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THE SOCIETY FOR REPRODUCTION AND FERTILITY

REPRODUCTION IN A CHANGING WORLD



ARTWORK BY IMOGEN HARRIS



Written by Amanda Sferruzzi-Perri, Erin Williams, Hannan Al-Lamee, Rod Mitchell and Agnes Stefansdottir from The Society for Reproduction and Fertility.

The SRF aims to enhance the knowledge of reproductive processes and fertility in humans and animals. The SRF committee is comprised of researchers at multiple career stages from a range of different countries across the world. They have expertise in different areas of reproductive and developmental biology and have contributed to the advancing knowledge within those fields. SRF is engaged in numerous activities, including running scientific conferences, and community outreach events. This comic is the first of an educational series directed towards young adults to raise awareness of environmental impacts on reproductive biology.

For more information, including how to join the society, check out
<https://srf-reproduction.org>.

Artwork by Imogen Harris

Imogen Harris is a scientific illustrator with a PhD in environmental and reproductive sciences who specialises in producing illustrations, diagrams and graphics.

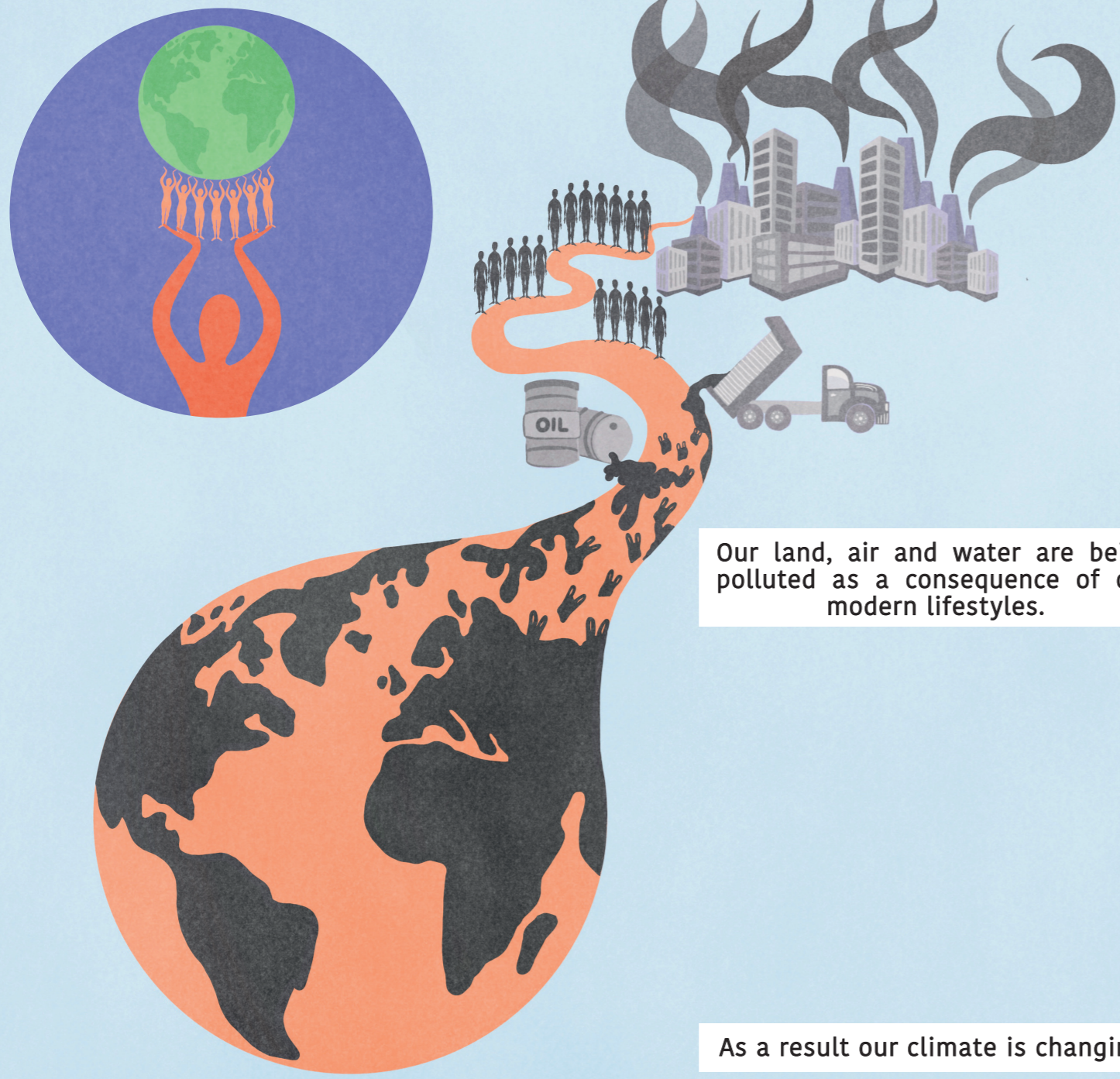
www.imogenharrisillustration.com

The world we live in is very different to what it was hundreds of years ago.



Changes in the environment are reflected at a global, societal and individual level.

The human population has grown and the natural environment has been replaced with city living.



Our land, air and water are being polluted as a consequence of our modern lifestyles.

As a result our climate is changing.

The temperatures of our atmosphere and oceans are rising and we are seeing unpredictable weather conditions including wildfires, flooding and droughts.



We are not as active as our ancestors.



Even our grandparents were a lot more physically active than us.

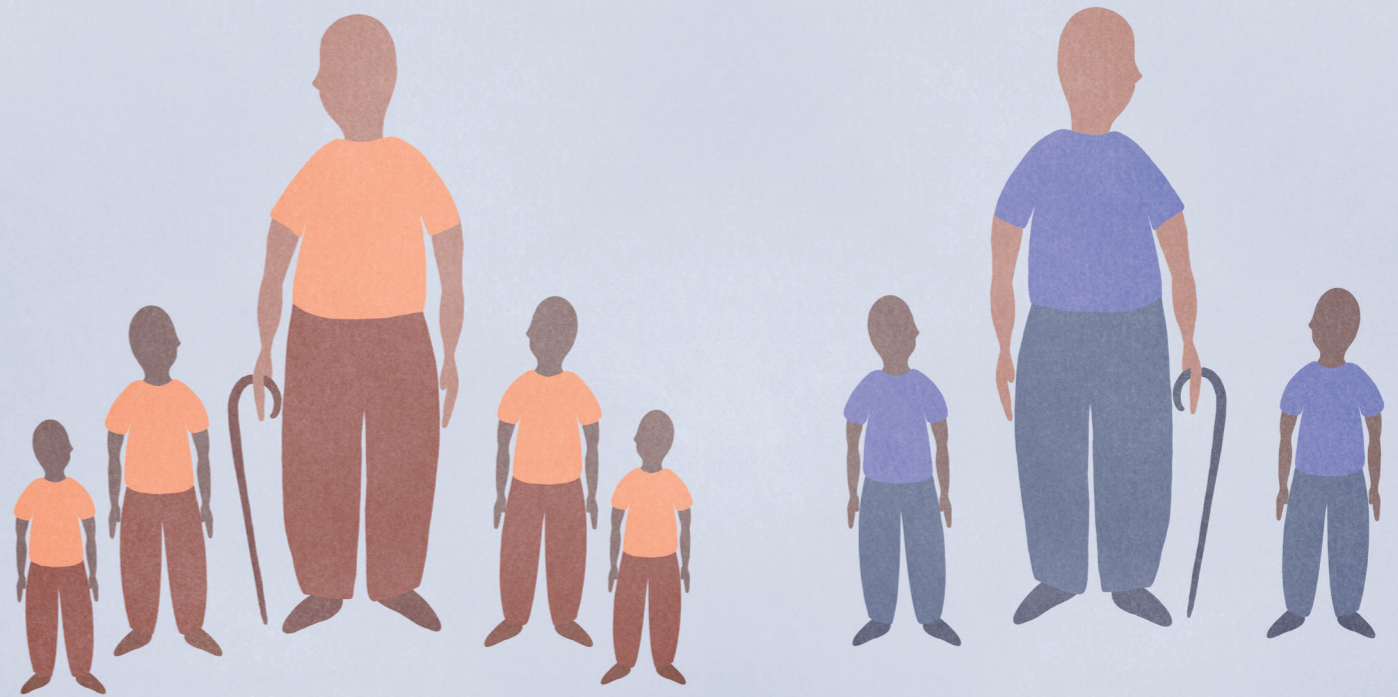
The food we eat has changed too. Hundreds of years ago 'fast food' had a different meaning.



In our everyday lives, we are exposed to harmful chemicals and plastics.



Our ability to reproduce - or have children - has also changed across generations and lifetimes.

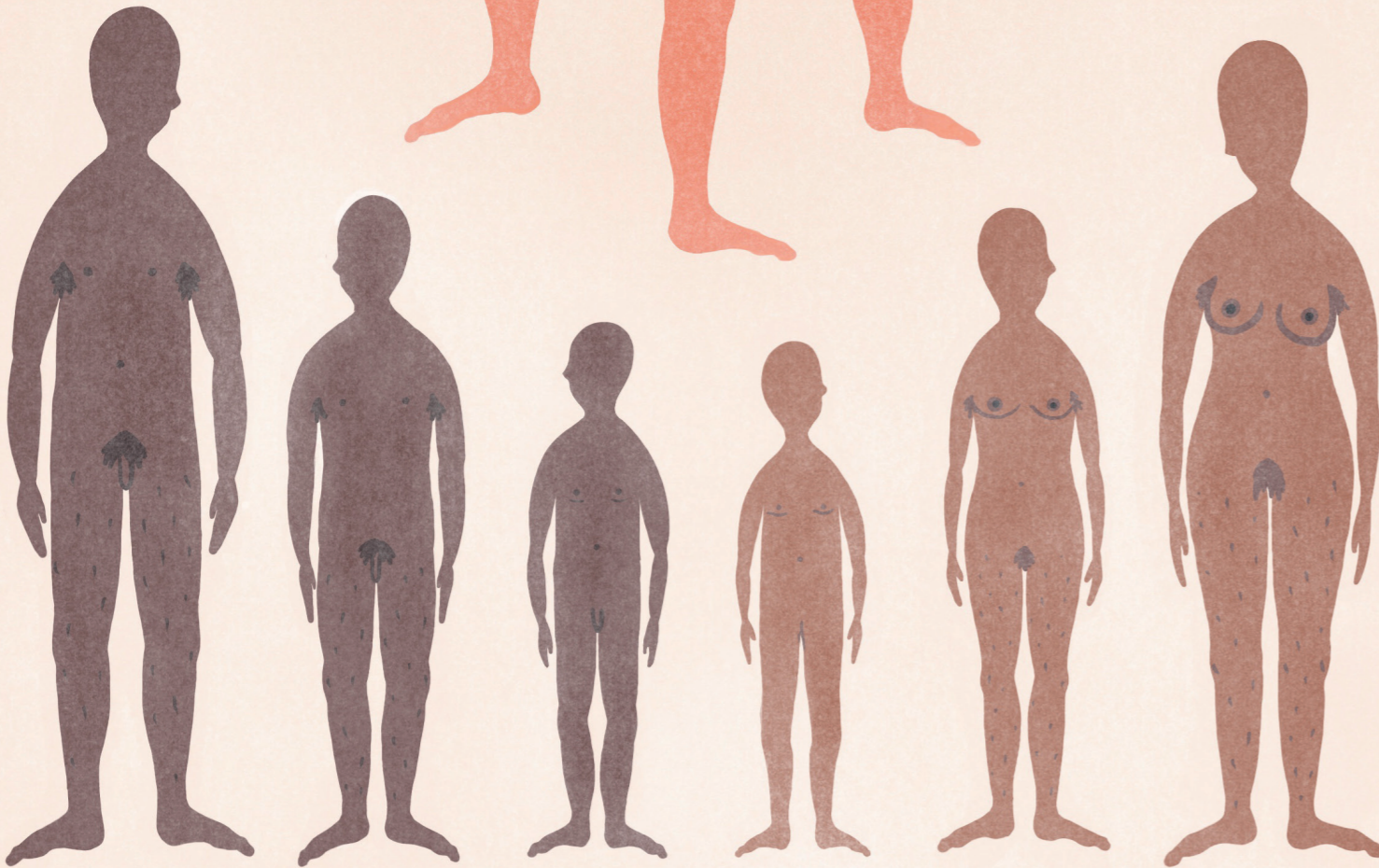


The body parts needed for reproduction are called the reproductive organs.

These develop when we are growing in our mother's uterus.

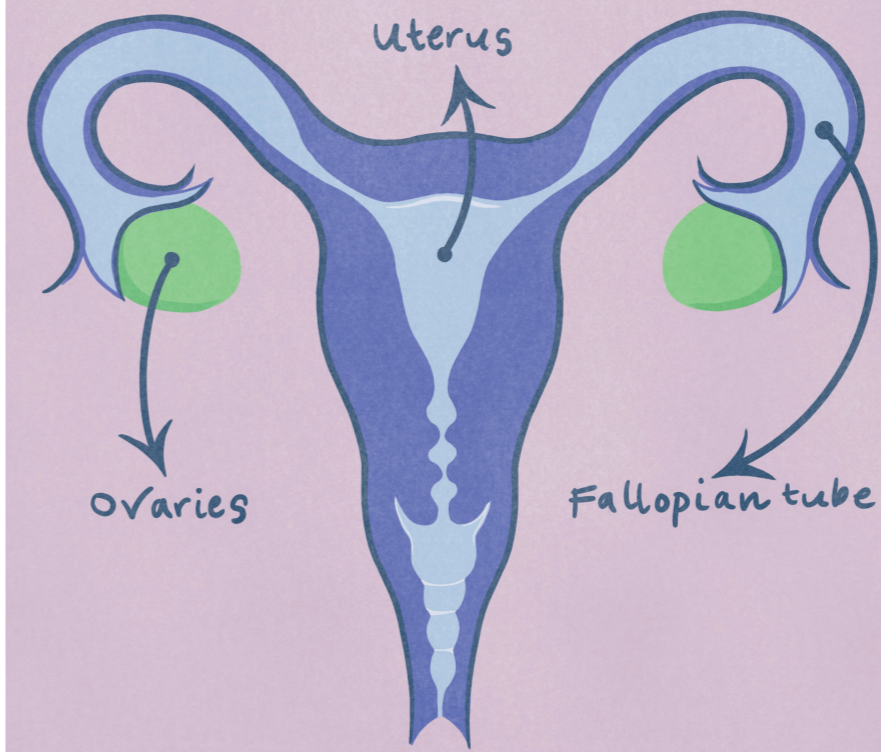


And they continue to develop throughout childhood.



As well as throughout puberty, allowing for our reproductive system to mature so we can have children, should we want to.

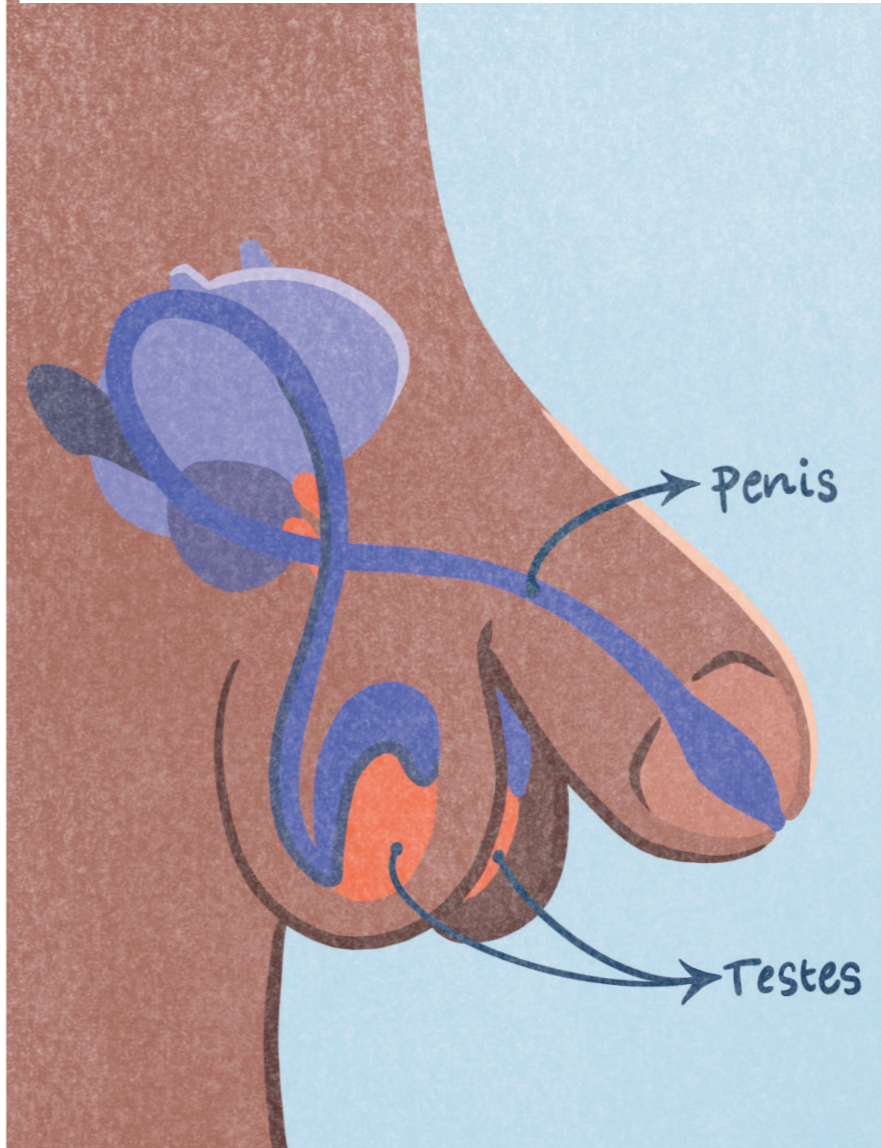
The female reproductive system includes the ovaries and the uterus.



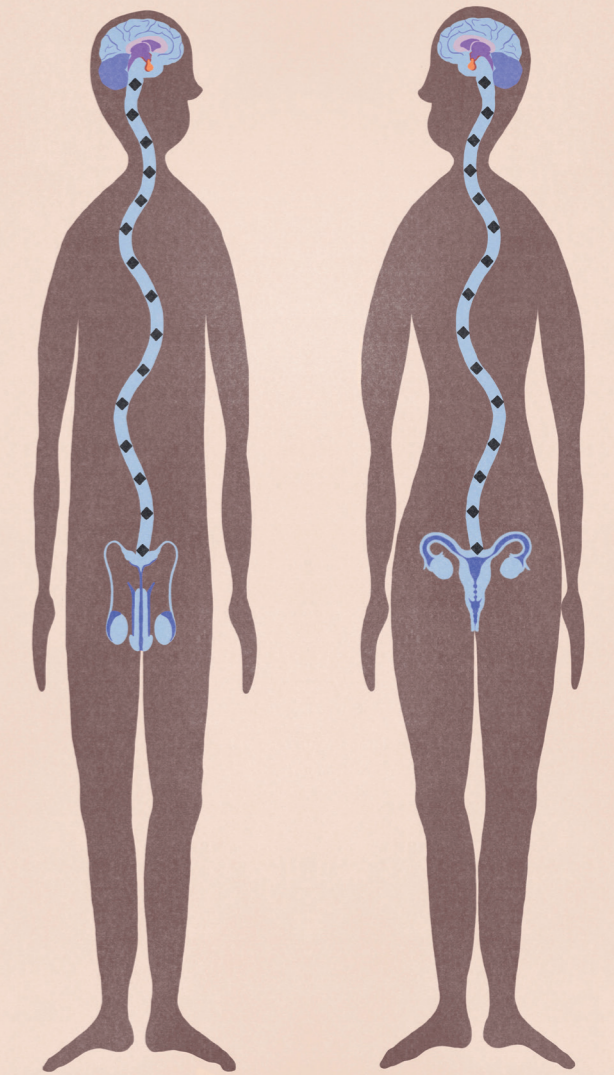
And the mammary glands.



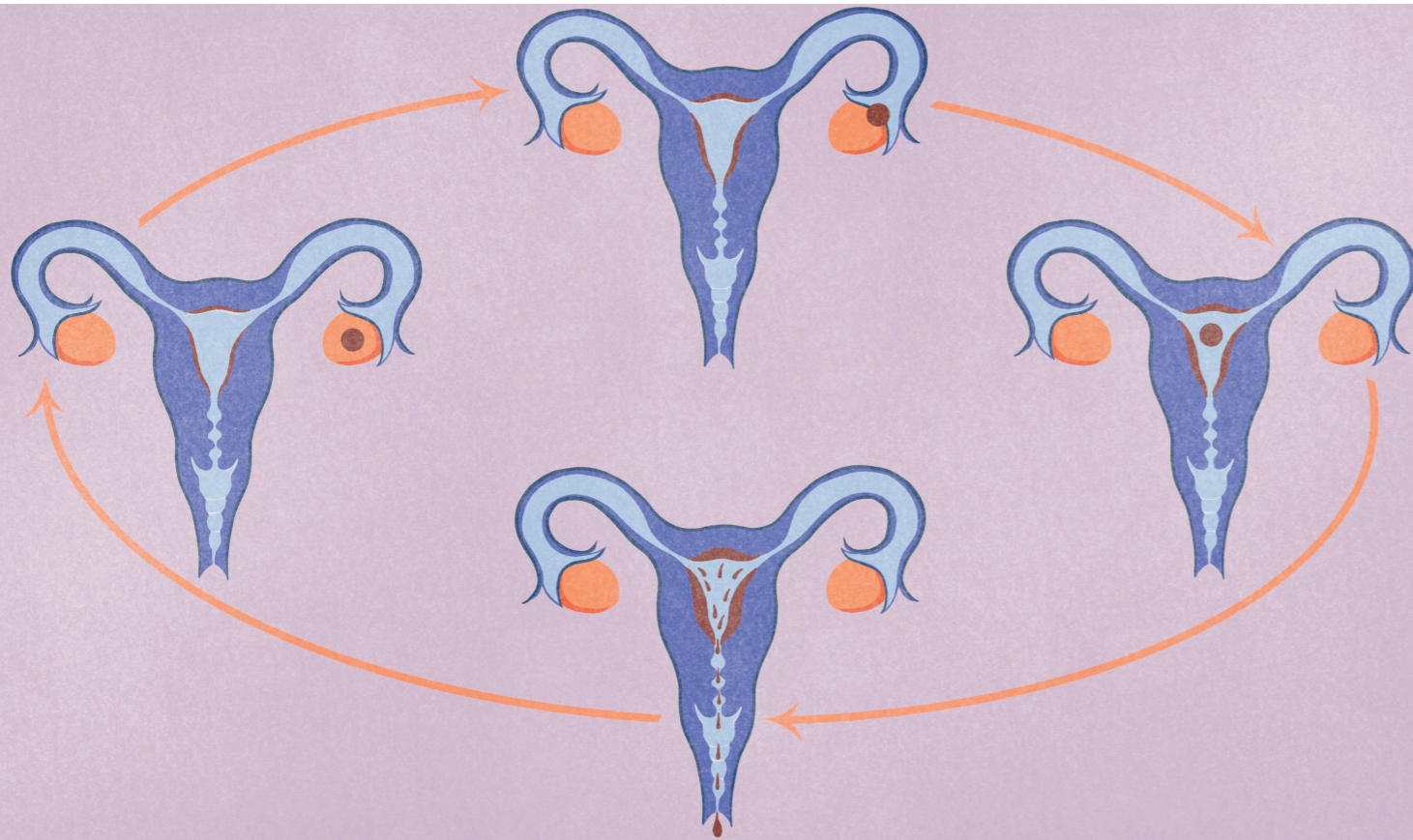
The male reproductive system includes the penis and the testes.



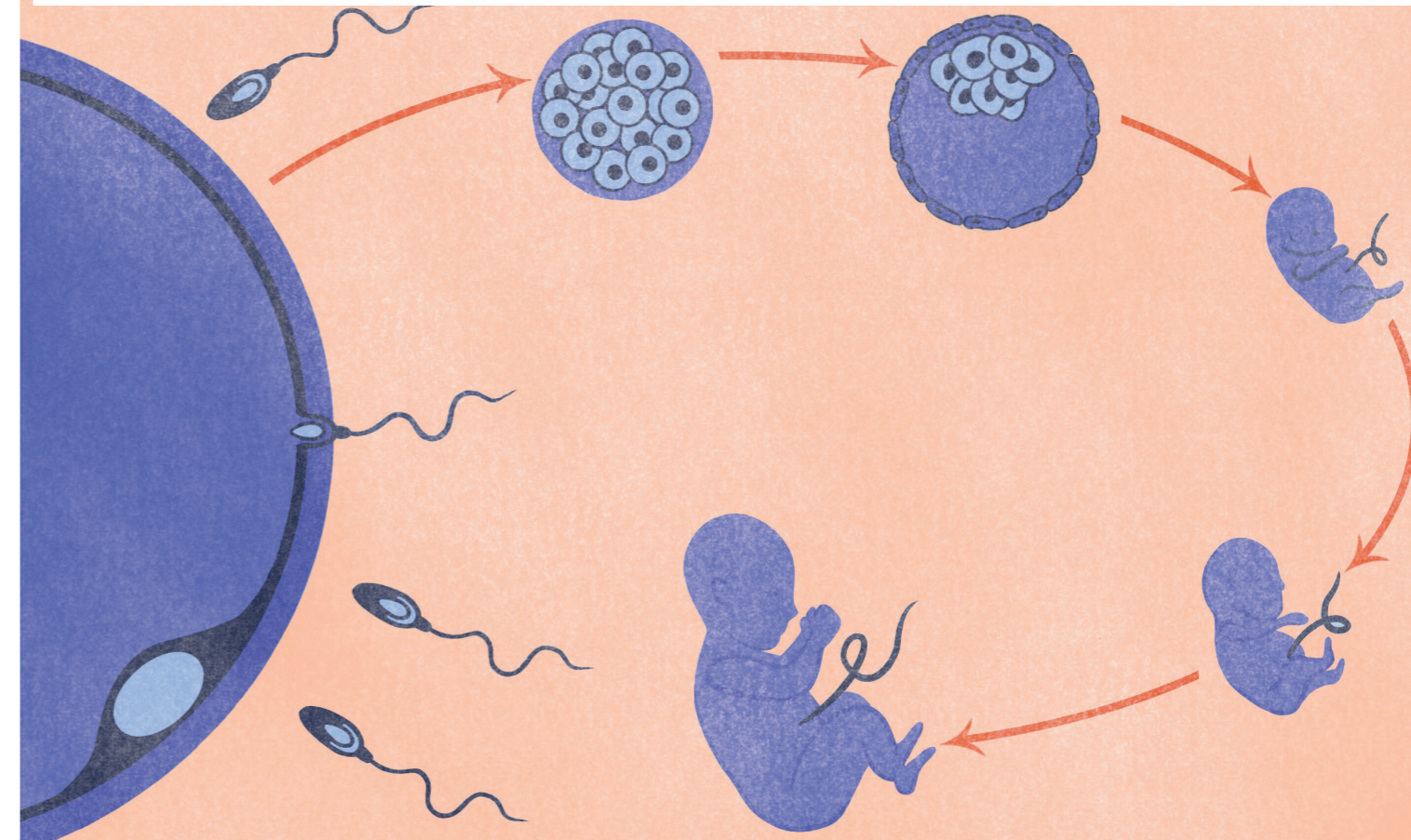
At puberty, hormones from the brain send signals to the ovaries in females and the testes in males.



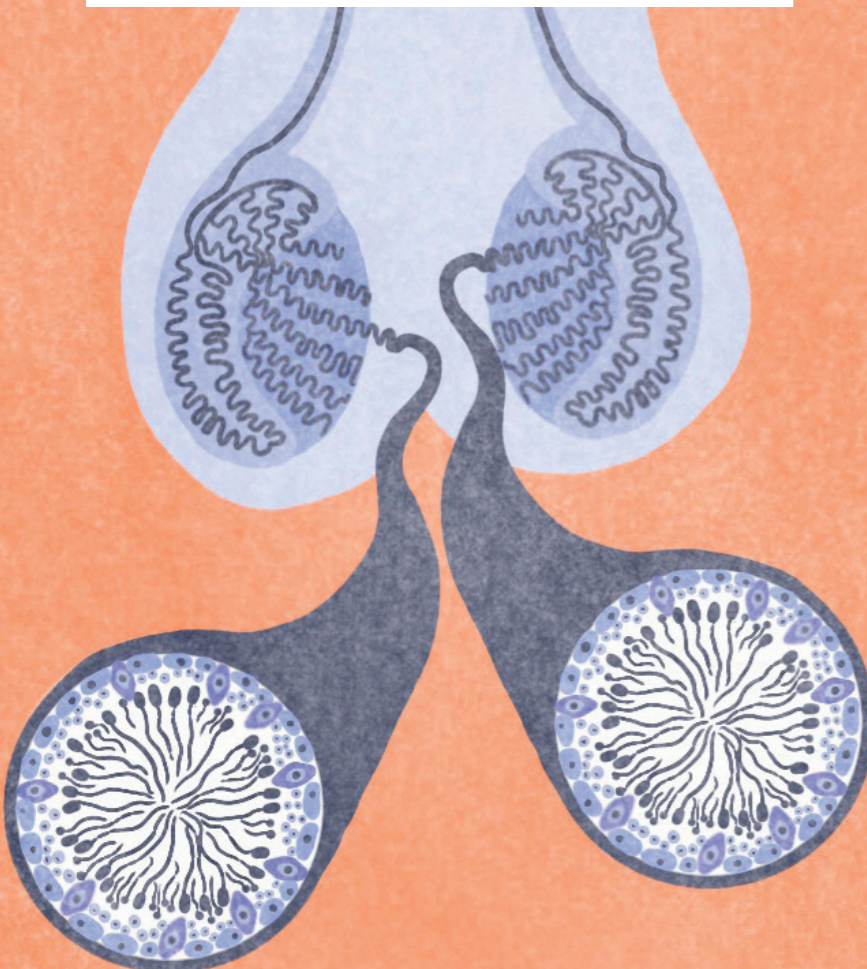
In females, these signals instruct the ovaries to start producing the hormones oestrogen and progesterone, and begin releasing eggs (ovulating). The hormones also cause the lining of the uterus to grow and shed every month, resulting in a period (menstruation).



On reaching the egg, the sperm breaks through its shell to fertilise it, allowing an embryo to form. This forms a fetus over 9 months of pregnancy.



In males, these signals instruct the testes to start releasing hormones including testosterone and produce sperm.

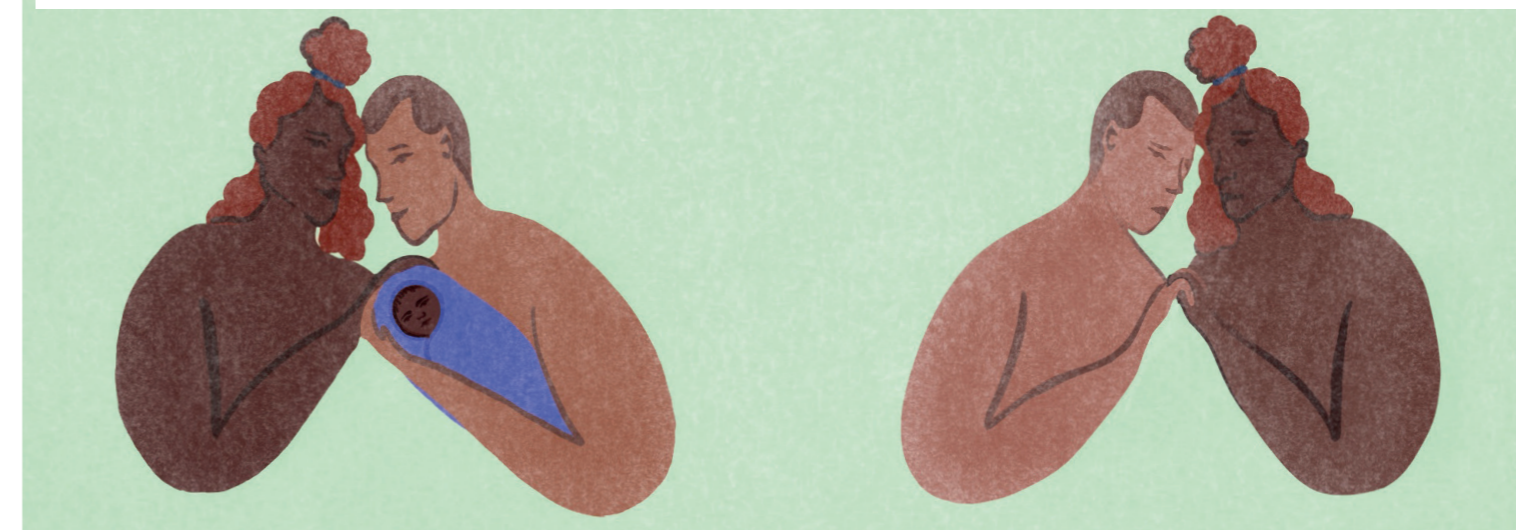


Millions of sperm are released after each ejaculation.



However not all are healthy enough to survive the long journey through the female reproductive tract to reach the egg.

Whilst some people have no issues with their reproductive health, or their ability to start a family, an increasing number do have problems.



Girls and boys are going through puberty at an earlier age. In girls, the average age of starting periods has fallen from 15 years to around 11 years old. In boys, the age when puberty occurs has fallen from 16 years to around 12 years old.

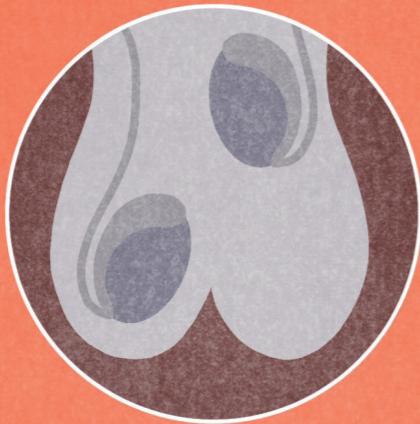


In recent decades there has been an increase in reproductive problems including:

Testicular cancer.



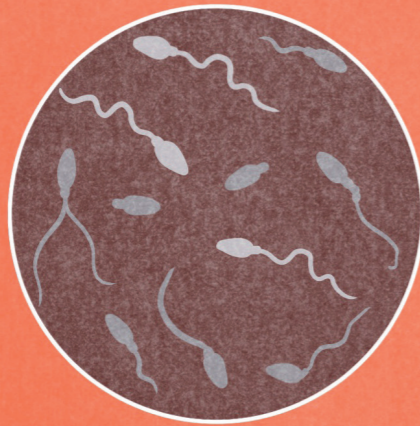
Cryptorchidism.



Hypospadias.



Poor sperm quality.



Cryptorchidism:
When one or both of the testes don't drop into their correct position before birth

Hypospadias:
Malformed penis with the opening being in the wrong place

Poor sperm quality:
Sperm DNA damage, reduction in sperm count and reduced motility

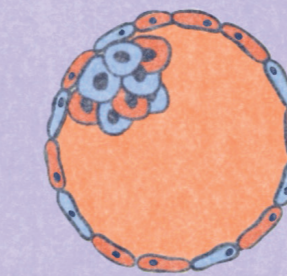
Infertility can be a result of problems with the sperm and egg, embryo development and survival, or poor uterine function.



Abnormal egg



Abnormal sperm



Abnormal embryo



Abnormal uterus

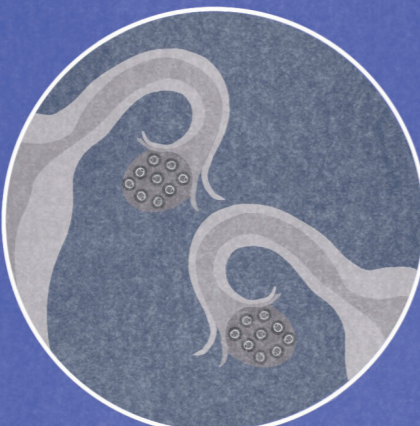
Reproductive problems could also be a result of multiple contributing factors including diet, lifestyle or exposure to chemicals in the environment.



Ovulation problems.



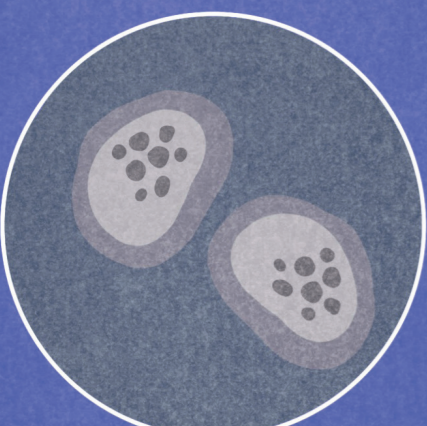
Reduced egg number.



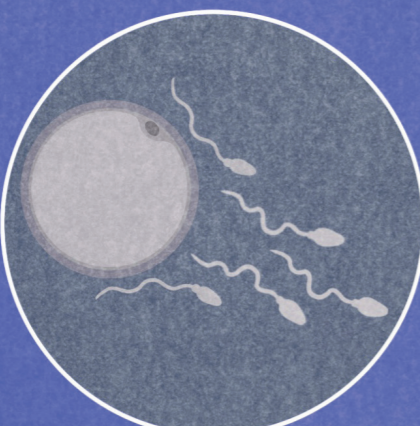
There is also a higher rate of infertility and miscarriage.



Damaged or abnormal eggs.



Eggs that don't fertilise.



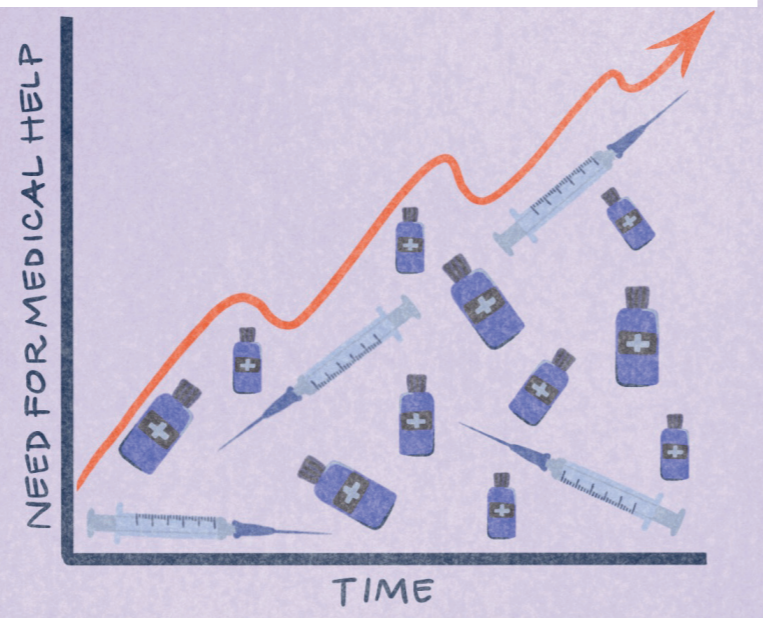
Medical treatment, also called Assisted Reproductive Technologies (ART), may help increase the likelihood of conceiving. These treatments can be used to collect sperm and eggs that are then mixed in the lab to help fertilisation.



However, ART doesn't always work and it is not an option for everyone, depending on where you live and the money and resources available.



Due to the impact of the environment on our fertility, the need for medical help is likely to further increase. But we can't rely on reproductive technologies forever.



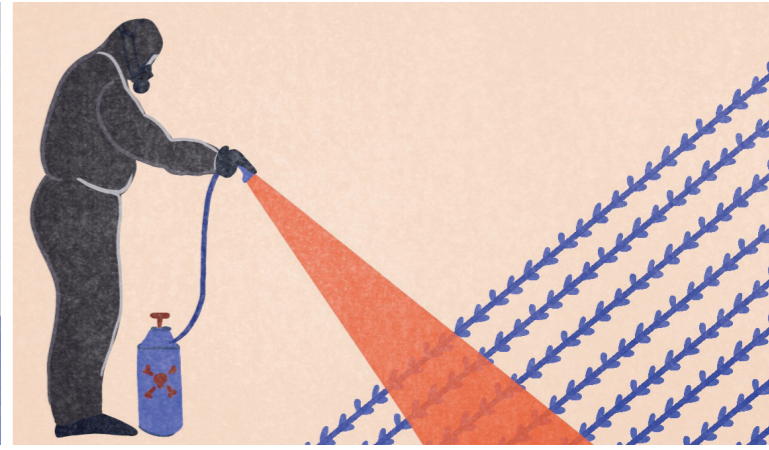
Perhaps these patterns are related to deforestation, increased temperatures, increased natural disasters and exposure to chemicals and pollutants in the environment.



The increase in reproductive problems isn't only happening in humans. There are also increased rates of infertility in the animals that live around us in our homes, on our farms and in the wild.



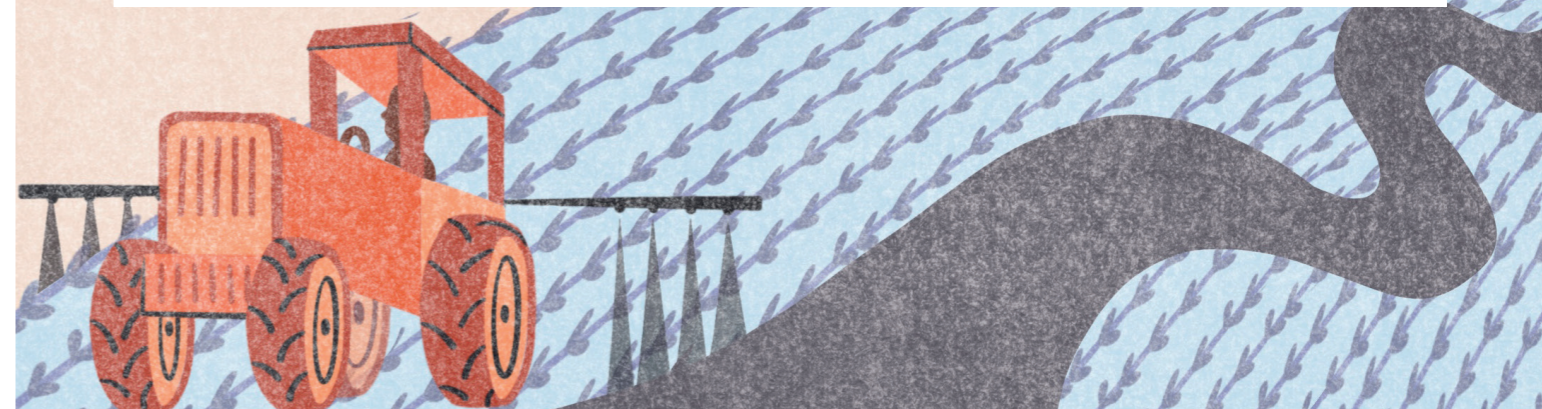
We know that population decline of animals in the wild is directly linked to changes in the environment. But are these changes also related to a decline in reproductive function?



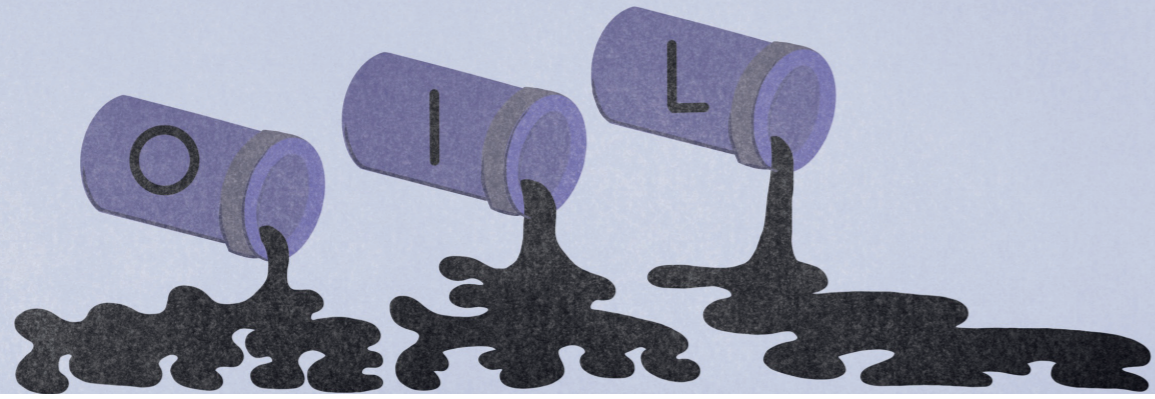
Humans are exposed to air pollution, rising temperatures, toxic chemicals, organic pollutants, natural disasters and infectious diseases.



As a result of chemicals used and generated through farming and agriculture, these can leak into our rivers, lakes and drinking water.



Through agriculture and ocean pollution, humans get exposed to oil spills, microplastics and pesticides.



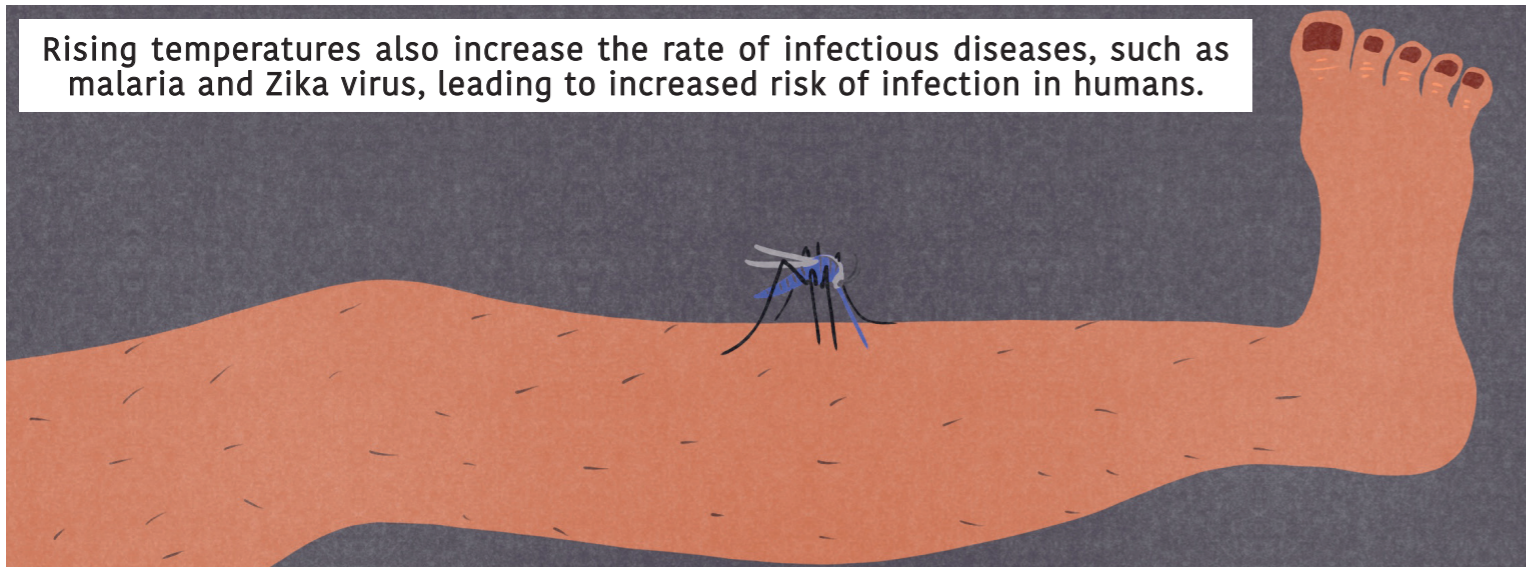
Chemicals and microplastics that leak into our environment also enter and accumulate in our food chain through the plants and animals we eat.



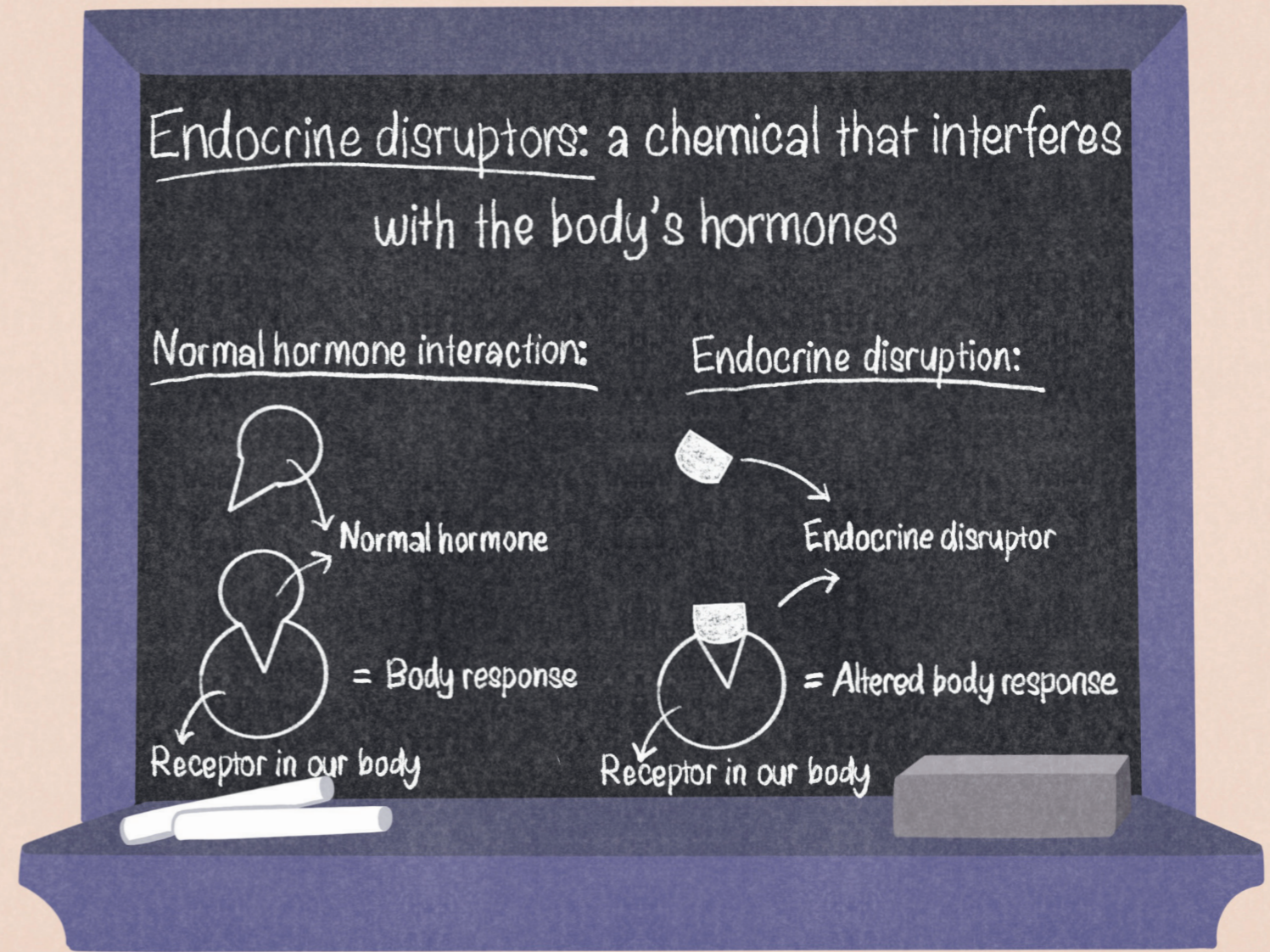
High temperatures can increase the release of persistent organic pollutants from within the soil and melting ice caps.



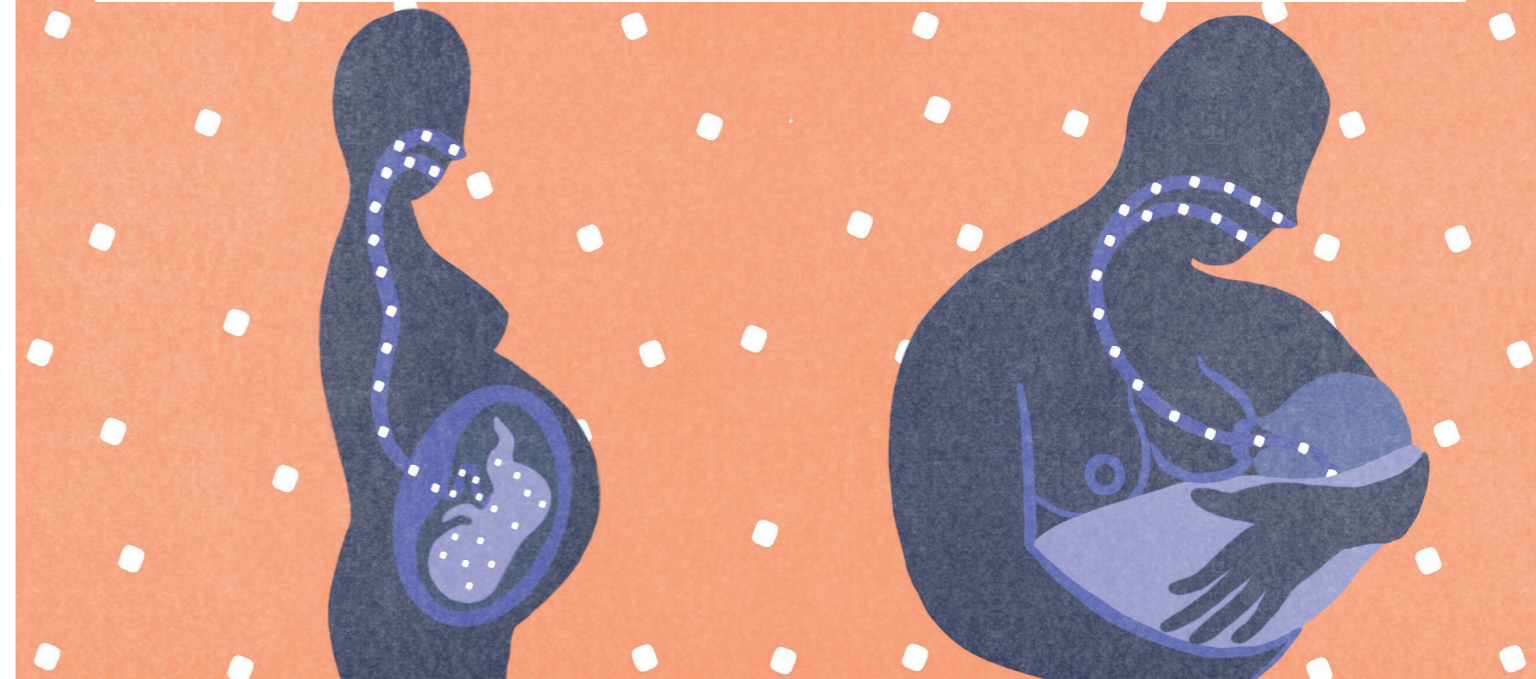
Rising temperatures also increase the rate of infectious diseases, such as malaria and Zika virus, leading to increased risk of infection in humans.



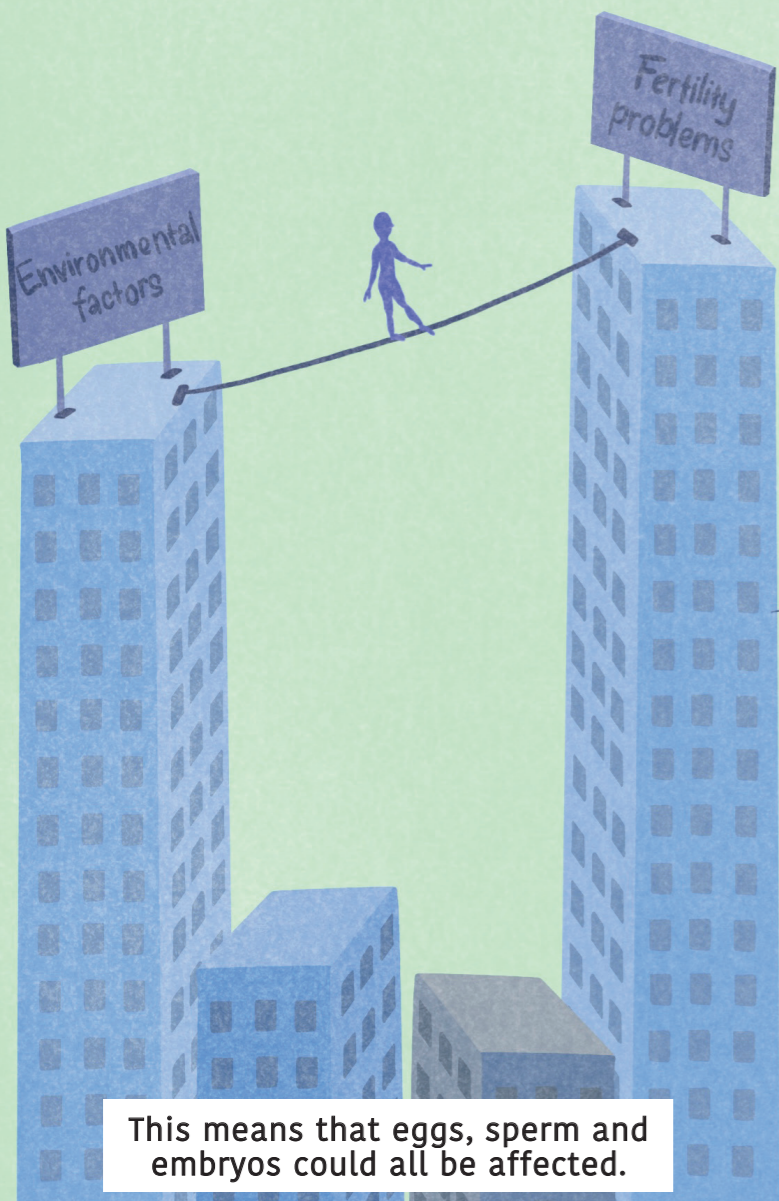
But how is our reproductive function affected by our environment and these chemicals we are exposed to? Some of the chemicals found in pollution can affect our reproductive hormones specifically. These are called endocrine-disruptors and can last a long time in our environment and in our bodies. They are sometimes known as forever chemicals.



Microplastics are small enough to pass into our bloodstream. These can cross into our reproductive organs and the placenta, which feeds a growing fetus in a pregnant mother. Microplastics have also been found in breast milk and testes.



In humans, studies are showing that the higher your exposure to these environmental factors, the higher your risk of having problems with fertility, reproductive health and pregnancy.



This means that eggs, sperm and embryos could all be affected.

The changes seen in human reproduction are also happening in both domestic and wild animals.



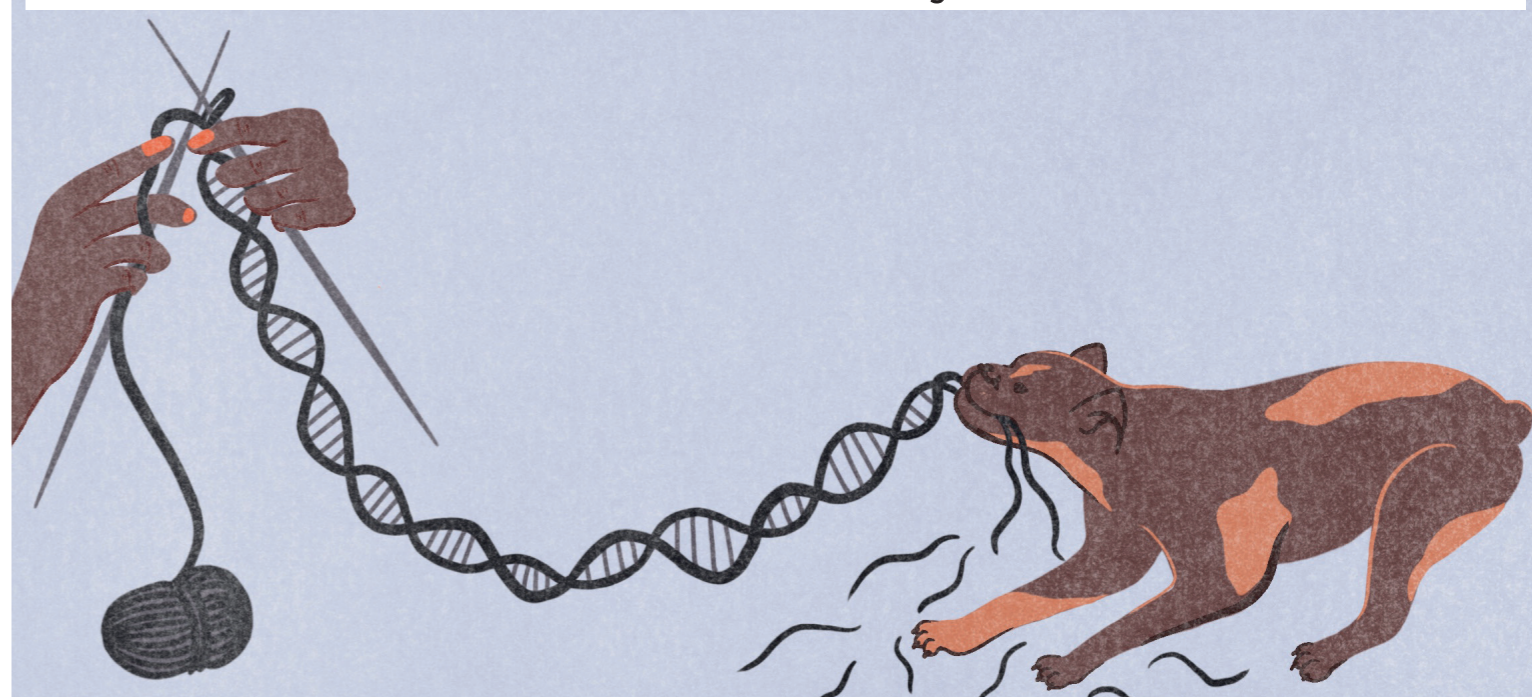
Scientists have run carefully designed experiments to understand how environmental exposures may impact our reproductive health and fertility. One of these studies has found that the sperm quality of guide dogs has declined over the last 25 or more years.



These scientists discovered environmental pollutants in the testes and sperm of these dogs.



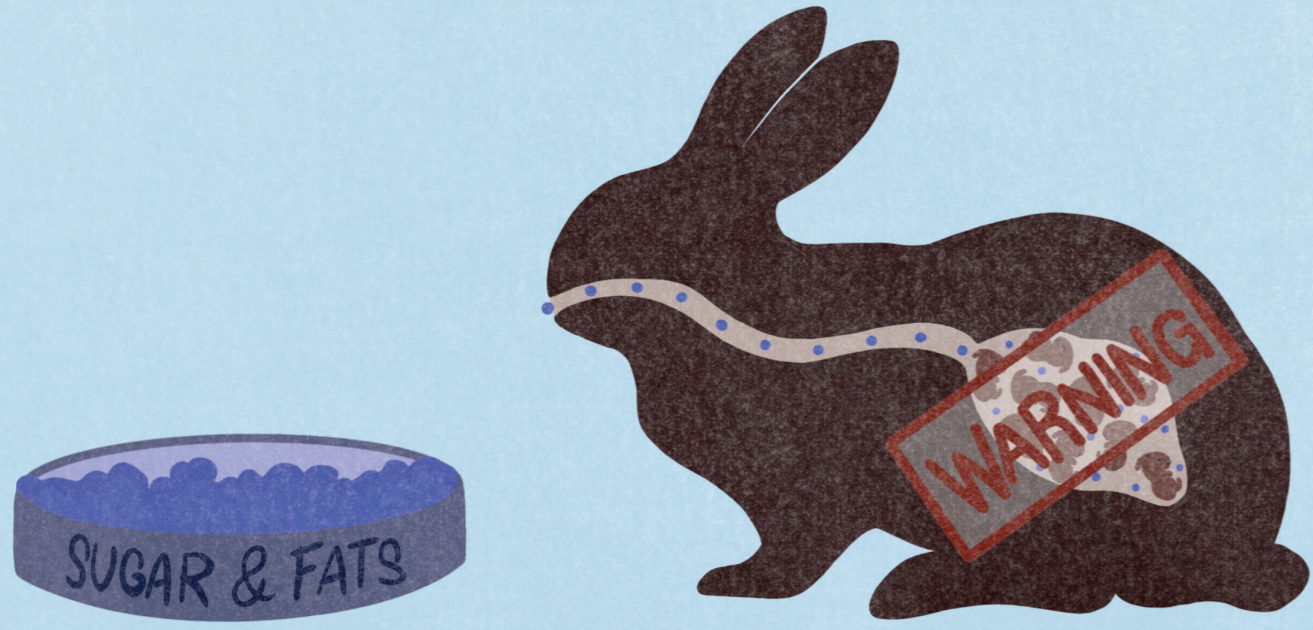
When they added these chemicals to sperm in the lab, it reduced sperm quality and motility and caused DNA damage.



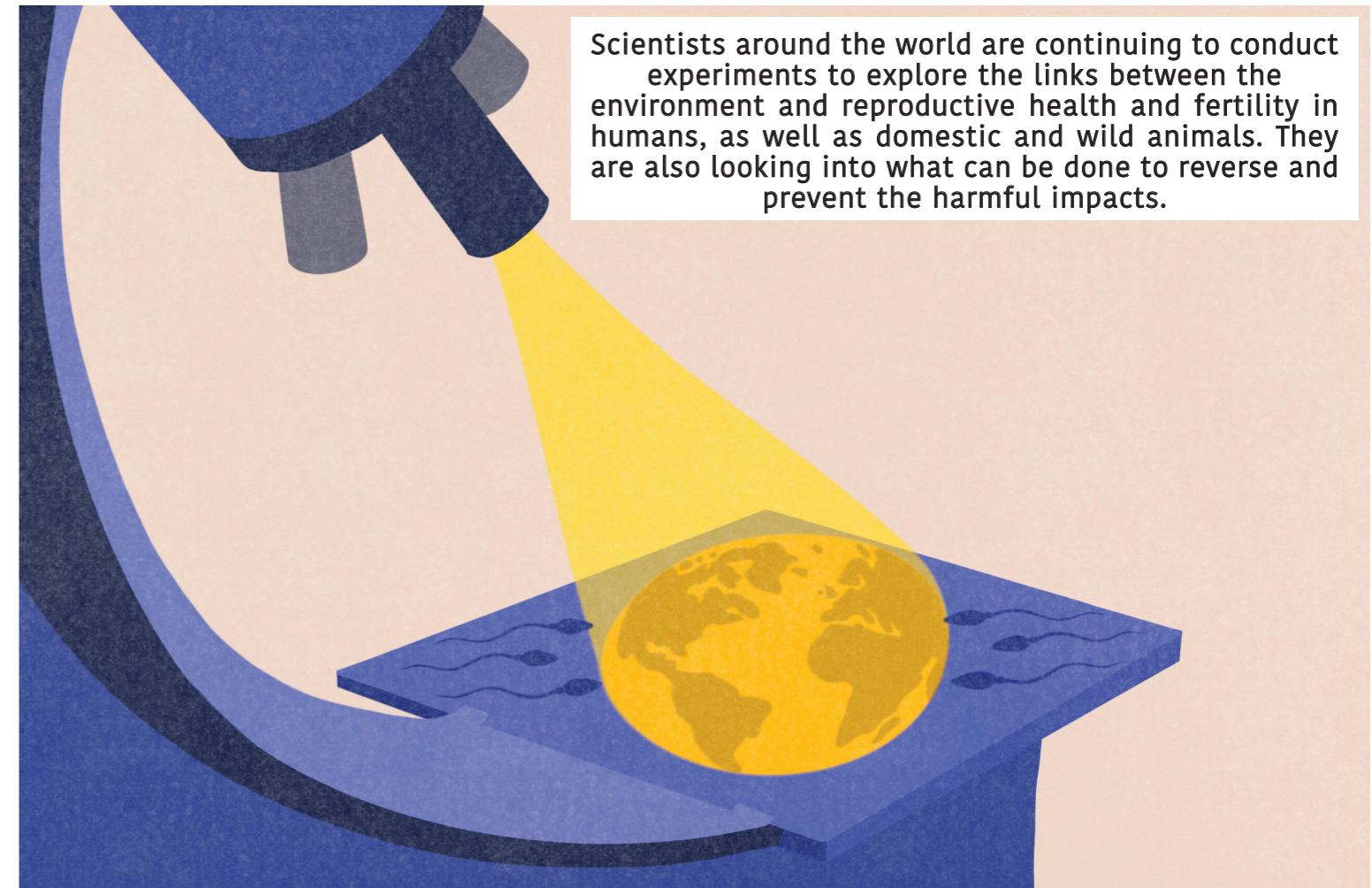
Scientists have found that many chemicals in the environment have the potential to affect development and function of the testes with consequences for sperm production and quality.



The foods that we now eat can also affect our bodies. Mounting evidence from animals such as mice, rats and rabbits suggest that eating diets high in processed sugars or saturated fats have a negative effect on egg number and quality, sperm quality, ability to get pregnant, as well as the health of a baby.



Scientists around the world are continuing to conduct experiments to explore the links between the environment and reproductive health and fertility in humans, as well as domestic and wild animals. They are also looking into what can be done to reverse and prevent the harmful impacts.



When eggs are grown in the lab with high concentrations of saturated fats, they become damaged and they are harder to fertilise and form an embryo.



Although we don't know the extent to which our changing world and lifestyle affects us, we do know that switching to a healthier diet can improve our reproductive health.



This is very important due to the effects that climate change is having on animal habitats and ecosystems, putting them at increasing risk of extinction.



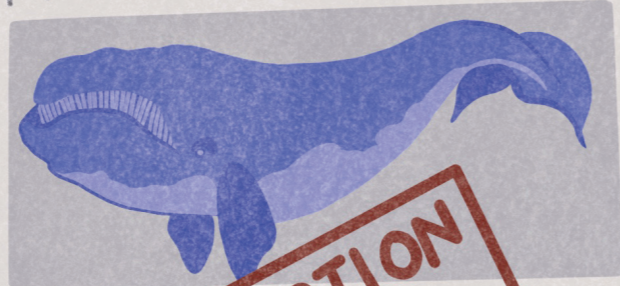
The changes in the environments animals live in seem to be having an effect on their ability to reproduce.

For instance, warming seas are leading to fewer male turtles being born. This is having an impact on the ability of the species to reproduce.



The North Atlantic whale is on the brink of extinction, with an estimated 336 individual animals remaining, the lowest count in 20 years.

Animal profile: North Atlantic Whale
Population: 336 Individuals



EXTINCTION RISK



So what can we do to change this?

Some things that we can consider are eating healthier diets, growing our own produce, switching to renewable energies, exercising more, planting new habitats for our wildlife, recycling and avoiding using single use plastics.



Look after the planet and its ecosystems, look after our animal friends, and look after our bodies for ourselves and future generations.



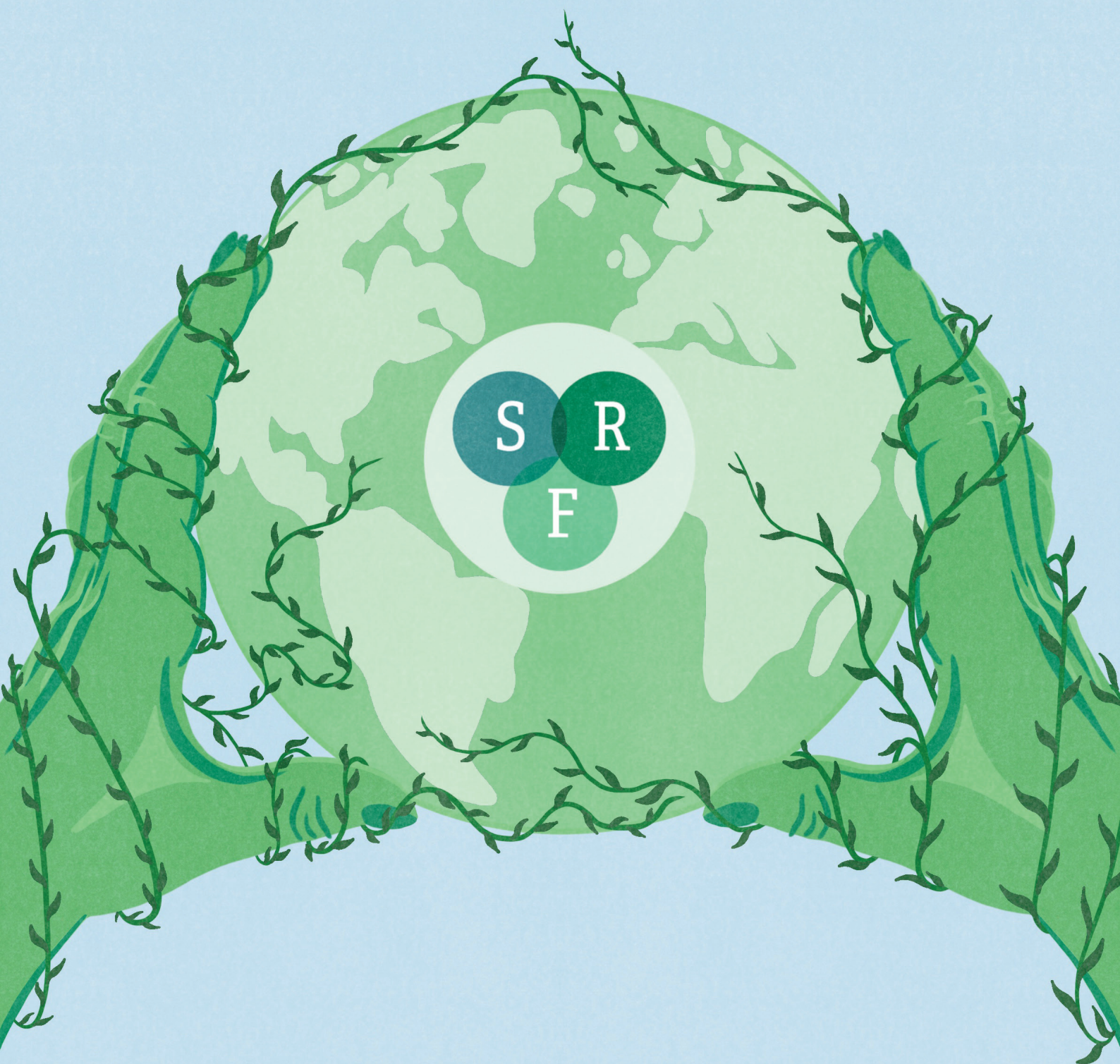
If we work together, we can look forward to a brighter future for all.



Don't be afraid to help make a change: educate yourself about the topic, talk to your friends, talk to your local MP or even do the experiments yourself and become a scientist. Follow the SRF.

- Educate yourself
- Talk to your local MP
- Talk to your friends
- Become a scientist
- Follow the Society of Reproduction & Fertility

Thank you for taking the first step to educate yourself by reading this book.
Thanks for helping us to create a brighter future for us all and the generations to come.



Cover design and artwork by Imogen Harris
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