Discussion Toolkit

CELEBRATING 25 YEARS

SCIENCE WEEK

8-15 Nov 2020

Supported by Science Foundation Ireland

CHOOSING OUR FUTURE

Science Foundation Ireland sfi For what's next

BACKGROUND

Science Week celebrates its 25th year in 2020, taking place from November 8th - 15th, against a societal backdrop of life changing experiences as we all live in the face of the COVID-19 pandemic. Now, more than ever, people have turned to the information science provides to guide our decisions.

The theme for Science Week 2020 is **Choosing Our Future**. Many of the choices we make today, in how we work, rest and play, will influence our cultural and societal norms tomorrow. With Climate Action still urgently required, and having lived together through the changes the pandemic has brought, this year Science Week will support conversations amongst the public about what they want future Ireland to look like, and how science will support the hope we have for our collective future.

Science Foundation Ireland, developed this toolkit in collaboration with Genuity Science, Pam O'Leary, Cork Educate Together Secondary School, SFI Centre for Research Training in Genomics Data Science, ADAPT the SFI Research Centre for Digital Media Technology, Huawei, The INTEGRITY Project at Trinity College Dublin (as funded by the European Union's Horizon 2020 research and innovation programme).

Some of us are excited to go back to exactly the way things were before the pandemic, others have found recent times to be a relief and want to keep the changes we've experienced, others want to hold on to some of the changes but not all of them. Our impact on the environment has improved in so many ways, such as air quality, and yet deteriorated in others, such as the use of single-use plastics. Remote working is the new norm for a significant number, this has directly impacted on quality of life in the positive and the negative for so many, for others it has resulted in a serious hit to livelihoods as footfall in office areas drop. Through all of this journey, the public has been largely united in turning to science for the data to inform decisions for today, and to bring hope for tomorrow.

This toolkit will introduce and provide information on four topic areas (Ethics and AI, Genomics, Future Cities and Vaccines) and ask groups to discuss, consider and debate the impact of these technologies on our future.

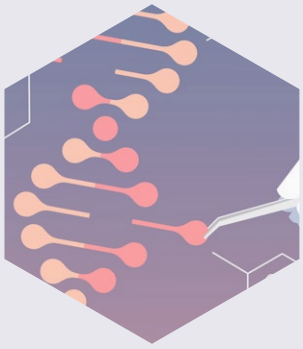
'We normalised a lot of rather bad habits before COVID-19 – long commutes, working too hard, rushing all the time, eating your food in front of the telly, now is the time to maybe correct an awful lot of that and have a better quality of life. I hope you think about it.'

Bibi Baskin – Twitter

HOW TO GET INVOLVED?

During Science Week host a discussion on what you hope to see science achieve in the future. This toolkit provides background and discussion stimulus for four topics.

Ethics and AI



Genomics

Future Cities

Vaccines

Share your thoughts on social media using #ScienceWeek or join the national online conversation on the Choosing our Future Public Forum, where a panel of experts will be asking the public to have their view across a range of issues. Find out more at ChoosingOurFuture.ie

TOPIC 1

ETHICS AND AI
Introduction and Background

What is AI?

Artificial intelligence is an umbrella term for lots of different approaches and fields of research. Their common goal is to harness the power of computers and data in useful ways. AI is sometimes sub-divided into 'narrow' artificial intelligence, where the computer carries out a specific task or set of tasks, or 'general' artificial intelligence, which tackles more complex decisions and tasks. Artificial Intelligence, or AI, involves computers working in a way that simulates, mimics, or augments human intelligence, and it is already part of your life. Airports use AI to route planes to the appropriate termini, banks use AI to search for suspicious activity on accounts and you know those recommendations you get online about films to watch or products to buy? That's due to AI.

Developed in collaboration with:

HUAWEI

ADAPT Engaging Content Engaging People

iNTEGRITY

TOPIC
1

Click on these videos throughout this toolkit to play a video.

The Royal Society (2018)

Technology is everywhere. We interact with mobile phones, computers, smart devices, and the internet multiple times every day. Much of this technology can be very helpful with our study and schoolwork, but only if we know how to use it properly!

Access to this technology also allows us to act unethically in our work and provides many opportunities to cheat, copy, and plagiarize material. A better understanding of technology allows us to think more critically and make more informed decisions about how we use the technology in our schoolwork.

TOPIC 1

Discussion Stimulus

AI debate shifts to ethics

Financial Times (2017)

Three Big Ethical Concerns with Artificial Intelligence

MaRS Discovery District (2019)

TOPIC 1

Guiding Questions for Discussions

1. Alexa and Smart Devices

a. Should you ask a smart device (e.g. a smart phone or voice assistant) to help with your homework?
b. How is this different to working with other (real) people or asking a parent, sibling, or friend for help?
c. Is this any different to looking up homework answers online?
d. Is it acceptable to pay someone online to complete one of your school assignments?
e. Is this any different to asking Alexa or someone else for help?

Read article on whether you should inform visitors to your house about smart devices in your house.

2. Smart and Driverless Cars

Self-driving cars are already cruising the streets today. And while these cars will ultimately be safer and cleaner than their manual counterparts, they can't completely avoid accidents altogether. How should the car be programmed if it encounters an unavoidable accident?

The Ethics of Driverless Cars

a) Can robots or machines be programmed to be ethical?
b) Is it ok to disagree with or challenge research findings when they go against your own personal beliefs?
c) Do you believe it is preferable to hit an "old man" rather than a "female doctor"?
d) Would these results be more useful if data was only collected in Ireland instead of worldwide? Should Irish data only be used to build cars for Irish roads?
e) Is it possible for robots to be creative?

Can robots truly be creative and use their imagination?

Additional Resources to Further Stimulate Discussions

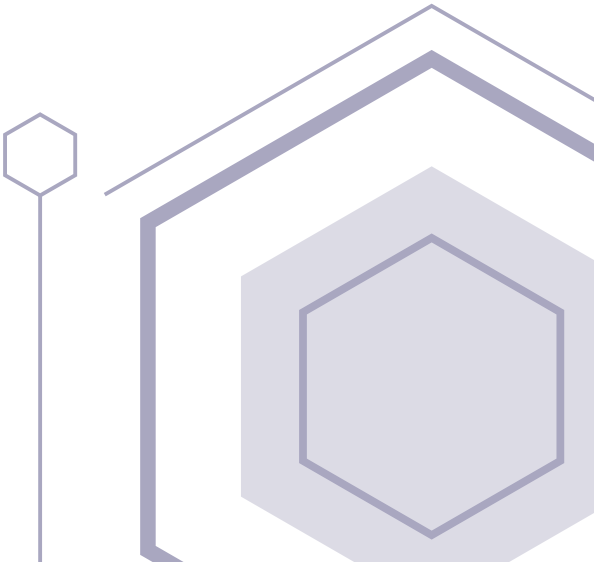
AI examples

AI Quick takes – a series of episodes explaining AI theory and practice,

- How does AI help run enterprises, taking Huawei as an example
- AI 's power in image perception
- How AI helps with the mobile base station installation processes
- How voice-activated AI can help you at work

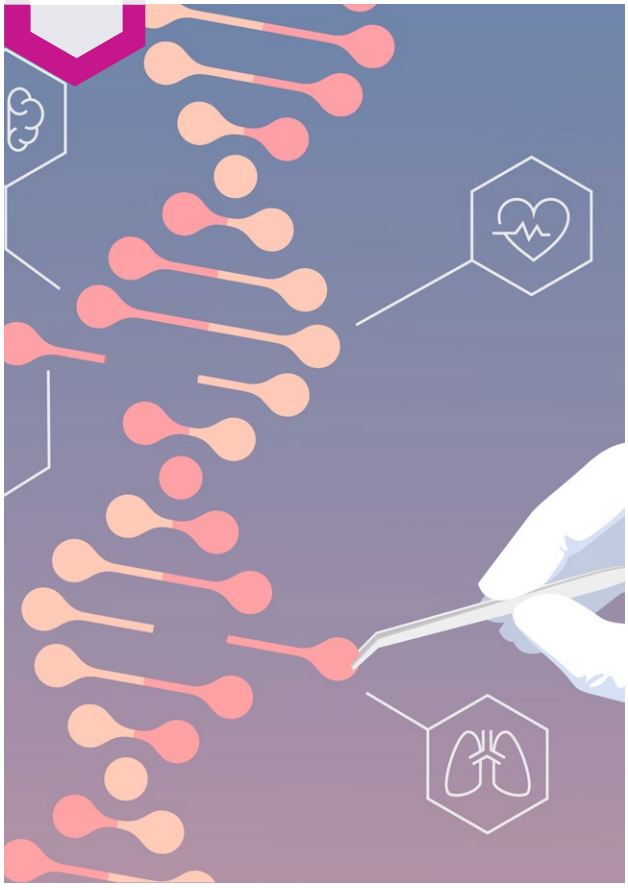
And also 2 other cool examples of AI application:

- AI Preserves Malaysian Cuisine Heritage (AI helps a Malaysian spice dealer to detect qualities of spices and improve the efficiency of the factory)
- Using AI to protect rainforests' (AI helps to collect and analyse sound patterns in a rainforest ecosystem for detecting and preventing illegal logging and protecting animal/plant life)



TOPIC 2

GENOMICS
Introduction and Background



What is DNA?

Put simply, genomics is the study of an organism's genome – its DNA – and how the information encoded within DNA is used to build the organism. All living things, from single-celled bacteria, to multi-cellular plants, animals and humans, have DNA.

Genuity Science (2020)

Developed in collaboration with:

genuity science

SFI Centre for Research Training in GENOMICS DATA SCIENCE

What is a genome?

- All living things have a genome made up of DNA, which contains the instructions to build and repair our bodies. DNA has four building blocks, which we refer to by the letters A, T, C, and G and our genome has more than 3 billion pairs of these letters arranged in a very precise sequence
- Every person's genome is around 99.9% the same as everyone else's, but that 0.1% equates to around 3 million differences.
- Some differences in our DNA determine physical characteristics, such as eye colour. Others can influence our chance of developing a disease.
- We can now sequence DNA (determine what those DNA letters are and what order they appear in) and analyse genomic information to inform healthcare, helping to better diagnose, treat and even prevent disease

What are genes?

Genes are sections of DNA which are the basic units of inheritance. This means that genes determine what traits are passed down from a mother and father to their child.

Humans have around 20,000 'coding' genes, which contain the information to build and regulate proteins – essential for building and repairing our bodies. Some genes determine physical characteristics, such as eye colour. Others can influence the chance of developing a health condition, such as cystic fibrosis.

- Genes account for 2% of our genome. We are only starting to discover what the other 98% of the genome does.

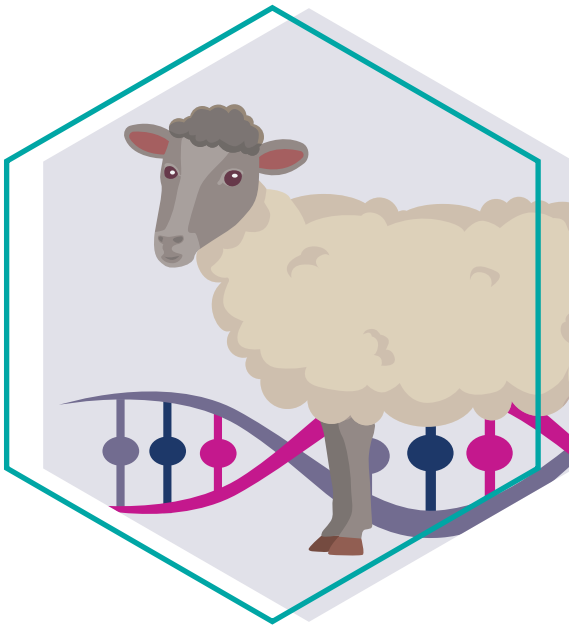
Other Applications of Genomics

- We can learn about our ancient ancestors through genomics. Read More.
- Metagenomics is the study of the genomes of our gut microbes (the microbiome), (ie the genomics of our gut microorganisms), we're starting to learn how our gut microbes affect our health. Read More.
- Potato genomics research at Teagasc helps us select for and breed crops with better qualities such as size or disease resistance. Read More.
- Researchers in Galway can monitor Irish marine biodiversity (ie the variety and levels of different aquatic species) by collecting and sequencing environmental DNA. Read More.

Discussion Stimulus

1. Mila's story - Mila was once like any happy, healthy child. But at age 3, she started to falter. At 6, she was diagnosed with Batten disease, a rare and fatal genetic disorder. She lost her sight, her language and her ability to walk independently. No one had an answer — until a plea on Facebook led her parents to Dr. Timothy Yu in Boston Children's Hospital's Division of Genetics and Genomics. Watch Mila's Story.
2. From incubation in a bra to an afterlife under glass, how a cloned sheep attained celebrity status. Read More.
3. Legal and Science arguments from Harvard on gene editing: Read More.

Guiding Scenarios for Discussions



There are many important personal, social and ethical questions surrounding genetics and genomics. Everyone's views are different and often there isn't a simple or definitive answer. This card-based activity helps you to discuss your views and explore what other people may think. Read More.

Additional Questions to Further Stimulate Discussions

1. Should human gene editing be allowed?
2. Is creating a designer baby ok if the baby could save a sibling's life e.g. a kidney or bone marrow?
3. What are the ethical issues involved in editing out disabilities such as blindness or chromosomal disorders?
4. What are the ethical issues involved in cloning humans?

TOPIC 3

FUTURE CITIES

Introduction and Background

By 2030, the UN estimates, 70% of people will be in our global cities, the hubs of innovation and economy that today provide about 80% of global GDP (World Bank). How these cities look, feel and operate will critically affect the lives of the community around the world, will impact our environment, and will influence our local, national and international economies.

The consequences of rapid urbanisation are frequently cited as overcrowding, traffic congestion, waste management issues and lack of green spaces, all of which result in high CO^2 emissions.

Developed in collaboration with:

INTEGRITY

The answer is thought to be in sustainability. Sustainable development of cities is a way of developing cities for the future so that they can be healthy, thriving places that will have minimal negative environmental and social impact. The more sustainable a city is, the more likely it is to be a desirable place to live according to the 'top' 5 sustainable cities, which regularly feature highly on quality of life and liveable cities lists. The 'top' 5, Vancouver, San Francisco, Oslo, Curitiba and Copenhagen, are considered to be the leaders in sustainability and many other cities are now looking at how they have achieved this (Royal Geographical Society, 2020).

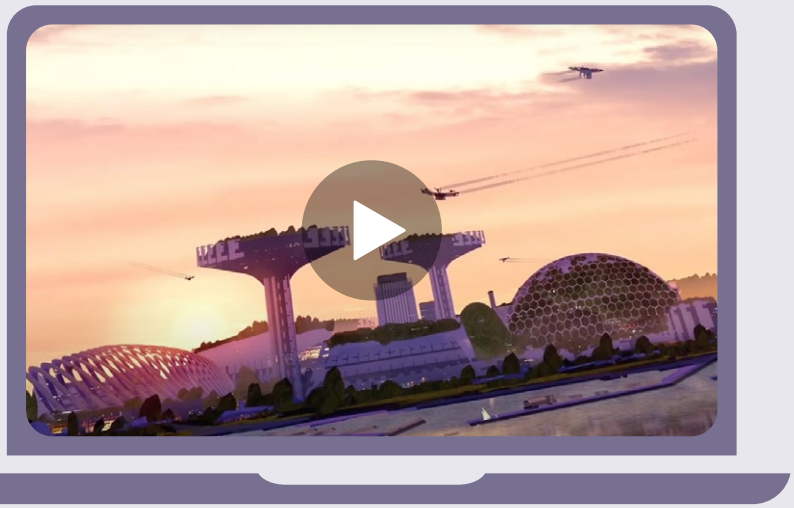
It is widely accepted that sustainable development of our cities should be the key driver for change so that cities can accommodate the growing number of inhabitants without having a detrimental effect on the physical, economic, environmental and social landscapes of the city (Royal Geographical Society, 2020).

Many cities today are trying to plan for the future and implement longer term strategies to cope with population growth and the longevity of the city, however there are some cities that are well ahead of the game (Royal Geographical Society, 2020).

TOPIC 3

Discussion Stimulus

Future City Predictions - A glimpse at Cities of the Future



Will Covid 19 have an impact on the way cities are designed?

Impact of Covid 19 on city design: Read More.

What is human centric urban planning? What does it look like?

Read More.

Explore the timeline of future predictions.

Read More.

Is human colonisation on other planets unethical?

- What is the difference between exploration and colonisation?
- Is the potential 'Plan B' of colonising other planets distracting us from tackling climate change? Does it make planet Earth seem less important if we can survive on another planet.
- If humans make Earth uninhabitable, what makes us think we will be able to live sustainably on another planet?

TOPIC
3

Guiding Questions for Discussions

Think about your local urban area, how would you create a sustainable city? Solutions are often best when they are targeted to specific areas depending on the characteristics of that area.

- What would you advise?
- How can the ideas become a reality?
- Who should fund your ideas?
- Public or private finance?
- What are the limitations?
- In the short term and long term. What are the implications from climate change in the future?
- Is public support an issue?
- Can a city ever really be carbon neutral?

TOPIC 4

VACCINES
Introduction and Background

Vaccination is one of the best methods of protection from highly infectious and sometimes deadly diseases. According to the World Health Organisation (WHO) vaccines are a vitally important application of scientific research that save millions of lives worldwide every year. They reduce healthcare costs and are an integral part of public health policy[1].

Vaccines work by priming your immune system to create special cells (called B and T Cells) **and proteins (Antibodies)** which recognise and destroy specific germs. These special cells will remain in your body to protect you in future. Generally, any side effects of vaccination are minor e.g. minor fever, pain/swelling at injection site.

Developed with collaboration from:

Trinity College Dublin
Coláiste na Tríonóide, Baile Átha Cliath
The University of Dublin

1 Wellcome. Vaccines: A world equipped to combat infectious disease. https://wellcome.org/what-we-do/our-work/vaccines [accessed 13 May 2019];

TOPIC 4

Discussion Stimulus

Vaccines are made with a very weak, partial or inactive form of the disease; just enough to trigger your immune system into action.

Scientists continue to improve vaccines. They are working to isolate even more specific components of germs. Vaccines made with these tiny bits of the germs may be more effective and have even fewer side effects.

DNA vaccines are also being developed which are made using genes that code for molecules called proteins. When the DNA vaccine is injected, these proteins are made in the body and trigger a very specific immune response. This technology means that we will be able to produce more effective vaccines and prevent and treat a new suite of diseases.

Discussion Stimulus (continued)

Although vaccines have always generated some anxiety among people, their uptake has generally been widespread enough that diseases such as smallpox have been eradicated, and many other infectious diseases such as tetanus and cholera, diphtheria and polio have largely disappeared in many countries.

However, over the past decade or so, an increasing number of studies[2 3] have documented a rising number of people in both high-income and low-income countries who seem to be losing confidence in some vaccines, to the point of choosing not to vaccinate their children[4].

According to organisations such as the WHO and UNICEF, gains made in the world's fight against vaccine-preventable diseases are at risk. Lack of confidence in the safety and/or effectiveness of vaccines and the health system, shortages of health workers and supplies, depleted or destroyed health infrastructure, poverty and access difficulties (such as distance to the nearest clinic), all threaten to disrupt the effectiveness of vaccination programmes.[5]

2 Larson HJ, et al. The State of Vaccine Confidence 2016: Global Insights Through a 67-Country Survey. EBioMedicine 2016;12:295–301.

3 Barrows M, et al. Parental Vaccine Hesitancy: Clinical Implications for Pediatric Providers, Journal of Pediatric Health Care 2015:29(4):385–94.

4 Diekema DS. Improving Childhood Vaccination Rates. The New England Journal of Medicine 2012;391–3.

5 World Health Organization. Immunization, Vaccines and Biologicals: Addressing Vaccine Hesitancy. 2018 12 September. https://www.who.int/immunization/programmes_systems/vaccine_hesitancy/en/(opens in a new tab)

TOPIC 4

Future of Vaccines

Trinity College Dublin
Coláiste na Tríonóide, Baile Átha Cliath
The University of Dublin

Discussion Stimulus

Some Facts about Childhood Vaccinations in Ireland

Online parenting community, BabyDoc Club, collaborated with the Vaccines Saves Lives campaign in 2020 to collect information about the knowledge base of parents regarding their child's vaccinations.

- 35% of parents don't know all of the illnesses their child has been vaccinated against
- 1 on 4 infant vaccine appointments were delayed due to COVID-19 restrictions and parental concerns with over a third (35%) delayed by 1 month or more
- 43% of parents feel it's important to pay to get their child vaccinated against the chicken pox virus as it falls outside of the Childhood Immunisation Programme
- 82% of parents think that children should have to prove their child has been vaccinated in accordance with the Childhood Immunisation Schedule in order to attend ECCE and school
- 69% of parents say the pandemic has made them value the importance of their baby's routine vaccines even more

Guiding Questions for Discussions

1. "Should a full set of vaccinations be required before a child can attend school?"

This is not a debate on whether vaccines are safe or a good idea. Plenty of resources on that topic exist already, and the scientific evidence is very strong on the side of vaccines being safer than catching communicable diseases. This debate is about what the best public health policy is, to protect the public, balancing individual freedoms against public health.

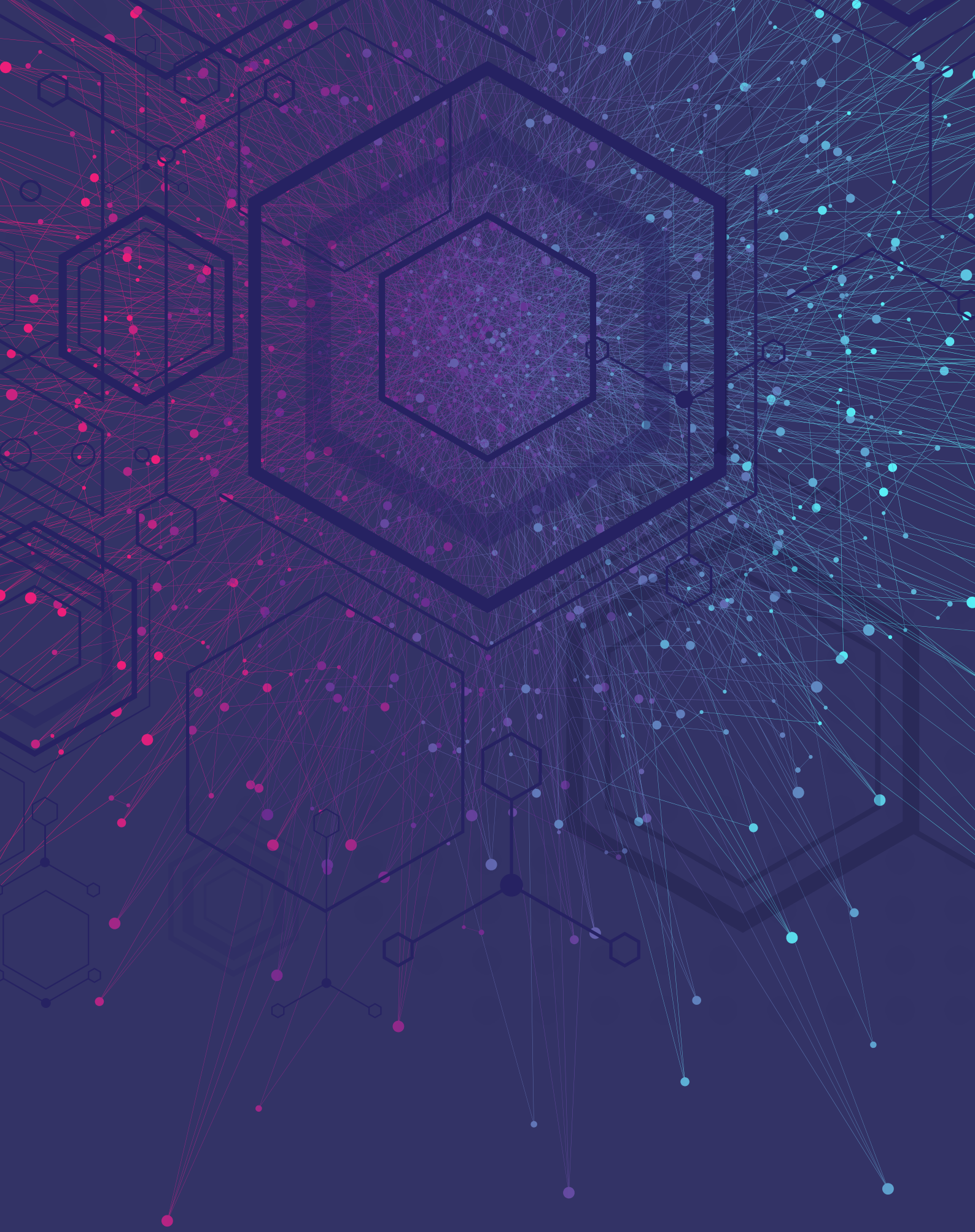
2. "The influence of the media on vaccines" does the media/ social media influence peoples opinion of vaccines?

A 1998 publication in The Lancet by Andrew Wakefield suggested there were links between the MMR vaccine and symptoms similar to autism. There was heavy media coverage about this issue, and much of the public began to fear the safety of the MMR vaccine. Andrew Wakefield's findings were fraudulent – the paper has been discredited and retracted from The Lancet. Wakefield is also barred from practising medicine. Many studies have found no links between the MMR vaccine and the subsequent development of autism or autism spectrum disorders (ASD).

a) What do you think happened to rates of uptake of the MMR vaccine?

b) How would this affect the rates of measles mumps and rubella infections in the population?

c) What are the ethical considerations of finding a vaccine for Covid 19? For example, if it was very expensive say $100,000 per dose.



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