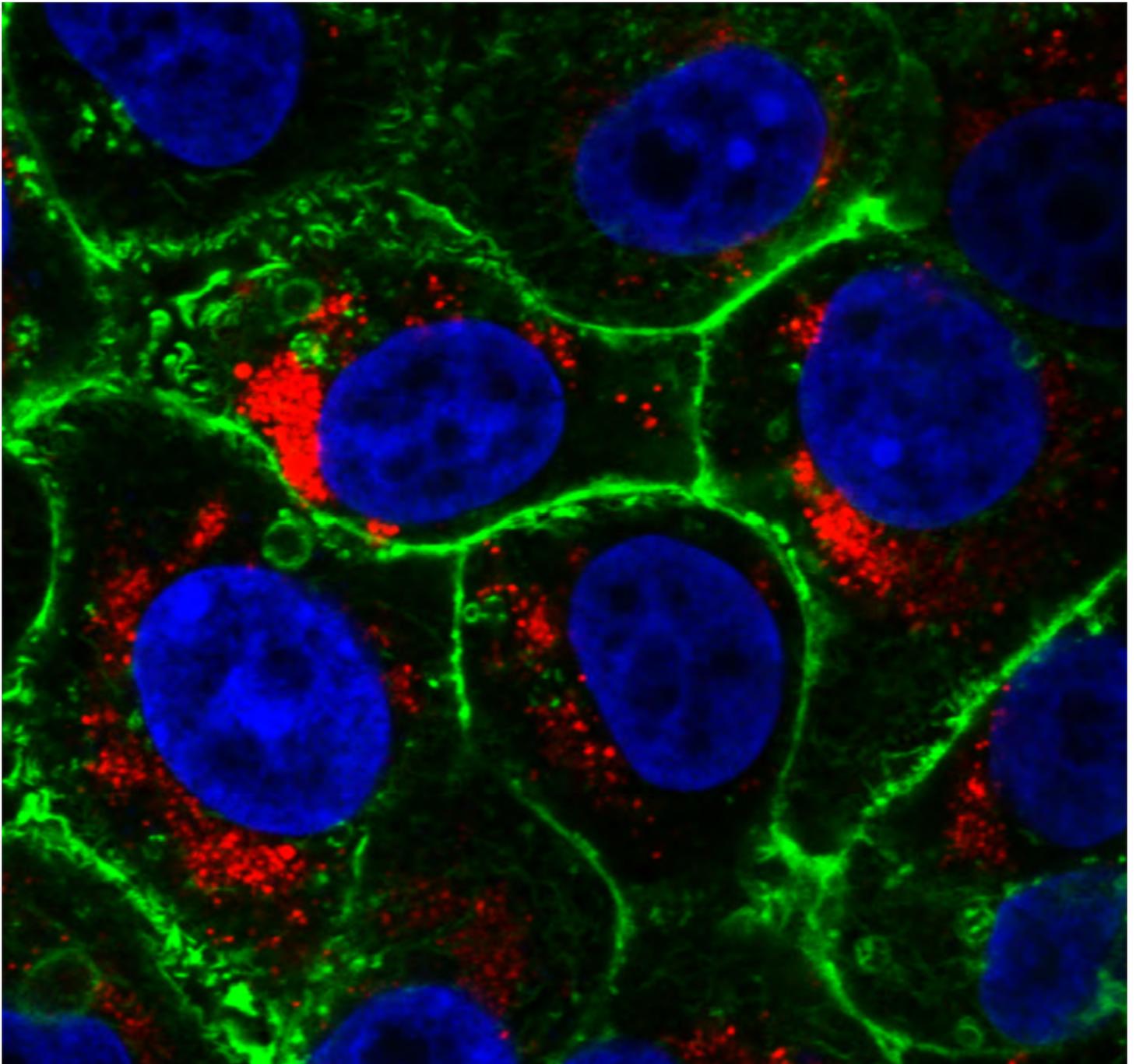


ANNUAL REPORT AND ACCOUNTS FOR THE YEAR ENDED 31 MARCH 2021

REGISTERED CHARITY NUMBER: 228824 / REGISTERED COMPANY NUMBER: 00559784



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Cover image: Confocal microscope image of cells in culture infected with SARS-CoV-2. Host cell components are stained in blue (nuclei) and green (actin cytoskeleton), red labelling indicates infected cells.
Credit: Nicole Doyle (Nidovirus-Cell Interactions), Dagmara Bialy (CL3 Virology), The Pirbright Institute.

Inside front image: Image shows cholesterol (blue) and MDV glycoprotein B (green) in infected cells in the presence of a cholesterol inhibitor. Nuclei are shown in white.

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FOREWORD BY THE CHAIR OF TRUSTEES



I am delighted to present the Trustees' Report incorporating the Strategic Report for the year 1 April 2020 to 31 March 2021.

The COVID-19 pandemic has provided challenges for UK and global communities. No other period in recent times has highlighted so powerfully the importance of science in preventing and controlling viral diseases. This is the purpose for which Pirbright exists and whilst the focus of the Institute is on viruses that affect livestock, I am justly proud of the Institute's role in helping to identify and control COVID-19. This includes vaccine testing, providing diagnostic tools and expertise to NHS laboratories, advice and training for the Brants Bridge Lighthouse Laboratory for the NHS Berkshire and Surrey Pathology Service and research to investigate the mechanisms of viral pathogenesis and immunity. It is astonishing to think that in December 2019 we were largely unaware of the emergence of a deadly new coronavirus or that it would spread globally resulting in over 3.9 million deaths¹ (at the time of writing in June 2021) and untold economic and personal hardship.

Yet, just 18 months later, hundreds of millions of people around the world have already been vaccinated with effective vaccines that have been developed and manufactured with unprecedented speed. The pace of scientific research has been astounding and has been critical in detecting, understanding and responding to COVID-19. Advances in genetic sequencing have enabled scientists to map the virus genome and subsequent mutations with exceptional accuracy and speed and then correlate these to changes in the viruses' behaviour. The sharing of scientific knowledge globally has enabled policy makers, public health officials and government to make decisions about how to control its spread and highlighted the key role diagnostics and surveillance play in disease control.

Understanding, detecting and responding to viral diseases are the cornerstones of Pirbright's science strategy. Predicting new emerging diseases is also a key role, making it possible to prepare for rapid and decisive action to stop new viruses spreading. Predicting the next potential pandemic requires investment in research on viruses that 'could emerge' from animals (zoonoses), as well as investing in tackling those viruses that already exist. Preparedness for disease outbreaks has a huge impact on animal and human health as well as food and economic security.

Preventing disease requires detailed scientific knowledge on how a pathogen might emerge, excellent surveillance and diagnostics, as well as the ability to develop treatments and vaccines quickly and efficiently. Working collaboratively with countries where diseases may be more likely to emerge or are already circulating is also important.

I continue to be impressed by Pirbright's critical contribution to the international efforts in preventing and controlling current and emerging diseases in livestock (such as foot-and-mouth disease (FMD)), influenza and African swine fever (ASF). Pirbright currently studies many of the zoonoses that are considered potential threats such as Nipah and Rift Valley fever but will continue to focus its research on highly infectious viral diseases that have the potential to threaten animal health and economic and food security.

All this activity has been achieved through stringent risk management and the implementation of a COVID-19 safe working environment which enabled scientists and essential support services to return to our site. The Board recognises the huge effort Pirbright's staff have made despite the many challenges to keep Pirbright operational and maintaining research impact.

Finally, I would like to acknowledge the generous support from our main sponsor, BBSRC UKRI, in providing funds for Pirbright's state-of-the-art research facilities and strong scientific programmes. We anticipate that this support will continue as we adapt our strategy to rapidly changing threats from virus diseases and move forward to phase three of our site development programme.

Professor John Stephenson
Chair of Trustee Board
The Pirbright Institute



We have developed methods, through the BMGF funded antibody hub, to sequence single cattle B cells. From these sequences we have expressed cattle antibodies, the heavy chain is shown in red and the light chain shown in green. Many cattle antibodies have extended heavy chain protrusions to bind to their targets. Understanding where antibodies bind to the viruses we study will help identify how to develop improved vaccines.

PANDEMIC PREPAREDNESS IS KEY

Dealing with the SARS-CoV-2 pandemic has dominated our lives over the last year. However, like other organisations we have found ways to continue working. During these challenging times we have made significant contributions to the control of the pandemic, delivered our research programmes, kept our site safe and continued to deliver our ambitious infrastructure development programme.

Our staff, collaborators and external contractors have risen to the challenges facing us to ensure everyone is safe and productive. New ways of working have emerged as a consequence of the crisis, some of these changes, such as video conferencing, can improve our efficiency, improve work life balance and reduce travel.

The speed of the spread of SARS-CoV-2 around the globe is testing modern society. There have been a huge number of tragic losses caused by the pandemic, but the response from scientists, industry and governments has by and large been impressive.

The possibility of a global pandemic has been high on the risk register of most countries for many years, especially after the Ebola outbreak in West Africa in 2014. A coronavirus pandemic was also highly probable as coronaviruses do jump between species more readily than some viruses, for example SARS and MERS infections in people and two global epidemics of coronaviruses in pigs in the last 10 years, originating from bats and birds.

Preparing for the next pandemic is vitally important. At Pirbright we will continue to focus on improving our understanding of viruses, how they cause disease and how they transmit between different species. We must also continue to develop diagnostic test and vaccine platforms to control current threats and be ready to adapt those platforms for emerging threats.

The known threats are a major concern and must not be forgotten, there is a huge global burden of animal diseases caused by pathogens that have been largely neglected in low- and middle-income countries, for example, foot-and-mouth disease, African swine fever and bovine tuberculosis. Improving the health of livestock improves human health and welfare and reduces the impact of agriculture on the environment.

Pirbright will continue to concentrate its efforts on finding solutions to the persistent and currently intractable diseases of livestock and prepare for emerging diseases. No organisation can work in isolation and our strategic collaborators in the UK and internationally are essential to bring the very best bioscience and medical science researchers together to find effective solutions to global problems.

Professor Bryan Charleston
Director and CEO
The Pirbright Institute



“Preparing for the next pandemic is vitally important. At Pirbright we will continue to focus on improving our understanding of viruses, how they cause disease and how they transmit between different species.”

PIRBRIGHT'S PERFORMANCE

FOR 2020/21 PIRBRIGHT'S PRINCIPAL OBJECTIVES WERE:

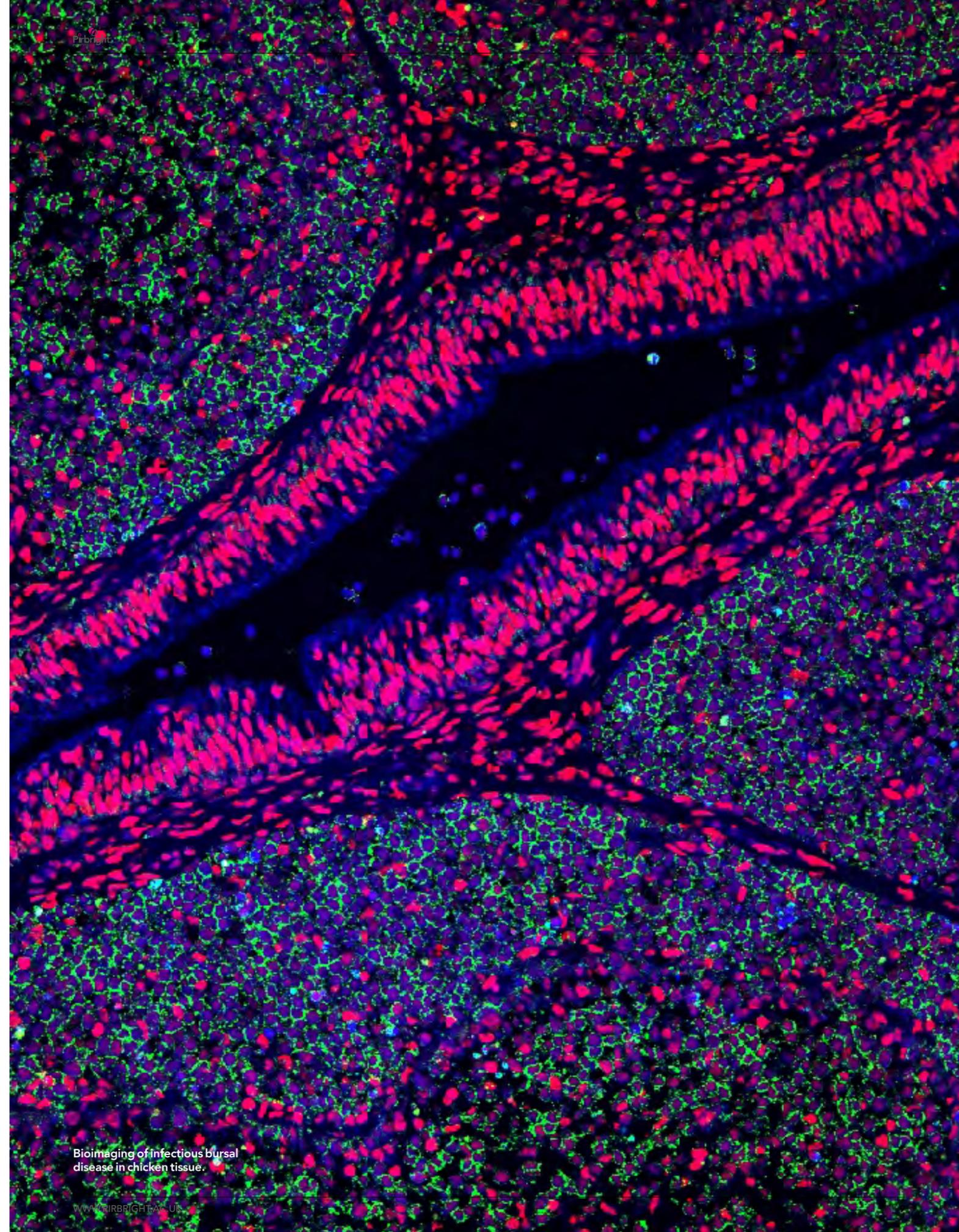
- To continue a world leading research programme by publishing ground-breaking scientific research, winning research funding, and recruiting and retaining the brightest and the best staff and students
- To further develop the Pirbright long term vision of scientific research with impact, in particular enhancing our collaborations with agencies to improve disease control in low- and middle-income countries
- To continue to implement the fully funded development programme to provide additional animal research facilities to study high consequence pathogens. These facilities will further enhance the Institute as a unique National and International capability
- To develop strong strategic collaborations with other global centres of excellence to support the Institute Strategic Programme Grants
- To diversify our funding through greater collaboration with international partners via various new funding opportunities
- To maintain high containment infrastructure, to manage the safety, security, environment and quality risks from our work with high consequence pathogens, and to provide training and expertise to external partners in these areas.

PIRBRIGHT'S KEY PERFORMANCE INDICATORS ARE:

- Publications in relevant scientific journals; being one paper per post doctoral scientist a year
- Success rates for research grant proposals over the next five years; 35 percent in terms of successful applications and 30 percent in terms of value of the awards
- Recruitment and the retention of high quality staff and students; to achieve less than 15 percent annual staff turnover within five years
- Annual research income of £11 million externally won funding each year over the next five years
- Compliance with all statutory requirements as a Major Hazard site, close cooperation with regulators, and conformity to applicable standards such as ISO/IEC 17025.

OUR PERFORMANCE AGAINST KPIs 2020/21:

- We published 144 papers in a range of high impact journals achieving an average of 1.01 publications per post doctoral scientist in the year
- We had 45 percent successful grant applications and 48 percent in terms of value of the awards
- At the end of March 2021, the rolling annual average voluntary staff turnover figure was 8.6 percent, significantly beating the 15 percent target
- The annual grant income for 2020-21 was £14.7m, exceeding the £11m million target by 34 percent due to the Institute's significant success in being awarded 45 percent of all grants applied for.
- Pirbright is subject to an HSE Major Hazard Intervention Plan comprising of a minimum of four scheduled HSE inspections each year to monitor compliance with its licence under the Specified Animals Pathogen Order (SAPO) 2008 and with regulations under the Health & Safety at Work etc Act 1974. No enforcement action notices were issued, or enforcement action taken by HSE against Pirbright in 2020/21, and we complied with all HSE recommendations. Pirbright reference laboratories are accredited to ISO/IEC 17025 and are subject to annual surveillance audit by UKAS. Accreditation was maintained in 2020/21 with no findings from the surveillance audit. No other enforcement was applied for Pirbright in 2020/21 by any regulatory or audit body on any aspect of biorisk, health & safety, security, environment, quality or wider compliance.



Bioimaging of infectious bursal disease in chicken tissue.

PIRBRIGHT HIGHLIGHTS IN 2020/21

COMBATTING COVID-19

Pirbright is ideally placed to support the global effort to control the pandemic. As a centre of excellence in viral research, vaccine development, and diagnostics and surveillance, Pirbright worked with colleagues in the Jenner Institute to evaluate a prime boost strategy for the AstraZeneca vaccine in the pig model. We also tested two other human vaccine candidates in pigs.



DEVELOPING VACCINES AGAINST AFRICAN SWINE FEVER



African Swine fever (ASF) has spread from Africa to Europe and Asia devastating pig production which has a significant impact on food security. Pirbright research, run in partnership with Zoetis, is evaluating three different ASF vaccine candidates to identify which is the most promising for further development. The partnership also aims to modify the vaccine so it can be distinguished from infection in the field during outbreaks.

Despite the pandemic Pirbright has continued its critical research during 2020-21 to both help support the fight against COVID-19 while continuing to advance its research and diagnostics in other viral diseases of global importance.

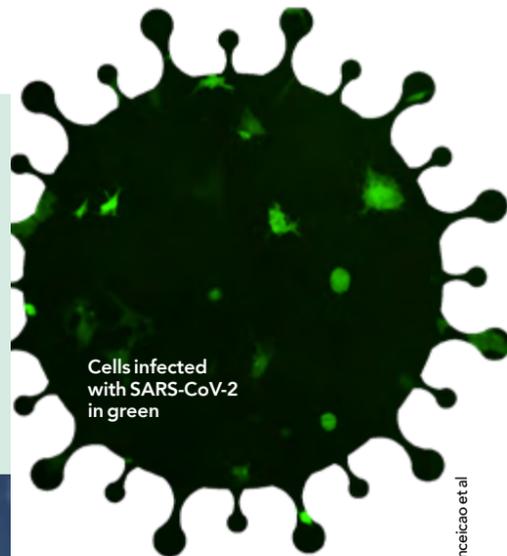
TRAINING DIAGNOSTIC STAFF

We were pleased to be asked to support the Brants Bridge Lighthouse Laboratory in Bracknell, run by NHS Berkshire and Surrey Pathology Services (BSPS). We provided a comprehensive specialist training programme for diagnostic scientists and staff who will be working at the lab. The laboratory is now operational and testing COVID-19 swabs as part of the national effort to help tackle the spread of coronavirus. It forms part of the Government's high throughput diagnostic national laboratory network to process swab samples from members of the public who have taken COVID-19 tests.



SARS-COV-2 RESEARCH

We have experienced researchers who have worked for many years on animal coronaviruses that cause widespread diseases globally, mainly of poultry and pigs, for example, infectious bronchitis virus (IBV) of poultry. Prior to 2020 the Institute did not work on human coronaviruses but last year we began research on SARS-CoV-2, which appears to have spread from a bat to an, as yet, unidentified intermediate animal, and then to humans. Pirbright research during 2020-2021 has unravelled some of SARS-CoV-2's secrets including development of a test that detects the antibodies that prevent the virus undertaking cell-to-cell fusion to enter cells, research showing the virus can enter the cells of a range of different animals and identifying key mutations that may have enabled it to make the jump to humans.



Cells infected with SARS-CoV-2 in green

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HOUGHTON OPENS FOR SCIENCE

Pirbright's newest completed science building, The Houghton Facility opened in November 2020. Designed as a specified pathogen free (SPF) poultry laboratory it enables researchers to incubate, hatch and grow birds that are disease free. The construction of the laboratory cost £4 million, part of a continuing strategic development investment of £255 million from BBSRC UKRI.



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101 DIFFERENT JOBS SUPPORTING SCIENCE

UKRI in collaboration with the Minister for Science Research and Innovation, Amanda Solloway, launched an initiative in 2021 to find 101 people, doing 101 different jobs that make major contributions to research and innovation, to highlight the fact that science is not just about 'lone geniuses' in labs. Pirbright relies on a wealth of experienced staff working in engineering, health, safety and biosafety, lab management, animal services, quality and assurance, research services and the campus development programme among others who support scientific research. Over the past year this was particularly evident, as for our essential research to continue, many support service personnel were also required to work on site to facilitate this research.



Anna Lawton interviewed by UKRI for 101 jobs that change the world campaign.

PIGS SUPPORTING HUMAN HEALTH

Physical and immunological similarities between pigs and humans make pigs excellent models for studying influenza as they are also naturally infected by the virus. Pig studies have shown that combining injection and aerosol flu vaccines results in better disease protection, demonstrated that pigs can still spread swine flu after vaccination and have developed the first antibodies against flu from pigs. Based on the successful influenza pig studies, Pirbright researchers have adapted the pig model to assess immune responses generated by COVID-19 vaccines, providing critical information for further development and human clinical trials.

PIRBRIGHT CONFIRMS AFRICAN HORSE SICKNESS OUTBREAK IN THAILAND

Scientists in the Non-Vesicular Reference Laboratory (NVRL) confirmed an outbreak of African horse sickness (AHS) in Thailand, the first that south-east Asia has ever experienced. AHS is the most lethal viral disease of horses known, affecting the economies and food security of low-income countries as well as impacting the billion-dollar horse racing industry. The identification of AHS in Thailand is unprecedented and demonstrates the fact that this virus can emerge without warning in new areas. The rapid diagnostic services we provided enabled Thai authorities to respond quickly to contain the disease. Pirbright's ability to collaborate with groups from around the world to ensure accurate diagnosis plays an essential role in combatting these threats and ensures we are ready to respond to any incursions of disease into the UK.



ABOUT PIRBRIGHT

OUR PURPOSE

Pirbright's mission is to prevent and control viral diseases of livestock and viruses that can spread from animals to people, known as zoonoses. 2020 has highlighted how important this area of research is with the emergence of COVID-19. As well as having scientific experts in coronaviruses like SARS-CoV-2, the Institute studies over 45 livestock and zoonotic diseases including foot-and-mouth disease virus (FMDV), African swine fever virus (ASFV), influenza viruses including avian and swine flu along with many other diseases of high consequence.

OUR STAFF AND STUDENTS

The Institute employs more than 370 staff and its research is supported by 60 students from a range of backgrounds and prides itself on its diversity. We are located on a campus in Pirbright, Surrey which over the past ten years has received, and continues to receive, considerable investment from Government through BBSRC UKRI in strategic site development. Scientists work in state-of-the-art laboratories including specialised high-containment laboratories and animal facilities.

OUR SCIENCE

Pirbright provides the UK and countries around the world with the capacity to predict, detect, understand and respond to emerging new viral diseases of livestock and viruses that are circulating in and outside of the UK. Our diagnostics and surveillance facilities and expertise enable us to protect the UK from livestock viral diseases that threaten our borders and act decisively and swiftly in the event of an outbreak in order to control it as rapidly as possible.

Our fundamental research falls under two science programmes which study either hosts or viruses and the interactions between these. Both programmes are funded by BBSRC UKRI over a six-year period. In addition to this the Institute receives funding for further research programmes and diagnostics from BBSRC UKRI and other organisations including Defra, the Wellcome Trust, Bill & Melinda Gates Foundation, and commercial partners.

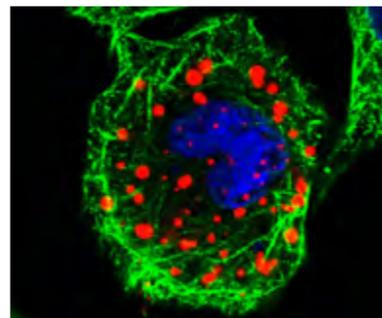
PROGRAMME ONE: UNDERSTANDING AND PREVENTING VIRAL DISEASES

Pirbright's research programme focusing on viruses is led by Dr Toby Tuthill and covers many aspects including:

- How viruses evolve and their diversity
- Viral structure and interactions with host proteins
- Transmission and epidemiology which encompasses spread of infection between individuals, populations as well as predicting the scale of outbreaks and designing and evaluating appropriate interventions to control outbreaks.

The programme aims to understand at a molecular and cellular level the structure and systems used by viruses that allow them to infect, replicate and transmit disease. This knowledge will then be used to prevent and control viral diseases, especially highly

infectious diseases that must be studied under high containment. Priority viruses that we are studying include: African swine fever virus, avian and swine influenza viruses, bluetongue virus, respiratory syncytial virus, coronaviruses including SARS-CoV-2, foot-and-mouth disease virus, infectious bronchitis virus, infectious bursal disease virus, Marek's disease virus, porcine reproductive and respiratory syndrome virus, swine influenza virus, pox viruses and mosquito-borne arboviruses.



PROGRAMME TWO: ENHANCING HOST RESPONSES FOR DISEASE CONTROL

Pirbright's host programme is led by Professor John Hammond and it focuses on four broad areas of research around livestock hosts and insect vectors:

- Disease pathogenesis
- Recognition and control of virus infections
- Viral persistence
- Viral transmission by insect vectors

The goal of the research is to develop innovative methods for the control of viral diseases through an enhanced understanding of host biology and host-virus interactions. Tools and disciplines that enable better understanding of the host-virus



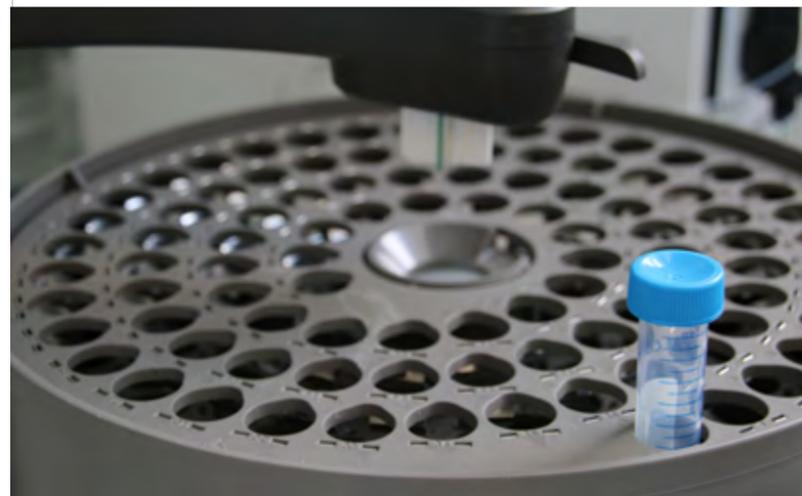
DIAGNOSTIC AND SURVEILLANCE EXPERTISE

Pirbright has a long history of protecting the UK from disease and has been home to the World Reference Laboratory for Foot-and-Mouth Disease for over 60 years; this status was recently renewed. We also operate the Non-Vesicular Reference Laboratory, which acts as OIE reference laboratory, for a number of viruses of high consequence including African swine fever virus, bluetongue, peste des petits ruminants, rinderpest, African horse sickness, lumpy skin disease, sheep pox and goat pox. These Reference Laboratories provide an essential diagnostic and advice service to the UK Government (Defra), United Nations Food and Agriculture

Organization (FAO), and the World Organisation for Animal Health (OIE).

We receive samples from all over the world and are instrumental in providing countries with sophisticated data on strains of viruses causing disease and helping to select vaccines to aid control. Last year we processed around 170,000 samples and have supported the UK's COVID-19 diagnostic capabilities throughout 2020-21 by providing expertise, high-throughput diagnostic machines and highly trained personnel.

The international reference laboratories are accredited to ISO/IEC 17025, a UKAS accredited laboratory number 4025. In 2021 this accreditation was renewed following an extremely successful assessment by UKAS.



OUR VALUES

We take PRIDE in everything we do which is reflected in our values:

Passion – for the highest quality standards, delivery and performance

Reliability – in everything we do; leadership, learning, biosafety, problem anticipation and bio-containment

Innovation – is the driving force behind our fundamental and applied science. Our work is positioned at the cutting-edge of science to deliver solutions for global good.

Dignity and respect – we respect and trust in our diverse community

Excellence – we aim to deliver the best in all aspects of our work, including scientific research, health, safety, biosafety, stakeholder support and protecting the environment.

We take PRIDE in being a world-class centre of excellence in scientific research, attracting experts in their field from around the world. This combined with our drive for professional excellence and rigorous academic, biosafety and ethical standards allows the Institute to have a measurable impact on health and wellbeing and economic and food security globally.

OUR GOVERNANCE

The Pirbright Institute is an independent company, limited by guarantee and a registered charity. It is governed by a Board of non-executive Trustee Directors who provide strategic input to the Senior Leadership Board at Pirbright. Science at the Institute is reviewed by an independent group of leading researchers who comprise the Science Advisory Board and whose role is to provide advice and guidance on science strategy and direction.

TRUSTEES



Ian Bateman
Ilan is currently Director of Quality at NHS Blood and Transplant. He is an Executive Director and Board Member with significant strategic leadership experience in healthcare organisations in both public and private sectors. He has a strong background in corporate leadership of quality, regulatory affairs, corporate governance, assurance, risk and health and safety.



Ian Black
Ilan worked as a senior executive in a range of global organisations with a business sector focus on Engineering, Technology and Fast-Moving Consumer Goods. This included various roles covering Strategy, HR, IT, Quality and Marketing Services worldwide. He has served as a Non-Executive Director in the public and private sectors where he has been a Member or Chair of Board Committees such as Audit, Remuneration, Nominations and Strategy. He is also a Director of BSH Ltd an international equestrian business and board advisor to CC North, an energy management consultancy.



Rona Chester
Rona is a fellow of the Institute of Chartered Accountants with over 30 years' experience in leading financial teams in both the public and private sector. During her early career

Rona worked in international finance managing the Finance and Treasury teams for an oil and gas shipping business followed by roles at Sotheby's as their European Finance Director and Ofcom the newly formed communications regulator. More recently Rona was the Chief Operating Officer at Sport England, the lottery distributor, where additional responsibilities included grants management, Commercial and IT as well as contributing to the development of the organisation's strategy.



Jon Coles
Jon Coles was a senior Partner at Brunswick Group LLP, a leading international communications consultancy, where he advised the Boards of Directors of global groups on strategic communications and corporate reputation. His particular focus was on clients in the pharmaceutical, biotechnology and agriculture industries.



Professor Vince Emery
Professor Vince Emery is Emeritus Professor of Translational Virology at the University of Surrey and holds an Honorary Professorship in Virology at UCL. His research, spanning over 33 years, aims to provide an interdisciplinary approach to understanding viral infections in immunocompromised hosts. He is a fellow of the Royal Society of Biology and has published 240 research articles, reviews and is a named inventor on five patents in the area of biotechnology and



CHAIR OF THE TRUSTEE BOARD

Professor John Stephenson

Professor John Stephenson became Chair on 1 January 2019. He has had a distinguished research career, with a long-standing interest in the interaction between virus infection and the immune system. He holds honorary professorships at the London School of Hygiene and Tropical Medicine and the University of Liverpool, and is an Independent Scientific and Technical Advisor (ISTA) for the UK Surgeon General.

molecular diagnostics, with the molecular diagnostics patent for cytomegalovirus detection licenced to Public Health England.



Emma Griffin

Emma Griffin has over 25 years professional experience across a multitude of sectors in cyber security, technology, and regulatory compliance. Experienced in all facets of cyber security including data protection, cloud, infrastructure, and application security, preventing business disruption, cyber fraud and intellectual property theft. She participates on several advisory boards to influence and drive cyber security development and solution innovation and regularly participates in industry and regulatory forums as an advisor and speaker. Emma is actively involved in promoting diversity and inclusion and seeks to encourage careers in science and technology to minority groups. Emma has a Masters degree in Information Security from Royal Holloway, University of London.



Alison Hardy

Alison Hardy is a solicitor and partner with City law firm Ashurst LLP where she leads the real estate dispute resolution practice. She is a former Chair of the Property Litigation Association, having earlier chaired its website and marketing committee. Alison is experienced in all aspects of commercial real estate and is a member of the

Royal Institute of Chartered Surveyors (RICS) Dilapidations Forum and chaired the UK RICS dilapidations conference in 2021. She is actively involved in diversity and inclusion and is the partner sponsor of Ashurst's Social Mobility and Inclusion network, which is working to remove barriers to entry into and progression within the legal profession.



Dr Paul Logan

Prior to his retirement in 2020, Dr Paul Logan was a Senior Civil Servant in the Health and Safety Executive (HSE) which he had joined as a regulatory scientist. During his time in HSE he chaired a number of industry/government committees, as well as representing the UK on a European Medicines Agency working group on Gene Therapy, and a World Health Organization group developing guidelines for the manufacture of pandemic flu vaccines. He was Director of the division in HSE with responsibility for regulation of major hazards industries, including chemical manufacturing, oil refineries, explosives manufacture and storage, and high containment laboratories.



Roger Louth

Roger Louth was a Senior Civil Servant in the Department for Business Innovation and Skills. In his final post before retirement in 2011 he was responsible for the strategic financial management of the Government's £6 billion per annum Science and Research Budget.

STAKEHOLDER ENGAGEMENT



Pirbright receives the majority of its income from government funding. We recognise the importance of engaging with all our key stakeholders including the public to ensure we comply with our operating and funding requirements and communicate the impact of our research. We have a range of stakeholders, some of which are included in the table below:

ILRI Stevie Mann

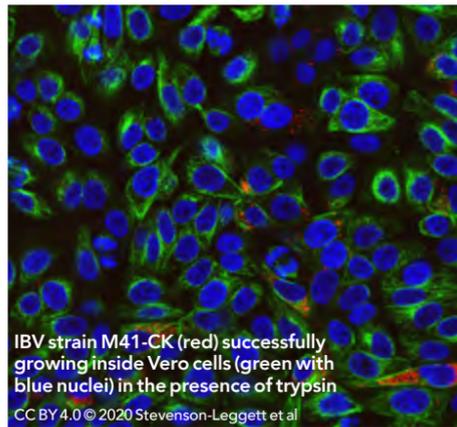
STAKEHOLDERS	HOW WE ENGAGE
FUNDERS	We communicate with funders at all stages of the funding process and have regular dialogue and face-to-face meetings with our key investors. Please see page 32 for more information.
PUBLIC	We engage with the public through our Outreach and Public Engagement programmes. These have been severely affected in 2020/21 due to the pandemic, although we continue to engage digitally where possible. More information can be found on page 26.
RESEARCH ORGANISATIONS AND PARTNERS	Pirbright undertakes numerous collaborations with universities, research institutes and disease control agencies around the world. See more on page 38.
PHARMA	Partnerships with pharmaceutical companies are essential for the development of vaccines, diagnostics and medicines. Find out more on page 34.
FARMERS	We engage with the farming community through specialist farming press, farming organisations and bodies and media outlets including <i>BBC World Service</i> and <i>BBC Radio 4 Farming Today</i> as well as at agricultural events.
EMPLOYEES	Employee Engagement forms a central part of the Institute's strategy. We employ a myriad of ways to communicate with our staff and students in a dialogue so we can also gain feedback. Communication channels include a fortnightly e-newsletter, intranet, forums, staff briefings, surveys, digital screens, seminars, blogs and workshops.
SUPPLIERS	One of the ways we engage with our suppliers is through an Annual Supplier Day held at Pirbright. However, due to the pandemic this was not possible but digital engagement continued throughout the year.
LOCAL COMMUNITY	Our neighbours are extremely important to us and we support the local community in a number of ways including sponsoring local events, volunteering in local conservation initiatives including Fox Corner Conservation and engaging with the Parish, Borough and County Councils over development on our campus. Our scientists also visit local schools and colleges – more can be found on page 26.
REGULATORS AND GOVERNMENTS	As a Major Hazard site, Pirbright works closely with the Health & Safety Executive (HSE), counter-terrorism security authorities, Home Office and other regulators. As a National Capability for the prevention and control of exotic viral diseases of livestock, Pirbright works closely with Defra, BBSRC UKRI and others. As the World Reference Laboratory for certain pathogens and a regional Reference Laboratory for others, Pirbright works closely with the UN Food & Agriculture Organization (FAO) and World Organisation for Animal Health (OIE). As an ISO/IEC 17025 accredited testing laboratory, Pirbright works with the UK Accreditation Service (UKAS). See page 28.
STUDENTS	Pirbright has a vibrant student community, and we are committed to supporting, nurturing and offering additional learning and training opportunities. Find out more on page 48.

SCIENTIFIC PROGRESS

Advances in research, vaccine development and new diagnostic tests help to ensure the world is better prepared to combat outbreaks of viral disease through prevention and control as well as fundamental understanding of the mechanisms used by existing and emerging viruses to infect hosts and spread.

NEW METHOD TO STUDY POULTRY VIRUS COULD REDUCE THE USE OF BIRDS IN RESEARCH

An enzyme called trypsin boosts the growth of infectious bronchitis virus (IBV) strains in lab cell cultures. The highly contagious poultry virus causes a respiratory disease, which has a large economic impact on industries worldwide. This finding could enable researchers to study strains of the poultry virus that don't grow well in a laboratory and potentially provide alternative vaccine production methods, which currently rely on eggs, therefore reducing the numbers of birds needed for research and vaccine production.



IBV strain M41-CK (red) successfully growing inside Vero cells (green with blue nuclei) in the presence of trypsin
CC BY 4.0 © 2020 Stevenson-Leggett et al

NEW CATTLE IMMUNE CELLS IDENTIFIED

Working with other partners across the globe, we have identified new immune cells in cattle, called mucosal-associated invariant T (MAIT) cells. Human MAIT cells have been shown to tackle bacterial and viral infections, as well as playing a role in wound healing and vaccine response. In the study, published in *Frontiers in Immunology*, researchers showed that cattle MAIT cells were extremely similar to human MAIT cells. Cells were mainly located in mucosal tissues (which cover internal organs and cavities) as well as in the lymph nodes (parts of the immune system that help to fight infection). The team also established that the cattle MAIT cells were stimulated by similar signals to their human counterparts and showed that they are activated in response to cattle bacterial infections suggesting they may play an important role in fighting infection.

PIGS CAN STILL SPREAD SWINE FLU AFTER VACCINATION

Effective flu vaccines are crucial for controlling disease outbreaks in pigs and to reduce potential threat of transmission to humans. Recent research between Pirbright and three collaborators has shown that several candidate vaccines against the 2009 swine flu pandemic virus (H1N1) were able to reduce signs of disease and virus shedding in pigs, but that immunised pigs could still pass the virus on to unvaccinated pigs in the same pen. The findings provide insight into whether immunised animals can continue to spread infection and show that a flu vaccine must virtually eliminate shedding of infectious virus to prevent onward transmission, otherwise even 'immune' pigs may still spread the virus to other animals, including humans.

FIRST PIG FLU ANTIBODIES IDENTIFIED THAT MAY HELP CONTROL HUMAN FLU

Our researchers have generated the first pig antibodies against swine influenza (flu) that protect against infection and recognise the same parts of the flu virus as human antibodies. Antibodies form a vital part of the immune system's response and help to fight off infections by latching on to important parts of invading microorganisms to neutralise them. In the case of flu viruses, many antibodies target a protein on the surface of the virus called haemagglutinin, which then prevents the virus from entering cells and replicating. This is significant because these pig antibodies could be used to develop and assess human antibody therapies and the most effective delivery methods. It is hoped that they also have the potential to improve how the evolution of flu viruses are monitored and inform decision-making on the annual flu vaccine selection.

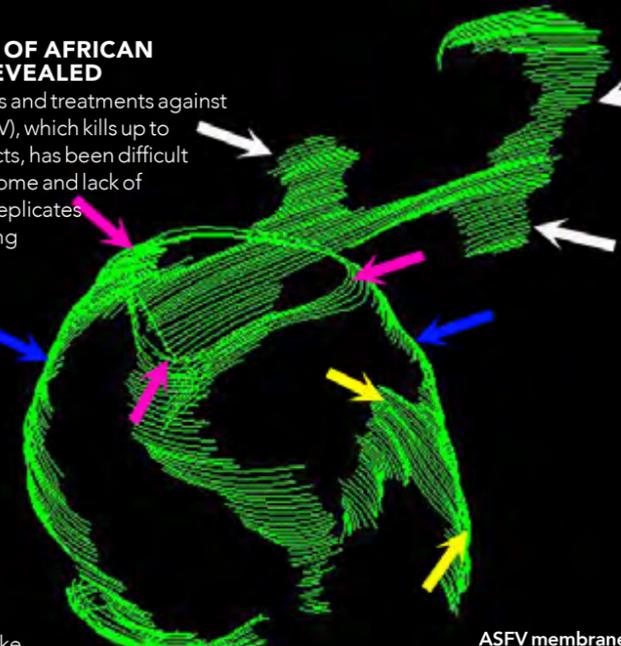


POOLED MILK CAN BE USED FOR FOOT-AND-MOUTH DISEASE SURVEILLANCE

A case study undertaken by Pirbright researchers working in Saudi Arabia is the first to confirm that milk tested from in-line milk samplers on a large-scale dairy farm can be used to detect circulating foot-and-mouth disease virus (FMDV) in cattle. This finding has major impact on how we can use a range of surveillance mechanisms to monitor the incidence of this devastating disease and prevent further spread.

REPLICATION SECRETS OF AFRICAN SWINE FEVER VIRUS REVEALED

Developing effective vaccines and treatments against African swine fever virus (ASFV), which kills up to 100 percent of the pigs it infects, has been difficult owing to the virus's large genome and lack of understanding about how it replicates within cells. Recent bioimaging studies from Pirbright have uncovered how ASFV forms new copies of itself in areas called viral factories, information which could inform future antiviral treatment development. Viral factories are complex structures that form within infected cells, which contain a mixture of viral DNA, viral proteins and sections of the virus membrane. These elements are packaged together to make new ASFV particles. The mechanisms by which the virus particles are assembled have remained unclear, but this research published in *Viruses* provides new super-resolution images of the early virus assembly stages that occur within viral factories which showed small, individual sections of virus membrane appear to grow and link together and can form 'skeletons' of virus particles.



ASFV membrane fragments assembling to form a 'skeleton' virus with a triangular pole (pink arrows). Fragments form vertically (blue arrows) and horizontally (yellow arrows) and also branch out (white arrows), possibly to link with other virions.

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FLIGHTLESS FEMALE MOSQUITOES COULD CONTROL DISEASE

Our scientists have created flightless mosquitoes by editing a specific gene that is required for flight – but only in females. The creation of flightless females are currently used to control populations but resistance could provide a more controlled and targeted way of reducing mosquito

populations (females bite to obtain a blood meal and thereby spread disease; males do not bite) in select areas where mosquito-borne diseases such as Zika and dengue are rife. Insecticides are currently used to control populations but resistance and the negative impact on the environment mean other more effective and

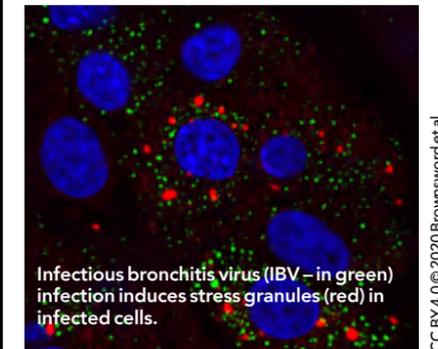
environmentally friendly control methods are required. Although further work is needed to assess the mating competitiveness of the engineered males and their compatibility with gene drive system, these findings are a positive step towards providing new tools to tackle diseases like dengue, Zika and West Nile fever.



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INFECTIOUS BRONCHITIS VIRUS SHUTS DOWN CELL STRESS SIGNALS

Together with scientists from the University of Surrey, we have shown that infectious bronchitis virus (IBV), an economically important poultry disease, can regulate the stress response of infected cells. The virus is able to manipulate several important cell signals, which would otherwise prevent a virus from making new copies of itself. Knowing the mechanisms and pathways that IBV disrupts will enable researchers to use a more targeted approach for generating effective treatments, such as antivirals.

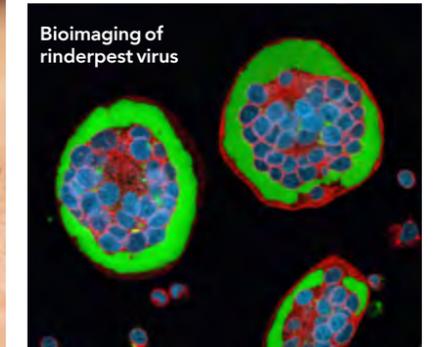


Infectious bronchitis virus (IBV – in green) infection induces stress granules (red) in infected cells.

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GENETIC ANALYSIS OF RINDERPEST REVEALS VALUABLE NEW INFORMATION

By analysing the genetic sequences of rinderpest stocks before destruction at the Rinderpest Holding Facility and World Reference Laboratory for Rinderpest held at Pirbright, our experts have shed new light on the genetics, evolution and spread of the only virus after smallpox to have been eradicated. The study is an exemplar to other laboratories on how to glean as much information as possible through genetic analysis from remaining lab samples prior to destroying them. Further bioinformatic analyses of these samples may reveal more detailed information about the growth and evolution of the virus.



Bioimaging of rinderpest virus

| 17





AFRICAN HORSE SICKNESS OUTBREAK CONFIRMED IN THAILAND

Diagnostic experts from the Non-Vesicular Reference Laboratory (NVRL) confirmed an outbreak of African horse sickness (AHS) in Thailand. AHS is the most lethal viral disease of horses known and the rapid diagnostic services provided by Pirbright has enabled authorities to respond quickly to the outbreak, the first that south-east Asia has ever experienced. As a designated AHS reference laboratory for the World Organisation for Animal Health (OIE), Pirbright tests samples sent from around the globe to verify suspected infections. Samples from Thailand were confirmed African horse sickness virus (AHSV) positive and further testing established that AHSV serotype 1 had caused the outbreak; the first time that this serotype has been seen outside of Africa. AHSV is spread mainly by *Culicoides* biting midges and Thailand has several species that have previously been implicated in the spread of viruses. There are nine serotypes of virus and knowing which is involved in an outbreak is important in choosing an effective vaccine.



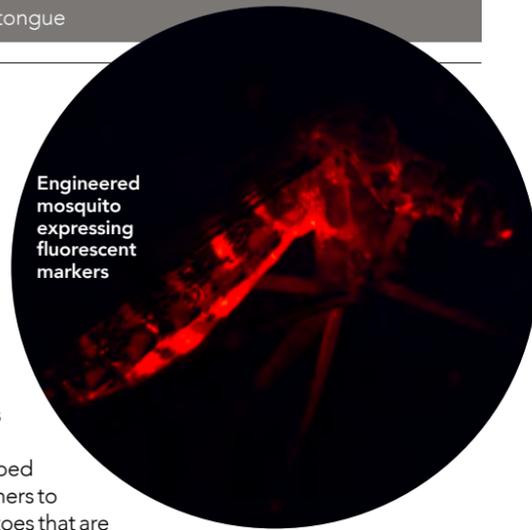
MIDGE HABITS IN ZOOS PROVIDE CLUES FOR POTENTIAL DISEASE OUTBREAKS

The first study ever undertaken to confirm the feeding habits of midges on exotic animals in UK zoos could hold important clues to prevent disease outbreaks in Northern Europe. Scientists from Pirbright, the Zoological Society London and the London School of Hygiene and Tropical Medicine worked together to collect midges from London and Whipnade zoos. They identified 25 different species of *Culicoides* midges, six of which are considered to be vectors for bluetongue

virus (BTV), Schmallenberg virus (SBV) and African horse sickness virus (AHSV). These viruses are known as arboviruses because they are transmitted by arthropods such as insects and ticks. Crucially the data showed midges feed opportunistically on a range of birds and animals including exotic zoo species and therefore these animals are at a risk of developing disease and potentially may be involved in cycles of transmission, important information for modelling potential outbreaks and conservation breeding programmes.

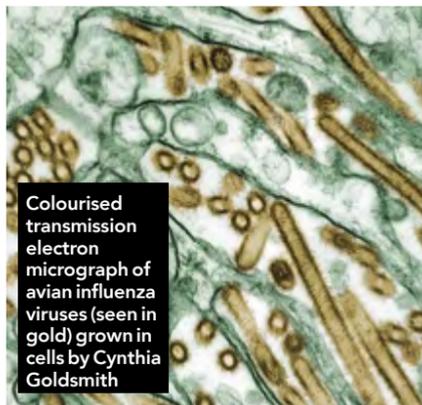
DISEASE RESISTANT MOSQUITOES COULD COMBAT CHIKUNGUNYA

We are using genetic engineering to disable the chikungunya virus genome in mosquito cells to hamper spread. Chikungunya, an alphavirus, is a mosquito-borne infection which is characterised by a sudden onset of fever usually accompanied by mild to severe joint pain. Although the majority recover, it can cause a longer illness with debilitating joint pain in some people which can last years. It is hoped this technology could help researchers to engineer disease resistant mosquitoes that are unable to spread chikungunya between animals and people.



Engineered mosquito expressing fluorescent markers

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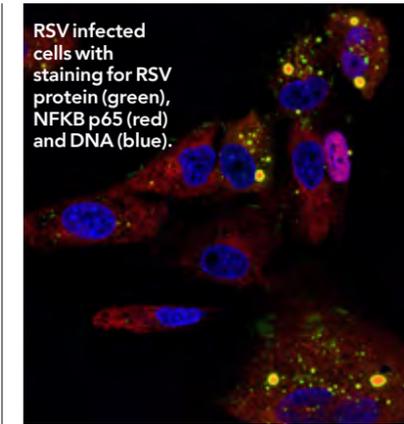
Colourised transmission electron micrograph of avian influenza viruses (seen in gold) grown in cells by Cynthia Goldsmith

BIRD FLU VIRUS COULD EVADE HUMAN ANTIVIRALS

We reveal that four mutations in bird flu viruses could allow them to escape human antiviral drugs without compromising their fitness. If flu strains with these mutations were to make the jump from birds to humans, this could potentially limit methods used for prevention and treatment. The research highlights the importance of constant surveillance on genetic changes in bird flu viruses and what this might mean for potential human infection.

IMPROVING POULTRY DISEASE VACCINES

Two recent studies in collaboration with the Roslin Institute could improve vaccines for infectious bronchitis virus (IBV), a member of the coronavirus family that infects poultry. Scientists revealed that a vaccine virus was unable to survive in the lower airways of chickens because the core temperature of the birds was too high to support replication. This could be the reason the vaccine virus was unable to provide complete protection against multiple strains of IBV. Generating vaccine viruses with greater heat resilience could enhance protection by improving levels of replication to prime the immune system more effectively, findings which could potentially be applicable to other coronaviruses.



RSV infected cells with staining for RSV protein (green), NFKB p65 (red) and DNA (blue).

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RESPIRATORY VIRUS STEALS PROTEINS TO EVADE IMMUNE SYSTEM

Viruses have evolved many ways to avoid detection by the immune system. A recent study reveals that bovine and human respiratory syncytial viruses (bRSV and hRSV respectively) steal a protein that is important for the antiviral response, holding it hostage to prevent cells signalling for help from the immune system. bRSV causes respiratory infections in cattle, which can result in severe illness associated with bronchiolitis and pneumonia in calves. hRSV causes similar infections in humans, particularly infants, the elderly and immunocompromised. Unravelling this sneaky method of escape could help us to understand how these viruses cause disease and develop methods to prevent them.

AFRICAN SWINE FEVER VACCINE STOPS PIGS DEVELOPING SEVERE DISEASE

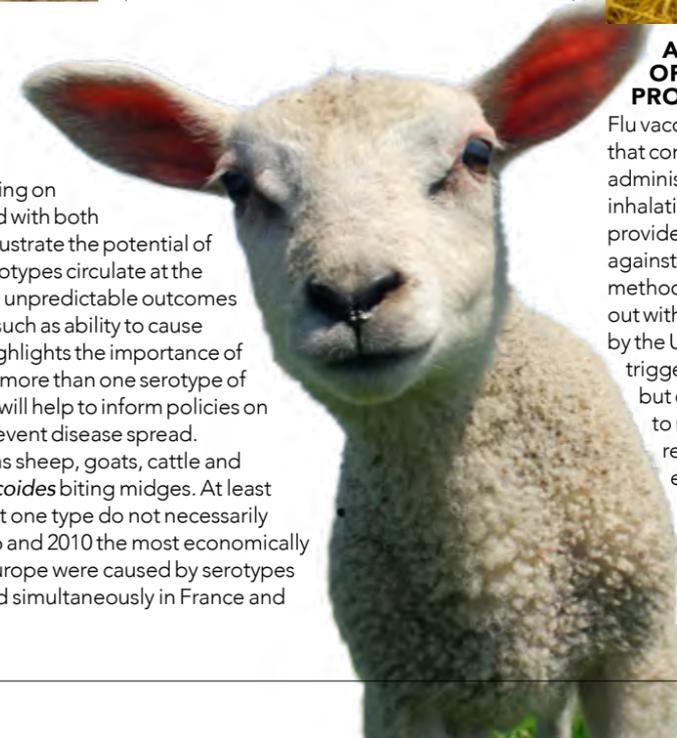
We are a step closer in the race to develop a vital vaccine for African swine fever (ASF), a haemorrhagic disease in pigs with up to 100 percent mortality. In a recent trial, published in *Vaccines*, pigs immunised with the new vaccine survived a lethal dose of ASF virus, although some clinical signs of disease were seen. The vaccine uses a non-harmful virus (a vector) to deliver eight strategically selected genes from the ASF virus (ASFV) genome into pig cells. Once inside the cell the genes produce viral proteins which primes the pig immune cells to respond to an ASF infection. One of the benefits of this type of vaccine is pigs that are infected can be differentiated from those that have been vaccinated (DIVA), which means it does not affect trade of vaccinated animals.



DOUBLE BLUETONGUE INFECTION POTENTIAL IN BRITISH SHEEP

British sheep can become infected with two serotypes of bluetongue virus (BTV) simultaneously and midges feeding on the sheep can also become co-infected with both strains. Importantly, the findings also illustrate the potential of reassortment occurring should two serotypes circulate at the same time, which could have rapid and unpredictable outcomes on virus characteristics and behaviour such as ability to cause disease and infectivity. The research highlights the importance of understanding the potential impact of more than one serotype of bluetongue circulating in the field and will help to inform policies on vaccination and control methods to prevent disease spread.

Bluetongue affects ruminants such as sheep, goats, cattle and deer and is transmitted mainly by *Culicoides* biting midges. At least 27 serotypes exist, but vaccines against one type do not necessarily protect against another. Between 2006 and 2010 the most economically damaging bluetongue outbreaks in Europe were caused by serotypes BTV-1 and BTV-8, which both circulated simultaneously in France and Spain between 2008-2009.



AEROSOL AND INJECTION OF FLU VACCINE IMPROVES PROTECTION IN PIGS

Flu vaccine research has demonstrated that combining two different routes of administering flu vaccine, namely aerosol inhalation and intramuscular injection, provides pigs with better protection against disease than using only one method. The research which was carried out with the S-FLU vaccine, developed by the University of Oxford, which triggers a strong antibody response but cannot spread since it is unable to make a vital protein needed to replicate, haemagglutinin. The exciting discovery that the pig immune response triggered by S-FLU is very different between blood and the lung could inform vaccination strategies for human flu and other respiratory diseases.

PIRBRIGHT'S ROLE IN COMBATting COVID-19

In December 2019, reports of a new kind of pneumonia were reported in China. The cause was quickly identified as a novel coronavirus, which has resulted in arguably the most devastating healthcare emergency the world has seen. Now known as COVID-19, the illness rapidly spread across the globe and was declared a pandemic by the World Health Organization on 11 March 2020. As governments grappled with measures that would protect their overwhelmed healthcare services, COVID-19 cases soared, as did the death toll. To date¹ there have been 181 million cases and 3.9 million deaths.

The urgent need to discover more about the new coronavirus, named severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), has seen many scientists realign their research to help fight against the pandemic. Pirbright's history of working with livestock coronaviruses and viruses that spread from animals to people (zoonoses) ideally positioned the Institute's scientists to aid the COVID-19 research effort. Throughout 2020, Pirbright committed to several projects that would uncover details about SARS-CoV-2. A year on, our researchers have made several important discoveries, adding to the growing knowledge about the virus that will ultimately help to save lives.

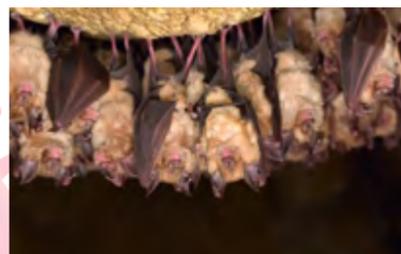
¹ Figures from Johns Hopkins University June 2021

SARS-COV-2 RESEARCH

How do SARS-CoV-2 mutations affect transmission, severity and vaccines? Pirbright is part of a new national research project to study the effects of emerging mutations in SARS-CoV-2. With £2.5 million of funding from UK Research and Innovation (UKRI), the 'G2P-UK' National Virology Consortium, comprising of ten partners, will study how genetic mutations in the virus affect key outcomes such as how transmissible it is, the severity of COVID-19 it causes, and the effectiveness of vaccines and treatments. Ongoing work at Pirbright is specifically investigating whether naturally acquired mutations in the spike surface protein of SARS-CoV-2 change any of the fundamental properties of this virus, such as how well it replicates.

WHERE DID SARS-COV-2 ORIGINATE?

SARS-CoV-2's origin is currently unknown. Coronaviruses are common in bats and some researchers are of the view that the disease originated in bats, but how it jumped hosts to infect humans remains unclear. Pirbright researchers have identified key mutations in SARS-CoV-2 that may potentially have been responsible for this cross species jump. These genetic adaptations were similar to those made by the coronavirus that caused the Severe Acute Respiratory Syndrome (SARS) epidemic in 2003 when it adapted from bats to humans. Uncovering the common traits that allow viruses to jump between animals and humans helps us to identify potential reservoirs of disease and forewarn us of future threats.



WHICH ANIMALS CAN SARS-COV-2 INFECT?

Pirbright scientists have revealed that out of 22 animal species tested, SARS-CoV-2 is able to enter the cells of dogs, cats and cattle most efficiently. This could mean that infection may be more easily established in these animals, although cell entry is only the first step of infection. Findings from this study will enable scientists to prioritise research on animals that might be susceptible to infection and have the potential to act as reservoirs for COVID-19. It also identifies those animals that could provide good experimental models for understanding the disease, such as hamsters and ferrets.

CAN ANTIBODIES PREVENT SARS-COV-2 CELL FUSION?

A new test developed by researchers at Pirbright, in collaboration with the University of Queensland and the University of Oxford, can detect antibodies that prevent cell-to-cell fusion, a method some viruses use to infect neighbouring cells. The team showed SARS-CoV-2 can induce cell fusion and that antibodies from recovered COVID-19 patients could prevent cells from fusing. This enabled the team to characterise an important sub-class of SARS-CoV-2 antibodies, which may provide an additional indication of immunity and could be useful for future vaccine development.

SHARING PIRBRIGHT'S CORONAVIRUS EXPERTISE

Our coronavirus experts have contributed to a new book, '*Coronaviruses*', detailing the *Coronaviridae* family and laboratory techniques used in the field to study them. Coronaviruses have long been known to cause devastating outbreaks and SARS-CoV-2 has further emphasised the pandemic potential of these viruses. The book provides a comprehensive collection of protocols which will help develop diagnostics, vaccines and antiviral therapeutics to manage disease outbreaks in both humans and animals.

ASSESSING COVID-19 VACCINES

TWO DOSES OF OXFORD ASTRAZENECA VACCINE MORE EFFECTIVE

In pivotal research, Pirbright scientists worked in collaboration with the University of Oxford to demonstrate that two doses of the Oxford AstraZeneca COVID-19 vaccine administered to pigs produce a greater antibody response than a single dose. The study provided data that supported human trials of the vaccine, which was approved for UK emergency use in December 2020 with a two-dose vaccination programme. This successful outcome demonstrates the value of pigs as a model for assessing immune responses to COVID-19 vaccines and other infectious respiratory illnesses such as flu.

TESTING NEW COVID-19 VACCINES

Pirbright's pig model is also being used to assess new COVID-19 vaccines that are in the early stages of development. Work to assess Imperial College London's RNA vaccine is underway and studies to evaluate the University of Oxford's new potential vaccine against COVID-19, named RBD-Spy-VLP, have been completed. Researchers revealed that RBD-Spy-VLP produced a strong antibody response against SARS-CoV-2 in mice and pigs. Antibodies were identified in samples taken from the nose and mouth of vaccinated pigs, which could be important for providing robust protection against infection. The vital information will feed into the further development of this vaccine, which could be useful as a standalone vaccine or as a booster for individuals primed with a different COVID-19 vaccine.



SUPPORTING THE UK'S DIAGNOSTIC EFFORT

INDUCTION AND TRAINING OF NHS TEST AND TRACE STAFF

We have supported the NHS Berkshire and Surrey Pathology Services (BSPS) and the national NHS Test and Trace programme by providing induction and training for staff joining the new Brants Bridge Lighthouse Laboratory in Bracknell. The Lighthouse Laboratory is designed to increase the UK's COVID-19 diagnostic testing capability by processing COVID-19 samples from drive-in centres and swabs that people take at home.

Huge efforts were made to repurpose existing Pirbright laboratory facilities to support the launch of the Lighthouse Laboratory and to generate a comprehensive training programme. As home to several Reference Laboratories for viral diseases of livestock, Pirbright's staff are well versed in high throughput diagnostic protocols and ideally placed to train the COVID-19 diagnostics team who are working in the new lab.

To recognise the tremendous support offered by Pirbright, the Lighthouse Laboratory has named one of its new testing laboratories after the Institute.



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PROVIDING HIGH-TECH INSTRUMENTS

Pirbright supplied 13 of its high-throughput testing instruments to the Milton Keynes COVID-19 Lighthouse Lab at the UK Biocentre. The highly specialised equipment comprised seven nucleic acid extraction robots and six polymerase chain reaction (PCR) machines, which were used to detect the presence of the COVID-19 virus in samples taken from potentially infected people and/or healthcare workers.

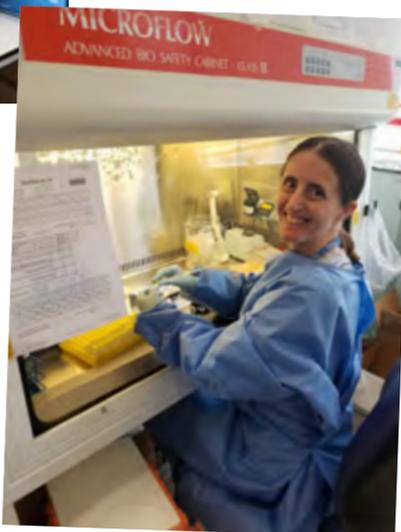
KEEPING RESEARCH ON TRACK

To ensure the Institute's critical research can continue throughout the pandemic and associated disruption, Pirbright has been awarded the UKRI COVID-19 Grant Extension Allocation (CoA). This funding supports Pirbright's research, staff and infrastructures to enable projects to be completed as well as sustaining the talent pool that will be needed to underpin the post-pandemic, national recovery. Pirbright has assembled a CoA Allocation Committee to prioritise the funding to projects that have been most significantly impacted, allowing the continuation of essential viral disease research.



VOLUNTEERING IN DIAGNOSTIC CENTRES ACROSS THE UK

Over 60 of Pirbright's diagnostic staff and scientists volunteered to join the diagnostics and surveillance effort for COVID-19 at seven Public Health England testing sites across the country. Volunteers began working in these laboratories from 23 March 2020 and continue to work away from their families and home to support the UK's Test and Trace efforts.



Director, Professor Bryan Charleston (right), and Head of the Non-Vesicular Reference Laboratory, Dr Carrie Batten visit the Brants Bridge Lighthouse Laboratory where a laboratory has been named Pirbright to acknowledge our support.



STATE-OF-THE-ART SCIENCE

Pirbright is a UK National Capability where fundamental research and advanced high-throughput diagnostics are carried out under high containment on diseases with the potential to severely affect national economic and food security, as well as animal and human health.

CONTROLLING EXOTIC DISEASES

Pirbright's research into exotic livestock diseases such as African swine fever and foot-and-mouth disease could not take place without the specialist high containment facilities afforded by the BBSRC National Virology Centre: The Plowright Building. The laboratories within allow scientists to study both structure and behaviour of high-consequence viruses as well as develop vaccines, antivirals and diagnostics to aid their control in countries where the diseases are prevalent. The Plowright Building has also recently enabled crucial COVID-19 research that has informed human vaccine development and clinical trials.

The high containment laboratory also houses Pirbright's reference laboratories which are fundamental to the global control of disease and the UK's National Capability to protect itself from devastating outbreaks. These include world reference laboratories for foot-and-mouth disease, rinderpest and peste des petits ruminants, as well as World Organisation for Animal Health (OIE) reference laboratories for African swine fever, bluetongue, goat pox and sheep pox, lumpy skin disease, Marek's disease and swine vesicular disease. Scientists track the spread of these diseases through global surveillance programmes, and develop new and improved tools to detect and control the spread of outbreaks.

DEVELOPING VACCINES

The BBSRC National Vaccinology Centre: The Jenner Building provides a collaborative space for scientists to carry out research at a lower level of containment than The Plowright Building. It has large labs and specialised rooms for bioimaging and flow cytometry, as well as a home office licenced facility to study embryonated chicken eggs. These facilities provide a unified space for fundamental research as well as applied research, such as vaccine development.

Many of the groups based in this containment level 2 laboratory work on avian diseases including infectious bronchitis virus and avian influenza, and detailed studies of the immune systems of the livestock hosts that are infected by viruses.

PREVENTING INSECT DISEASE TRANSMISSION

Two insectaries at Pirbright provide the specific controlled environments needed to study mosquitoes and midges, which spread a variety of human and animal diseases. The IS4L Insectary offers precise humidity and temperature control to support mosquito colonies

that spread diseases such as Zika and dengue. Research with these insects aims to engineer resistance to transmitting viruses that could offer more targeted alternatives to current disease control methods such as environmentally harmful pesticides. The Phillip Mellor Insectary provides facilities for the production, growth and maintenance of unique *Culicoides* midge colonies that are used to understand the relationship between the insect, virus and host animal. Pirbright supplies midges and expertise to other researchers across the UK to help address the critical shortage of insect research facilities in the UK.



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ANIMAL FACILITIES

LIVESTOCK LABORATORIES

Animals are used in Pirbright research to gain a better understanding of viral diseases that affect millions of animals each year. High containment animal housing facilities enable researchers to study viral diseases in their natural host and how these viruses transmit between animals. These studies provide vital information for the development of vaccines, diagnostic tests and disease modelling advice to improve global animal health.

POULTRY FACILITIES

Pirbright has a long history of working with viruses that have severe impacts on the global poultry industry. Opened in November 2020, The Houghton Facility is a Specific Pathogen Free (SPF) hatchery that allows us to hatch and grow poultry under very clean conditions. This maintains the disease-free status of the birds, enabling scientists to study antiviral responses in the absence of infections that could affect results, leading to the improved control of diseases that are important to the welfare of chickens and ultimately to ensure security of food supply for the UK.

ANIMAL WELFARE

Pirbright's team of specialist animal technicians and veterinary staff are all licenced and highly trained to provide the highest levels of care possible. The dedication of Pirbright staff ensures the highest standards of animal welfare that consistently exceed the legal requirements set by the Home Office. All animal research proposals are assessed by an Animal Welfare & Ethical Review Board, which ensures scientists have considered all aspects of the 3Rs (whether they can Replace, Refine and Reduce the use of animals in research) have been considered before being submitted to the Home Office for approval.

The Institute is a signatory to the Concordat on Openness on Animal Research and a member of Understanding Animal Research (UAR), which reflects the dedication of our animal services staff and scientists to inform the public about our work with animals. Pirbright was named a Leader in Openness for 2019-22 by UAR in recognition of the continuous and innovative work invested in



communicating Pirbright's animal research transparently.

ESSENTIAL INVESTIGATIVE TOOLS

Specialist tools are often needed to answer specific research questions. Bioimaging is a core component of viral research, and recent funding from BBSRC UKRI has enabled Pirbright to purchase a new transmission electron microscope and a confocal microscope to upgrade existing facilities. This high-tech equipment will allow scientists to view individual virus particles and infected cells within high containment and take images of even the weakest fluorescence signals for examining the location and interactions of virus and host cell proteins.

A suite of genetic sequencing and bioinformatics technology within high containment offers scientists the ability to gain in depth data about the genomes of viruses, insects and host animals. Detailed genetic information can be used for multiple purposes, such as identifying how viral strains mutate and spread for global disease surveillance and understanding how host immune systems

respond to infection.

The UK Immunological Toolbox, ran by researchers here and the University of Edinburgh's Roslin Institute, provides a platform for veterinary researchers to find resources and collaborate. It features the most up-to-date and comprehensive repository of antibodies and modified proteins available from commercial companies and academic institutes. Researchers are able to freely search the location, supply and application of these immune reagents, as well as submit requests for new reagents and antibody production, providing a central hub for the veterinary community.

FUTURE PROOFING RESEARCH

Pirbright is committed to delivering world class research which requires cutting-edge facilities and the leading scientific experts. Over the coming years new high containment animal facilities will become operational and our vision is to develop a campus that can adapt to the changing requirements in viral research to deliver to the One Health agenda.

VIRTUAL SCIENCE FOR ALL

The importance of engaging the public on why scientific research is crucial in preventing and controlling diseases has never been highlighted so clearly as during the COVID-19 pandemic. Pirbright's robust public engagement programme has always focused on generating valuable face-to-face interactions with a wide range of audiences, including schools, students, farmers, and the public. However, Pirbright's annual programme of live public engagement events has been severely restricted because of COVID-19 which has prevented all face-to-face public dialogue.

We had been selected to exhibit at the prestigious Royal Society's Summer Science Festival 2020 to showcase our exhibit 'Disease Detectives', but sadly the event, along with hundreds of others, was cancelled. Ironically, months before the pandemic had emerged, we were developing an interactive exhibit that was designed to showcase the essential role scientists play in preventing and controlling potential epidemics by using research to unravel the mysteries behind viruses that cause disease, especially new and emerging zoonotic viruses (those that spread from animals to people), SARS-CoV-2 being just such a virus. The last year has made the public even more aware of the threat of disease and familiar with scientific terms like 'R number', herd immunity, genetic sequencing and spike proteins.

So, we have taken this opportunity to rework our engagement programme to bring events online and cover scientific research, science misinformation and vaccine development. During 2020-21 Pirbright has taken part in 35 online public engagement activities, from hosting classroom talks via Zoom to exhibiting in virtual booths at online festivals.

FESTIVAL OF TOMORROW

FESTIVAL OF TOMORROW

In February 2021, Pirbright showcased its COVID-19 research in Science Swindon's online Festival of Tomorrow. Our virtual booth provided visitors with the chance to view our cutting-edge science and explore our animal facilities via an Understanding Animal Research virtual 360° Laboratory Animal Tour. Professor Simon Graham also provided a live talk to visitors about the COVID-19 pig vaccine studies carried out at Pirbright and answered the audience's keen questions.

INSPIRING FUTURE SCIENTISTS

As schools have adapted to online teaching, so have the careers events that we usually attend. This year, Pirbright volunteers have imparted their wisdom and experience to students through online talks and mentoring, videos, blogs and virtual fairs. This new emphasis on electronic communication has led us to expand our range of online outreach tools, helping us to inspire more students from a wider range of backgrounds to consider scientific careers than was previously possible via face-to-face interactions.

I'M A SCIENTIST

Several of our researchers took part in the 'I'm a scientist, get me out of here' initiative, where students from multiple schools chatted to scientists in online forums and asked questions about what they do. Students then voted for their favourite scientists in a series of knockout rounds that left the most popular scientist as winner at the end. The format is not only engaging for the students, but also specifically targets schools that are under served by higher education establishments due to their location.



SUPPORTING OLD AND NEW VOLUNTEERS

Pirbright's engagement programme could not exist without our superb volunteers, so training is essential to support both experienced staff and students, as well as encouraging prospective volunteers. We actively encourage participation in the Science, Technology, Engineering and Maths (STEM) Learning network which connects schools with STEM Ambassadors – experts from a range of disciplines that volunteer their time to help with talks and events. This year, we organised STEM Ambassador training for 20 Pirbright staff and students, who will add valuable knowledge and skills to our pool of over 70 STEM Ambassadors. We also provided specialised training for both PhD and placement students to help them understand the importance of engagement and equip them with confidence and tools to effectively communicate with the public.



Our scientists carried out public dialogue virtually.

Virtual tours show our animal research facilities.

FUTURE PLANS

We will be developing more interactives including our 'Disease Detectives' exhibit, which will include elements on how scientists act like sleuths, looking for clues to understand how existing and emerging viruses spread and cause disease, as well as finding ways to prevent and control outbreaks. We will be including COVID-19 and how researchers are learning more about the SARS-CoV-2 virus and how it spreads and mutates, along with developing ways to combat it. Pirbright uses animals in its research when absolutely necessary, such as testing new vaccines – we plan to hold more public dialogue events to explain why we do this and the steps we take to reduce, refine and replace animals used in our studies.



A SUSTAINABLE INSTITUTE

The Institute is committed to environmental sustainability and is undertaking a number of energy-saving projects that will make a positive contribution. These will be completed over the next couple of years and will reduce energy consumption, help reduce our carbon emissions and make us more efficient. The most significant of these projects is the installation of a Combined Heat and Power Plant which will provide around 75 percent of Pirbright's power needs on campus. The contract for this equipment has been agreed and it is anticipated that it will be fully operational in spring 2022.

The Institute will base its environmental objectives around the UKRI Environmental Sustainability Strategy which drives towards a zero-carbon future by 2040.

The Institute has established an Environment and Energy Team to promote the continual improvement of energy and environment performance on the site, monitor and review the Energy and Environment policy, report on and action results of inspections and audits and provide a forum for personnel to raise queries related to energy and environmental sustainability. Due to the impact of COVID-19 lockdowns the work of this committee has been somewhat limited this year, although they have overseen the installation of charging points for electric vehicles and sown a new wildflower garden alongside the BBSRC National Vaccinology Centre: The Jenner Building. The team has recently been restructured and its remit refocused to ensure this important area is given the attention it deserves during the coming year as staff and students all return to site.



GREENHOUSE GAS EMISSIONS	2020/21	2019/20
EMISSIONS TONNES CO₂e		
Scope 1: Gas	913,500	3,620,551
Scope 2: Electricity	2,792,600	2,858,250
Scope 3: Official business travel	1,700	5,577
Total emissions	3,707,800	6,484,378
Emissions per £ of grant received	0.11	0.20
ENERGY CONSUMPTION - kWh		
Scope 1: Gas	3,937,196	17,466,483
Scope 2: Electricity	11,978,211	11,182,512
Scope 3: Official business travel	6,998	1,622
Total energy consumption	15,922,405	28,650,617
Consumption per £ of grant received	0.48	0.87
FINANCIAL INDICATORS		
Total Energy cost - £'000	2,232	2,059
Energy cost per £ of grant received	6.685p	6.2265p
Cost of official business travel - £'000	8	12
Cost of official business travel per £ of grant received	0.0003p	0.0003p

MANAGING RISK AT PIRBRIGHT: A MAJOR HAZARD SITE

Risk management at Pirbright has three broad objectives:

- 1 to facilitate research excellence and diagnostic surveillance capability
- 2 to strengthen financial sustainability to ensure high reliability such that
- 3 the work of the Institute cannot jeopardise the UK livestock population and agricultural economy, the health and safety of people, or the environment.

Risk management at Pirbright is broadly aligned with ISO 31000 and ISO Annex L, including a Risk and Opportunities Register, Key and Safety Performance Indicators (KPIs & SPIs), and operational planning linked to the Register and to strategic objectives. The Register, KPIs and SPIs and operational plans are regularly updated and reviewed for action by Senior Leadership Board (SLB) and Trustee Directors. The Register covers operational risks (biorisk, security, cyber/IT, health and safety, environment, quality), continuity risks, and strategic risks (reputational, enterprise, financial, political). There is an internal audit programme broadly aligned with ISO 19011, covering critical risks and areas, and subject to ongoing review by SLB and Trustee Directors. Risk metrics (KPIs and SPIs) and internal audit findings together generate assurance for stakeholders. Pirbright actively maintains excellent, open and cooperative relationships with stakeholders, regulators and accreditation bodies.

A comprehensive portfolio of insurance protects Pirbright and its stakeholders. Policies in place include: Property damage and business interruption; employers, public, product and management liabilities; professional indemnity; and security and cyber incident response.

REGULATED VIRUS RESEARCH

Many of the animal viruses studied at Pirbright are high consequence pathogens, in that they are not endemic



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to the UK and so could cause a disease outbreak if released. The authority to work with these pathogens is via a SAPO (Specified Animals Pathogens Order) licence issued and enforced by the Health and Safety Executive (HSE). Pirbright's SAPO licence is at Containment Level 4 (CL4, highest level) and the Institute is classed as Major Hazard Site. Each year there is a HSE intervention plan, and in 2020/21 there were four visits by specialist HSE inspectors scrutinising internal audit, containment and control in a sample of CL4 laboratories, major hazard leadership, and an annual performance review. There were also security inspections by specialist counter-terrorism officers. The outcome of these regulatory interventions were all

Risk management is core to the operation of Pirbright requiring specialist knowledge and an understanding from all staff and students on what a highly reliable organisation looks like and how we all play our part to ensure the Institute continues to be a centre of excellence.

extremely positive, with just a few minor improvement actions.

Biorisk management at Pirbright comprises containment engineering including sealed facilities, negative air pressure cascades and HEPA air filtration, effluent treatment plant, automation and control systems etc; and operational arrangements including risk assessment, control measures and operating procedures, training and competency, waste management, transport procedures, emergency plans, audit and inspection, planned preventative maintenance and testing etc. Pirbright has all these in place, and each element is examined by a HSE planned intervention every few years. All CL4 facilities at Pirbright are less than 15 years old.

ACCREDITED DIAGNOSTICS

Diagnostic surveillance at Pirbright is accredited to the ISO/IEC 17025 quality standard, which is required for its role as a UK National Capability and its global role as an OIE Reference Laboratory and a FAO/OIE World Reference Laboratory for some viruses. A Quality Management System ensures conformity with 17025 and increasingly further underpins risk management across the wider Institute. The annual 17025 surveillance audit of the Reference Laboratories in 2020/21 by the UK Accreditation Service gave an extremely positive outcome with no improvement actions.

In addition to its risk management system, and the assurance arrangements and regulatory oversight, Pirbright actively works to enhance its risk control and resilience. Examples in 2020/21 include capital projects for upgrades of an effluent treatment plant, electrical supply infrastructure, containment automation and control systems and physical security infrastructure; and operational projects to enhance cyber security, to improve organisational structure and effectiveness, to develop a new competency framework, and to improve asset obsolescence and functional safety management.



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DEVELOPING SCIENCE FOR THE FUTURE

Pirbright is a National Capability and provides unique facilities and infrastructure to the UK to monitor and to support the control of diseases that are circulating globally and are a threat to the UK's livestock.

Over the past ten years there has been substantial investment by UK government through BBSRC UKRI into Pirbright's campus and infrastructure to ensure the Institute can continue to deliver its responsibilities as a National Capability and its programmes of research into highly infectious viral pathogens. The development that started about ten years ago is delivered in three phases.



DEVELOPMENT PHASE ONE

THE PLOWRIGHT BUILDING

Development phase one encompassed the construction of a cutting-edge high-containment laboratory at a cost of £135 million to replace outdated facilities to study highly infectious viruses. The BBSRC National Virology Centre: The Plowright Building became operational in 2015 to provide diagnostics service through the Reference Laboratories and undertake fundamental research on viruses such as foot-and-mouth disease virus (FMDV), African swine fever (ASF) and bluetongue. It was named in honour of Walter Plowright who played a key role in the eradication of rinderpest by developing a vaccine.

THE BROOKSBY BUILDING

Construction began on Brooksby, a high containment large animal facility, in 2019 and building continued throughout 2020 under the 'critical construction' works designation. Post March lockdown only essential contractors and safety teams were permitted on the construction site to ensure concrete pouring (enough to fill an Olympic sized swimming pool - over 2,600m³) could go ahead at a critical point in the project timeline. The construction site

implemented the Construction Leadership Council guidelines and bubbles of contractors enabled building to continue throughout the year, although there is now a ten week delay due to COVID-19. New ways of working including virtual Factory Acceptance Testing (FAT), which despite initial teething problems is now an efficient and carbon-friendly approach to construction. By November 2020 external

cladding was applied and the building topped out to ensure it was weatherproof, which was followed by the installation of mechanical services such as cabling and pipework. The Air Handling Units, Effluent Treatment Plant (ETP) tanks have been installed and most of the containment coatings have been completed. Manufacture of the incinerator components is in progress, and we are expecting delivery later this year. Brooksby will be capable of handling highly infectious viruses that must be studied under a Specified Animal Pathogen Order (SAPO 4) including FMDV



25 February 2019



17 June 2019



13 August 2019



3 September 2019

DEVELOPMENT PHASE TWO

THE JENNER BUILDING

Development phase two is well underway and has already delivered important facilities to enable Pirbright to continue its research on poultry viruses and vaccine development. The first stage of this phase was the construction of a £23 million new containment level 2 energy efficient laboratory, the BBSRC National Vaccinology Centre: The Jenner Building. The laboratory has been operational since 2017 and is home to over 100 scientists working on strategically important endemic and exotic diseases which can be handled at low containment such as infectious bronchitis virus (IBV) and low pathogenic influenza viruses. The building named after Edward Jenner who developed the vaccine that was used to eradicate smallpox is a leading UK vaccine development hub as well as the centre for the Bill & Melinda Gates Foundation Livestock Antibody Hub and Immunological Toolbox.



@RichardChivers



THE BIGGS BUILDING

Repurposing of an existing high containment animal facility at a cost of £7.5 million will result in a new avian research laboratory which will operate under containment level 2 for 'in vivo' research. Animal room renovations, updates to the mechanical and electrical plant and a new effluent treatment plant are nearing completion and will enable the building to open for scientific research in late 2021. The laboratory is named after Peter Biggs who was the first scientist to isolate the virus that causes Marek's disease, a disease of poultry that has huge economic and animal welfare impact globally every year. Another project allowed the separation of Biggs from the existing high containment facility ISO11 and a £4.9 million investment in a new effluent treatment plant for ISO11 which became operational in the spring of 2021.



THE HOUGHTON FACILITY

The £4.44 million Houghton Facility is a specified pathogen free poultry laboratory that allows scientists to carry out experiments on disease free birds. Birds are hatched from eggs within this 'clean' facility and rigorous biosafety protocols applied to ensure pathogens do not enter the building. Phase three of development is detailed in the Master Outline Planning Application (MOPA) and is currently in the early stages of being scoped out in more detail.

@ James Brittain

and ASFV along with zoonotic viruses that can infect humans which are studied under ACDP3 regulations, for example Rift Valley fever virus. The animal facility has six rooms and the capacity to handle large livestock up to 250kg. The Brooksby Building, which will cost in the region of £72 million for construction with a total project value of circa £85 million,

is crucial to further the development of the Pirbright Campus and will be a key component that allows sustained success in livestock and zoonotic pathogens research

and vaccine development. It is named in honour of John Brooksby who joined the Foot-and-Mouth Research Institute at Pirbright in 1939 and became Director in 1957. His laboratory was designated the World Reference Laboratory for foot-and-mouth disease (FMD) in 1958.



13 August 2020



15 April 2021



25 May 2021

FUNDING FOR OUR RESEARCH

Pirbright can only progress its research to prevent and control viral diseases of livestock with financial support from BBSRC UKRI for its two programmes of research and income from a variety of other funders. In 2020/21 the Institute Programme Grants were extended by BBSRC UKRI to 2023 and we were awarded £9,080,673 from other funding bodies including Defra, Bill & Melinda Gates Foundation and ICRAD.

Scientist: Bryan Charleston
Project: G2P-UK; A National Virology Consortium to address phenotypic consequences of SARS-CoV-2 genomic variation
Value: £194,607 (£2,520,248)*
Funder: UK Research and Innovation (UKRI) - Medical Research Council (MRC)
 Pirbright is part of a new national research project to study the effects of emerging mutations in severe acute respiratory syndrome virus 2 (SARS-CoV-2), the cause of coronavirus disease (COVID-19). With funding from UK Research and Innovation (UKRI), the 'G2P-UK' National Virology Consortium, comprising of ten partners, will study how mutations in the virus affect key outcomes such as how transmissible it is, the severity of COVID-19 disease it causes, and the effectiveness of vaccines and treatments. Ongoing work at Pirbright is specifically investigating whether naturally acquired mutations in the spike surface protein of SARS-CoV-2 change any of the fundamental properties of this virus, such as how well it replicates.

Scientist: Toby Tuthill
Project: Understanding RNA packaging signals in foot-and-mouth disease virus (FMDV) for improved vaccine production
Value: £385,907 (£421,812)*
Funder: Biotechnology and Biological Sciences Research Council (BBSRC)
 How do the components of foot-and-mouth disease virus (FMDV) assemble together to make new viruses inside an infected cell? This project aims to answer this question and more by understanding how the virus genome uses 'hooks' to latch on to virus proteins, allowing the virus to package itself up ready for exiting the cell and infecting the next. Gaining detailed information about this critical part of the virus lifecycle may enable scientists to reprogramme the viral genome to improve on the production of FMD vaccines by increasing yield and/or the stability of vaccines.

Scientist: Venugopal Nair
Project: The consequences of transmissible vaccines on disease ecology and pathogen evolution: Marek's disease virus as a case study (US-UK collaboration)
Value: £477,500
Funder: Biotechnology and Biological Sciences Research Council (BBSRC)
 Transmissible vaccines are vaccines that are able to transmit between individual animals. These vaccines show great promise for disease interventions in wildlife populations as well as farmed animals that may be difficult to vaccinate such as fish or poultry. Together with Penn State University as part of the Ecology and Evolution of Infectious Diseases (EEID) programme, scientists will investigate the effects that a potential transmissible Marek's disease vaccine would have on the spread of disease in birds as well as the effects on Marek's disease virus evolution.

Scientists: Chris Netherton/ Linda Dixon
Project: Vaccines, diagnosis and epidemiology for control and prevention of African swine fever
Value: £495,901 (£1,307,501)*
Funders: International Coordination of Research on Infectious Animal Diseases (ICRAD) - UK funding through Defra
 There are currently no vaccines or treatments commercially available for African swine fever (ASF), a deadly pig disease. Understanding which ASF virus genes are important for replication and immune system interaction will help scientists to develop these vital disease control tools. To discover if specific genes are important for replication or evading the pig immune response, six European partners, including Pirbright, will identify the roles of around half of the 150-170 ASF virus genes. This could provide new pathways for antivirals to target or additional genes that could be used in vaccine development.

Scientist: Shahriar Behboudi
Project: A novel platform for producing cell-free third generation Marek's disease virus vaccine
Value: £516,435
Funder: Biotechnology and Biological Sciences Research Council (BBSRC) – Industrial Partnership Award (IPA)
 Around 22 billion doses of Marek's disease virus vaccine are administered to chickens every year. The cost of vaccination is very high as the vaccine must be grown in chicken eggs and then stored and transported at very low temperatures using liquid nitrogen. Any error in storage and handling can reduce the effectiveness of the vaccine. This project aims to produce a vaccine that can be grown in cells and which do not require very low temperatures for storage or transportation, thereby greatly reducing the cost and reliability of vaccine production and distribution.

Scientist: John Hammond
Project: Using CRISPR/cas9 gene editing for increased vaccine yields in avian cell lines Phase II proposal
Value: £584,500
Funder: International Development Research Centre (IDRC)
 The natural defence mechanisms of chicken eggs and cells used to grow poultry vaccine viruses limit the amount of virus that can be produced. To improve vaccine virus yields, Pirbright scientists will collaborate with multiple international commercial partners to use advanced gene editing technology (CRISPR/Cas9) to remove a defence gene from cells that limits virus growth. These modified cells would then be able to support high levels of vaccine viral growth and used to quickly respond to emerging disease threats.

Scientist: Linda Dixon
Project: Exploiting novel African swine fever virus virulence factors and a porcine macrophage cell line to develop a live attenuated vaccine
Value: £813,238 (£955,741)*
Funder: Biotechnology and Biological Sciences Research Council (BBSRC) LINK award
 This LINK project brings together a cutting-edge academic and industry partnership between Pirbright, the University of Plymouth and an international animal health company to rapidly progress African swine fever (ASF) vaccine development. ASF has rapidly spread across Europe and Asia, killing up to 100 percent of pigs that it infects and currently there is no licenced vaccine to prevent it. By deleting combinations of genes from the ASF virus, the team aims to create a weakened virus that primes the pig immune system and protects 80 to 100 percent of pigs from disease. They will also optimise and scale up a cell line that can be used to grow the vaccine virus.

Scientists: Donald King and Anna Ludi
Project: Improved FMD vaccine quality control
Value: £826,319 (£1,055,285)*
Funder: Bill & Melinda Gates Foundation
 This funding will enable the World Reference Laboratory for Foot-and-Mouth Disease (WRLFMD) at Pirbright to develop an improved pipeline that can be used to assess the quality of FMD vaccines in countries where the disease is widespread. WRLFMD scientists will develop new tests and provide technical support to ensure vaccine quality is maintained throughout the manufacturing process so that vaccinated animals are afforded the best possible protection against FMD.

Scientist: Linda Dixon
Project: Vaccines, diagnosis and epidemiology for control and prevention of African swine fever
Value: £899,730
Funder: Department for Environment, Food and Rural Affairs (Defra)
 Pirbright scientists will establish important characteristics about African swine fever virus (ASFV), in order to protect the UK pig farming industry against this deadly porcine disease which has no treatments or vaccine. Researchers will investigate the virus's survival rate in water and excrements and the role that biting flies play in ASFV transmission. This will provide vital information for decontamination procedures and will be integrated into models for disease spread within and between farms in the UK and beyond. They will also build on their successful approaches to vaccine development and improve diagnostic methods by investigating cell lines that can replace the currently used primary pig cells, contributing to 3Rs of animal research (Replace, Reduce, Refine). The research will be important for controlling an outbreak should the virus reach our shores.

Scientist: Bryan Charleston
Project: Foot-and-mouth disease virus like particle vaccines for Africa
Value: £419,800 (£1,092,251)*
Funder: Bill & Melinda Gates Foundation
 Foot-and-mouth disease (FMD) is estimated to cost Africa over US\$2 billion in direct production losses and vaccination programmes. Pirbright's ongoing work with the University of Reading, the University of Oxford and a multinational animal health company aims to provide low cost and accessible vaccines to reduce the impact of the disease in East Africa. Further funding from the Bill & Melinda Gates Foundation will enable scientists to progress key research that will tailor the vaccines to African strains of FMDV, providing a strong foundation for manufacturing them at scale and bringing them to market.

* Numbers in brackets represent total funding for project to all collaborators.

PIRBRIGHT INNOVATIONS

Commercial activity is an important element of the Institute's strategy to diversify funding streams and ensure a sustainable organisation for the future. Pirbright has recently established a commercial arm, Pirbright Innovations, to capture and manage operations that attract income on business activities and services. Existing industry partnerships, licensing and patents will form part of this, including new income streams which have been introduced during the 2020-21 reporting period.

SHARING PIRBRIGHT'S EXPERTISE

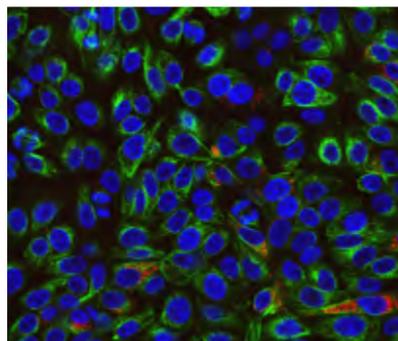


SPiRE
Sharing Pirbright's Expertise

In January 2020 Pirbright launched Project SPiRE (Sharing Pirbright's Expertise),

an initiative designed to bring its internationally recognised science and training to a global audience through online and instructor-led courses. Having launched in January 2020, the project was immediately faced with the first lock

down of the pandemic. With face-to-face training no longer possible, members of Project SPiRE team turned their focus to the development of e-learning materials. E-learning courses have been created to cover a range of areas of research expertise including African horse sickness virus, Newcastle disease virus, African swine fever virus, HEPA filtration (Validating, Testing and Changing), and Biological Safety Cabinets (Maintenance and Validation). This use of virtual reality has helped to provide accessible training



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courses suitable for today's global needs and address the challenges of delivering training in the pandemic. Training has been delivered to people located in over 80 countries worldwide.

SUPPORTING COVID-19 DIAGNOSTICS TRAINING FOR BRANTS BRIDGE LIGHTHOUSE LABORATORY

Since October 2020, Pirbright staff have been heavily involved in providing training for Berkshire and Surrey Pathology Services to establish a new lighthouse laboratory for COVID-19 high-throughput testing. Members of the SPiRE, HSBS and QA Teams worked together to develop a General Laboratory Practice induction course which has since been delivered to over 350 people. More advanced training courses for BSPS including Spill training and Biological Safety Cabinet use were also created. Scientists from the Non-Vesicular Reference Laboratories played a critical role in assisting with the installation, set up and validation of the diagnostic equipment and have provided training on sample accessioning and on the Thermo Fisher Scientific Amplitude Solution testing rig.

COMMERCIAL ZONE

Pirbright commenced its first commercial sublet of science laboratories within its campus in February 2021 with company 272BIO who work with biotherapeutics for animal health, finding solutions with innovative biotherapies to improve veterinary medicine for both livestock and companion animals. This has taken approximately six months of negotiation with the company and with BBSRC UKRI, the lessor, and it is a significant milestone in the project which was funded initially through an Enterprise M3 investment. Not only does it bring a new income stream to the Institute but will generate new jobs within the M3 corridor.

PARTNERSHIP TRAINING

Two important collaborations were also progressed during the year. One of these, with APHA and the University of Surrey, is to explore the production of e-learning courses on exotic viral diseases of animals as training for Government and private practice vets, as well as final year veterinary students. Two courses have been produced so far for foot-and-mouth disease virus (FMDV) and African swine fever virus (ASFV), both diseases of livestock with a huge impact on the



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global economy and food security. More modules are planned. The second project is a collaboration with the University of Nottingham, producing e-learning modules on viral diseases of poultry which will be accredited and form part of their planned Certificate in Advance Veterinary Practice on Poultry Health.

DEVELOPING AFRICAN SWINE FEVER VACCINES FOR AFRICA

Reports of African swine fever's (ASF) rapid spread through Europe and Asia often overshadow outbreaks of the deadly pig disease in African countries where the virus originated. Several different ASF virus types (genotypes) circulate in sub-Saharan Africa. To aid with the control of outbreaks, Pirbright scientists received funding

from GALVmed (with funding from UK aid of the UK Government) to develop African swine fever virus (ASFV) vaccine candidates. They will also investigate if a vaccine strain developed from one genotype can also protect against other circulating genotypes. If cross protection is possible, vaccination programmes would be cheaper and easier to coordinate, benefiting ASF control across sub-Saharan Africa.

EVALUATING PROMISING AFRICAN SWINE FEVER VACCINES

An African swine fever vaccine is desperately needed to contain the devastating disease that has been decimating pig populations across the globe. New research run in partnership

with an international animal health company will evaluate three ASF vaccine candidates developed by Pirbright scientists to identify which is most promising for further development. They also aim to modify the selected vaccine virus to allow differentiation between infected and vaccinated animals (DIVA) as well as developing the complementary DIVA test. This is essential for enabling trade in countries where outbreaks are occurring.

FOUR IN ONE VACCINE TO PROTECT POULTRY HEALTH

Vaccines that can protect against multiple diseases at once are highly desirable for the poultry industry. Pirbright researchers have developed the first stable vaccines that protect against four economically important poultry diseases in one shot. Follow-on research with a multi-national animal health company will extend and broaden the successful work to improve the effectiveness of the current vaccines and develop new vaccines that can be used in combination to protect against even more diseases.

USING CRISPR/CAS9 GENE EDITING FOR POULTRY VACCINES

The CRISPR/Cas9 gene editing tool has the potential to revolutionise vaccine development through allowing targeted and efficient editing of vaccine viruses, making the process quicker and more flexible. Pirbright scientists have recently employed the CRISPR/Cas9 system to generate vaccines that can simultaneously protect against multiple poultry viruses. Their latest project, funded by a small start-up animal health company based outside the UK, will use innovative CRISPR/Cas9-based tools to develop efficient vaccines that use herpesvirus of turkeys to deliver components of other viruses to poultry, stimulating their immune response against several diseases. This will not only reduce costs but will also allow vaccines to be adapted more easily to protect against circulating virus strains.

EVALUATING NEW PRRSV VACCINES

In a collaborative project between Pirbright, The Vaccine Group (TVG) and ECO Animal Health, Pirbright will assess two porcine respiratory and reproductive syndrome virus (PRRSV) vaccine candidates for their effectiveness at tackling the disease in pigs. The vaccines

are created by using TVG technology to insert non-infectious PRRSV genes supplied by Pirbright into a benign herpesvirus, which then stimulates the immune system when delivered into animals. Generating effective vaccines against PRRSV is essential for curbing one of the most economically damaging diseases for the global pig industry, which costs European pig farmers an estimated €1.5 billion a year and those in the US approximately \$600 million.

GENETIC ENGINEERING TO IMPROVE PRRSV VACCINES

Pirbright scientists are working with ECO Animal Health to develop a significantly improved inactivated porcine respiratory and reproductive syndrome virus (PRRSV) vaccine. The team aim to generate modified PRRSV strains and then inactivate them to create vaccine candidates. The strain modifications

aim to prevent inappropriate antibody responses and enhance those that are thought to provide immunity against multiple strains of PRRSV. This 'killed' vaccine would offer an attractive alternative to the current generation of live vaccines, which are only partially effective against different strains and suffer from safety constraints owing to the potential for the live vaccine virus to revert back to an infectious form.

PROTECTING ANIMALS AGAINST COVID-19

Vaccines can protect people against COVID-19, but it is possible that virus variants currently circulating within the human population may evade the present COVID-19 vaccines. It is also possible that the viruses could re-emerge to infect humans from new or existing animal populations. A vaccine which is able to broadly target the virus that

causes COVID-19 and related viruses in a diverse range of animal species may be a critical tool to combat these potential threats. Pirbright researchers will use their highly successful pig model to evaluate the immune responses against vaccines developed by The Vaccine Group, which are intended to protect a variety of animals against COVID-19.

LICENCING PIRBRIGHT'S INNOVATIONS

Pirbright's scientific innovations are of great interest to pharmaceutical and animal health companies for further development and commercialisation. This financial year the Institute signed two licences with companies to evaluate two new technologies.

NEW PATENT APPLICATIONS

Pirbright has five new priority patent applications covering a range of inventions. Three patents relate to potential African swine fever vaccines, which could help to bring the devastating disease of pigs under control. Another covers a possible avian influenza vaccine for protecting poultry against the flu. The final application encompasses a novel method to prevent gene drive resistance. Gene drives are intended to spread through target populations to promote a particular genetic characteristic, so inhibiting resistance will make gene drives more durable and reliable to ensure the intended beneficial effects are realised.

EIGHT NEW PATENTS GRANTED

Eight new patents have also been granted in various countries this financial year.

A patent granted in Australia covers the use of a gene editing technology to enhance the growth of vaccine viruses for avian diseases. By removing an immune system gene that reduces virus growth, cells without the gene can produce higher yields of vaccine viruses, which could make vaccine production more viable for developing countries. The invention has already been patented in Mexico, Japan, Europe, USA and South Africa.

Three more patents have been granted for an African swine fever vaccine in Eurasia, China and Africa. The vaccine is

generated by deleting ASF virus genes that allow it to evade the pig immune system. This creates a weakened virus that can provoke an immune response, which protects pigs from natural strains of ASF. These patents are in addition to a previous patent granted in the USA and Europe.

Two patents granted by Canada and Japan cover the development of effective infectious bronchitis virus (IBV) vaccines using genetic engineering to weaken IBV. The weakened virus can then be used to prime the poultry immune system against future IBV infections. Another IBV patent was accepted by India, which extends the ability of the virus to grow in multiple different cell types.

This financial year, Brazil granted a patent for Pirbright's foot-and-mouth disease (FMD) vaccine. The vaccine is made of synthetic 'virus like particles', which imitate the FMD virus and stimulate an immune response. They have no need for cold chain storage and can be produced outside of high containment, making them far more accessible to low- and middle-income countries where FMD circulates. The vaccine is already patented in Vietnam, India, China, Europe, Singapore, South Africa, South Korea, Russia, Thailand, USA and Indonesia, and in 2019 it was licenced to MSD Animal Health to take forward for development, registration and manufacturing.

5

NEW PATENT APPLICATIONS

- 3 AFRICAN SWINE FEVER VACCINES
- AVIAN INFLUENZA VACCINE
- GENE DRIVE RESISTANCE

8

NEW PATENTS GRANTED

- GENE EDITING TECHNOLOGY TO ENHANCE THE GROWTH OF VACCINE VIRUSES FOR AVIAN DISEASES
- AFRICAN SWINE FEVER VACCINE
- INFECTIOUS BRONCHITIS VIRUS (IBV) VACCINES
- FOOT-AND-MOUTH DISEASE (FMD) VACCINE



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GLOBAL IMPACT

Pirbright's reputation for scientific excellence continues to extend across the globe enabling us to have positive outcomes in animal health and food and economic security for millions of people who rely on their livestock to

survive. In 2020/2021 we began 48 new projects (including studentships) in different countries. Over half of these projects were working with partners in Belgium, Germany, Ghana, Nigeria, Philippines, South Africa, South Korea,

UK and the USA. We also continued to collaborate with 108 partners on 218 ongoing projects in 42 countries during the year. In addition our students were involved in over 60 projects worldwide.

BETTER BIRD FLU VACCINES AND DIAGNOSTICS

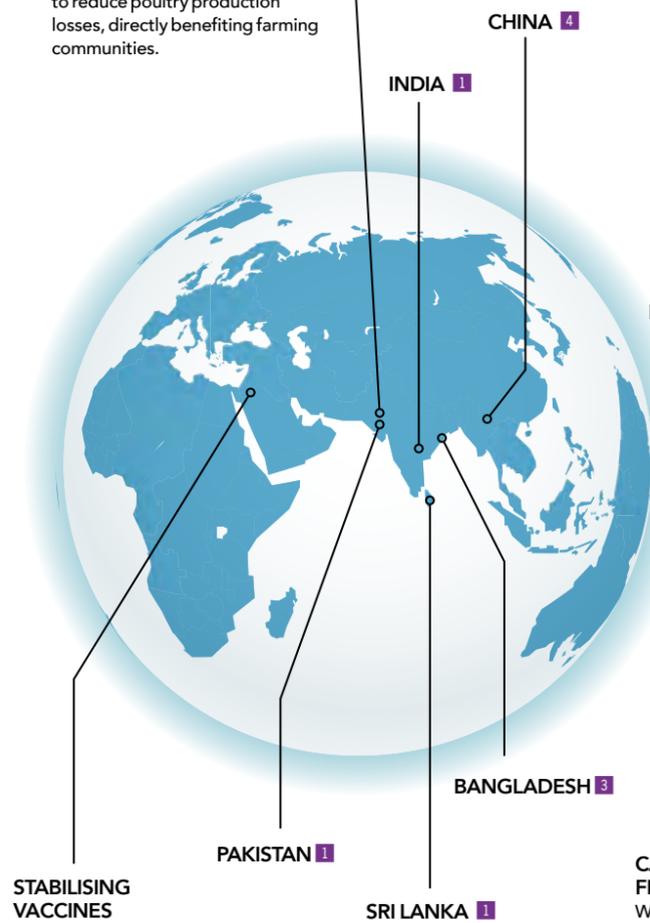
Pirbright is collaborating with researchers in Pakistan and Vietnam to improve avian influenza vaccines and diagnostics and transferring them to in-country partnered laboratories. This will help these countries to reduce poultry production losses, directly benefiting farming communities.

HARMONISING REFERENCE LABS

The World Reference Laboratory for Foot-and-Mouth Disease at Pirbright is working with other reference labs in Belgium, France, the Netherlands and Italy to harmonise methods used for post-vaccination monitoring.

PROTECTING NEWBORN ANIMALS

The International Coordination of Research on Infectious Animal Diseases (ICRAD) supports Pirbright to work with five other research partners in France, Sweden, Switzerland, and Norway. Funded by BBSRC UKRI, the project is designed to develop vaccine strategies to improve the protection of new-born animals against two economically important livestock diseases: bovine respiratory syncytial virus (BRSV) in cattle, and porcine reproductive and respiratory syndrome virus (PRRSV) in pigs.



STABILISING VACCINES

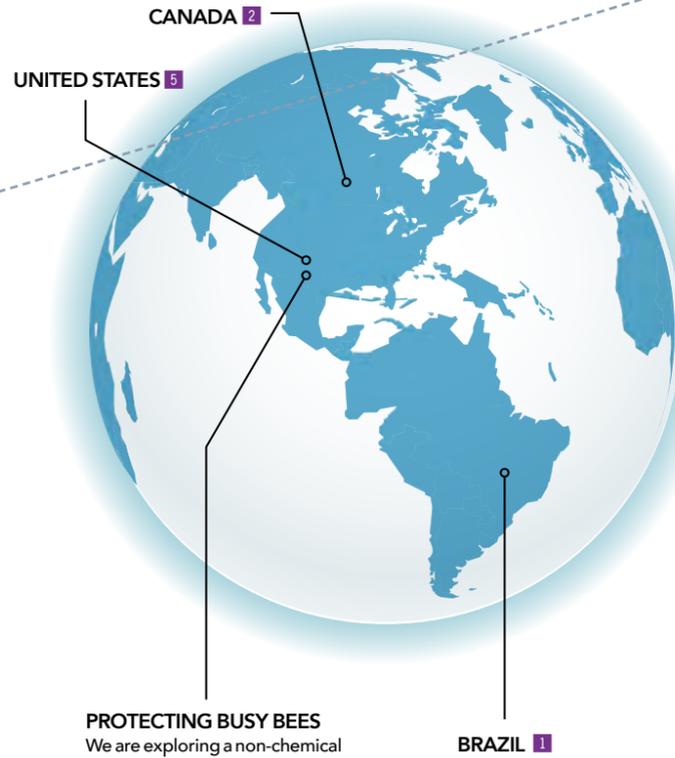
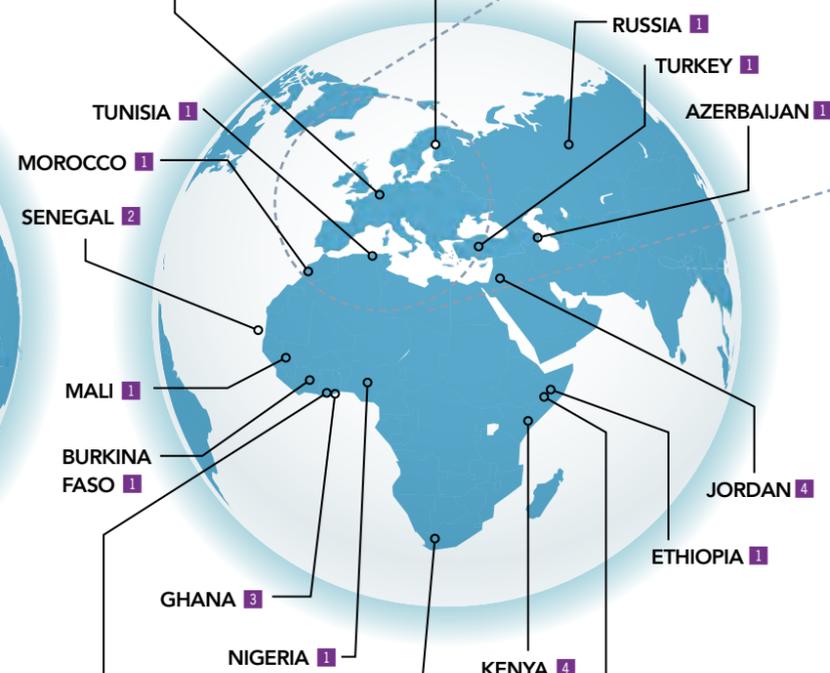
A collaboration with Jordan will evaluate a vaccine stabilisation technology using a peste des petits ruminants (PPR) vaccine.

CATCHING BITING FLIES IN GHANA

We are working with researchers in Ghana to test a trap for *Culicoides* biting midges and sand flies against traps that use humans as bait. This will help to characterise which species are present in Ghana and facilitate understanding of the diseases they spread.

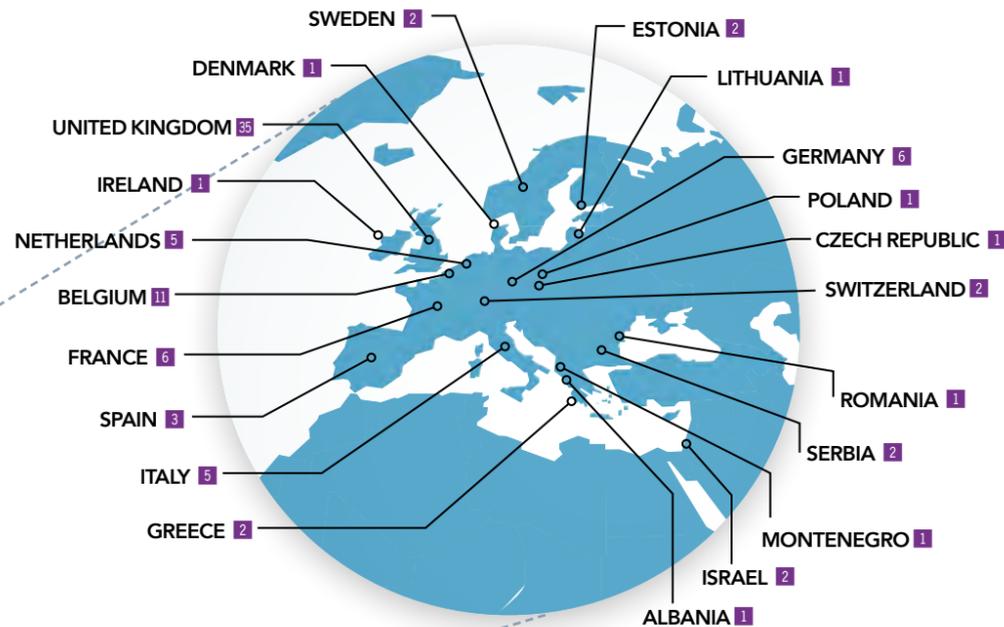
QUALITY VACCINES FOR AFRICA

The World Reference Laboratory for Foot-and-Mouth Disease (WRLFMD) is assisting the African Union Pan African Veterinary Vaccine Centre (AU-PANVAC) in Ethiopia to establish capacity for independent evaluation of foot-and-mouth disease (FMD) vaccines in Africa. Implementing an efficient FMD vaccine quality control system will help to control the disease by ensuring vaccines are as effective as possible.



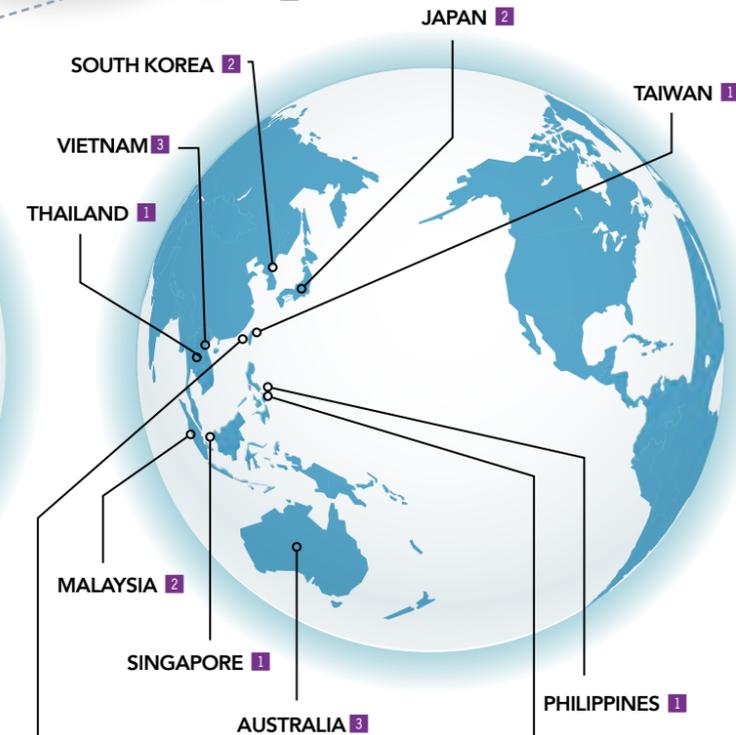
PROTECTING BUSY BEES

We are exploring a non-chemical approach for inhibiting deadly bee viruses with partners in the USA. This could form part of an enhanced and sustainable integrated bee health programme.



EXCHANGING POULTRY DISEASE EXPERTISE

Pirbright is partnering with the National Taiwan University to exchange knowledge and expertise about infectious bronchitis virus, a devastating disease of poultry.



TWINNING WITH THE PHILIPPINES

A twinning project will enable the Institute's experts to share their extensive knowledge and experience with laboratories in the Philippines to build capacity for African swine fever testing. This is essential for bringing the disease under control and will work towards the laboratories meeting specific standards that will help them to gain reference laboratory status for South East Asia.

Number of collaborations within country

INVESTING IN OUR PEOPLE

Pirbright prides itself on valuing its diverse community of staff and students, from virologists to veterinarians, cleaners to communicators and biosafety experts to biomathematicians. We all work to support each other in achieving Pirbright's mission to eliminate viral diseases of livestock through fundamental research, vaccine development and diagnostics and surveillance.

The coronavirus pandemic and resulting lockdowns that began in March 2020 have presented challenges that none of us have had to face before - at work, at home and in our personal lives. We have all risen to these challenges and continued to deliver scientific impact throughout the year, despite the unprecedented disruption and difficulties that have tested our resilience, our stamina, and our flexibility. We are rightly proud of how well our staff and students have coped and responded in such difficult circumstances. Our priority throughout the year has been to ensure that all our staff and students have stayed safe and well, particularly when working on site. We have liaised closely with our Occupational Health partner, Cordell, to provide personal health reviews for those with underlying health conditions, and who were pregnant, as well as offering support to those staff self-isolating or impacted by COVID-19.

SUSTAINING OUR SCIENCE

Many staff continued to work physically on site throughout the pandemic in order to deliver our critical science including testing COVID-19 vaccines on animals and developing diagnostic tests which, as well as researchers, required support from operational staff to maintain key services and engineering facilities. We did not have to furlough any staff and have adapted our ways of working to minimise attendance on site, whilst seeking to maximise productivity.

Managers and leaders were actively supported and given guidance on how to help their teams, whether they were working fully remotely, on site, or a hybrid of both – a very different way of managing. Our staff and students have been able to change their working routine to best suit their personal circumstances, e.g., to accommodate childcare arrangements and caring responsibilities, whilst also fulfilling their work requirements. This has been very positively received by staff. Our



Pirbright volunteers supporting delivery of COVID-19 diagnostics in NHS and PHE labs

Information Services team has done an amazing job ensuring that staff could access their work from home.

GIVING OUR SUPPORT

We are proud to say that Pirbright provided the NHS Royal Surrey Hospital and Public Health England with several volunteers who have helped to support the setting up and delivery of diagnostics throughout the pandemic, as well as training of staff to the Berkshire and Surrey Pathology Services Lighthouse Laboratory at Brants Bridge. This work is ongoing. We provided several staff with recognition vouchers during the summer

for their voluntary services and celebrated their achievement internally.

RECRUITMENT AND RETENTION

Our recruitment activity was paused during the summer months and our long-term visiting scientist process was also suspended, as well staff and student travel within the UK and overseas. Nonetheless, we have been able to recruit 68 new colleagues in the last year, 49 into Science roles and the remainder spread across our other functions. We welcomed two new Science Group Leaders, who will help strengthen our Virology and Immunological Science

expertise. We also appointed a new Director of Capability in April 2021, ahead of the retirement of our current Director of Capability in June 2021. In total 43 staff left the Institute during this period which represents an annual turnover rate of just under 11.18%, which is reflective of the national average.

REWARD AND REMUNERATION

The organisation has taken a prudent approach to staff reward and remuneration during the year with a modest pay increase of 1% implemented last September. We have this year introduced a new benefit – selling and buying of up to one week's annual leave, which has been well received.

BREXIT has also had an impact on the Institute this year. Combined with the impact of the pandemic, this has resulted in a small number of colleagues resigning and returning to their home country. The number of overseas applicants for roles at Pirbright does not appear to have declined and we have put in place financial support to contribute to the increased immigration costs. We hope this will help us to continue to attract the best talent to Pirbright.

DEVELOPING MANAGERS

Supporting management in the last year has included training and development on the following topics:

- Managing teams remotely
- Absence Management
- Managing Performance
- Managing Capability
- Understanding Mental Health at Work.

WELLBEING

In supporting our staff wellbeing, our focus has been to introduce a range of options which could be remotely accessed as we were not able to deliver these physically. Mental wellbeing was prioritised with topics covered including:

- Building Personal and Emotional Resilience
- Looking after your Mental Health
- Healthy Home Working
- Stress Awareness
- Sleep Clinics
- Mindfulness practical sessions.

These activities were in addition to our annual Wellbeing Calendar which is published on the intranet.

EQUALITY, DIVERSITY AND INCLUSION

Our Equality, Diversity & Inclusion (ED&I) Committee has been actively promoting this important area throughout the year. We have reviewed and updated our ED&I strategy and policy and identified key topics of focus, many in recognition of national/international events. Children on the Edge, the staff 'charity of the year' was introduced in January 2021 following a staff vote. The Committee raised over £800 by completing over 2 million steps in March. Fundraising efforts will be increased on site as COVID-19 restrictions ease.

Our Gender Pay Gap reduced this year to a mean of 14.2% and median of 8.1%. We have increased the gender diversity within our Trustee Board membership, with three of the four new appointees being women. We have developed more guidance for managers in supporting staff to avail of our suite of family friendly policies.

Our work towards our next Athena SWAN application continues, and we are aiming for the Silver Award in 2021/22. Some progress on our Employee

Engagement Action Plan arising from our last staff survey has been achieved but the pandemic has prevented us from progressing all the actions. A staff survey will take place next financial year (2021-22) along with a specific COVID-19 survey to assess the effectiveness of Pirbright's response and COVID-19 secure site management and how the pandemic has impacted our staff/students.

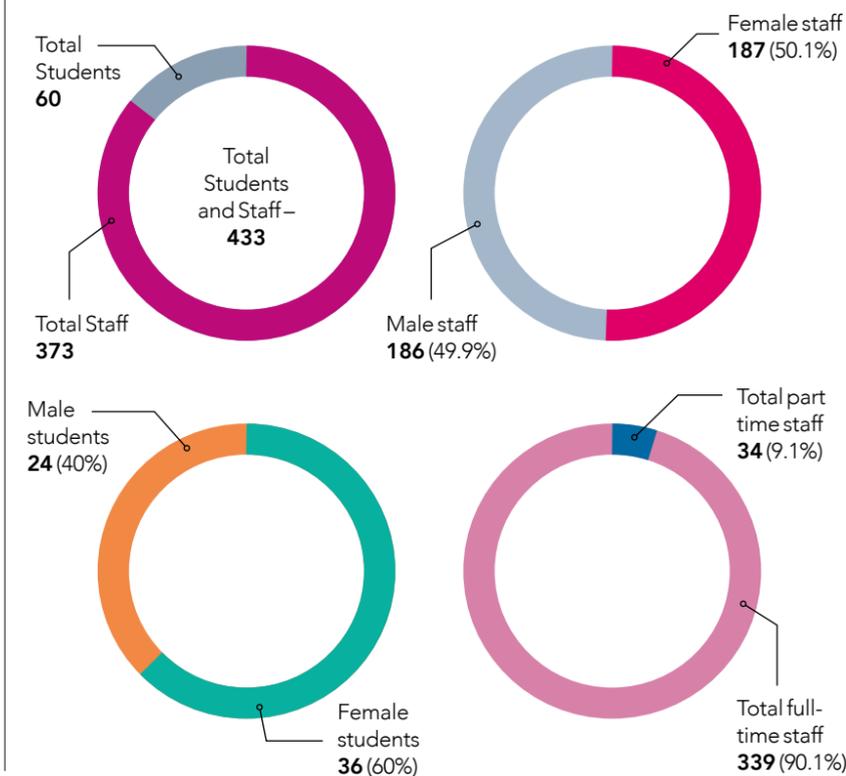
Following the appointment of new Trustee Board members, our gender balance has been positively impacted with female Trustee membership increasing from 21.5% to 36.4% during the year.

2020:
Total: 14
Male: 11 (78.5%)
Female: 3 (21.5%)
Chair: Male

2021:
Total: 11
Male: 7 (63.6%)
Female: 4 (36.4%)
Chair: Male

STAFF/STUDENT PROFILE AND GENDER BREAKDOWN

An overview of our staff profile is shown below:



TOP TALENT

Recruitment of top talent and investment in our staff and students is a priority at Pirbright. World-class researchers and specialist support staff enable the Institute to deliver its cutting-edge research, diagnostics and surveillance.



DR MIKE JOHNSON RETIRES

After 13 years of service at the Institute, Dr Mike Johnson will retire this summer as Director of Capability. Having overseen major development projects at Pirbright and led the Capability Directorate which includes Estate Management Services, Animal and Research Services and Development Project Team. Mike moved to the UK from Australia to join the Institute as Head of The Pirbright Laboratory and Head of Estates. Key development projects that Mike was responsible for includes the BBSRC National Virology Centre: The Plowright Building, the BBSRC National Vaccinology Centre: The Jenner Building and Houghton Facility, a specified pathogen free poultry facility, which are all part of Pirbright's Master Plan for future development on the site. Mike will return to his native Australia and we wish him a happy and healthy retirement.



DR SIMON CARPENTER NEW DIRECTOR OF CAPABILITY

Dr Simon Carpenter was appointed to the Director of Capability in March 2021. Simon, who was previously Head of the Entomology research group at Pirbright and leads the Core Capability Grant (CCG) funded by BBSRC UKRI that provides approximately £12m per year to deliver the facilities and infrastructure to support our science, took up the position in April. Simon's strong science background and experience in leading the CCG grant means he is ideally placed to take on this new role and become a member of Pirbright's Senior Leadership Board (SLB).



KEVIN MARINGER GROUP LEADER: FLAVIVIRUS TRANSMISSION AND PATHOGENESIS

Dr Kevin Maringer joined the Institute as a Group Leader at the beginning of October 2020 and will lead the new Flavivirus Transmission and Pathogenesis Group. A virologist and immunologist, Kevin started working on flaviviruses as a Sir Henry Wellcome postdoctoral fellow at the Icahn School of Medicine at Mount Sinai in New York City. He joined the Institute from the University of Surrey, where he set up his own research group focussed on dengue virus-host interactions, with a primary interest in virus-immune interactions in the mosquito.



DR WILHELM GERNER GROUP LEADER: T CELL BIOLOGY

Dr Wilhelm Gerner previously worked at the Institute of Immunology, University of Veterinary Medicine Vienna in Austria. His research focused on basic aspects of T cell and NK cell biology in pigs (cells involved in the immune response). His most recent research focuses on T follicular helper cells, which support B cells to generate effective antibodies. Now at Pirbright, Wilhelm will lead the T cell Biology Group at Pirbright which involves research in both pigs and cattle.



DR CHRISTOPHER SANDERS FELLOW: ENTOMOLOGY

Dr Christopher Sanders joined Pirbright fifteen years ago, back in 2006, as a postdoctoral scientist. His role at that time was to look at the long-distance flight potential of *Culicoides* biting midges and, although his role has changed significantly since then, he still works with midges.

Chris has taken up a research Fellow position and now heads up the Entomology group at Pirbright where he will continue to investigate the role of insect vectors in virus transmission to understand how they determine the emergence, spread and persistence of virus outbreaks and how we might minimise the impact of vector-borne disease.

NICK KNOWLES CELEBRATING 50 YEARS AT PIRBRIGHT

Congratulations to Nick Knowles, Head of the Molecular Epidemiology team in the World Reference Laboratory for Foot-and-Mouth Disease (WRLFMD), for an astonishing 50 years of service to the Institute.

Nick joined the then Animal Virus Research Institute as a Scientific Assistant, on 8 February 1971, shortly before his 17th birthday and has served under ten Institute Directors, eight Heads of the WRLFMD and has published over 200 papers. During his long career at Pirbright he has become an internationally renowned expert for his pioneering work to characterise foot-and-mouth disease virus (FMDV) and many other picornaviruses. He truly has an encyclopaedic knowledge of historical FMD events and his contribution to monitoring the global epidemiology of FMD has been previously recognised with a medal from the Food and Agriculture Organization of the United Nations.



PERSONAL PROMOTIONS

Pirbright's Personal Promotion scheme provides our staff with an opportunity to move to a higher grade based on consistently excellent performance and personal contribution to the Institute. Our Personal Promotion Scheme had a high number of applications this year and 12 people were successfully promoted through this process – with a 50/50 split in gender. We continue to support the apprenticeship scheme and were pleased that several completed their training and were successful in securing positions at the Institute in Engineering and HR.



LIZELLE GOVERNEUR KNOWLEDGE EXCHANGE AND COMMERCIALISATION MANAGER

Lizelle joined the Institute in 2013 in the Knowledge Exchange and Commercialisation (KEC) team. The KEC team works closely with research groups, reference laboratories and other operational teams to manage the Institute's intellectual property portfolio and support engagement with external partners, especially industry. Lizelle is looking forward to supporting the establishment of Pirbright Innovations, the Institute's wholly-owned trading subsidiary, and enabling the full exploitation of our research for social and economic benefit.



DR MARION ENGLAND SENIOR POSTDOCTORAL SCIENTIST

Marion joined Pirbright in 2013 as a postdoctoral research scientist in the Entomology Group to run a network of surveillance traps for *Culicoides* vector population monitoring, and to maintain expertise in both *Culicoides* taxonomy and ecology. She has long-standing collaboration with the Zoological Society of London (ZSL), carrying out extensive *Culicoides* collections to understand the risk that viruses such as bluetongue, Schmallenberg and African horse sickness pose to susceptible animals in zoo collections. Marion also advises Defra on the risk of bluetongue virus posed by the windborne incursion of infected *Culicoides* and how this risk varies throughout the year. As vice-chair of Pirbright's Equality, Diversity and Inclusion Committee (EDIC) Marion is passionate about driving forward positive cultural and behavioural change within Pirbright. Marion's commitment and dedication were recognised last year through her promotion to Band E and now works in the Transmission Biology group.

Promotions were also awarded to the following staff:

Amin Asfor
Antonello Di Nardo
Clare Browning
John Flannery
Jurkea Gould
Michael Boylan
Pengxiang Chang
Priscilla Tng
Vishi Avalakuppa Papi Reddy
Will Lerner



ASPIRING APPRENTICE JAMES GASKELL

James Gaskell joined Pirbright four years ago as an electrical apprentice within our Estate Management Services (EMS) department. His professional attitude, attention to detail and commitment to his role led to him being shortlisted in the 2021 Top 6 UK Apprentices after being nominated by his college, Farnborough Technical College (Aldershot Campus).

James has now transitioned into working within the Building Monitoring Services (BMS) team specialising in building automation and control systems to further enhance his knowledge and expertise. James has been a prime example of how effective training and mentoring can allow an individual to prosper and gain key industry skills and experience.

CELEBRATING SUCCESS

The Institute, its scientists and staff received a variety of prestigious awards last year, recognising Pirbright's scientific and operational commitment to excellence.

STAFF AWARDS

The 2020 Institute staff awards recognised and celebrated teams who have consistently made a difference to work and life at Pirbright, by going above and beyond during an exceptionally challenging year.

Nominations were shortlisted by our Equality, Diversity and Inclusion Committee (ED&I) based on the following criteria and voted on by Institute staff:

- What was done and how did it support the wider teams at the Institute to ensure business needs were met?
- The impact the work has had reinforcing our PRIDE value
- Does this demonstrate going the extra mile?



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TEAM OF THE YEAR: PRRS IMMUNOLOGY

Professor Simon Graham's team Porcine Reproductive and Respiratory Syndrome (PRRS) Immunology were awarded Team of the Year and received a certificate and monetary gift. The group undertook testing of COVID-19 vaccine candidates in pigs which significantly contributed to the development of the Oxford/AstraZeneca vaccine which millions of people have received.

The values demonstrated included:
Passion: an unwavering commitment to science and vaccine development.

Reliability: completing the studies in challenging conditions

Innovation: using pigs as a respiratory disease model for vaccine testing

Excellence in scientific research

Extra mile: The team worked extremely long hours during the pandemic, putting aside personal commitments to complete the COVID-19 vaccine pig studies.

Six further teams were shortlisted in the nominations:

- Animal Services
- Cleaning, Laundry and Autoclave team
- Communications
- Information Technology (IT)
- Estate Management Services (EMS)
- Stores



Fieldwork testing portable diagnostics for foot-and-mouth disease virus with the Maasai Tribe

RENEWAL OF WORLD REFERENCE LABORATORY STATUS

The Vesicular Disease Reference Laboratory team achieved renewal of its status as the FAO World Reference Laboratory for Foot-and-Mouth Disease (WRLFMD) for a further four years. Pirbright's status as the World Reference Laboratory involves leadership in global projects aiming to control foot-and-mouth disease (FMD) through large scale surveillance programmes as well as coordinating a network of 15 reference centres across the world. These programmes help by providing diagnostic support and training to countries where the disease is endemic,

preventing further spread and halting existing outbreaks by providing scientists and farmers with tools to tackle FMD. Renewal of this status with the FAO acknowledges decades of hard work and experience to contribute to the development of effective diagnostics, vaccines and control strategies. First designated in 1958, the WRLFMD recently commemorated 60 years as the FAO World Reference Laboratory, marking a historic point in the Institute's accomplishments, and celebrated the contributions of the many scientists at the Institute whose work provides a vital service in the surveillance and control of FMD.

MEDAL OF APPRECIATION

Pirbright's donation of high throughput diagnostic equipment to support the UK's COVID-19 testing programme in 2020, has been recognised with a medal and letter of thanks awarded by the Alderley Park Lighthouse Laboratory in Cheshire which received one of the testing instruments. As well as equipment, Pirbright also offered specially trained diagnostic scientists as volunteers to work at testing sites across the UK. The Alderley Lighthouse Laboratory recently reached a testing milestone, processing its six millionth sample, with Pirbright's equipment contributing to a sizeable proportion of those patient samples.



STUDENT PLACEMENTS A SUCCESS

Eight undergraduate students joined Pirbright in August 2019, to undertake a 12-month placement as part of their degree. The students from universities across the country including Bath, Birmingham, Bristol, Glasgow, Leeds, Leicester, and Reading presented their work and achievements in July 2020 at the end of their time at Pirbright.

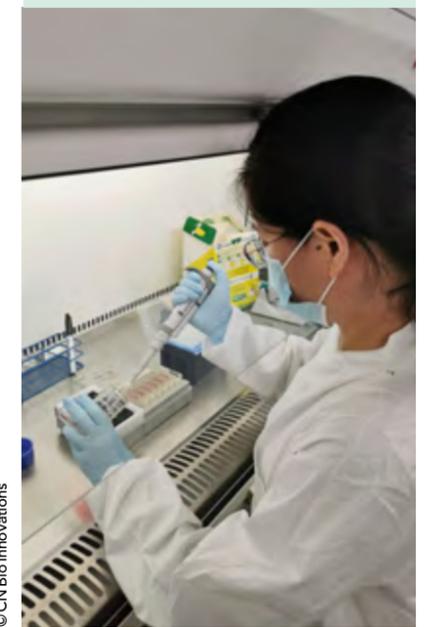
The students' positive attitude and determination to achieve, despite a considerable amount of time out of the lab, shone through in their presentations. Well done to Ellie Hayhurst, Emma Benham, Isaac Dowell, Lucy Tate, Matthew McKeating, Matthew Thomas, Sian Wells and Zoe Hargreaves.

NEW SCITECH IN LIVESTOCK RESEARCH

CN BIO INNOVATIONS

Dr Yaoyao Zhang undertook four weeks of intensive training, at CN Bio Innovations, a Cambridge-based bioengineering company, to incorporate new technology and skills into her own research at Pirbright.

Dr Zhang's training involved learning how CN Bio's PhysioMimix™ cell culture technology works – a clever microphysiological system that allows scientists to mimic tissues and organs in the lab, thus reducing the use of animals in research. Although originally designed for human tissues, Dr Zhang will be adapting the system for use with animal cells so that it can be used at Pirbright to aid research into livestock viral diseases. The training was made possible by a Flexible Talent Mobility Account (FTMA) Innovation Fellowship, supported by BBSRC part of UKRI. The funding enables researchers to spend time in different industries to learn new skills and transfer knowledge between organisations.



© CN Bio Innovations



DEVELOPING THE NEXT GENERATION OF SCIENTISTS

STUDENTSHIPS

Pirbright has a diverse and energetic student community, which is comprised of more than 60 PhD students, MSc research project students, BSc year-in-industry students and undergraduate veterinary students. We offer our students so much more than basic benchwork research skills - our transferable skills training courses are combined with a Careers Day and the opportunities to attend placements off-site with other universities and organisations, providing them a wealth of possible choices following graduation. A large number PhD of students have inevitably lost time at the bench due to the ongoing pandemic which has resulted in increased anxiety and confusion about the future of their studentships. We have worked tirelessly throughout the year to provide pastoral and academic support during lockdown, and all students who required an extension have been granted the extra time and funding.

Student training courses continued to run throughout the year, with both trainers and students having to adapt to a virtual learning environment. Courses included presentation skills, developing professional researcher networks,

imposter syndrome, secrets of successful CVs and interview skills, writing a paper with impact and viva workshops.

The students have also been very proactive at supporting each other, particularly during periods of lockdown and they have organised some fantastic virtual social events during the year. These proved to be very popular and helped to forge a sense of community and highlighted some creative abilities! Events included: themed painting and photograph competitions, a 1920s Murder Mystery games evening, a Halloween quiz and a Christmas gingerbread house making competition.

STUDENT PLACEMENTS

The placement student scheme at Pirbright has been enhanced in recent years – originally this was a scheme for just two students per year from the University of Surrey, but it has now grown to 12 students from August 2020 to July 2021, and 14 students will be joining us in August 2021. We advertise our placements to around 20 universities directly (where we know they have suitable degree courses with a placement / year-in industry) and on our website. Placements

represent a valuable work experience for the students, and they are often involved in writing papers on the research work conducted. Placements are also valued by our Group Leaders as a hard-working, valuable academic resource. The students present at the Pirbright Placement Day in July and the standard is always very high.

RECRUITMENT

Recruitment has of course been virtual throughout 2020 and 2021 it has worked very well. We do not feel that anyone has been put at a disadvantage, which is important in terms of equal opportunities. In fact, we are considering continuing this because it makes interview days easier to organise, and staff and students save time and money on not having to travel. In this case, we would run an interview virtually and then call the top two candidates to visit the Pirbright campus and meet the research team before making a final decision.

BREXIT has had an impact on PhD studentships this year (from Jan 2021, so affecting the Oct 2021 cohort intake). Before BREXIT, only UK and some European students were eligible for PhD

studentships funding, but the changes now mean that international students can also apply, provided they can pay the difference between home and international university tuition fees. As such it is likely that we will receive a higher number of applications per studentship, opening up opportunities to a wider pool of international candidates.

APPRENTICESHIPS

Pirbright runs an extremely successful apprenticeship scheme covering a wide range of career areas within the Institute including engineering, Finance, HR, Learning and Development, IT and health & safety and biosafety. Our apprenticeship scheme last year included:

- Four Animal Technicians completed their Animal Technologist Apprenticeships successfully whilst in-post, each passing with Distinction
- Two full-time apprentices passed their apprenticeships successfully in March 2021 - one HR apprentice and a Science

Technician apprentice

- Future funding has been approved to recruit seven new full-time apprentices in 2021 - four in Engineering, one in HSBS, one Science Technician and one Business Admin apprentice.

FUTURE INNOVATORS

As part of the National Productivity Investment Fund awarded to Pirbright in 2019 (from BBSRC UKRI for the development of entrepreneurial and innovation skills in early career researchers) we teamed up with Skillfluence Ltd to deliver a Future Innovators Masterclass. We had a great uptake of 23 postdocs and final year PhD students who followed this six-week interactive programme supported by guest speakers from industry.

DEVELOPING STAFF

Staff development continued throughout lockdown with training moving to online delivery. Workshops were provided on: Mental wellbeing and resilience; Understanding and managing stress; Sleep is vital – how to get better sleep; and Active bystander training.

SHARING INDUSTRY EXPERTISE

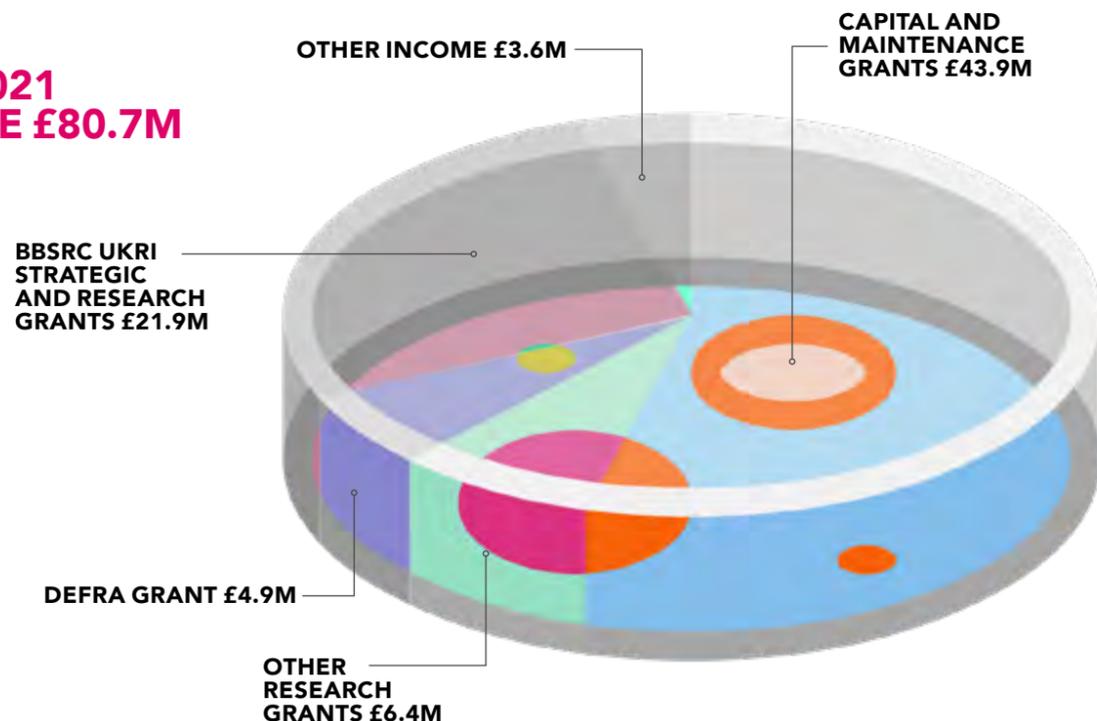
Secondments and training between Pirbright and commercial partners provide an excellent opportunity for early career post-doctoral scientists to develop industry skills and explore different job roles. Pirbright researchers were paired with a variety of companies in different industries, such as intellectual property and technology management, the poultry industry and biotechnology. We also took on a scientist from a farm animal vaccine company in Jordan to share our expertise in the development of poultry vaccines.



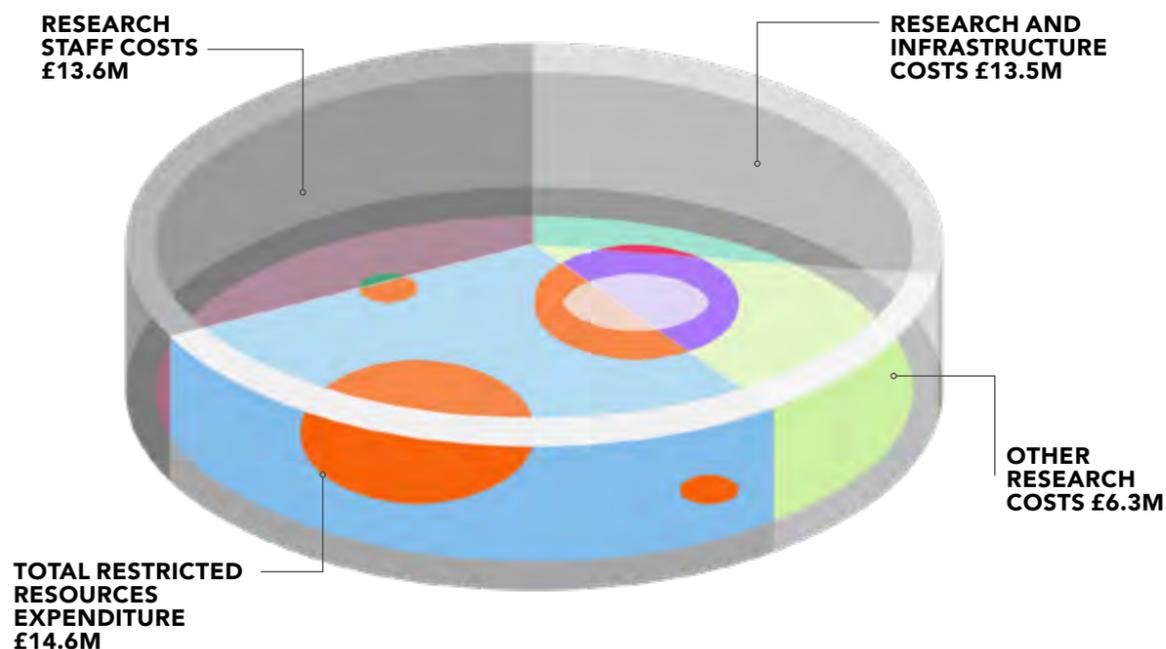
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FINANCIAL CHARTS

2020-2021 INCOME £80.7M



2020-2021 EXPENDITURE £48M



INCOME

Total incoming resources amounted to £80.7m (2020: £60.1m). Investment in tangible fixed assets in the year totalled £36.7m (2020: £21.4m). This was substantially funded by grants from the Institute's principal sponsor Biotechnology and Biological Sciences Research Council part of UK Research and Innovation (BBSRC UKRI), Defra and other grant awarding bodies. The change relates to both an increase in capital funding (£18.5m), and non-capital income being £37.0m in 2021 compared to £34.9m in 2020.

EXPENDITURE

Recurrent expenditure for the year amounted to £48.0m (2020: £45.6m) Staff costs accounted for £18.1m (37%) (2020: £17.1m; 37%) of expenditure. The rise in staff costs from 2020 relates to the pay award for the year.

CASH AND TERM DEPOSITS

Cash and terms deposits at March 2021 were £42.4m (2020: £40.7m). Pirbright deposits its cash with UK registered financial institutions. Investment income from cash deposits in the year was £0.1m (2020: £0.3m).

GRANT PROPOSALS

During the year, Pirbright researchers submitted grant proposals with a sponsor value of £20.1m (2020: £40.0m) and were awarded grants with a value of £9.5m (2020: £19m).

GOING CONCERN

The Trustees have reviewed whether it is appropriate for the financial statements to be prepared on a going concern basis. The Institute has in principle received its five-year strategic grant funding from BBSRC UKRI, £15m per annum; this award runs from 5 April 2017 to March 2022. The Institute has now been advised by BBSRC UKRI that the grant period will be extended for a sixth year to March 2023. This source of confirmed funding, the consistent performance of attracting income from other funding bodies, the successful occupation of new laboratory facilities and the development of a business plan that is built on an income stream that is very likely to be achievable, provides a high degree of confidence of future financial security. Having considered the risks in

respect of future funding, financial forecasts for the period to March 2023 and the level of reserves, the Trustees have concluded that it remains appropriate to prepare the financial statements on a going concern basis.

NET MOVEMENT IN RESERVES

The Pirbright Institute recorded a net increase in unrestricted reserves of £1.9m. (2020: £1.0m decrease) There was a £0.5m decrease in the designated reserve with the general reserve increasing by £2.4m. Due to the phasing of the Pirbright Development Programme, the restricted reserves increased by £30.8m. (2020: £15.5m). Capital expenditure in the year was £36.7m (2020: £21.4m). There has been an ongoing major development of the Pirbright site which has resulted in building new laboratory facilities and providing additional state of the art science equipment.

RESERVES POSITION

Total Institute reserves increased by £32.7m in the year to £330.6m (2020: £14.5m to £298.0m). Restricted reserves increased by £30.8m (2020: £15.5m) to £320.6m (2020: £289.8m), of which £320.6m relates to capital reserve in connection with funding received from BBSRC UKRI (2020: increased by £15.5m to £289.8m). Unrestricted reserves increased by £1.9m (2020: £1.0m decrease) in the year to £10.0m (2020: £8.1m), of which £2.5m relates to a designated reserve to support ongoing non-operational activity and £7.5m to general reserves.

RESERVES POLICY

Unrestricted funds
It is the policy of the Trustees to ensure the General Fund in the Unrestricted Reserves reaches £4.5m by the end of the current business plan cycle being 2021/22 to enable the Institute to manage fluctuations in income and unforeseen cost pressures. At 31 March 2021 unrestricted general funds showed a surplus of £7.5m (2020: surplus of £5.1m) reaching the target as set by the Trustees. It is anticipated that over the coming years it will be possible for the Institute to undertake further development of science activity to enhance the overall sustainability and improvement of activity. The redevelopment of the site will also provide the world class facilities required to ensure the Institute is best placed to succeed in future grant submissions.

DESIGNATED FUNDS

The use of the unrestricted designated fund as set out in note 15 comprises sums set aside for specific purposes as decided by the Trustees to support ongoing non-operational activity and the continued development of the Pirbright site in support of the construction programme.

RESTRICTED NON-ENDOWMENT FUNDS

The Institute has been undertaking a significant building programme within the Pirbright site for which funding has been received from BBSRC UKRI. The funding of this programme is via grants which are held within the restricted funds and comes to a total of £317.2m. This funding is solely and specifically granted for the purpose of the building programme hence the inclusion within the restricted fund and mostly this represents the value of the buildings which have been constructed.

FUNDRAISING ACTIVITIES

Section 162a of the Charities Act 2011 requires charities to make a statement regarding fundraising activities. Although we do not undertake direct fundraising from the general public, with the legislation defining fundraising as "soliciting or otherwise procuring money or other property for charitable purposes", we have to disclose the value of such income in the year. We have received no such income during the current or previous financial year.

STRUCTURE, GOVERNANCE AND MANAGEMENT

MEMBERS

Members of the Institute are as follows:
 Chair of the Trustee Board
 Chair of the Science Advisory Board
 BBSRC UKRI
 National Farmers' Union
 Royal College of Veterinary Surgeons

ORGANISATION AND GOVERNANCE

The Pirbright Institute is a company limited by guarantee and a registered charity. The Annual Report provides information for legal purposes of the charity, its business activities and its main achievements. The financial statements have been prepared in accordance with the Charities Act 2011, the Companies Act 2006, the Memorandum and Articles of Association and Accounting and Reporting by Charities: Statement of the Recommended Practice applicable to charities preparing their accounts in accordance with Financial Reporting Standards applicable to the UK and Republic of Ireland (FRS102), effective 1 January 2015.

THE BOARD OF TRUSTEES AND ITS INTERESTS

The Directors of the Trustee Board during the year were:
 Professor John Stephenson – Chair
 Professor Vince Emery – Deputy Chair and Chair of Risk and Assurance Committee
 Roger Louth – Chair of Finance and Audit Committee
 Sir Bertie Ross – resigned March 31 2021, Chair of Nominations and Governance Committee
 Ian Bateman
 Ian Black
 Rona Chester (appointed - January 1, 2021)
 Jon Coles
 Alison Hardy (appointed - January 1, 2021)
 Dr Paul Logan (appointed - January 1, 2021)
 Dr Vanessa Mayatt OBE (resigned - December 31, 2020)
 Dr Sandy Primrose (resigned - August 10, 2020)
 Jane Tirard

Trustee Directors are appointed by the existing Trustee Directors for a period of up to three years, when they are eligible for re-

appointment for a second term.

The purpose of the Trustee Board is to ensure that the Institute carries out its purpose for the public benefit in accordance with its memorandum, articles of association and governing law. The main focus of the Trustee Directors is on leadership, strategy, performance, and assurance with focus on maintaining Pirbright's reputation, staff and infrastructure whilst protecting the Institute's sustainability.

Furthermore, the Trustee Directors must act in the Institute's best interests; they must ensure that the Institute's resources are managed responsibly; they must act with reasonable care and skill; they must ensure that the Institute complies with all statutory accounting and reporting requirements; and they must meet the oversight requirements expected of a major hazard site.

The Trustee Board has established three committees to support it in its work: the Finance and Audit Committee, the Risk and Assurance Committee and the Nomination and Governance Committee and work closely with the Institute Director and senior management of the Institute to achieve its aims.

Trustee Directors and co-opted members are required to declare any conflicts or potential conflicts of Interests at Trustee Board and committee meetings, and these are recorded in the minutes. During the year, no Trustee Director declared a conflict of interest. Depending on the conflict, the Chair may require a Trustee Director or co-opted member to either leave the meeting, or not take part in a discussion or decision on a particular Issue.

The Trustee Board has also established a Scientific Advisory Board, comprised of independent leading scientists, to provide advice, guidance, and recommendations regarding the scientific strategy and direction of the Institute. In addition, the Science Advisory Board provides assurance to the Trustee Board on the quality of science and research, the relevance and importance of the strategy, and advise on the Institute's positioning within the international scientific landscape.

BOARD/ COMMITTEE	REMIT
Trustee Board	To ensure that the Institute carries out its purpose for the public benefit in accordance with its memorandum, articles of association and governing law.
Finance and Audit Committee	To provide assurance and advice to the Board in relation to the Institute's finances and other assets; business planning and corporate reporting; the Institute's strategic risks; and the statutory external audit and the programme of internal audits covering the corporate functions
Nominations and Governance Committee	To provide assurance to the Board in relation to all governance matters, with the aim of obtaining the highest possible standard of governance and compliance.
Risk and Assurance Committee	To provide assurance to the Board on the arrangements to meet legal duties and to manage risk within the Institute, working in consort with the Risk and Assurance Strategy and Plan, to oversee all risk management systems, controls and processes that may have an impact on the Institute's ability to meet its objectives.

TRUSTEES' INDEMNITY INSURANCE

The Institute maintains liability insurance for its Trustee Board, with an annual aggregate cover limit for all claims against them in that capacity. The Trustees have also been granted a qualifying third-party provision under section 233 of Companies Act 2006. Neither the Institute's indemnity nor insurance provides cover in the event that a Trustee Director is proved to have acted fraudulently or dishonestly. The premium and related costs in respect of this policy were £20,432, (2020: £14,924). The Trustees are satisfied they have complied with their duty in section 4 of the Charities Act 2011 to have due regard to public benefit guidance published by the Charities Commission. Based on this guidance, and as described in the Trustees' Report, the Trustees believe the activities of The Pirbright Institute to be charitable in nature.

TRAINING OF TRUSTEES

The Institute continually reviews its practices for induction and ongoing Trustee training. Trustees are encouraged to attend appropriate external training events where these will facilitate the undertaking of their role.

SENIOR LEADERSHIP BOARD

The Trustee Board consider that the Senior Leadership Board (SLB) is accountable for Institute strategy, risk mitigation and governance of day-to-day operational delivery. The SLB comprising the Institute Director and the Directorate heads; namely Director of Risk and Assurance, Director of Capability and Director of Finance and Company Secretary.

The remuneration and benefits of the SLB is based on the agreed and recognised salary banding for the Institute and reviewed annually.

RELATED PARTIES

The Institute's subsidiary undertaking, Pirbright Innovations Limited, (formerly Avrico Limited), last traded in 2003 and is currently dormant. Avrico Limited was formed as part of the Institute's role in the 2001 UK foot-and-mouth disease outbreak and provided diagnostic and testing services to Defra. Genomia Management Limited was formed on 16 April 2004 and is also a company limited by guarantee. The company was established by way of grants from the Department of Innovation, Universities and Skills and the European Regional Development Fund. The company manages the Genomia Fund the objective of which is to assist in the development of research output from the members into commercially realisable opportunities. The Institute has equal membership in this company with The Roslin Foundation, Moredun Research Institute, Rowett Institute of Nutrition and Health and Scotland's Rural College (SRUC).

STATEMENT OF TRUSTEES' RESPONSIBILITIES

The Trustees who are also Directors of the charitable company for the purposes of company law are responsible for preparing the Trustees' Report incorporating the Strategic Report in accordance with applicable law and regulations.

Company law requires the Trustee Board to prepare financial statements for each financial year. Under that law the Trustee Board has elected to prepare the financial statements in accordance with United Kingdom Generally Accepted Accounting Practice (United Kingdom Accounting Standards and applicable laws), including FRS102 (the Financial Reporting Standard applicable in the UK and Republic of Ireland). Under company law the Trustee Board must not approve the financial statements unless they are satisfied that they give a true and fair view of the state of affairs of the charitable company and the incoming resources and application of resources, including the income and expenditure, of the charitable company for that period.

In preparing these financial statements, the Trustee Board is required to:

- select suitable accounting policies and then apply them consistently;
- observe the methods and principles in the Charities SORP (FRS102);
- make judgments and accounting estimates that are reasonable and prudent;
- state whether applicable UK Accounting Standards have been followed, subject to any material departures disclosed and explained in the financial statements;
- prepare the financial statements on the going concern basis unless it is inappropriate to presume that the charitable company will continue in business.

The Trustee Board is responsible for keeping adequate accounting records that are sufficient to show and explain the charitable company's transactions

and disclose with reasonable accuracy at any time the financial position of the company and enable them to ensure that the financial statements comply with the Companies Act 2006. It is also responsible for safeguarding the assets of the charitable company and hence for taking reasonable steps for the prevention and detection of fraud and other irregularities.

The Trustee Board confirms that:

- so far as each Trustee Director is aware, there is no relevant audit information of which the charitable company's auditor is unaware;
- and the Trustees have taken all steps that they ought to have taken to make themselves aware of any relevant audit information and to establish that the auditor is aware of that information.

The Report of the Trustees incorporating the Strategic Report was approved and signed on behalf of the Trustee Board.

INDEPENDENT AUDITOR'S REPORT TO THE MEMBERS OF THE PIRBRIGHT INSTITUTE (LIMITED BY GUARANTEE)

Opinion on the financial statements

In our opinion, the financial statements:

- give a true and fair view of the state of the Charitable Company's affairs as at 31 March 2021 and of its incoming resources and application of resources for the year then ended;
- have been properly prepared in accordance with United Kingdom Generally Accepted Accounting Practice; and
- have been prepared in accordance with the requirements of the Companies Act 2006.

We have audited the financial statements of The Pirbright Institute ("the Charitable Company") for the year ended 31 March 2021 which comprise the principle accounting policies, the statement of financial activities, the balance sheet, the cash flow statement and notes to the financial statements, including a summary of significant accounting policies. The financial reporting framework that has been applied in their preparation is applicable law and United Kingdom Accounting Standards, including Financial Reporting Standard 102 The Financial Reporting Standard applicable in the UK and Republic of Ireland (United Kingdom Generally Accepted Accounting Practice).

BASIS FOR OPINION

We conducted our audit in accordance with International Standards on Auditing (UK) (ISAs (UK)) and applicable law. Our responsibilities under those standards are further described in the Auditor's responsibilities for the audit of the financial statements section of our report. We are independent of the Charitable Company in accordance with the ethical requirements relevant to our audit of the financial statements in the UK, including the FRC's Ethical Standard, and we have fulfilled our other ethical responsibilities in accordance with these requirements. We believe that the audit evidence we have obtained is sufficient and appropriate to provide a basis for our opinion.

CONCLUSIONS RELATED TO GOING CONCERN

In auditing the financial statements, we have concluded that the Trustees' use of the going

concern basis of accounting in the preparation of the financial statements is appropriate.

Based on the work we have performed, we have not identified any material uncertainties relating to events or conditions that, individually or collectively, may cast significant doubt on the Charitable Company's ability to continue as a going concern for a period of at least twelve months from when the financial statements are authorised for issue.

Our responsibilities and the responsibilities of the Trustees with respect to going concern are described in the relevant sections of this report.

OTHER INFORMATION

The Trustees are responsible for the other information. The other information comprises the information included in the Annual Report and Accounts, other than the financial statements and our auditor's report thereon. The other information comprises the Trustees Report. Our opinion on the financial statements does not cover the other information and, except to the extent otherwise explicitly stated in our report, we do not express any form of assurance conclusion thereon. Our responsibility is to read the other information and, in doing so, consider whether the other information is materially inconsistent with the financial statements or our knowledge obtained in the course of the audit, or otherwise appears to be materially misstated. If we identify such material inconsistencies or apparent material misstatements, we are required to determine whether this gives rise to a material misstatement in the financial statements themselves. If, based on the work we have performed, we conclude that there is a material misstatement of this other information, we are required to report that fact.

We have nothing to report in this regard.

Other Companies Act 2006 reporting
In our opinion, based on the work undertaken in the course of the audit:

- the information given in the Trustees' Report, which includes the Directors' Report and the

Strategic report prepared for the purposes of Company Law, for the financial year for which the financial statements are prepared is consistent with the financial statements; and

- the Strategic report and the Directors' Report, which are included in the Trustees' Report, have been prepared in accordance with applicable legal requirements.

In the light of the knowledge and understanding of the Charitable Company and its environment obtained in the course of the audit, we have not identified material misstatement in the Strategic report or the Trustee's report.

We have nothing to report in respect of the following matters in relation to which the Companies Act 2006 requires us to report to you if, in our opinion;

- adequate accounting records have not been kept, or returns adequate for our audit have not been received from branches not visited by us; or
- the financial statements are not in agreement with the accounting records and returns; or
- certain disclosures of Directors' remuneration specified by law are not made; or
- we have not received all the information and explanations we require for our audit.

RESPONSIBILITIES OF TRUSTEES

As explained more fully in the Trustees' responsibilities statement, the Trustees (who are also the directors of the charitable company for the purposes of company law) are responsible for the preparation of the financial statements and for being satisfied that they give a true and fair view, and for such internal control as the Trustees determines is necessary to enable the preparation of financial statements that are free from material misstatement, whether due to fraud or error.

In preparing the financial statements, the Trustees are responsible for assessing the Charitable Company's ability to continue as a going concern, disclosing, as applicable,

matters related to going concern and using the going concern basis of accounting unless the Trustees either intend to liquidate the Charitable Company or to cease operations, or have no realistic alternative but to do so.

AUDITOR'S RESPONSIBILITIES FOR THE AUDIT OF THE FINANCIAL STATEMENTS

We have been appointed as auditor under the Companies Act 2006 and report in accordance with the Act and relevant regulations made or having effect thereunder.

Our objectives are to obtain reasonable assurance about whether the financial statements as a whole are free from material misstatement, whether due to fraud or error, and to issue an auditor's report that includes our opinion. Reasonable assurance is a high level of assurance, but is not a guarantee that an audit conducted in accordance with ISAs (UK) will always detect a material misstatement when it exists. Misstatements can arise from fraud or error and are considered material if, individually or in the aggregate, they could reasonably be expected to influence the economic decisions of users taken on the basis of these financial statements.

Extent to which the audit was capable of detecting irregularities, including fraud.

Irregularities, including fraud, are instances of non-compliance with laws and regulations. We design procedures in line with our responsibilities, outlined above, to detect material misstatements in respect of irregularities, including fraud. The extent to which our procedures are capable of detecting irregularities, including fraud is detailed below:

Based on our understanding of the Charitable Company and the sector in which it operates, we identified that the principal risks of non-compliance with laws and regulations related to its registration with the Charity Commission for England and Wales and the Animals (Scientific Procedures) Act 1986 (ASPA) – under licence from the Home Office. We considered the extent to which non-compliance might have a material effect on the Financial Statements or the charity's continued operation. We also considered those laws and regulations that have a direct impact on the financial statements such as relevant companies acts and charities acts in the UK.

We evaluated management's incentives and opportunities for fraudulent manipulation of the financial statements (including the risk of override of controls), and determined that the principal risks were related to posting

inappropriate journal entries to manipulate financial results and management bias in accounting estimates.

The audit procedures to address the risks identified included:

- Challenging assumptions made by management in their significant accounting estimates in particular in relation to the assumptions related to the estimated useful economic life of tangible fixed assets and assessment of the risks and rewards of ownership of the leasehold land and buildings owned by third parties;

- Testing journals including those which potentially impact remuneration and other performance targets and evaluating whether there was evidence of bias by management or Those Charged with Governance that represented a risk of material misstatement due to fraud;

- Reading minutes of meetings of those charged with governance, reviewing internal audit reports and reviewing correspondence with the Home Office, HMRC and the Charities Commission for England and Wales.

We challenged assumptions made by management in their significant accounting estimates, in particular in relation to the assumptions related to the estimated useful economic life of tangible fixed assets and assessment of the risks and rewards of ownership of the leasehold land and buildings owned by third parties.

We did not identify any matters relating to irregularities, including fraud. As in all of our audits, we also addressed the risk of management override of internal controls, including testing journals including those which potentially impact remuneration and other performance targets and evaluating whether there was evidence of bias by management or Those Charged with Governance that represented a risk of material misstatement due to fraud.

Our audit procedures were designed to respond to risks of material misstatement in the financial statements, recognising that the risk of not detecting a material misstatement due to fraud is higher than the risk of not detecting one resulting from error, as fraud may involve deliberate concealment by, for example, forgery, misrepresentations or through collusion. There are inherent limitations in the audit procedures performed and the further removed non-compliance with laws and regulations is from the events and transactions reflected in the financial

statements, the less likely we are to become aware of it.

A further description of our responsibilities for the audit of the financial statements is located at the Financial Reporting Council's ("FRC's") website at:

<https://www.frc.org.uk/auditorsresponsibilities>.

This description forms part of our auditor's report.

USE OF OUR REPORT

This report is made solely to the Charitable Company's members, as a body, in accordance with Chapter 3 of Part 16 of the Companies Act 2006. Our audit work has been undertaken so that we might state to the Charitable Company's members those matters we are required to state to them in an auditor's report and for no other purpose. To the fullest extent permitted by law, we do not accept or assume responsibility to anyone other than the Charitable Company and the Charitable Company's members as a body, for our audit work, for this report, or for the opinions we have formed.



James Aston (Senior Statutory Auditor)
For and on behalf of BDO LLP,
Statutory Auditor Gatwick
Date: 26 July 2021

BDO LLP is a limited liability partnership registered in England and Wales (with registered number OC305127).

PRINCIPAL ACCOUNTING POLICIES

The following accounting policies have been applied consistently in dealing with items which are considered material in relation to the Institute's financial statements.

BASIS OF ACCOUNTING

The financial statements have been prepared in accordance with Accounting and Reporting by Charities:

Statement of Recommended Practice applicable to charities preparing their accounts in accordance with the Financial Reporting Standard applicable in the UK and Republic of Ireland (FRS 102) (effective 1 January 2019) – (Charities SORP (FRS 102), the Financial Reporting Standard applicable in the UK and Republic of Ireland (FRS 102) and the Companies Act 2006.

The Institute meets the definition of a public benefit entity under FRS102. Assets and liabilities are initially recognised at historical cost or transaction value unless otherwise stated in the relevant accounting policy note(s).

GOING CONCERN

The Trustees have reviewed whether it is appropriate for the financial statements to be prepared on a going concern basis. The Institute has in principle received its five-year strategic grant funding from BBSRC UKRI, £15m per annum. This award runs from 5 April 2017 to March 2022. The Institute has now been advised by BBSRC UKRI that the grant period will be extended for a sixth year to March 2023.

This source of confirmed funding, the consistent performance of attracting income from other funding bodies, the successful occupation of new laboratory facilities and the development of a business plan that is built on an income stream that is very likely to be achievable, provides a high degree of confidence of future financial security.

Having considered the risks in respect of future funding, financial forecasts for the period to March 2023 and the level of reserves, the Trustees have concluded that it remains appropriate to prepare the financial statements on a going concern basis.

GROUP FINANCIAL STATEMENTS

The Institute is exempt from the requirement

to prepare consolidated financial statements by virtue of section 405(2) of the Companies Act 2006 as the result of its dormant subsidiary undertaking, Pirbright Innovations Limited, is not material for the purposes of providing a true and fair view.

Accordingly, these financial statements present information about the Institute as an individual entity and not its group.

The associated company, as detailed in note 10, has also been excluded from the consolidation on the grounds of this being immaterial to the Institute's financial statements.

INCOME

Income comprises unencumbered grants received from research councils; grant income from collaborative, commissioned and competitively awarded research projects; income from miscellaneous charitable activities; commercial and residential rents from the letting of Institute controlled property; and interest earned on the temporary investment of surplus funds.

Income is recognised when the Institute becomes legally entitled to the income and the amount can be quantified with reasonable accuracy.

All core BBSRC UKRI grants are recognised as revenue in the year they are received. Grant income including research grants received in advance of conditions being met is deferred until those conditions are fully satisfied. Rental and interest income is recognised based on the period to which it relates.

Capital grants are recognised in the statement of financial activities when entitlement passes, and once the criteria of certainty and measurement are met.

EXPENDITURE

Costs of charitable activities comprises costs incurred directly or in support of scientific research whether carried out in the Institute's own facilities or in other laboratories. Raising funds represents the costs associated with trading and raising income including the Institute's rental activities and tenant services and investments.

All costs are allocated between the expenditure categories of the Statement of

Financial Activities on a basis designed to reflect the use of the resource. Costs relating to a particular activity are allocated directly. Support costs, representing the staffing and associated costs of finance, personnel and general administration in supporting the operations of the Institute, are apportioned on an appropriate basis (see note 5).

RESTRICTED NON-ENDOWMENT FUNDS

Income received by way of grants, sponsorship, donation or legacy which is directed by the provider as to be applied for specific purposes is accounted for within restricted income.

Awards applied within the terms dictated by the awarding authority on the acquisition or improvement of tangible fixed assets are also accounted for within restricted non endowment funds in full. The balance of the restricted fixed asset fund is reduced by the depreciation or amortisation charges over the expected useful life of the asset. This treatment has been applied to reflect the assets being on land owned by a third party, therefore at the end of the lease they will revert to that third party (see further explanation below regarding the ownership of land and buildings). In addition, as detailed in note 19, there is a contingent liability to account to BBSRC UKRI for the net proceeds of disposal of fixed assets acquired with grant assistance and for recurrent grant in excess of the financing requirements.

DESIGNATED FUNDS

Unrestricted designated funds comprise sums set aside by the Trustees for specific purposes including the acquisition and improvement of tangible fixed assets, the presentation of scientific conferences, and contributions towards capital to be replaced using the fully economic costing policy adopted by the Institute.

UNRESTRICTED FUNDS

Income received which is not directed by the provider to be applied for specific purposes to an extent which exceeds the constraints of the Institute's constitution is accounted for within unrestricted general funds.

FIXED ASSETS

Fixed assets with a cost of £10,000 or more are capitalised and depreciated to their estimated residual values basis as set out below. Plant and machinery and fixtures and fittings with a cost of less than £10,000 are expensed in year of purchase.

- Land – 99 years being the length of the lease from BBSRC UKRI
- Buildings – on a component basis, between 15 and 50 years
- Plant and machinery – 5 years on a straight line basis
- Fixtures, fittings, tools and equipment – 5 years on a straight line basis
- No depreciation is provided on assets in the course of construction.

The Institute includes in its financial statements leasehold land and buildings owned by third parties, that it occupies and enjoys through peppercorn leases, at their full value. Both leases have recently been renewed. The North side lease was renewed in December 2020 for 25 years and the South site lease for a term of 99 years. The Trustees consider that in substance the risks and rewards of ownership of the assets have passed to the Institute, and as such follow a policy of recognising the assets on the balance sheet to reflect the continuing occupancy of these assets for the foreseeable future. The only circumstance under which the Institute could be asked to vacate the site is due to a failure to deliver the required programme, which in the Trustees' view is highly unlikely.

Individual freehold and leasehold properties at the Pirbright site were revalued to fair value upon transition to FRS 102 (1 April 2014) with the surplus on book value being transferred to the revaluation reserve, except that a deficit which is in excess of any previously recognised surplus over depreciated cost relating to the same property, or the reversal of such a deficit, is charged (or credited) to the Statement of Financial Activities. The fair value at the transition date was recognised as the deemed cost of the assets.

LEASED ASSETS

Rentals payable under operating leases are charged to the Statement of Financial Activities on a straight line basis over the lease term.

Assets acquired under finance leases are capitalised as tangible fixed assets and depreciated over their useful lives. Finance charges and interest are taken to the income and expenditure account in proportion to the remaining balance of capital repayments or net obligations outstanding.

STOCK

Laboratory consumables are valued at the lower of cost and net realisable value.

DEBTORS

Trade and other debtors are recognised at the settlement amount due after any trade discount offered. Prepayments are valued at the amount prepaid.

CREDITORS AND PROVISIONS

Creditors and provisions are recognised where the Institute has a present obligation resulting from a past event that will probably result in the transfer of funds to a third party and the amount due to settle the obligation can be measured or estimated reliably. Creditors and provisions are normally recognised at their settlement amount.

FINANCIAL INSTRUMENTS

The Institute only has financial assets and financial liabilities of a kind that qualify as basic financial instruments. Basic financial instruments are initially recognised at transaction value and subsequently measured at their settlement value.

FOREIGN CURRENCY TRANSLATION

Monetary assets and liabilities denominated in foreign currencies are translated into sterling at the rates of exchange ruling at the balance sheet date. Transactions in foreign currencies are recorded at the rate ruling at the date of the transaction.

STAFF AND PENSION COSTS

Staff engaged at the Institute prior to April 2015 were previously employed by BBSRC UKRI and deployed back to the Institute. Following the Transfer of Undertakings (Protection of Employment) exercise as of 1 January 2017, all BBSRC UKRI employees are now covered under the Institute's position as a separate legal entity. The Institute therefore retains responsibility for paying employment costs in relation to all employees, including basic pay and allowances, contractual payments, tax, national insurance and pension contributions. Employees engaged prior to April 2015 remain members of the Research Councils' Pension Scheme (RCPS), a defined benefit scheme for multiple employers. The BBSRC Employment Code remains applicable and frozen at the date of TUPE transfer.

The Institute does not have any liability for pensions other than for monthly employer contributions, the rate of which is determined by the Government Actuary's Department on a periodic basis. The cost of providing pension and related benefits is charged to the statement of financial activities. Some

payments are to a defined benefit scheme as explained above and in Note 8 but there are no separately identifiable assets and the actuarial cost to the Institute is not known. Consequently, it is not possible to supply the information referred to in Financial Reporting Standard 102, Section 28 and the Institute has accounted for the scheme as though it were a defined contribution scheme.

TAXATION

The Pirbright Institute is a registered charity within the meaning of the UK Taxes Acts and is, therefore, eligible to claim exemptions to income tax and capital gains tax.

JUDGEMENTS IN APPLYING ACCOUNTING POLICIES AND KEY SOURCES OF ESTIMATION UNCERTAINTY

Preparation of the financial statements requires management to make significant judgements and estimates. The items in the financial statements where these judgements and estimates have been made include:

- Depreciation, which has been charged in line with the accounting policy above.
- The amount of depreciation charged and net book value of the assets is included in Note 9.
- The Institute includes in its financial statements leasehold land and buildings owned by third parties because the Trustees consider that in substance the risks and rewards of ownership of the assets have passed to the Institute, and as such follow a policy of recognising the assets on the balance sheet to reflect the continuing occupancy of these assets for the foreseeable future. These assets are held at their deemed cost, being their fair value at the transition date. The judgements applied and the revaluation adjustments and net book value of the assets is included in Note 9.

STATEMENT OF FINANCIAL ACTIVITIES

For the year ended 31 March 2021

	Note	Unrestricted Funds £'000	Restricted Funds £'000	2021 Total Funds £'000	2020 Total Funds £'000
Income from Donations					
Core strategic grant	1	-	18,928	18,928	15,449
Charitable activities					
Grants and contracts	2	14,503	43,687	58,190	41,532
Other charitable income	2	2,609	-	2,609	2,053
<i>Investment income</i>	3	956	-	956	1,045
Total		18,068	62,615	80,683	60,079
<i>Expenditure on</i>					
<i>Raising funds</i>					
Rental income and tenant services		312	324	636	628
Investment management costs		18	-	18	20
<i>Charitable activities</i>					
Scientific research		31,639	13,211	44,850	42,582
Rental income and tenant services		963	1,062	2,025	1,834
Other charitable activities		422	49	471	515
Total	4	33,354	14,646	48,000	45,579
Net (expenditure)/income before tax		(15,286)	47,969	32,683	14,500
Transfers between funds	15	17,155	(17,155)	-	-
Net movement in funds		1,869	30,814	32,683	14,500
Balances brought forward		8,128	289,835	297,963	283,463
Balances carried forward	16	9,997	320,649	330,646	297,963

All incoming resources and resources expended derive from continuing activities. The accompanying accounting policies and notes form an integral part of these financial statements.

BALANCE SHEET

At 31 March 2021. Company Number 00559784

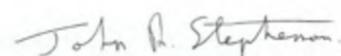
	Note	2021 £'000	2020 £'000
Fixed assets			
Tangible fixed assets	9	295,172	267,984
Current assets			
Stocks	11	264	306
Debtors	12	13,397	6,704
Term deposits over three months		23,194	21,169
Cash at bank and in hand		19,237	19,529
		56,092	47,708
Creditors: amounts falling due within one year	13	(20,618)	(17,729)
Net current assets		35,474	29,979
Total assets less current liabilities		330,646	297,963
Net assets		330,646	297,963
Financed by			
Unrestricted funds	16	9,997	8,128
Restricted			
Fixed asset fund (including revaluation reserve of £15,299k (2020: £16,135k))	15	317,191	284,798
Other restricted reserve	16	3,458	5,037
Total funds	16	330,646	297,963

The Institute includes in its financial statements leasehold land and buildings owned by third parties, these are detailed further in Note 9.

Approved by the Board of Trustees on 20 July 2021 and signed on their behalf on 20 July 2021.

The accompanying accounting policies and notes form an integral part of these financial statements.

Professor John Stephenson
Trustee Director



Roger Louth
Trustee Director



STATEMENT OF CASH FLOWS

For the year ended 31 March 2021

	£'000	2021 £'000	£'000	2020 £'000
<i>Net cash provided by operating activities</i>				
Net movement in funds	32,683		14,500	
Interest and rent receivable	(956)		(1,045)	
Depreciation charged	9,469		10,191	
Profit on disposal of plant & equipment	-		(2)	
Realised gain on disposal of investments	-		(14)	
Decrease/(increase) in stocks	42		(148)	
(Increase)/decrease in debtors	(6,693)		2,147	
Increase in creditors	1,288		2,044	
Net cash provided by operating activities		35,833		27,673
Cash flows from investing activities:				
Proceeds of sale of plant & equipment	-		2	
Proceeds of sale of investments	-		173	
Interest and rents received	956		1,045	
Increase in cash deposits > 3 months	(2,025)		(562)	
Purchase of property, plant and equipment	(35,056)		(18,669)	
Net cash used in investment activities		(36,125)		(18,011)
Change in cash and cash equivalents in the reporting period		(292)		9,662
Cash and cash equivalents at the beginning of the reporting period		19,529		9,867
Cash and cash equivalents at the end of the reporting period		19,237		19,529
Cash and cash equivalents as above		19,237		19,529
Cash placed on term deposits longer than 3 months		23,194		21,169
Cash at bank and in hand per the balance sheet		42,431		40,698

The accompanying accounting policies and notes form an integral part of these financial statements.

NOTES TO THE TRUSTEES' REPORT AND FINANCIAL STATEMENTS

For the year ended 31 March 2021

1 INCOME FROM DONATIONS

	2021 £'000	2020 £'000
BBSRC UKRI – core strategic grant	15,449	15,449
Resource contribution grants	3,479	-
	<u>18,928</u>	<u>15,449</u>

All income from donations in the current and prior year was restricted.

2 INCOME FROM CHARITABLE ACTIVITIES

	2021 £'000	2020 £'000
<i>Grant income</i>		
BBSRC UKRI – research grants	2,960	2,854
BBSRC UKRI – other grants	43,885	25,462
Other research grants	11,345	13,216
	<u>58,190</u>	<u>41,532</u>
Other charitable activities	2,609	2,053
	<u>60,799</u>	<u>43,585</u>

Income from charitable activities includes restricted income from grants and contracts of £43,687k (2020: £25,171k)

All other income from charitable activities in the current and prior year was unrestricted.

The analysis by region is set out below:

	2021 £'000	2020 £'000
United Kingdom	55,636	35,158
Europe	1,106	704
North America	2,573	3,822
Others	1,484	3,901
	<u>60,799</u>	<u>43,585</u>

INCOME FROM CHARITABLE ACTIVITIES (CONT)

	Unrestricted £'000	Restricted £'000	2021 Total £'000	2020 Total £'000
<i>Analysis of grant income</i>				
BBSRC UKRI				
Competitive Project Grant – research grants	2,960	-	2,960	2,854
Other grants	198	43,687	43,885	25,462
Total BBSRC UKRI	3,158	43,687	46,845	28,316
Defra “Umbrella” commission projects	2,250	-	2,250	2,472
Defra Surveillance	2,697	-	2,697	2,648
Other government departments, public sector	540	-	540	166
European Union	1,106	-	1,106	703
Industry, levy boards	1,176	-	1,176	513
Trusts, foundations, charities	1,003	-	1,003	2,892
Other research grant income	2,573	-	2,573	3,822
Total incoming resources – grants including research	14,503	43,687	58,190	41,532

Ancillary trades and activities

Other charitable income consists of trades and activities which are ancillary to the charitable activities of the Institute:

	Unrestricted £'000	Restricted £'000	2021 Total £'000	2020 Total £'000
Royalties	388	-	388	361
Diagnostic kits	2	-	2	141
Other	2,219	-	2,219	1,551
	<u>2,609</u>	<u>-</u>	<u>2,609</u>	<u>2,053</u>

3 INVESTMENT INCOME

	2021 £'000	2020 £'000
Rental income and tenant services	849	755
Bank interest	107	290
	<u>956</u>	<u>1,045</u>

All investment income in the current and prior year was unrestricted.

4 ANALYSIS OF EXPENDITURE

	Staff costs £'000	Other direct costs £'000	Allocated support costs £'000	2021 Total £'000	2020 Total £'000
Unrestricted funds					
<i>Costs of raising funds</i>					
Rental income and tenant services	-	-	312	312	307
Investment management costs	-	9	9	18	20
<i>Charitable expenditure</i>					
Grants for scientific research	13,620	6,043	11,976	31,639	33,158
Rental income and tenant services	-	(7)	970	963	960
Other charitable activities	-	206	216	422	462
Total unrestricted resources expended	13,620	6,251	13,483	33,354	34,907
Restricted funds					
Cost of raising funds	-	-	324	324	321
Charitable expenditure	-	-	14,322	14,322	10,351
Total restricted resources expended	-	-	14,646	14,646	10,672
Total resources expended	13,620	6,251	28,129	48,000	45,579
Total resources expended – 2020	12,549	9,013	24,017	45,579	

Included in allocated support costs are normal staff costs of £5,034,466 (2020: £4,946,242)

5 ANALYSIS OF SUPPORT COSTS

	Rental income and tenant services £'000	Investment management costs £'000	Grants and contracts for scientific research £'000	Science rental income and tenant services £'000	Staff restaurant £'000	Other charitable activities £'000	Total 2021 £'000	Total 2020 £'000	wBasis of allocation
Unrestricted									
Premises	174	-	7,473	867	65	-	8,579	8,760	% of floor area
Financial costs	27	9	593	46	27	26	728	669	time spent
Management	39	-	953	17	19	10	1,038	960	time spent
Human resources	54	-	391	-	16	-	461	457	time spent
Information technology	10	-	2,059	23	11	23	2,126	2,004	time spent
Purchasing and procurement	5	-	424	16	11	5	461	457	time spent
Governance	3	-	83	1	2	1	90	38	time spent
	312	9	11,976	970	151	65	13,483	13,345	
Restricted									
Depreciation	296	-	8,335	789	49	-	9,469	10,191	
Repairs / compliance	28	-	4,876	273	-	-	5,177	481	
	324	-	13,211	1,062	49	-	14,646	10,672	
	636	9	25,187	2,032	200	65	28,129	24,017	

6 OPERATING COSTS

	2021 £'000	2020 £'000
Operating costs stated after charging:		
Auditor's remuneration		
- audit services	48	44
- non-audit services	12	8
Depreciation	9,469	10,191
Loss on foreign exchange translations	189	93
Hire of plant and machinery	17	28
Rental of land and buildings	52	59

Operating costs are stated net of laboratory supplies carried forward in stock amounting to £264,046 (2020: £305,937).

7 REMUNERATION OF THE MEMBERS OF THE TRUSTEE BOARD

None (2020: none) of the members of the Trustee Board received any remuneration from the Institute during the year. Eleven members (2020: eleven members) of the Trustee Board had travel expenses of £907 (2020: £7,917) reimbursed during the year.

8 STAFF NUMBERS AND COSTS

The average number of persons employed by the Institute (including members of the Governing Council) during the year, analysed by category, was as follows:

	Number of employees	
	2021	2020
Office, management and estate support	126	122
Scientific	247	241
	373	363

The aggregate payroll costs of these persons were as follows:

	2021 £'000	2020 £'000
Wages and salaries	14,103	13,275
Social security costs	1,418	1,297
Other pension costs	2,613	2,520
	18,134	17,092

STAFF NUMBERS AND COSTS (CONTINUED)

Some employees of the Institute are members of the Research Councils' Pension Schemes, which are funded principally through employer and employee contributions. The pension schemes are analogous to the Principal Civil Service Pension Scheme (PCSPS), except that while the schemes that are defined benefit schemes and provide retirement and related benefits on final emoluments, redundancy and capability ill health are administered and funded by the council, the pension schemes are administered by the Research Councils' Joint Superannuation Services and the schemes' finances are administered by BBSRC UKRI. It is an unfunded scheme, and there are no separately identifiable assets and the actuarial cost to the Institute is not known. Consequently, it is not possible to supply the information referred to in Financial Reporting Standard 102, Section 28 and the Institute has accounted for the scheme as though it were a defined contribution scheme. The Institute pays employers' contributions,

at a percentage of scheme members' pensionable pay and emoluments assessed by the Government Actuary's Department (GAD) on a periodical basis. The rate for the year was 26.0%, which was established following GAD's most recent assessment. The pension costs represent contributions payable by the Institute to the scheme and amount to £1,011,524, (2020: £1,129,452). Since April 2015, all new staff (including promoted staff) are employed directly by the Institute, rather than BBSRC UKRI under the Institute's own terms and conditions. These staff are members of The Pirbright Company Pension, a defined contribution scheme administered by Aviva on behalf of the Institute. The Institute contributes 10% of scheme members' pensionable pay and emoluments. The pension costs represent contributions payable by the Institute to the scheme and amount to £1,516,186 (2020: £1,315,851). Staff engaged at the Institute prior to April 2015 were previously employed by BBSRC UKRI and deployed back to the Institute. Following the Transfer of Undertakings (Protection of Employment) (TUPE) exercise

as of 1 January 2017, all BBSRC employees are now covered under the Institute's position as a separate legal entity. The Institute therefore retains responsibility for paying employment costs in relation to all employees, including basic pay and allowances, contractual payments, tax, national insurance and pension contributions. Employees engaged prior to April 2015 remain members of the Research Councils' Pension Scheme (RCPS), a defined benefit scheme for multiple employers. The BBSRC Employment Code remains applicable and frozen at the date of TUPE transfer. The Institute does not have any liability for pensions other than for monthly employer contributions, the rate of which is determined by the GAD on a periodic basis. The key management personnel of the Institute comprise the Senior Leadership Board and the Trustees (Note 7). The total employee benefits (including wages and salaries, employer's national insurance and pension costs) of the key management personnel of the Institute were £558,121 (2020: £574,405).

The number of staff with emoluments greater than £60,000, (excluding pension costs), was:

	2021 Number	2020 Number
£60,000 – £69,999	13	11
£70,000 – £79,999	6	5
£80,000 – £89,999	4	3
£90,000 – £99,999	4	2
£110,000 - £119,999	1	1
£140,000 – £149,999	1	1

The number of staff earning over £60,000 for whom retirement benefits are accruing under defined benefit schemes amounted to 13 (2020: 12) and the amounts paid in the year were £273,183 (2020: £232,785)

9 TANGIBLE FIXED ASSETS

	Land and buildings £'000	Plant and machinery £'000	Fixtures, fittings, tools and equipment £'000	Payments on account and assets in course of construction £'000	Total £'000
Cost/revaluation					
At 1 April 2020	244,321	19,238	1,283	68,103	332,945
Additions	-	1,003	-	35,654	36,657
Disposals	-	(761)	-	-	(761)
Transfers	4,471	-	-	(4,471)	-
At 31 March 2021	248,792	19,480	1,283	99,286	368,841
Depreciation					
At 1 April 2020	46,918	16,760	1,283	-	64,961
Charge for year historic	7,442	1,121	-	-	8,563
Charge for year revaluation	906	-	-	-	906
Disposals	-	(761)	-	-	(761)
At 31 March 2021	55,266	17,120	1,283	-	73,669
Net book value at 31 March 2021	193,526	2,360	-	99,286	295,172
Net book value at 31 March 2020	197,403	2,478	-	68,103	267,984

Land and buildings include land with a book value of £13,603k.

The Institute includes in its financial statements leasehold land and buildings owned by third parties, that it occupies and enjoys through peppercorn leases, at their full value. The North side leases was renewed in December 2020 for 25 years and the south side lease for a term of 99 years. The Trustees consider that in substance the risks and rewards of ownership of the assets have passed to the Institute, and as such follow a policy of recognising the assets on the balance sheet to reflect the continuing occupancy of these assets for the foreseeable future. The only circumstance under which the Institute could be asked to vacate the site is due to a failure to deliver the required programme, which in the Trustees' view is highly unlikely. The Institute derives a rental income from some of the buildings included in its financial statements which it does not classify as investment properties as the cost of doing so exceeds the benefits.

The Institute used the option in FRS102 to use fair value at the date of transition to FRS102, (1 April 2014), as deemed cost on transition. GVA Grimley Limited, Chartered Surveyors, and an independent valuer derived these values from a professional valuation.

Part of the site is leased to Boehringer Animal Health UK Ltd. The lease is currently in the process of being renegotiated. If this process is successfully completed then this part of the site will be reclassified as an investment property.

10 INVESTMENTS

Investment in subsidiary undertaking

During the year Avrico Limited, which is incorporated in England and Wales, changed its name to Pirbright Innovations Limited. This Company which previously undertook foot-and-mouth disease testing on behalf of the Institute, was dormant during the current and previous year. The Institute owns the entire share capital of 100 ordinary shares of £1 each.

The assets and liabilities of the subsidiary were:

	2021 £'000	2020 £'000
<i>Current assets</i>		
Creditors: amounts falling due within one year	(8)	(8)
Net liabilities	(8)	(8)
Aggregate share capital and reserves	(8)	(8)

The Institute has provided for the deficit shown by the subsidiary undertaking by writing off the amount owed to it by Pirbright Innovations Limited.

Investment in associated undertaking

Genomia Management Limited was formed on 16 April 2004 and is a company limited by guarantee. The company was established by way of grants from the Department of Innovation, Universities and Skills and the European Regional Development Fund. The company manages the Genomia Fund the objective of which is to assist in the development of research output from the members into commercially realisable opportunities. The Institute has equal membership in this company with Roslin Foundation, Moredun Research Institute, Rowett Institute of Nutrition and Health and Scotland's Rural College (SRUC). The company's turnover for the year ended 31 March 2021 was £94,000 (2020: £229,000) and its net assets as at 31 March 2021 were £162,000 (2020: £114,000).

11 STOCKS

	2021 £'000	2020 £'000
Laboratory consumables	264	306

The Institute's stock consists of laboratory supplies for research purposes.

12 DEBTORS: AMOUNTS FALLING DUE WITHIN ONE YEAR

	2021 £'000	2020 £'000
Trade debtors	2,181	2,967
Prepayments	1,539	1,375
Accrued income	2,321	1,836
Other debtors	7,356	526
	<u>13,397</u>	<u>6,704</u>

13 CREDITORS: AMOUNTS FALLING DUE WITHIN ONE YEAR

	2021 £'000	2020 £'000
Trade creditors	2,484	1,451
Taxation and social security	550	563
Other creditors	154	110
Accruals	7,655	5,715
Deferred income	9,285	9,276
Short-term compensated absences	490	614
	<u>20,618</u>	<u>17,729</u>

14 RECONCILIATION OF MOVEMENT IN ACCRUED AND DEFERRED GRANT INCOME

	2021 £'000	2020 £'000
Accrued income	2,321	1,836
Deferred income	(9,285)	(9,276)
	<u>(6,964)</u>	<u>(7,440)</u>
Net deferred research grant income at the beginning of the year	(7,440)	(2,202)
Research grant income received during the year	(14,027)	(21,600)
Research grant money released to SOFA during the year	14,503	16,362
	<u>(6,964)</u>	<u>(7,440)</u>

15 FUNDS

	Balance 1 April 2020	Net incoming/ (outgoing) resources	Transfer between funds	Balance 31 March 2021
	£'000	£'000	£'000	£'000
<i>Unrestricted funds:</i>				
General	5,102	(14,953)	17,355	7,504
Designated	3,026	(333)	(200)	2,493
<i>Restricted non-endowment funds:</i>				
Fixed Asset Fund	284,798	29,400	2,993	317,191
<i>Other restricted funds:</i>				
Fixed Asset Project Support Costs	3,343	-	(2,750)	593
DP2 phase 2 occupation	1,620	(359)	(37)	1,224
IS4L Interim Insectary	6	-	(6)	-
BBSRC UKRI core grant funding	-	18,928	(18,928)	-
Brooksby support costs	-	-	1,573	1,573
Other	68	-	-	68
	<u>297,963</u>	<u>32,683</u>	<u>-</u>	<u>330,646</u>

Unrestricted designated funds

Unrestricted designated funds comprise sums set aside for specific purposes including the acquisition and improvement of tangible fixed assets, the presentation of scientific conferences, and contributions towards capital to be replaced using the fully economic costing policy adopted by the Institute. This includes £1,661k for occupation costs relating to capital projects (2020: £2,167k), £41k to maintain scientific equipment capacity and capability (2020: £15k), £43k for IT resilience (2020: £153k), £352k for group leaders (2020: £624k) and £396k for other projects (2020: £67k)

FUNDS (CONTINUED)

Restricted non-endowment funds

Restricted non-endowment funds comprise grants received from funders specifically to be applied in the acquisition or improvement of tangible fixed assets or otherwise applied for such purposes as specified by the grants provided.

	2021 £'000	2020 £'000
Fixed Asset Fund		
Balance brought forward	284,798	266,596
Grants received	43,687	25,171
Depreciation/impairment (Note 6)	(9,469)	(10,191)
Revenue spend	(4,818)	(381)
Transfers	2,993	3,603
Balance carried forward	<u>317,191</u>	<u>284,798</u>

The Fixed Asset Fund is not an endowment fund, but represents funding received, principally from BBSRC UKRI, for the past and future acquisition of tangible fixed assets. These assets are built on land that is not owned by The Pirbright Institute. The capital fund has been set up to assist in identifying those funds that are not free funds and it represents the net book value of tangible fixed assets held by the Institute and amounts received for capital but not yet spent.

The unexpended balance of unrestricted designated funds and restricted funds is invested temporary in deposits and appears in the balance sheet under current assets.

Other restricted funds

Fixed Asset Project Support Cost grants have been received from BBSRC UKRI to provide funding towards support costs and overrun costs relating to the DP1 capital projects.

The Capital Rebuild Grant, Additional Construction Support has on approval from BBSRC UKRI been transferred to development phase 2 occupation fund. As part of the ongoing development, project funds from these reserves have been transferred to the Fixed Asset Fund.

The BBSRC UKRI core grant funding is received from BBSRC UKRI to ensure that the Institute's facilities are maintained at the necessary cutting-edge high containment level that is essential to provide a national capability.

Transfers between funds

	Unrestricted general funds £'000	Unrestricted designated funds £'000	Restricted funds £'000
Transfer of funds to general reserves	17,355	(200)	(17,155)

The transfers during the year are as follows:

The BBSRC UKRI core grant funding restricted fund transfer of £17,355k has been made to set overhead expenditure incurred in the year against the restricted grant received for this purpose.

£1,573K has been transferred from the BBSRC UKRI core grant funding restricted fund to Brooksby support costs in respect of funds received from BBSRC to be utilised against the running costs of the new Brooksby large animal experimental facility across the 2021/22 and 2022/23 financial years.

£200k has been transferred from the designated reserve for group leaders to the fixed asset fund in respect of a reallocation of funds to the restricted fixed asset fund.

£2,750K has been transferred from the Fixed Asset Project Support cost restricted fund to the restricted fixed asset fund in respect of expenditure incurred and subsequently capitalised as construction in progress.

£37K has been transferred from the DP2 phase 2 occupation restricted fund in respect of a reclassification of expenditure.

£6K of funds not utilised have been transferred from the IS4L Interim Insectary restricted fund to the restricted fixed asset fund.

16 ANALYSIS OF NET ASSETS BETWEEN FUNDS

	Fixed assets £'000	Net current assets £'000	Total £'000
Unrestricted funds	-	9,997	9,997
Restricted funds			
Capital fund	279,873	22,019	301,892
Revaluation reserve	15,299	-	15,299
Other restricted funds	-	3,458	3,458
	<u>295,172</u>	<u>35,474</u>	<u>330,646</u>
	Fixed assets £'000	Net current assets £'000	Total £'000
Prior year			
Unrestricted funds	-	8,128	8,128
Restricted funds			
Capital fund	251,849	16,814	268,663
Revaluation reserve	16,135	-	16,135
Other restricted funds	-	5,037	5,037
	<u>267,984</u>	<u>29,979</u>	<u>297,963</u>

17 FINANCIAL INSTRUMENTS

	2021 £'000	2020 £'000
Financial assets measured at amortised cost	9,537	3,493
Financial liabilities measured at amortised cost	(3,188)	(2,124)
	<u>6,349</u>	<u>1,369</u>

Financial assets measured at amortised cost comprise trade debtors, amounts owed by related parties and other debtors.
Financial liabilities measured at amortised cost comprise trade creditors, other tax and social security and other creditors.

18 COMMITMENTS

(a) Capital commitments at the end of the financial year for which no provision has been made:

	2021 £'000	2020 £'000
Authorised but not contracted for	28,835	8,923

The capital commitments of £28,835k (2020: £8,923k) will be significantly funded by the BBSRC UKRI.

(b) Operating lease commitments

The Institute is committed to the following charges in respect of:

	2021 £'000	2020 £'000
Land and buildings		
Within one year	52	52
In two to five years	210	207
In over five years	293	340
Plant and Machinery		
Within one year	8	-
In two to five years	16	-

19 CONTINGENT LIABILITIES

There is a contingent liability to account to BBSRC UKRI for the net proceeds of disposal of fixed assets acquired with grant assistance and for recurrent and capital grants in excess of the financing requirements. No such liabilities existed at either 31 March 2021 or 31 March 2020.

20 RELATED PARTY TRANSACTIONS**Biotechnology and Biological Sciences Research Council part of UK Research and Innovation (BBSRC UKRI)**

BBSRC UKRI provides substantial funding to the Institute. The Institute is affiliated with BBSRC UKRI along with seven other institutes. Details of grants received from BBSRC UKRI are detailed in Notes 1 and 2. During the year, BBSRC UKRI charged the Institute £0, (2020: £3,983) for other costs and Engineering and Physical Sciences Research Council UKRI charged the Institute £41,789 (2020: £0) for other costs.

Genomia Management Limited

During the year our associated undertaking in Genomia Management Ltd (Note 10) provided the Institute with £0 of grant income (2020: £71,831).

REFERENCE AND ADMINISTRATIVE DETAILS

Trustees:

Professor John Stephenson: Chair
 Professor Vince Emery: Deputy Chair
 Ian Bateman
 Ian Black
 Rona Chester
 Jon Coles
 Emma Griffin
 Alison Hardy
 Paul Logan
 Roger Louth
 Jane Tirard

Director of the Institute:

Professor Bryan Charleston MRCVS

Company Secretary:

Helen Watts

Registered office:

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Bankers:

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Lloyds Bank PLC
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Solicitors:

Charles Russell LLP,
 1 London Square,
 Cross Lanes,
 Guildford, GU1 1UN

Penningtons Manches LLP,
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An internal shot of The BBSRC National Vaccinology Centre: The Jenner Building, which houses Pirbright's low containment laboratories



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