



OPEN TO THE WORLD

A part of the global
scientific community

The Francis Crick Institute
Annual Review 2019/20

**Science often relies on partnerships,
as we have seen during the
extraordinary events of this year.**

*Sir Paul Nurse
Director of the Francis Crick Institute*



INTRODUCTION FROM PAUL NURSE

Welcome to our annual review for 2019/20, where we are highlighting some of the ways we are strengthening our global connections and promoting international collaboration.

Science often relies on partnerships, as we have seen during the extraordinary events of this year.

The UK's exit from the EU underlined the need for the UK science community to reinforce its international links, while the

COVID-19 pandemic has shown how much science can achieve when we work towards a common goal.

Sir Paul Nurse
Director of the
Francis Crick Institute

ABOUT THE CRICK

The Crick is a place for collaboration, innovation and exploration. We are a biomedical research institute that aims to break down the barriers between disciplines; a space where some of the most talented and ambitious scientists in the world can pursue imaginative and bold ideas.

We support our scientists in a stimulating environment, fostering excellence with state-of-the-art infrastructure and a creative and curious culture. We are tolerant of risk and undertake unusual, pioneering research that answers fundamental questions about human health and disease. And we aim to bridge the gap between research and application to ensure our discoveries change lives for the better.

We have five strategic priorities:

- **Pursue discovery without boundaries**
- **Create future science leaders**
- **Collaborate creatively to advance UK science and innovation**
- **Accelerate translation for health and wealth**
- **Engage and inspire the public**



FOUNDING PARTNERS



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RESEARCH HIGHLIGHTS

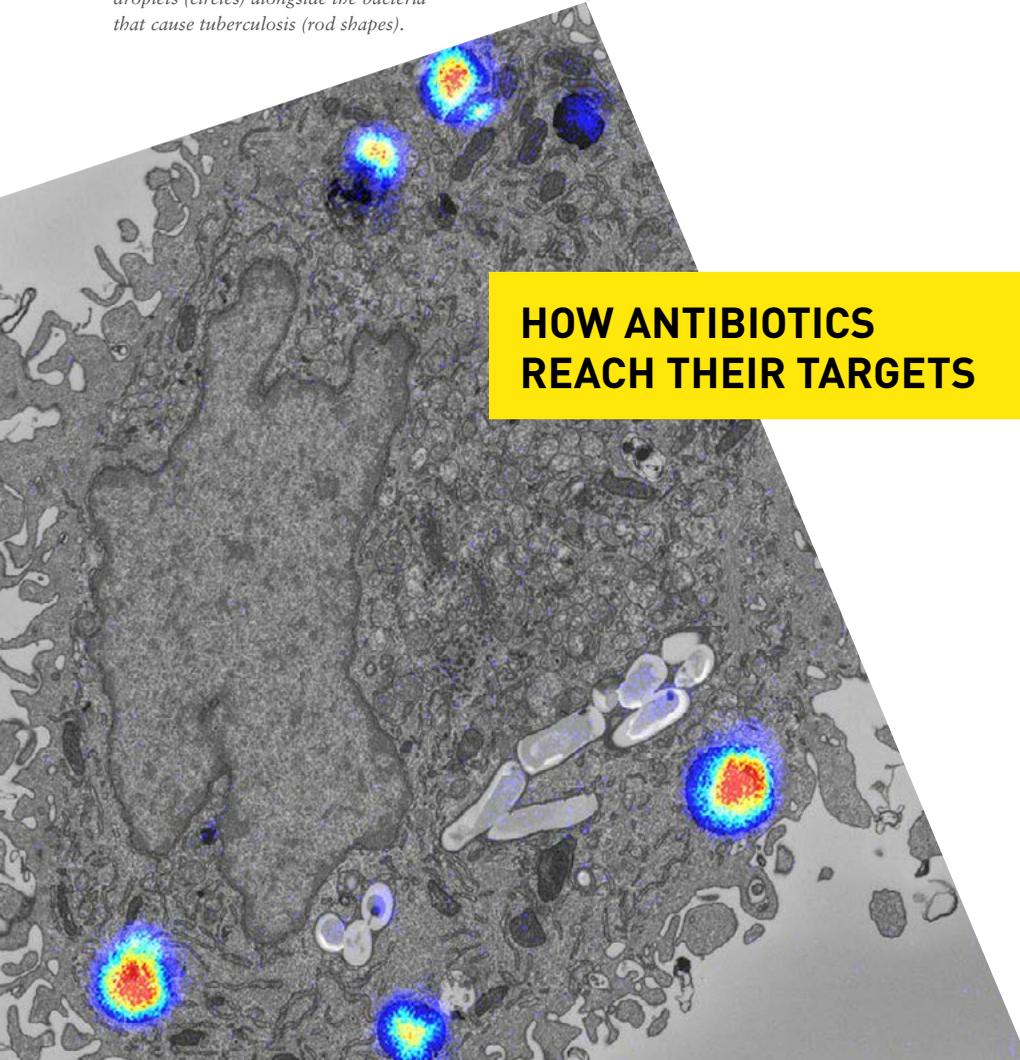
Over the past year, Crick researchers have worked towards solving hundreds of unanswered questions about health and disease.

The antibiotic bedaquiline forms lipid droplets (circles) alongside the bacteria that cause tuberculosis (rod shapes).

HOW ANTIBIOTICS REACH THEIR TARGETS

A team from Max Gutierrez's group at the Crick, the University of Western Australia, and GSK developed a new imaging method and used it to examine how the antibiotic bedaquiline moves inside cells to fight tuberculosis.

By seeing how the antibiotic behaves, they were able to identify a group of compounds that could be used in tuberculosis treatments in the future.



HOW OUR IMMUNE SYSTEMS RESPOND TO INFECTIONS

A large collaborative project, led by Adrian Hayday, developed a high-throughput platform that combines monitoring of the immune system with genetic screening to discover how variations

that we inherit can affect how our immune systems respond to infections.

It identified over 100 genes that regulate the immune system, most of which were never previously linked to immunology, opening new directions for study.

HOW CELLS' SIZE AFFECTS THEIR FATE

Nathan Goehring's group found that cells in nematode worm embryos can detect their own size, and use that information to determine how they divide and grow.

The team saw that when a particular set of cells get below a certain size, they stop dividing asymmetrically and start dividing symmetrically. Unlike the typical case in which cells base their physical form on their function, this work shows that a cell's physical form can define its function.

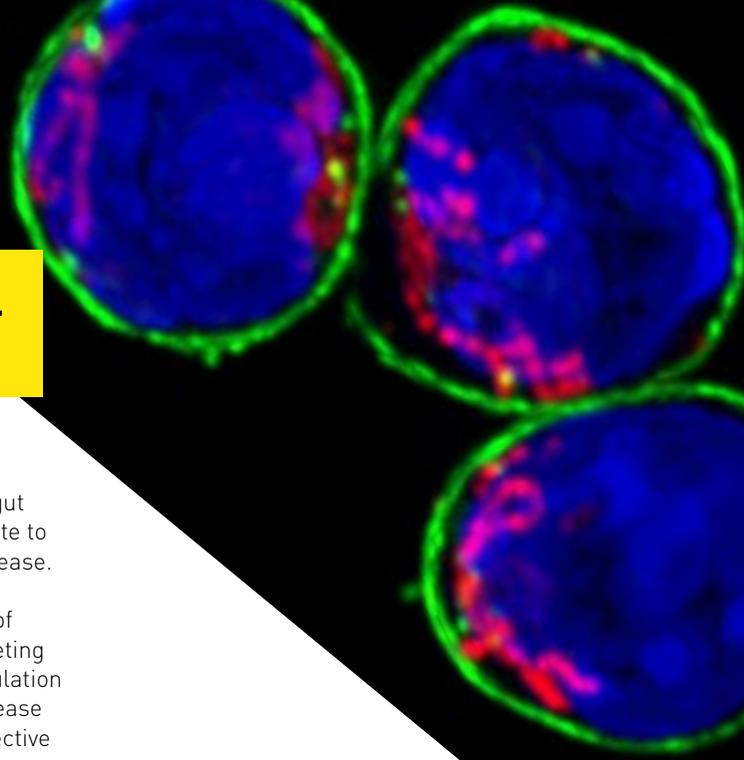
HOW CANCER EVOLVES

The Crick's Peter Van Loo is part of the Pan-Cancer Analysis of Whole Genomes consortium, a large international group of researchers studying the genetic makeup of thousands of cancers to find patterns in how cancer evolves over time.

Working with the European Bioinformatics Institute, Peter's group looked at 47 million genetic changes in 2,500 tumours to show that there could be signs of cancer years before diagnosis. Developing tests for these genetic signs could provide new ways to spot cancer earlier.



*Th17 immune cells
from the gut of a
healthy mouse.*



HOW TO TELL INTESTINAL T CELL 'FRIENDS' FROM 'ENEMIES'

A team from Gitta Stockinger's and Max Gutierrez's groups at the Crick discovered that immune cells in the gut called Th17 exist in two different forms.

As 'friends' they maintain normal gut health, but as 'enemies' they can cause gut inflammation and contribute to conditions like Crohn's disease. Identifying the differences between these two forms of Th17 cells could help targeting the 'enemy' Th17 cell population in inflammatory bowel disease whilst preserving the protective Th17 cells.

HOW CELLS SENSE OXYGEN LEVELS

A collaboration between researchers in the UK and Italy, led by the Crick's Peter Ratcliffe, found an enzyme in humans that senses the oxygen level in cells.

Hypoxia, the state a cell enters when it is deprived of oxygen, occurs in a range of diseases including cancer. Knowing how our bodies detect a lack of oxygen could reveal new ways to treat these diseases.

HOW HIV DEVELOPS RESISTANCE

Researchers in Peter Cherepanov's group discovered how HIV develops resistance to a widely-prescribed group of drugs - strand transfer inhibitors.

The team used an ultra-low temperature, high resolution imaging technique, called cryo-electron microscopy, to study how the drugs bind with the intasome, the part of the virus that the drugs target. This let the researchers spot the weakness in the interaction that allows HIV to develop and become resistant to treatment.

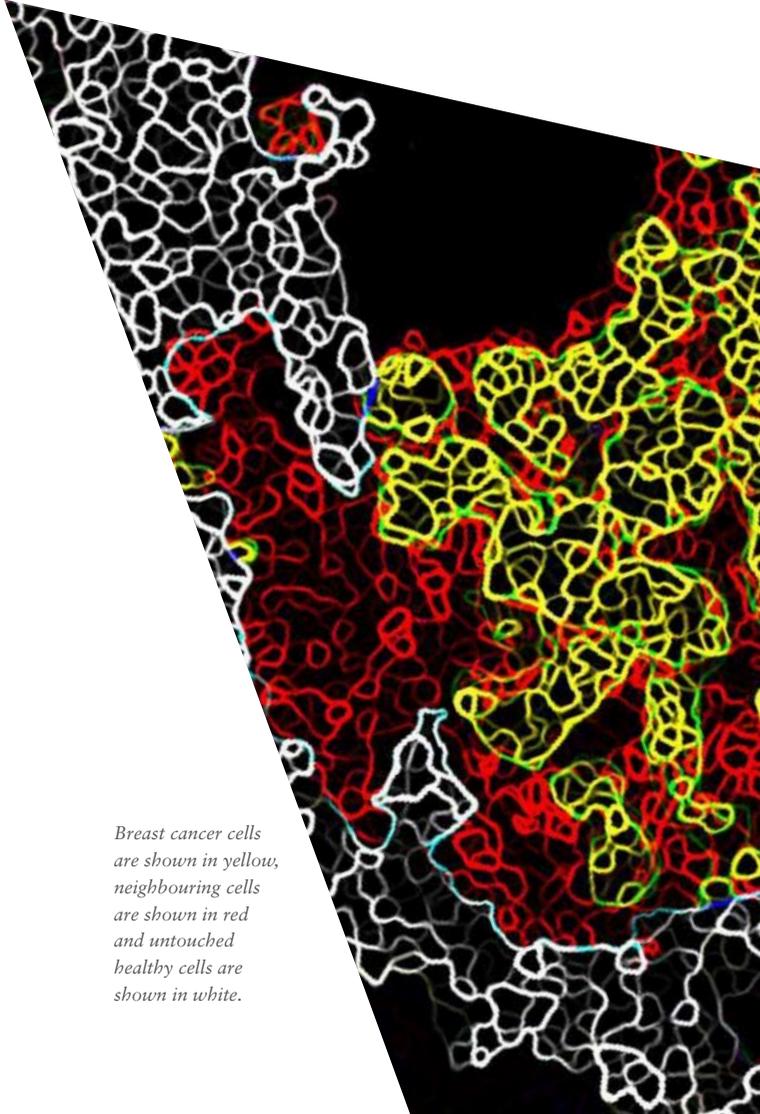
We found that by corrupting its neighbours, cancer transforms its local environment to support its own survival.

Ilaria Malanchi, Group Leader

HOW CANCER HIJACKS ITS NEIGHBOURS

Researchers from Ilaria Malanchi's group at the Crick found that cancer cells 'corrupt' the healthy cells around them and cause them to become more like stem cells, activating regeneration in the area and helping the cancer grow.

The discovery was made using a new technique developed to study the area around a tumour – called the tumour microenvironment – and means that we now know about another part of the cancer lifecycle that could be targeted by treatments.



Breast cancer cells are shown in yellow, neighbouring cells are shown in red and untouched healthy cells are shown in white.

HOW DNA PREPARES FOR REPLICATION

Two teams at the Crick, led by **Alessandro Costa** and **John Diffley**, collaborated to use **cryo-electron microscopy techniques** to visualise the series of molecular events that prepare DNA for replication.

The work explained how bidirectional symmetry is established in DNA replication.

By drawing on different teams at the Crick and internationally, we were able to combine expertise.

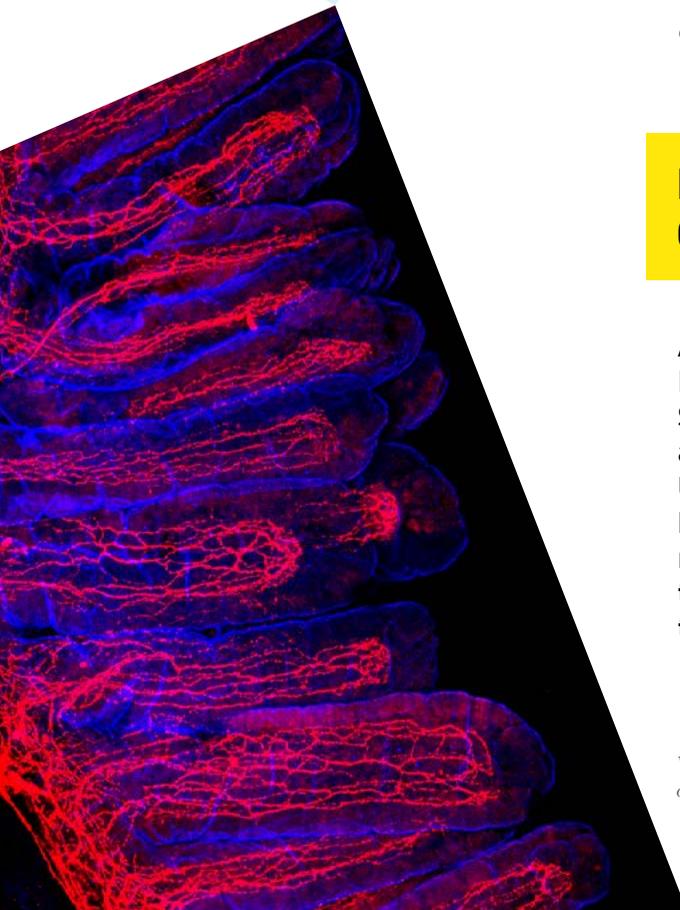
Gitta Stockinger, Group Leader

HOW GUT BACTERIA CONTROL THE COLON

A team from Vassilis Pachnis's and Gitta Stockinger's groups at the Crick, and Bern University, discovered how gut bacteria can regulate the function of the nerves that control the muscles of the colon.

The researchers found that gut bacteria are necessary to activate a specific gene in nerve cells, which in turn signals to the muscles to push the colon contents along. This work helps us understand how the gut and nerve cells communicate to control intestinal function. It could also explain why people on antibiotics, which reduce the amount of bacteria in the gut, can suffer from intestinal problems.

Villi in the lining of the gut.



OUR RESPONSE TO THE COVID-19 PANDEMIC

Our scientists have worked in partnership with local hospitals, labs across the UK, and researchers around the world to help tackle the coronavirus pandemic.

We rapidly set up a COVID testing facility to boost the UK's ability to test frontline healthcare staff and are using our expertise and facilities to understand the virus and its effect on patients.

Our research into COVID-19 and SARS-CoV-2 focuses on five areas where we are able to help the most:

- **How can we compare and improve testing methods?**
- **Why are some cases so much worse than others?**
- **How does the virus interact with our cells?**
- **How does the virus move through the population?**
- **How is the virus affecting people who are already ill?**

Check www.crick.ac.uk/covid19 for the latest updates on our response to the pandemic.

Samples from cancer patients with suspected or confirmed COVID-19 are studied by Samra Turajlic's group to examine how the two diseases interact.



HIGHLIGHTS FROM THE YEAR

In October 2019, our director of clinical research, Peter Ratcliffe, was awarded the Nobel Prize in Physiology or Medicine for his work on hypoxia, the state that cells enter when they're starved of oxygen. He shared the prize with Dana-Farber Cancer Institute's William Kaelin and Johns Hopkins University's Gregg Semenza.

We work closely with similar organisations around the world to share knowledge. In 2019, we helped establish the BRIDGE Network, a global group of institutes that combine basic research with PhD student training. Our academic training team are part of the International PhD Coordinators Group, where biomedical research institutes across Europe work together to provide the best support and training for their students.

In November 2019, we received a Bronze Athena SWAN award in recognition of our work to support equality of opportunity and promote diversity.

We wrapped up our Craft & Graft: Making Science Happen exhibition in February, after 11 months and more than 25,000 visitors. Craft & Graft highlighted the work of the technicians, engineers and specialists who work behind the scenes to keep the Crick running.

We launched our online alumni network CrickConnect in 2019, building a community of people around the world who have been a part of the Crick during their career. More than 800 people from 30 countries have signed up.

*Sir Peter Ratcliffe,
Director of Clinical
Research and 2019
Nobel Laureate.*





We welcomed 72 new PhD students from 19 countries.

The President of Colombia visited the Crick in June 2019 to speak to some of the Crick's Colombian researchers about their work and discuss the importance of effective international collaboration for scientific research.

We actively campaigned for an immigration system that supports the future of UK science and welcomes researchers at all career stages. Crick researchers with experience of the current immigration system took part in parliamentary hearings and media interviews to show policymakers how the UK can remain an attractive place to do science.

The second cohort of companies graduated from KQ Labs, our 16-week accelerator programme for promising data-driven health start-ups. The programme gives early-stage companies funding, skills and guidance. Funded by Wellcome, it supported 10 companies from around the UK.

Nine new group leaders joined the Crick this year. Four of them have set up their first research group at the Crick and five are joining the Crick on secondment from one of our partner universities. Our newest group leaders bring expertise from studying and leading research around the world.

The Crick African Network, a programme funded by UKRI's Global Challenges Research Fund that offers postdoctoral fellowships for African researchers, has now awarded 17 fellowships. The fellows will be dividing their time between the Crick and an African partner institute, studying a range of diseases that disproportionately affect Africa, including tuberculosis, HIV and malaria.

Crick African Network fellows at the first annual meeting.



We held two 'Medicine at the Crick' events. These half-day events bring together Crick researchers and clinicians to discuss the impact that current research will have on patients, with local, national and international speakers.

Clinical group leader Rickie Patani launched CrickMed, a programme that takes Crick group leaders into hospitals to work with clinicians and learn more about how their work can be translated to medical advances for patients.

Our PhD students have been making all-important international connections at the beginning of their research careers. We launched our partnership with the European Molecular Biology Laboratory

through a PhD student conference in November 2019. In June 2019, Crick researchers attended the International Student Cancer Conference in Amsterdam, meeting peers from institutes across Europe.

WORKING WITH OUR LOCAL COMMUNITY



16,000

local school students engaged with our education programme.



7,000

people took part in local health programmes supported by our community fund.



93

work experience students spent time at the Crick.



SUPPORT US

The Crick is a registered charity that partners with Cancer Research UK to fundraise effectively. We rely on grants and donations from our generous funders and donors to maintain and sustain our work.

To learn more about how you can support our vision to translate discoveries into new ways to prevent, diagnose and treat diseases please visit www.crick.ac.uk/support-us

Want to work with us?

To find out more about the Francis Crick Institute, visit our website at www.crick.ac.uk or contact us:

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