

**BLACK  
LIVES  
MATTER**

**TOGETHER**

**WE**



**CAN**

WRITTEN BY  
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ILLUSTRATED  
BY THE TEAM AT **MUTI**

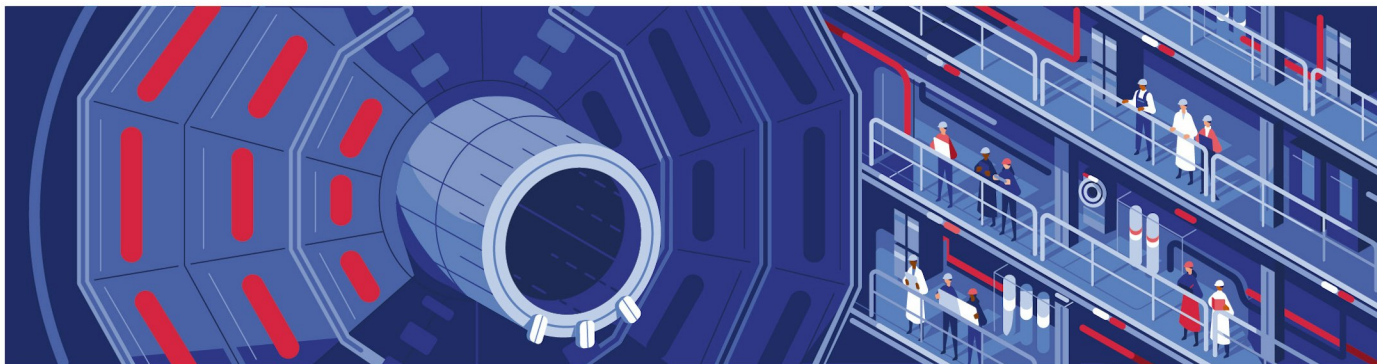
**40**

**INSPIRATIONAL STORIES  
ABOUT WHAT HUMANS  
CAN ACHIEVE WHEN  
WE WORK AS A TEAM**

**SKOLSTREJK  
FOR  
KLIMATET**

**GIVE US THE VOTE**





## SCIENCE

# CERN AND THE LARGE HADRON COLLIDER

CERN (Conseil Européen pour la Recherche Nucléaire) is the European Organisation for Nuclear Research. It is an international scientific research organisation for the study of high-energy particle physics. There is a huge CERN laboratory on the border between France and Switzerland which brings thousands of scientists from all over the world together to collaborate on groundbreaking

scientific research. Over 12,500 scientists of more than 110 nationalities collaborate at CERN.

CERN promotes the Open Science movement, which aims to make scientific research accessible to everyone. This means that all publications by CERN authors can be accessed by anyone, and the data and software are also available.

Sharing research means that scientists all around the world can collaborate and build on each other's work.

CERN is the home of the Large Hadron Collider, which is the largest and most powerful particle accelerator in the world. It cost around \$10 billion to create. It is a 27-km (17-mile) ring of superconducting magnets,

which is big enough to circle the entire city of Geneva. It works by creating two beams of energy, then firing them at each other at nearly the speed of light. When the beams hit each other, tiny subatomic particles smash into each other and break apart, which gives scientists a glimpse of the building blocks of creation. It's incredibly difficult work, as the particles involved are so small. It's the equivalent of firing two needles 10 km (6 miles) away from each other and making them hit in the middle. The Large Hadron Collider has a special cryogenic cooling system to keep it at  $-271.3^{\circ}\text{C}$  ( $-456.34^{\circ}\text{F}$ ), which

means that it is colder than outer space.

The Large Hadron Collider was able to confirm the existence of the Higgs boson. The Higgs boson is a fundamental particle associated with the Higgs field, which gives mass to other particles. The Large Hadron Collider is the only place in the world where Higgs bosons can be studied. Previously, scientists had predicted the existence of these particles, but we did not have the equipment to study them. It's a very important piece of scientific discovery and helps us understand not only the past, but also the future of our

universe. Hundreds of scientists, engineers and programmers worked together on the Large Hadron Collider to make this scientific feat possible.

While it is one of the most important pieces of scientific research to have ever been attempted, the Large Hadron Collider is still at the mercy of outside influences. Animals have managed to damage the Collider twice. In 2016 a weasel chewed through electrical wiring which meant the power had to stop, and there was another power outage in 2009 when a bird dropped a bit of baguette onto electrical equipment!



## HUMAN GENOME PROJECT

Genome is the name for all our genetic information. It is the blueprint that contains the information about who we are and how we are made. Genes are made up of DNA (see page 16 for the discovery of DNA) and all our genes together are known as our genome. Your DNA is about 99.9 percent the same as any other human being, so the difference in genomes is very subtle. The Human Genome Project was a massive, international collaborative research programme which

allowed scientists to read and understand the complete genetic instruction manual for a human being for the first time. When the first sequence was shared in June 2000, the US President, Bill Clinton, called it 'the most important, most wondrous map ever produced by humankind.'

The Human Genome Project began in 1990 and was set up in the National Centre for Human Genome Research in the US. However, the actual work of

studying and sequencing DNA took place at universities and research centres all over the world, with researchers from the US, UK, France, Germany, Japan and China all sharing results. It took 13 years and nearly \$3 billion to put the map of a human together.

Francis Collins, who was the director of the National Human Genome Research Institute, said that mapping the genome is like reading a book. He explained, 'It's a history book.

A narrative of the journey of our species through time. It's a shop manual, with an incredibly detailed blueprint for building every human cell. And it's a transformative textbook of medicine, with insights that will give health care providers immense new powers to treat, prevent and cure disease.'

The way that the information about the genome is shared is almost as important as the work itself. The Human Genome Project is not owned by anyone,

and every part of the genome that was sequenced was made public as soon as it was found, with new information about the genome posted almost every day. When the project began, sharing data before the results were published wasn't the normal way for scientists to operate, and this project showed the benefits of scientific collaboration and information sharing.

The Human Genome Project has been incredibly important

in the fight against COVID-19. Thanks to work completed as part of the project, it is relatively easy to map the sequence of a virus and to track it. This also means scientists can follow how a virus spreads and evolves, and see why it affects some people differently to others. Knowledge of the human genome has also meant huge advances in other areas, including the study of cancer, diabetes and migraines.

## MEDICINE



## CONSERVATION AND RESCUE

# THE 2010 COPIAPÓ MINING ACCIDENT

On 5 August 2010 there was a catastrophic cave-in at the San José copper-gold mine near Copiapó in northern Chile. The collapse trapped 33 men underground, nearly 5 km (3 miles) from the mine's entrance and 700 m (2,300 ft) underground. The story of how these men were saved is about teamwork, cooperation and unity in the face of great danger.

At first, no-one knew what had happened to the miners after the cave-in, so rescue teams drilled holes into the mine to see if they could reach any survivors. Seventeen days after the accident when one of the drill bits was pulled back, it had a note attached to it, saying, 'We are well in the shelter, the 33.'

The 33 miners survived because they came together and worked as a disciplined and organised team. There were people of different ages, the youngest was Jimmy Sanchez, who was only 19 at the time, and the oldest was 59-year-old Mario Gomez, so they all took different roles. They divided themselves into three eight-hour shifts, with different teams taking responsibility for sanitation,

preventing further rockfalls and environmental safety.

The miners had limited supplies and had been living on two mouthfuls of tuna and a sip of milk a day, with a few bites of cracker every other day. Each miner lost about 9 kg (20 lb) and became dangerously dehydrated. Once the miners were located, rescue teams could start to send down food, but they had to be careful that the miners did not put on too much weight, as they were about to be pulled out from under the earth.

Every part of the Chilean government began working on rescuing the trapped miners and they also called in NASA's Engineering and Safety Centre to help. The NASA team built two special capsules to lower into the mine, called Fenix 1 and Fenix 2. The capsules were long and thin, 4-m (13-ft) tall but only 53 cm (21 in) in diameter, because they had to navigate through very tight spaces. The capsule was fitted with audio and video links, an emergency oxygen supply and heart rate monitors. The aim was to bring the miners to the

surface as quickly and safely as possible. The capsules even had trapdoors at the bottom in case the capsule got stuck and the miners needed to escape. Three different drilling rig teams drilled into the mine to make a hole big enough to rescue the miners, but they had to be very careful not to cause another cave-in.

On 13 October 2010, with the whole world watching, a rescue was attempted. The Fenix 2 capsule was lowered into the hole, a miner was strapped in, then it was pulled to the surface. Each trip took between 10 and 15 minutes. One by one, the miners were pulled to the surface after 69 days underground. 5.3 million people worldwide watched as the last man, crew foreman Luis Urzúa, was pulled up, completing the rescue. Amazingly, all 33 miners were in good health when they were pulled out as they had worked together to stay alive in the most difficult conditions.



## POLITICS AND ACTIVISM

# CLIMATE CHANGE ACTIVISM

The dangers of climate change are beyond debate. The temperature of the Earth

is rising and globally we must reduce the amount of carbon released into the atmosphere. Climate change activism takes the form of direct protest, education and political activism. There are many different activist groups who have been working to encourage meaningful action on climate change.

The School Strike for Climate is an international youth movement which demands that political leaders take action to prevent climate change. Also known as Fridays For Future, school students skip classes on

Fridays to raise awareness for the cause. The School Strike movement came to international attention in August 2018 when 15-year-old Swedish pupil Greta Thunberg held a protest outside the Swedish parliament. The movement grew and in 2019 millions of people took part in the largest climate strikes in history. Thousands of scientists have signed a letter supporting the school strikes, writing 'concerns of young protesters are justified [...] and supported by the best available science.'

Tackling climate change means making political changes and the Sunrise Movement is an American political action organisation committed to

making these changes. The Sunrise Movement works to elect politicians who will back renewable and cleaner energy sources. The movement has organised sit-ins in various politicians' offices, where activists have demanded that politicians stop taking money from companies that create fossil fuels. The Sunrise Movement is fighting for a Green New Deal, a piece of legislation designed to tackle the climate crisis, create millions of clean jobs and help the communities most affected by the climate crisis.

Coming together as part of a global movement for climate action also means thinking

about our own personal choices. Things like the food we eat, how we travel and the products we buy all affect the environment. Big changes, like living without a car, reducing the amount of plane journeys we take, buying more sustainable products and moving to a plant-based diet can have a big impact. However, these personal changes must be accompanied by action from big businesses and governments.

Although the reality of climate change can make it seem like an enormous and scary topic

with no solution in sight, the huge levels of activism and demand for action are incredible. Politicians and corporations are starting to listen to a new generation of young climate change activists. As the Global Climate Strike team puts it, 'There is hope in the leadership of our young people, in our collective power and in our unwavering faith in justice.'