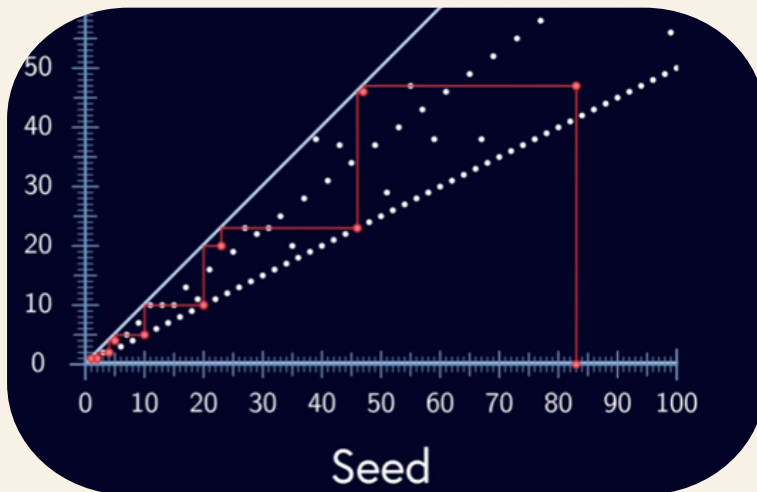


Veritasium “Number reached plotted against the seed number on a graph”, YouTube, 30 July 2021, <https://www.youtube.com/watch?v=094y1Z2wpJg>

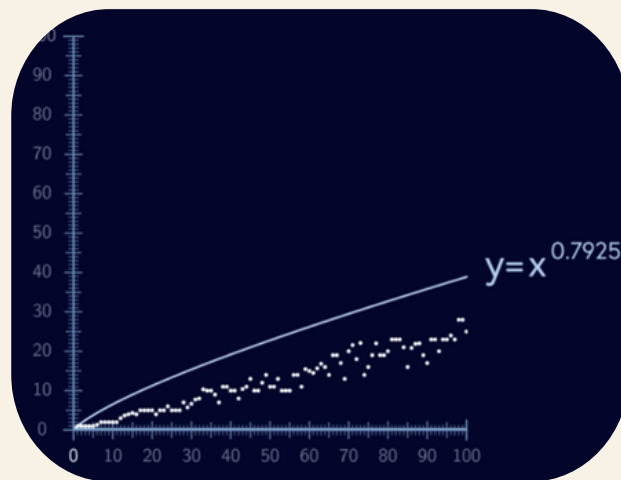
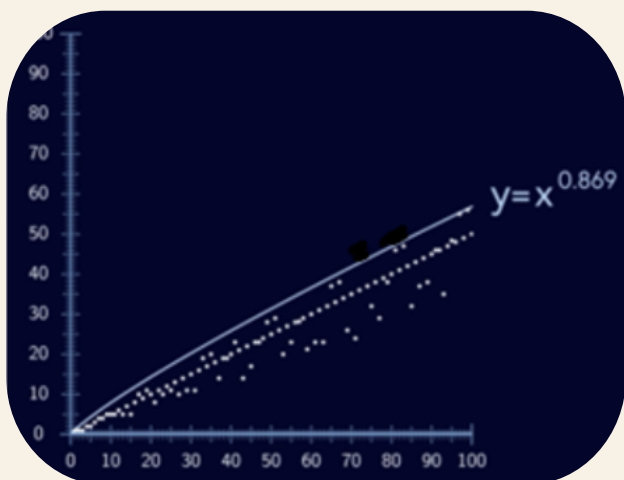
If the point is below the $y=x$ line [it's a line that shows the original value of the seed e.g. if seed numbers shown from 1-50 were to be plotted on the graph above, they would make a $y=x$ line : (1,1), (2,2),(3,3),..., (50,50)] then this sequence must eventually be brought to 1 as we know that every picked seed number will eventually get smaller and that number being now our seed also must get smaller etc. until we get a 4,2,1 loop.

What then?...

In 1976 Rihō Terras showed that almost every number reached by the sequence is smaller than its initial seed. In 1979 the line ($x=y$) was lowered to $y=x^{0.869}$ and in 1994 it was $y=x^{0.7925}$



Veritasium "Path of a random number put under the Collatz conjecture", YouTube, 30 July 2021, <https://www.youtube.com/watch?v=094y1Z2wpJg>



Veritasium " $y=x^{0.869}$ and $y=x^{0.7925}$ visualized on a number reached against seed number graph showing that no numbers appear above it thus the conjecture until 100 is correct", YouTube, 30 July 2021, <https://www.youtube.com/watch?v=094y1Z2wpJg>

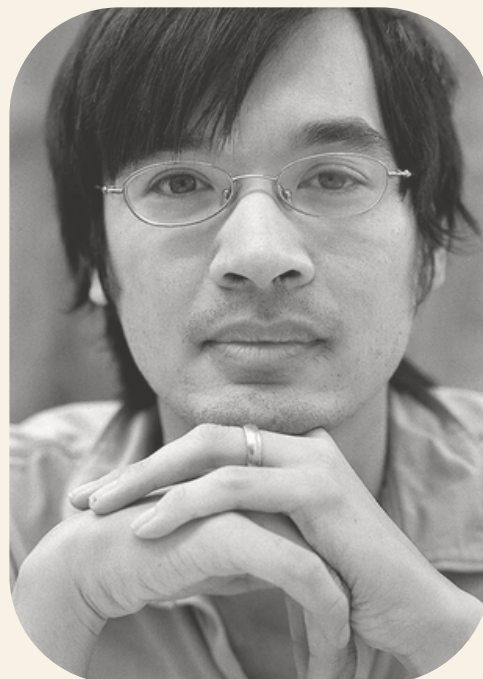
In 2019 Terry Tao discovered a stricter rule this sequence obeys and stated that "it's probably as close as a man can get to completing the $3x+1$ without actually solving it.". He discovered that any reached numbers will be smaller than any function $f(x)$ that goes to infinity as long as x goes to infinity, represented by

$$\lim_{x \rightarrow \infty} f(x) = \infty$$

If so easy, why impossible to solve?

Still, this is not a proof as almost every number obeys these rules, not every. So why do we not look for counter examples? We need just one to prove the hailstone numbers sequence is wrong, so why still struggle on finding the actual proof? It's most likely because humans have checked only 2^{68} numbers none of these serving as a counter nor an example under the $3x+1$ sequence and compared to all the numbers available for us, that much is basically nothing.

To show you the scale, George Pólya's thesis from 1919 was proved to be wrong in 1958 after testing 1.845×10^{361} numbers which is 40 times bigger than what we've checked for the Collatz conjecture up until now. It's impossible for anyone to guess it and by using brute force we don't have enough time as humans to test every single seed number. According to J.H. Conway's generalization of $3x+1$, we might never be able to find either counter or examples of this case.



"Terence Tao" ,Heidelberg laureate forum, 19 June 1975, <https://www.heidelberg-laureate-forum.org/laureate/terence-cao/>, Accessed 14 Dec. 2024

In the end...

What I have presented in this article is just the very, very up tip of the iceberg of the $3x+1$ case. There are much more complex ideas and properties that I cannot describe in just 2 pages. In the mathematical column I'd like to present you with some curious mathematical ideas that one doesn't have to have college knowledge to understand. This case is purely amazing as it's easy to understand yet impossible to solve. It creates organic forms from making a directed graph of this sequence similar to corals and even though it has strictly set rules, it still follows randomness. For more explanations like this you are welcome to follow the Instagram account [@mocnauki](#) as I will explain this and many more phenomenon in more detail during organized lectures in our school. Be prepared!



Kaurov, Vitaliy. "Collatz Conjecture on a Directed Grph Forming an Organic Form Simmilar to a Coral." Wolfram Community, 2014, community.wolfram.com/groups/-/m/t/558256. Accessed 14 Dec. 2024.

Imaginary Numbers: The Gateway to Modern Mathematics

“I tell you, with complex numbers you can do anything”

-John Derbyshire

Introduction to imaginary world

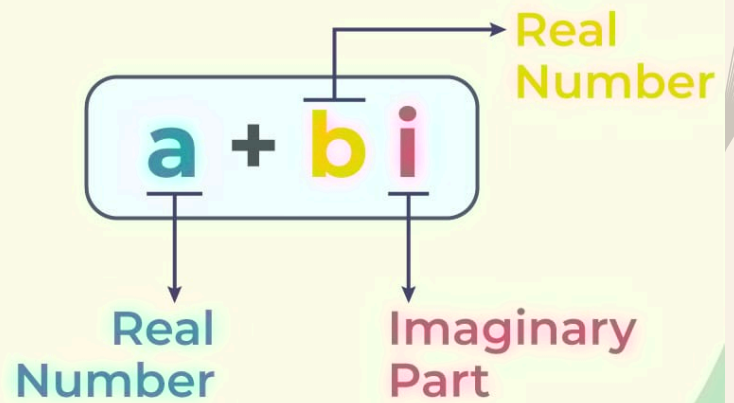
For centuries, mathematicians faced an intriguing dilemma: how could equations like $x^2+1=0$ have a solution? People used to think it was impossible for a number to have a square that equals a negative value because this didn't fit the rules of real numbers, where squaring any number always gives a positive result or zero. This challenge was not unprecedented. Mathematicians had previously encountered a similar problem when they realized that within the set of rational numbers, no number squared would yield 2. The solution came by extending the number system from rational to a broader set — the real numbers — which included numbers that cannot be written as a fraction. This expansion of mathematical systems proved successful, and mathematicians applied a similar approach to the problem of negative square roots.

A bit of history...

In the 16th century, driven by the need to solve cubic equations, Italian mathematicians like Rafael Bombelli introduced the idea of a new type of number. René Descartes later formalized and named this entity defining it as the square root of -1 . The addition of i to the real numbers created the system of complex numbers, expressed in the form $a+bi$, where a and b are real numbers and part b is called imaginary number. However, they were initially met with skepticism. Mathematicians were hesitant to accept these new entities because they lacked a clear physical interpretation. Real numbers had concrete applications—they described distances, times, and other measurable quantities. Imaginary numbers, by contrast, appeared to be purely abstract constructs, invented by mathematicians to solve problems in algebra. René Descartes himself coined the term "imaginary" as a pejorative, reflecting the prevailing sentiment of doubt.

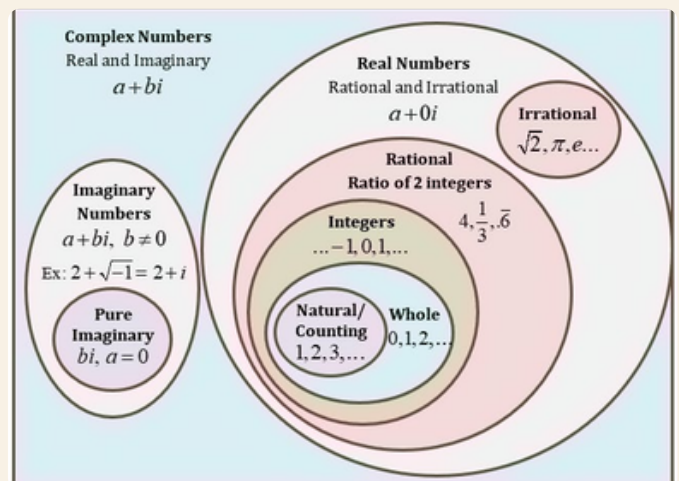
The resistance was not surprising—mathematics had long been grounded in tangible reality, and the leap to accept numbers without an apparent connection to the physical world was a significant shift.

Complex Number



"Complex Number." Math Monks, <https://mathmonks.com/complex-number> Accessed 14 Dec. 2024.

Despite this skepticism, mathematicians gradually began to uncover the profound nature of imaginary numbers. Over time, they realized that these numbers were not just convenient abstractions but integral elements of mathematics. Imaginary numbers, just like real numbers, exist as part of the mathematical fabric of our reality (we will discuss some of them later)—perhaps even more so, given their role in understanding phenomena far beyond human perception.



How can we visualize them?

One of the most transformative developments in understanding imaginary numbers came with their geometric representation. In the early 19th century, Jean-Robert Argand introduced the concept of representing complex numbers graphically on what is now known as the Argand plane. In this system, real numbers correspond to points along the horizontal axis, while imaginary numbers extend along the vertical axis. A complex number $a+bi$ is then represented as a point or as a vector originating from the origin. This visualization revealed the inherent beauty and symmetry of complex numbers, allowing mathematicians to analyze them as geometric objects. Euler further expanded the understanding of complex numbers. His work showed how imaginary numbers naturally integrate into geometry, providing a framework to explore rotations, waves, and periodic phenomena. The interplay between algebra and geometry through the Argand plane transformed imaginary numbers from abstract curiosities into essential elements of mathematical reasoning.

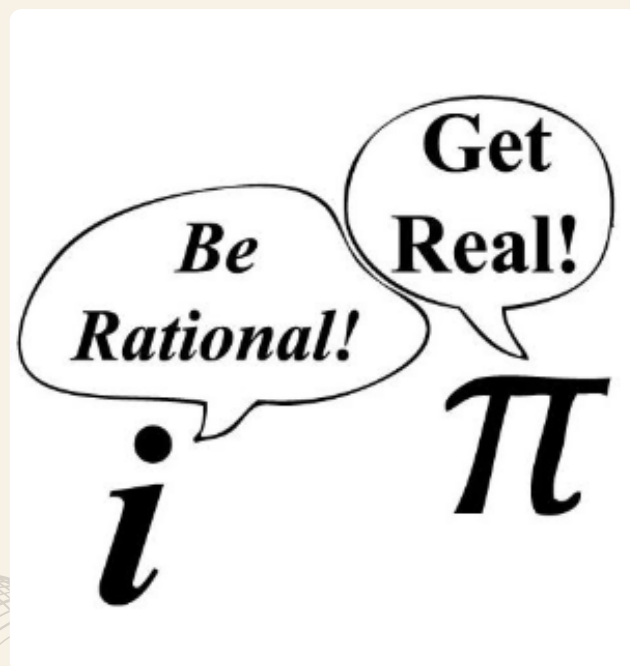


Fig. 1. Chase, Mr. "Be Rational, Get Real." Random Walks, 3 Jan. 2010, <https://mrchasemath.com/2010/01/03/be-rational-get-real/>.

Technology powered by imaginary numbers

Imaginary numbers, far from being abstract curiosities, are essential for solving real-world problems, particularly in physics and engineering. They play a key role in describing waves, which many modern physical theories consider fundamental building blocks of the universe. For instance, in quantum mechanics, Schrödinger's equation uses imaginary numbers to describe the behavior of particles, while technologies like MRI (Magnetic Resonance Imaging) rely on them to process signals and create detailed images of the human body. During an MRI scan, the patient is placed in a magnetic field, and hydrogen nuclei emit signals that behave like waves. These waves have two key components: amplitude (how strong the wave is) and phase (where it is in its cycle). Imaginary numbers allow these components to be elegantly combined into a single expression, $e^{i\theta}$, instead of representing them separately as sine and cosine functions. According to Euler's formula $e^{i\theta} = \cos(\theta) + i\sin(\theta)$, the real part represents the amplitude, and the imaginary part captures the phase. Without imaginary numbers, engineers and scientists would need to write separate equations for amplitude and phase, doubling the complexity of every calculation. This compact representation makes it far easier to analyze and process waves, enabling efficient technologies like MRI to function effectively. From wave functions in quantum mechanics to the vibrations of strings in string theory, waves determine the properties and behavior of matter and energy.

Real numbers alone cannot capture the full picture of oscillatory motion because they lack the ability to represent both amplitude and phase in a unified way. Imaginary numbers provide the mathematical framework to describe and manipulate waves, making them indispensable for understanding the oscillatory and wave phenomena that shape our reality.



"I Can't Math." Reddit, r/ExplainTheJoke, 21 June 2013, https://www.reddit.com/r/ExplainTheJoke/comments/1gv8xy4/i_cant_math/. Accessed 14 Dec. 2024.

Beyond Imaginary

But did you think it ends with imaginary numbers and their applications? Not at all.

Imaginary numbers opened the door to an entirely new way of thinking about mathematics, inspiring the development of even more complex number systems. Quaternions, discovered by William Rowan Hamilton in 1843, extend the idea of complex numbers into four dimensions. Unlike complex numbers, which exist in two dimensions on the Argand plane, quaternions include three distinct imaginary units, and along with a real component. These follow specific multiplication rules that make them especially useful for representing rotations in three-dimensional space. Quaternions are widely used in computer graphics, robotics, and aerospace engineering, such as in modeling the orientation of satellites or the movement of virtual cameras in video games. Building on quaternions, mathematicians discovered octonions, which further extend the idea into eight dimensions. Octonions, like quaternions, feature multiple imaginary units but differ in that they are non-associative—meaning the order of operations affects the result of multiplication.

While their practical applications are less common than those of complex numbers or quaternions, octonions have intrigued physicists for their potential connections to string theory and efforts to unify fundamental forces in the universe. These systems demonstrate that imaginary numbers are not an isolated curiosity but part of a broader family of mathematical constructs that extend far beyond the real numbers. Just as expanded our understanding of two-dimensional systems, quaternions and octonions provide tools to explore higher-dimensional spaces.

Schrödinger equation

$$\hat{H}|\psi(t)\rangle = i\hbar \frac{\partial}{\partial t} |\psi(t)\rangle$$

Quantum Mechanics

General Physics. "The Mandelbrot set in a bubble – A fascinating example of how mathematics and physics come together." X (formerly Twitter), 12 Dec. 2017, <https://x.com/GeneralPhysics/status/940696260142620674>. Accessed 14 Dec. 2024.

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