



THE  
Pirbright
INSTITUTE

PREVENTING AND CONTROLLING VIRAL DISEASES

ANNUAL REPORT
AND ACCOUNTS
FOR THE YEAR
ENDED 31
MARCH 2019


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Cover image:
© Professor Bryan Charleston,
Director


African buffalo (*Syncerus caffer*) are the primary carrier host of foot-and-mouth disease virus (FMDV) in African savannah ecosystems, where the disease is endemic. The cover image shows one of the captured buffalo housed in the veterinary facilities in Skukuza, Kruger National Park, South Africa. The studies showed some viruses persist for up to 400 days in buffaloes

Image: Cells infected with African swine fever virus (ASFV). Nuclear proteins in blue, endoplasmic reticulum proteins in red, early ASFV proteins in green

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 The Pirbright Institute

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FOREWORD BY THE CHAIR OF TRUSTEES



On behalf of the Board of Trustees of The Pirbright Institute, I am delighted to present our Trustees' Report incorporating the Strategic Report for the year ended 31 March 2019. This has been a very successful year for the Institute and the report includes details of our mission, objectives, scientific achievements, commercial collaborations, public engagement and financial performance.

Pirbright is the UK's leading research institute for virus diseases of livestock, the World Reference Laboratory for Foot-and-Mouth Disease (WRLFMD), among other important veterinary pathogens, and one of the few international laboratories that can study the most dangerous veterinary viruses in both the laboratory and in the animals they infect. Therefore, we make a substantial contribution to food security in the UK and globally. We will increasingly contribute to 'One Health' agendas by expanding our work on zoonotic agents which cause severe disease in both farm animals and humans.

Our research activity has continued to grow this year and has been matched by an increase in income which has enabled the Institute to maintain a healthy level of reserves. Uncertainty over the Brexit negotiations, however, continues to affect our financial and strategic planning, but the Institute has made significant progress in mitigating these challenges by attracting funding from many sources, both in the UK and internationally, and from the commercial and charitable sectors as well as the UK Government. Furthermore, many Pirbright staff are involved in a large number of international collaborative projects sharing their expertise and best practice with others around the globe. This success recognises the international reputation of our scientific staff who have been greatly supported by the expert advice and guidance provided by our Scientific Advisory Board.

The Institute continues to receive substantial capital funding from the Biotechnology and Biological Sciences Research Council on behalf of UK Research and Innovation (BBSRC UKRI), and we plan to commission three new research facilities in the near future. This has been possible, not only with substantial help from BBSRC UKRI staff, but also through a constructive relationship with the Health and Safety Executive (HSE) and with a great deal of professional expertise and commitment from Pirbright staff.

Excellent, internationally recognised science continues to remain at the heart of Pirbright, with research programmes exploring the properties of viruses that determine their ability to cause disease, replicate, evolve

and spread and developing enhanced host responses for disease control. Work with arthropod-borne diseases continues to expand, facilitated by the commissioning of new insectaries.

A key facet of Pirbright's strategy is working with industry to ensure the Institute's research is translated into products that directly benefit the UK and other countries. This year we have been granted ten patents involving new vaccines or vaccine production and are working with several commercial companies to develop other products.

Research at Pirbright is for everyone; this year over 120 Pirbright staff have undertaken over 40 public engagement activities including national science festivals, agricultural shows, STEM careers events and hands-on school workshops.

These substantial achievements have only been possible due to the professionalism and expertise of the front-line scientists and also those who support them and ensure the smooth operation of the extensive range of complex facilities at Pirbright. The Trustee Board would like to take this opportunity to thank all the employees of Pirbright for their continued hard work and dedication throughout this year.

Professor John Stephenson
Chair of the Trustee Board
The Pirbright Institute



New high and low containment laboratories stand side by side facilitating Pirbright research objectives

A VISION FOR HEALTH



Emerging diseases, particularly viruses that have the potential to cause pandemics in animals and humans, are a growing concern, and international disease control agencies quite rightly recognise the need for funding in scientific research to combat these threats. The viral diseases Pirbright studies pose some of the world's biggest threats, not just to animal health, but to food and economic security, so impacting on human health.

Pirbright's unique combination of high containment laboratories and animal facilities, and expertise in biosafety and research enables us to study many highly infectious viruses, their hosts and the interaction between the two. Foot-and-mouth disease virus (FMDV), a highly infectious disease affecting cloven-footed animals, has a huge impact globally and our research is facilitating the development of a safer, cheaper and effective vaccine against multiple strains of the disease, designed to improve animal and human health.

In 2018-19 African swine fever (ASF), a deadly haemorrhagic disease of pigs, swept through Eastern Europe and China resulting in the death of at least 150 million animals so far, threatening global food supplies and causing economic hardship. It is still spreading throughout Asia. There is no vaccine or cure and since this highly infectious virus can remain viable in the environment for many weeks, controlling the disease relies on strict biosecurity measures and culling.

Pirbright is one of the few laboratories in the world that has continued research into ASF over the past 20 years and we are currently working to develop a vaccine as well as testing antivirals for this devastating disease. This highlights our position as a global leader in the field of animal and human health, where our knowledge and expertise inform policy on disease prevention and control around the world.

The Institute has undergone significant change over the past ten years and has received over £350 million of capital investment from BBSRC UKRI to ensure it has the capacity to respond swiftly and effectively to these global threats. We are now seeing the benefits of this investment as new specialist buildings come on stream and construction commences on a high containment large animal laboratory and a pathogen-free poultry facility. We continue to operate efficiently and cost-effectively compared to similar high containment research facilities, delivering good value for UK Government.

Our new laboratories will give us the flexibility to respond to new and emerging diseases, particularly those that spread between animals and people (zoonoses). In preventing and controlling viral diseases of animals we are playing a key role in protecting human health and furthering research in these viruses and tools to combat their spread, fulfilling the 'One Health' agenda.

The Institute studies four zoonotic viruses highlighted by the World Health Organization as a priority for research – Crimean-Congo haemorrhagic fever, Nipah, Rift Valley fever,

and Zika – as well as carrying out research on their livestock hosts and insect vectors. All have epidemic potential and insufficient control measures, and our research will support the drive to be ready to respond. Work has already begun on developing a vaccine against Nipah for pigs; trials are underway to test a more effective vaccine against Rift Valley fever; and we continue to develop genetic engineering solutions to control the spread of diseases like Zika and dengue by the *Aedes aegypti* mosquito.

Much of our work is done in collaboration with partners, both commercial and academic, and we are proud of the fact that in 2018-19 we were involved in 154 partnerships and networks across 53 countries.

Our collaborative approach in sharing our scientific expertise is highlighted further with the launch of the immunological toolbox, a web-based repository for antibodies, reagents and information to advance veterinary vaccine development through knowledge exchange and working together.

Working with partners and engaging with the public and key stakeholders globally remains a top priority to ensure we are well positioned to respond rapidly and effectively to outbreaks and protect the world's health, food and economic security.

Professor Bryan Charleston
Director and CEO
The Pirbright Institute



ABOUT PIRBRIGHT

OUR VISION

Pirbright's purpose is to eliminate viral diseases of livestock and those that spread from animals to people (zoonoses). We receive strategic funding from BBSRC UKRI and work to enhance the UK's capability to eliminate and control economically important diseases through highly innovative fundamental and applied bioscience.

OUR VALUES

The Institute employs around 375 staff, research students and visiting scientists, and is situated in Pirbright, Surrey. We promote a culture of openness and transparency which is underpinned by our core values which are:

- Passion** – for the highest quality standards, delivery and performance
- Reliability** – in everything we do: leadership, learning, biosecurity, problem anticipation and containment of unexpected events
- Innovation** – the driving force behind our fundamental and applied research. Our work is positioned at the cutting edge of science to deliver solutions for global good
- Dignity and respect** – we respect and trust all in our diverse community
- Excellence** – we aim to deliver the best in all aspects of our work including health, safety, biosafety, scientific research, stakeholder support and protecting the environment.

We take **PRIDE** in being a world-class organisation where knowledge, expertise, facilities, professional excellence and rigorous academic, biosafety and ethical standards combine to generate global health and economic impacts.

GOVERNANCE

The Pirbright Institute was established as a tuberculosis cattle testing station in 1914 and over the past 100 or so years both the scientific

research and facilities at Pirbright have evolved to provide the UK with its capability to prevent and control viral diseases of livestock.

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

BBSRC UKRI provides capital funding for campus development and research funding for our two science programmes as well as

our core capability grant. The Institute also received grants from other funders including Wellcome Trust, the Bill & Melinda Gates Foundation, Department for Environment, Food and Rural Affairs (Defra) and Defence Advanced Research Projects Agency (DARPA). Our current Trustee Board members are:

Chair: Professor John Stephenson
Trustees: Ian Bateman, Ian Black, Jon Coles, Professor Vince Emery, Roger Louth, Dr Vanessa Mayatt OBE, Dr Sandy Primrose, Sir Bertie Ross, Professor David Rowlands and Jane Tirard.



BBSRC National Vaccinology Centre: The Jenner Building

OUR SCIENCE

Pirbright provides the UK with its capacity to predict, detect, understand and respond to the threat of specific potentially devastating viral livestock diseases. We have two research programmes – one linked to the study of viruses, the other to the study of hosts – which are funded by BBSRC UKRI over a five-year period. One of Pirbright's strengths is that it has the capability to study both viruses (particularly highly infectious viruses that must be studied under high containment) and the natural hosts (livestock and insects also under high containment), and the relationship between the two. Unusually Pirbright combines fundamental and applied research to develop a range of scientific methods to prevent, diagnose and control these diseases.

PROGRAMME 1: ENHANCED HOST RESPONSES FOR DISEASE CONTROL

Professor John Hammond heads up the host research programme which focuses on immunology, genetics, entomology, vaccinology and bio-informatics to investigate host-virus interactions from the perspective of the host. This includes virus vectors such as arthropods (mosquitoes, midges and ticks), host responses to viral infection and the translation of this knowledge to develop new methods to control viral diseases.

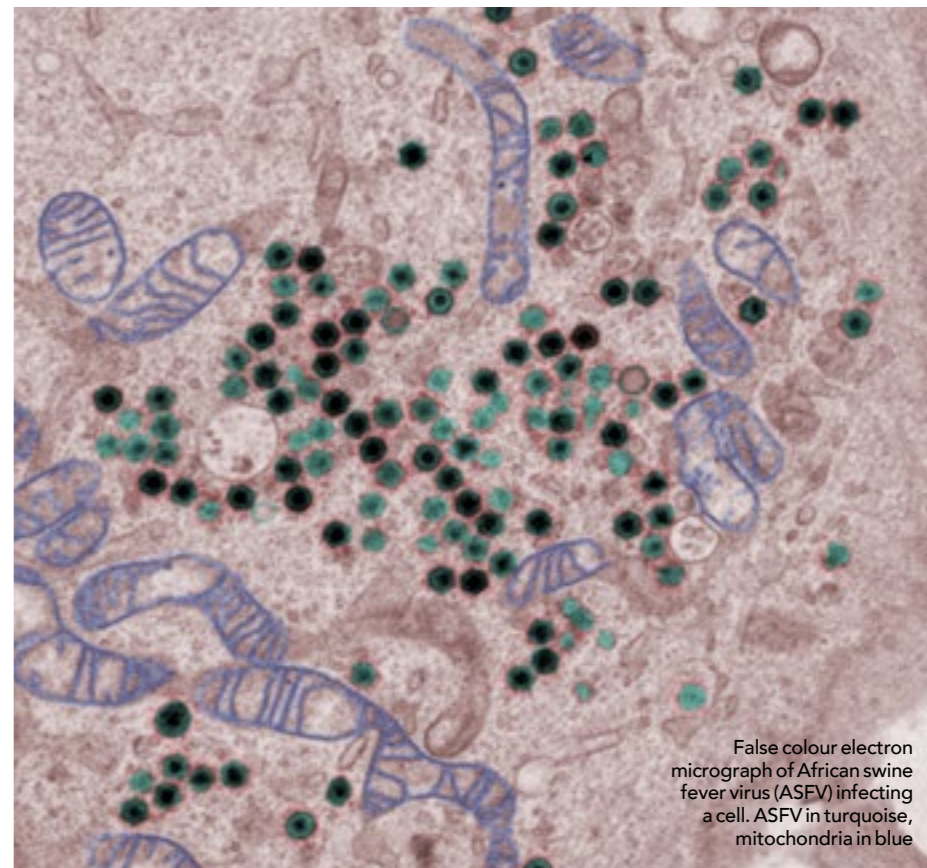


PROGRAMME 2: UNDERSTANDING AND PREVENTING VIRAL DISEASES

Dr Toby Tuthill oversees the virus research programme which studies the interaction between virus and host from the perspective of the virus. It explores those properties of viruses that determine their ability to cause disease, replicate, evolve and spread. By understanding how viruses behave at many levels, including molecular and cellular biology, and how they evolve within the host, we can better reconstruct and predict how viruses are spread and cause disease with the aim of creating new vaccines, diagnostic tests and predictive models.

PROTECTING THE UK

Pirbright provides the UK with its capacity to respond to high consequence livestock and zoonotic viral pathogens to protect our food and economic security and improve health and



False colour electron micrograph of African swine fever virus (ASFV) infecting a cell. ASFV in turquoise, mitochondria in blue

wellbeing.

The Institute is a world centre of excellence that ensures the UK remains prepared in the event of a major viral disease outbreak of livestock. Pirbright's capabilities include:

- World-class scientists who are experts in the fields of virology, vaccinology, immunology, epidemiology, entomology, biomathematics and genetic engineering
- Unique high containment research facilities to study animal viruses of economic importance in the natural host (*in vitro* and *in vivo* study facilities)
- International Reference Laboratories accredited to ISO/IEC 17025, a UKAS accredited laboratory number 4025
- Genetically defined and inbred lines of animals, collections of arthropod vectors and a range of well characterised virus stocks
- Production and engineering of recombinant antibodies for veterinary research



- Multidisciplinary immunological research to enable detailed understanding of recognition and control of viral infection by the natural host
- Facilities for infection of vectors with viruses
- Next generation sequencing and *in vitro* bioimaging in high containment
- High biocontainment engineering and health, safety and biosafety expertise

OUR PARTNERS AND STAKEHOLDERS:

- Biotechnology and Biological Sciences Research Council (BBSRC), part of UK Research and Innovation (UKRI)
- UK Department for the Environment, Food and Rural Affairs (Defra)
- Other UK research funding agencies
- International funding and disease control agencies, such as the World Organisation for Animal Health (OIE), Food and Agriculture Organization of the United Nations (FAO), World Health Organization (WHO), the European Commission, and Bill & Melinda Gates Foundation
- Veterinary vaccine manufacturers and animal breeding companies
- Farmers and livestock keepers

OUR EXPERTISE

ANIMAL RESEARCH SERVICES

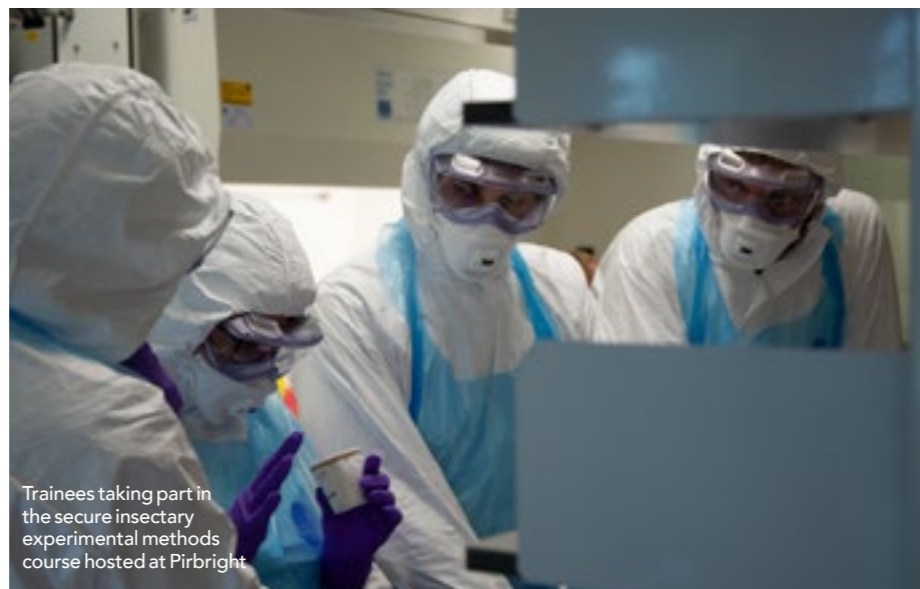
Pirbright's animal facilities are managed by a small specialist trained team who are highly experienced in the care and welfare of animals. Each animal unit has a Named Animal Care and Welfare Officer (NACWO) to ensure high standards of welfare, husbandry and care are in place. Pirbright staff go above and beyond the legal requirements set by the Home Office for the use of animals in research. We have a culture of care to ensure that animals are treated with compassion and respect which positively impacts on our quality of science. The Institute is a signatory to the Concordat on Openness on Animal Research in the UK, demonstrating our commitment to enhance our communication about the use of animals in our research and its importance in improving animal health.

BIORISK

Pirbright's work with high consequence pathogens poses one of the highest inherent risks to the UK, and as such, Pirbright is licenced as a Major Hazard site, subject to intensive scrutiny by regulatory agencies. To manage and control this biorisk, Pirbright maintains a complex, advanced high containment infrastructure, and applies rigorous operational and management systems, policies and processes. This utilises extensive in-house risk management and engineering specialist expertise and is achieved in conjunction with world-class scientists and good leadership. Pirbright works in close cooperation with regulators and stakeholders on biorisk, including safety, security, quality, environmental and engineering aspects, and plays a leading role nationally and internationally in these areas.

BIOIMAGING

Pirbright offers bioimaging facilities inside and outside of containment featuring confocal and electron microscopes, flow cytometry and cell sorters. The imaging and analytical



Trainees taking part in the secure insectary experimental methods course hosted at Pirbright

techniques available within high containment can be used to image, analyse and sort live cells from host animals infected in high containment.

BIOINFORMATICS

Modelling is a crucial element of disease prediction and control and requires complex mathematical calculations to build a picture of how disease can spread, depending on different factors such as where farms are located, how many animals they keep, how animals are moved between them and the weather. Understanding transmission is essential for improving disease control and surveillance. This can be done using data from transmission experiments or from disease outbreaks to estimate how long animals are infectious for and how likely they are to spread infection to others.

REFERENCE LABORATORIES

The reference laboratories at Pirbright provide the UK with its national capability for diagnostics and surveillance to monitor livestock for ten diseases of high consequence such as foot-and-mouth disease (FMD), African swine fever (ASF), lumpy skin disease (LSD) and bluetongue (BT). This work underpins global disease control and is

delivered through a combination of skilled and expert personnel, high containment facilities, effective and reliable diagnostic tests, reagents and archive materials. The reference laboratories work closely with our research programmes, enhancing our ability to control disease through fundamental understanding of viruses, their hosts and vectors and their interrelationships.

TRAINING

Pirbright's global training activities contribute to the prevention and control of viral diseases of animals worldwide. Courses in laboratory diagnosis of viral diseases provide a platform where the Institute shares its scientific expertise and knowledge internationally and in-country through twinning projects and collaborations. Pirbright's impact has recently increased through the development of online e-learning courses which are accessible, despite geographical boundaries, and cost-effective, particularly to allow all scientists to participate. Pirbright also utilises staff's specialised expertise in biosafety and high containment engineering to deliver high-quality training in response to the needs of the global community.



Scientists working in the BBSRC National Virology Centre: The Plowright Building enjoy a light and airy working environment, a departure for high containment laboratories

SCIENTIFIC IMPACT

Pirbright's work has global impact, touching the lives of people who depend on livestock for survival, informing policy on disease control and helping to rid the world of devastating disease through vaccination, prevention and control.

UNDERSTANDING THE PIG IMMUNE SYSTEM

Researchers from Pirbright, together with the University of Bristol, Cardiff University and University of Oxford, have generated tools to improve understanding of the pig immune system. Researchers used a unique line of Babraham



inbred pigs to develop novel tools for tracking the response of immune cells, killer T cells, following influenza infection or vaccination. These tools will enhance our understanding of how best to vaccinate animals and humans to achieve powerful protective

immune responses and are particularly important for studying flu in pigs because they act as 'mixing vessels' for the creation of new virus strains with pandemic potential.

PIRBRIGHT REDUCES THE NEED FOR CHICKENS IN RESEARCH

Our birnavirus researchers have established a lab procedure which allows the response of chicken immune cells to infectious bursal disease virus (IBDV) to be studied without infecting live chickens. The protocol shows scientists how to isolate the immune cells, called B cells, and grow and infect them in the lab via a published video. The work has received funding from the National Centre for the 3Rs (reduction, refinement, and replacement of animals used in research) to improve the control of different immunosuppressive viruses in poultry.



DESIGNING AFRICAN SWINE FEVER VACCINES

African swine fever (ASF), a deadly haemorrhagic disease of pigs, has affected an estimated 150-200 million pigs since August 2018 in China alone, threatening global food supplies and causing economic hardship. The virus is still spreading and currently there is no vaccine. Pirbright has maintained a research programme on African swine fever virus (ASFV) since 1963, even when the disease was restricted to Africa and did not attract research funding. We continue to provide knowledge, diagnostic tests and reagents to global disease control agencies to find solutions for this emergency.

Pirbright scientists are developing a vaccine against ASF by identifying and deleting an ASFV gene that codes for a protein that is thought to play a role in suppressing the pig immune system. The resulting weakened strain of ASFV does not appear to cause severe disease or death in pigs and protects them against natural strains of ASFV.

Further research is being undertaken on other viral proteins thought to play a role in the immune response.

GETTING TO GRIPS WITH THE MIDGE GENOME

Experts in genetics and bioinformatics at Pirbright and the European Bioinformatics Institute (EBI) have built a complete *Culicoides* biting midge genome, paving the way for better disease control. Midges transmit a range of important animal

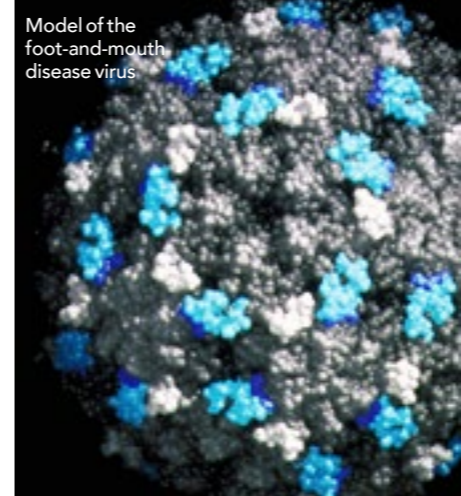
The *Culicoides* biting midge is responsible for the spread of several animal diseases



viruses on UK farms including bluetongue virus (BTV). The genome sequence is freely available to scientists with the aim of improving our knowledge about which genes are involved in the transmission of livestock viruses. It will also allow comparisons to be drawn with other groups of vectors, including mosquitoes and sandflies. Further innovations in disease control could be made via genetic manipulation of the midge vector, now the genome is fully sequenced.

CREATING HYBRID FMDV VIRUSES TO MAKE BETTER VACCINES

In a quest to create foot-and-mouth disease viruses (FMDV) with improved stability, which will increase the effectiveness of FMDV vaccines, collaborative research led by scientists at Pirbright has resulted in the generation of a 'hybrid' FMDV. The team genetically engineered a virus of the Southern African Territories (SAT) 2 serotype by replacing most of its internal material with that of an O serotype virus, which is known to be more stable. The resulting 'hybrid' and wild type vaccines were then exposed to elevated temperatures and only the hybrid was shown to induce antibody responses predicted to protect against foot-and-mouth disease (FMD) infection. The study shows that this could be an effective method for improving other FMD serotype vaccines.



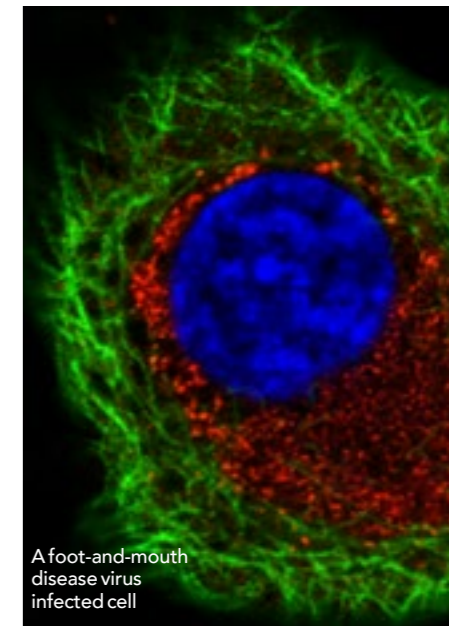
Model of the foot-and-mouth disease virus

THE COMMON COLD COULD BECOME LESS COMMON

Most remedies for the common cold rely on treating the symptoms of the infection rather than the virus that causes the infection. Researchers at Imperial College London, Queen's University Belfast, University of Dundee and University of York worked with scientists at Pirbright to test a molecule designed to target the virus-infected host instead of the virus itself, since the virus mutates rapidly making it more difficult to target. The new molecule targets a protein in the host called N-myristoyl transferase (NMT) which helps construct the protein 'shell', or capsid, that protects the virus' genetic material. Without NMT the virus is unable to replicate. Researchers demonstrated that this drug was active against multiple viruses in the same family as the common cold, including poliovirus and FMDV, without affecting host cells, though further study is needed to make sure it is not toxic in whole organisms.

MILK SAMPLES USED TO DETECT FOOT-AND-MOUTH DISEASE

Control of foot-and-mouth disease (FMD) is heavily reliant on the rapid and accurate detection of the virus, but current tests normally use tissue or blood samples. Scientists from Pirbright and the US Department of Agriculture (USDA) Animal and Plant Health Inspection Service (APHIS) have shown it may be possible to detect FMDV in pooled milk samples stored in bulk tanks. These encouraging results demonstrate that milk testing could play a key role in disease surveillance during and after outbreaks. It also removes the need to test animals individually, or require a vet to be on hand, reducing both testing costs and the potential stress to animals. Further research also showed that milk samples collected in the field in Tanzania could be used successfully to detect cattle infected with FMD. These results provide an accessible and cost-effective way of monitoring FMD outbreaks, which could strengthen surveillance capabilities.



A foot-and-mouth disease virus infected cell

REWRITING THE EVOLUTIONARY HISTORY OF FOOT-AND-MOUTH DISEASE VIRUS

Pirbright scientists have reconstructed the global evolutionary history of FMDV lineage that is currently spreading widely outside of the Indian subcontinent. Using samples submitted to the World Reference Laboratory for Foot-and-Mouth Disease (WRLFMD), researchers revealed evidence of 'recombination events', where genetic sequences coding for the FMDV outer shell proteins, known as the capsid, were exchanged between lineages. These recombination events previously prevented scientists from accurately interpreting FMD virus movements, leading to the new recommendation that only sequences encoding capsid proteins should be used for broad-scale mapping of lineage distributions.

Further analysis of recombination events in buffalo has provided insight into the molecular evolution of the virus and showed that the role of recombination as a generator of genetic variability in FMDV has been greatly underestimated.



Infectious viral diseases often affect livestock communities in those countries that rely on their livestock herds to survive. We work to alleviate this burden to improve peoples lives

HOW PIRBRIGHT'S KNOWLEDGE IS HELPING CURB THE SPREAD OF LUMPY SKIN DISEASE

Lumpy skin disease (LSD) is a disease of cattle which has recently spread from Africa, where it is endemic, to Greece and much of the Balkans. To better understand more about how LSD is spread between animals Pirbright scientists have developed a bovine model of LSD to investigate the mechanism of transmission, particularly by insect vectors. The stable fly *Stomoxys calcitrans* is thought likely to be the most efficient at transmitting lumpy skin disease virus (LSDV), with the mosquito *Aedes aegypti* also seen as an efficient vector, although there remains uncertainty regarding exact transmission from insect to bovine. However, the long-term persistence of LSDV in a range of insect vectors, and the existence of subclinical LSDV have filled key knowledge gaps and enabled Pirbright to offer advice to help control the LSD epidemic in Southeast Europe in 2015-2018 and inform strategy on the prevention and control of LSD in the UK, making us better prepared in the event of an outbreak.



FOOT-AND-MOUTH DISEASE VACCINATION STRATEGY COULD REDUCE RURAL POVERTY

Targeted vaccination programmes against FMD could help alleviate poverty in eastern Africa. Research undertaken with the University of Glasgow and Pirbright showed that livestock production losses due to FMD are estimated to be around \$2.3 billion each year in Africa, affecting national economies, food security and the livelihoods of livestock keepers – 85% of which live in extreme poverty. The study found that in East Africa FMD serotypes pass through livestock in slow waves, but that it was rare for livestock to become infected by viruses circulating in wild buffalo. Understanding this pattern of infection means that scientists can tailor control methods to make them more effective, rather than copying methods used in other regions that may not work. This could provide a cost-effective vaccination strategy that would aid in alleviating poverty in communities that are dependent on their livestock for income.

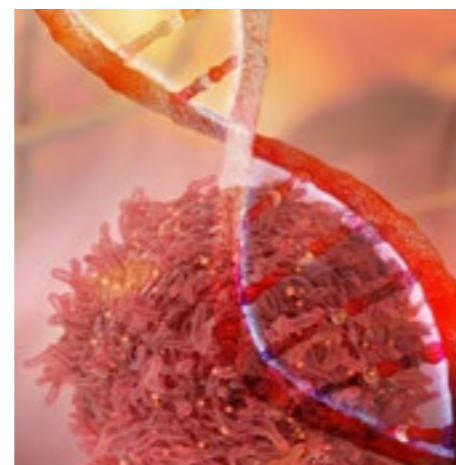
PIRBRIGHT HELPS THE UK REMAIN BLUETONGUE FREE

Bluetongue virus (BTV) type 8 was successfully identified in imported cattle on at least two occasions in 2018-19 by the National Reference Laboratory for Bluetongue Virus, part of the Non-Vesicular

Disease Reference Laboratory Group's (NVDRL) diagnostic facilities. BTV affects domestic farmed animals such as cows, sheep and goats, and infection can reduce milk yield and cause infertility, which has a massive impact on livestock production and movement. This shows the importance of the routine post-import testing regime in place, and that active surveillance carried out on live animal consignments moving from neighbouring countries where BTV is circulating is vital in the control of disease.

GROUND-BREAKING METHOD PINPOINTS HOW LIVESTOCK VIRUS COULD BECOME A ZOOZOSIS

Peste des petits ruminants virus (PPRV), which causes disease in sheep and goats, and is a close relative of the measles virus, could overcome barriers that currently prevent it from entering human cells. The study revealed that a single amino-acid change to the PPRV haemagglutinin protein enables it to use the receptor SLAMF-1 to gain entry into human cells. It is important to note that this does not mean the virus would have the potential to cause disease in humans as many other factors are required for the virus to successfully replicate and cause clinical symptoms, but it does indicate that these viruses have the potential to jump from animals to humans given the right mutations and conditions. The innovative techniques used for the study negated the requirement for live infectious virus and high containment laboratories, which meant modified live viruses with potential zoonotic capability were not, and will not, be generated. These techniques could give researchers the ability to monitor and predict the emergence of such viruses with increased accuracy.



INEXPENSIVE IBV VACCINE ON HORIZON
 Infectious bronchitis virus (IBV) is the most economically important infectious disease affecting chickens in the UK. IBV vaccines are currently produced in hen's eggs – a cumbersome and expensive process – because most IBV strains do not grow in cell cultures. Our researchers have identified the exact genetic code that allows a non-virulent lab strain of IBV to grow in cell cultures rather than eggs. By transferring this code into a vaccine strain, scientists demonstrated it could also be grown in cells enabling rapid production of many IBV vaccine viruses in large volumes. This results in lower production costs and allows for greater flexibility for protecting against the ever-changing circulation of IBV strains.



Chicken cells infected with infectious bronchitis virus (red), a major cause of economic loss in poultry production worldwide



The BBSRC National Virology Centre: The Plowright Building

A GLOBAL CENTRE OF EXCELLENCE

Pirbright's campus comprises both high and low containment research laboratories and high and low containment animal research facilities which enable us to study viruses of livestock, and those that spread from animals to people and develop methods to combat their spread.

PIRBRIGHT RESEARCH FACILITIES

THE BBSRC NATIONAL VIROLOGY CENTRE – HIGH CONTAINMENT LABORATORY

The BBSRC National Virology Centre: The Plowright Building became fully operational in April 2015 and is the result of £135 million government investment to develop a new high containment laboratory for research of viruses of high consequence such as foot-and-mouth disease (FMD) and African swine fever (ASF). The laboratory houses 160 staff, including 125 scientists, and is essential to underpin the Institute's two scientific programmes for the purposes of *in vitro* research into virus diseases of livestock. At the highest level of containment to study animal diseases (SAPO 4), it is designed to ensure virus research can be undertaken safely so no virus can be released. It is named in honour of Walter Plowright who played a key role in the eradication of rinderpest and was a leading scientist at the Institute.

BBSRC NATIONAL VACCINOLOGY CENTRE – LOW CONTAINMENT LABORATORY

The award-winning BBSRC National Vaccinology Centre: The Jenner Building was opened in 2017 by The Princess Royal as part of phase two of the redevelopment of the Pirbright site. This facility houses a wide range of groups working on strategically important endemic and exotic viral pathogens that can be handled under low containment including Marek's disease virus (MDV), infectious bronchitis virus (IBV), and low pathogenicity animal influenza viruses. The Jenner Building replaces old laboratory space at Pirbright (and the now closed Compton campus) and is home to over 100 scientists.

THE HOUGHTON FACILITY – DISEASE FREE POULTRY LABORATORY

The Houghton Facility is a Specific Pathogen Free (SPF) hatchery that allows Pirbright to hatch and grow poultry under clean conditions. This maintains the disease-free status of the birds for use in animal experiments to study viral disease which is important to the welfare of chickens and ultimately to ensure security of food supply for the UK. Part of a £250 million investment by BBSRC UKRI, the £4 million poultry facility is a purpose-built animal house dedicated to the incubation, hatching and growth of SPF chickens. Houghton was named after the poultry research station that was started at Houghton Grange, Cambridgeshire in 1948 and will be fully operational in late 2019.

THE PHILIP MELLOR INSECTARY – NON CONTAINMENT LABORATORY

Research on viruses spread by insect vectors requires expertise in insect production and supply. The Philip Mellor Insectary, which was named in honour of Professor Philip Mellor who established entomology research at Pirbright, is outside of containment and is used for the production and maintenance of unique insect colony lines of disease vectors of veterinary, medical and agricultural importance. Species include biting midges *Culicoides*, and mosquitoes such as *Aedes* and *Culex*, including genetically modified lines. These insects can be studied in and out of high containment (using The Plowright Building) to improve our understanding of the relationship between virus, vector and host. Insect lines are also supplied externally to research organisations.

RESEARCH FACILITIES UNDER DEVELOPMENT

THE BROOKSBY BUILDING – HIGH CONTAINMENT ANIMAL FACILITY FOR LARGE ANIMALS

This laboratory, which is currently under construction, is designed for experimental work on high consequence pathogens such as foot-and-mouth disease virus (FMDV). The building will have all the engineering

features of high containment to the highest international standards that will allow safe working for our staff and protect the environment. The new high containment building will provide a stand-alone SAPO4 and Advisory Committee on Dangerous Pathogens Containment Level 3 (ACDP3) large animal facility with sufficient flexibility to house small animals (mice, guinea pigs, rabbits), for *in vivo* experiments. The Brooksbury Building is crucial in the overall development of the Pirbright campus and will be a key component that allows sustained success in livestock and zoonotic pathogens research. It is named in honour of John Brooksbury who joined the Foot-and-Mouth Disease Research Institute at Pirbright in 1939 and became Director in 1964. The laboratory was designated the World Reference Laboratory for Foot-and-Mouth Disease (WRLFMD) in 1958.

THE BIGGS BUILDING – LOW CONTAINMENT AVIAN RESEARCH LABORATORY

The Biggs Building is an avian research facility operating at Containment Level 2 which will be used for *in vivo* avian research and is named after Peter Biggs, who was the first to isolate a herpesvirus, the causative agent of Marek's disease. The project will consist of the repurposing and refurbishment of an existing *in vivo* high containment large animal facility. Investment of £6.5 million from BBSRC UKRI has facilitated the project and will enable the transfer of current avian research from temporary facilities. The laboratory is due for completion in 2020.

FUTURE PLANS

Pirbright's vision is to deliver a campus that fulfils the following objectives under its masterplan outline planning:

- New insectary
- New low containment *in vitro* building
- Stores and facility management centre
- New administration building

SCIENCE FOR EVERYONE

Pirbright researchers are committed to engaging with the public on all aspects of their research including controversial topics such as the use of animals in research and genetic engineering. Over 120 Pirbright staff (83 scientists) undertook 43 public engagement activities including national science festivals, agricultural shows and events, Science, Technology, Engineering and Maths (STEM) careers events and hands-on school workshops. There were over 70 STEM careers ambassadors who actively promoted the benefits of working in STEM careers to students at all key stages.



the choices scientists and public health officials should make during a pandemic of an unknown deadly virus, therefore shaping the ultimate outcome.

CONSERVING COMMUNITY WILDLIFE

Local engagement is particularly important to the Institute, and every year volunteers dedicate time to maintaining the Fox Corner Community Wildlife Area, which is used by the public and many community groups. This year participants helped to remove invasive plant species and clear the pond to allow native wildlife to flourish.



animals to people) and why the viruses that cause them are of global concern. Pirbright's exhibit included a containment box that required visitors to crack codes based on how scientists study viruses, a genetic build a virus puzzle that highlighted the challenges our scientists face in identifying viral diseases and preventing their spread and Dr Zoo's Travelling Science Lab (see right).

ROYAL INSTITUTION FAMILY FUN DAY

Pirbright researchers represented BBSRC UKRI at the Royal Institution Family Fun Day where they showcased how cutting-edge CRISPR genetic technology is used to modify mosquitoes so they are unable to spread viral diseases like Zika and dengue. With a LEGO®-inspired Bug Busters exhibit, our scientists continued to inspire the younger generations as they demonstrated how gene editing research can be used to control viral diseases and benefit people all over the world.

VIRAL SURVIVAL

Innovate Guildford 2019, a local science and arts festival, saw the debut of Pirbright's 'Viral Survival' exhibit, which introduced zoonoses (diseases that spread from



FARMING FOCUS

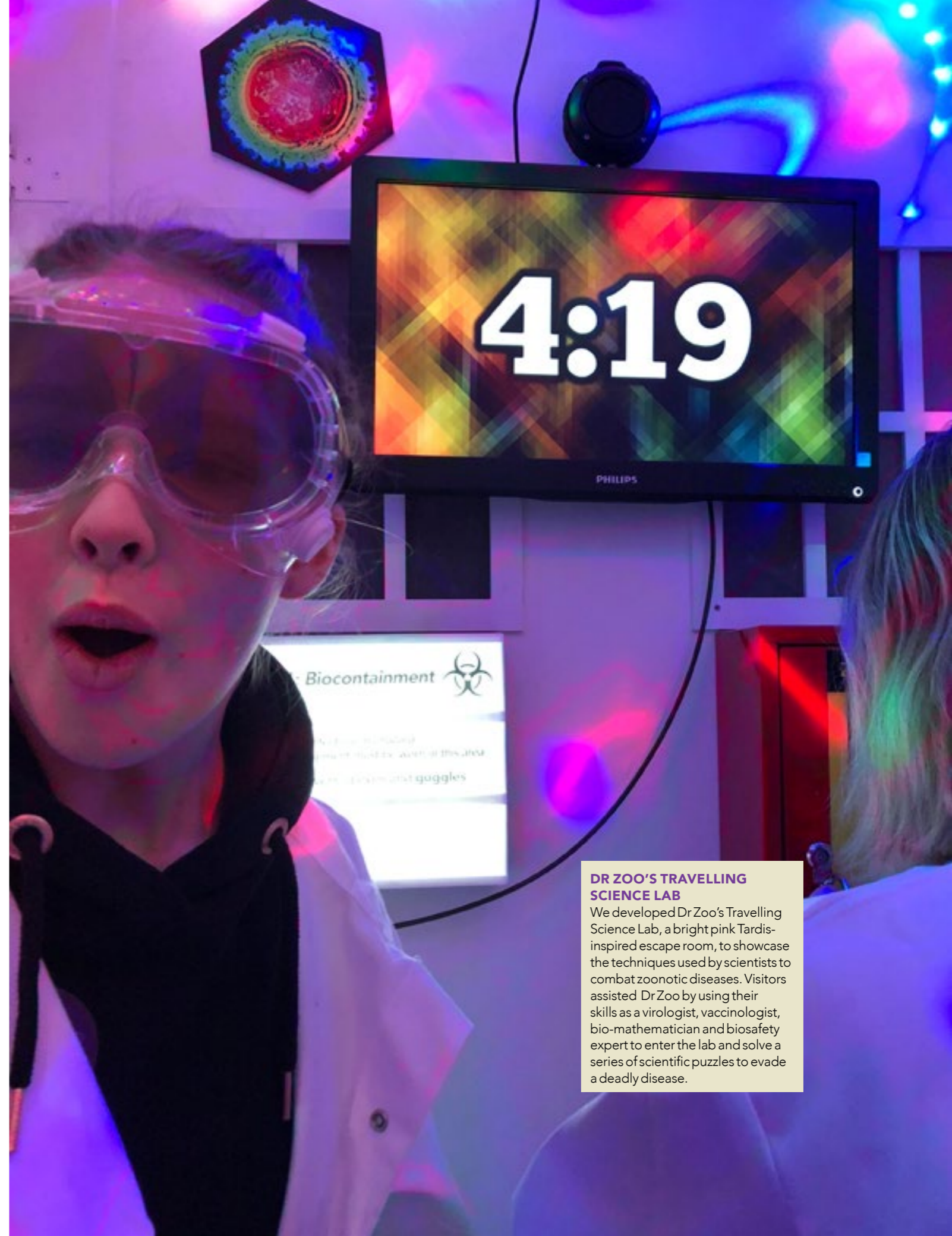
Our scientists attended the biannual British Pig and Poultry Fair to speak to farmers, vets and industry workers about the key avian and swine viral diseases being studied at Pirbright. African swine fever, a fatal disease of pigs was of particular interest due to its rapid spread throughout Eastern Europe and Asia and there is currently no cure or vaccine.

BUSTING BUGS

Pirbright wowed visitors at the 2018 Cheltenham Science Festival with 'Bug Busters', a LEGO® interactive created to showcase innovative genetic engineering research that allows the control of mosquito populations to manage viral disease. We also sponsored two interactive talks. 'How safe are our food supplies?' explored the ways livestock and crop disease have a direct impact on food and economic security and what approaches scientists are taking to combat these diseases. 'Pandemic Live', an interactive event, saw audiences making live decisions on



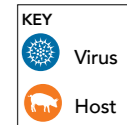
Volunteers helping to clear Fox Corner pond



DR ZOO'S TRAVELLING SCIENCE LAB
We developed Dr Zoo's Travelling Science Lab, a bright pink Tardis-inspired escape room, to showcase the techniques used by scientists to combat zoonotic diseases. Visitors assisted Dr Zoo by using their skills as a virologist, vaccinologist, bio-mathematician and biosafety expert to enter the lab and solve a series of scientific puzzles to evade a deadly disease.

INVESTMENT IN THE FUTURE

Our funding continues to grow as we attract investment from a diverse range of organisations.



Dr Don King and Dr Anna Ludi have been awarded £1.2 million from the World Organisation for Animal Health (OIE) to assist the African Union Pan African Veterinary Vaccine Centre (AU-PANVAC) in Ethiopia to assess the quality of FMD vaccines used in Africa.



The Bill & Melinda Gates Foundation has awarded Professor John Hammond £1.1 million to investigate antibody responses to a new foot-and-mouth disease (FMD) vaccine in cattle. This research will help improve the protective properties of the vaccine by pinpointing the regions on the surface of foot-and-mouth disease virus (FMDV) that cattle antibodies recognise to control infection.



The Defence Advanced Research Projects Agency (DARPA) has awarded a consortium led by Professor Luke Alphey US\$1.4 million to develop proof-of-concept tools that could prevent mosquitoes from transmitting a broad range of viruses. The project forms part of DARPA's Preventing Emerging Pathogenic Threats (PREEMPT) programme, which aims to predict and contain viral mutations to prevent cross-species transmission of viral infectious disease from animals and insects to humans.

Professor Munir Iqbal has received £640,000 as part of a new 'One Health Poultry Hub', led by the Royal Veterinary College, one of twelve global research hubs funded by the Global Challenges Research Fund (GCRF) of UK Research and Innovation (UKRI) worth more than £18.1 million. The Hub aims to work in collaboration to address the significant challenges faced by the poultry industry from avian diseases especially in light of the increasing demand for poultry meat and egg production.



As part of a project with investigators at The Jenner Institute (University of Oxford), Dr Elma Tchilian has been awarded £826,000 from the Medical Research Council (MRC) to test influenza vaccines combining multiple antigens in viral vectors in pigs as a model for human influenza. The study will address the impact of route of administration on vaccine efficacy.

BBSRC UKRI has awarded Dr Shahriar Behboudi £484,000 to study immune responses to Marek's disease virus (MDV), which causes lymphoma in chickens. The study aims to understand why MDV vaccines fail to control virus replication, allowing the virus to evolve and form increasingly virulent strains, by looking at specific cells in the immune response called T-lymphocytes which are responsible for controlling tumour formation and viral replication.



BBSRC UKRI has funded Dr Jarek Krzywinski £746,000 to adapt a gene-drive system created in the fruit fly *Drosophila*, for disease control in the mosquito *Aedes aegypti*. This 'Medea' gene drive system aims to introduce, and rapidly spread through the natural mosquito populations, genetic elements that suppress the ability of mosquitoes to transmit diseases such as dengue, chikungunya, and Zika.

Dr Simon Carpenter has been funded £483,000 from Defra to investigate the factors that determine transmission of arboviruses such as bluetongue virus (BTV) and Schmallenberg virus (SBV). The project aims to define limitations such as the infectious period for BTV in cattle, the survival rate of *Culicoides* during the winter, and seasonality in arbovirus transmission to provide tools that could enable prediction of disease outbreaks more accurately.



Dr Elma Tchilian has been awarded £471,000 from the Bill & Melinda Gates Foundation to identify and test antibodies for their ability to protect against influenza virus infection. Pigs and humans are infected by the same subtypes of virus and have the same distribution of sialic acid receptors in their respiratory tract. The pig is genetically, immunologically, physiologically and anatomically more similar to humans than small animals. The similarity of clinical disease and pathogenesis of flu infection in the two species make pigs an excellent animal model to study the effectiveness of antibodies for their ability to protect against influenza.

Funding of £443,000 from the Medical Research Council (MRC) was awarded to Dr Toby Tuthill to study part of the virus that causes the common cold, the human rhinovirus. His team will investigate how VP4 (a protein on the cell membrane that allows the virus to replicate) is affected by antibodies during immune response.



BBSRC UKRI has invested £440,000 in Dr Andrew Broadbent's research to investigate why some vaccines against infectious bursal disease virus (IBDV) fail. This virus is responsible for Gumboro disease in chickens, which is a worldwide concern for the poultry industry.

Dr Holly Shelton has been awarded £187,000 from BBSRC UKRI as part of a project to generate flu resistant chickens, which is led by Professor Wendy Barclay at Imperial College along with collaborators at The Roslin Institute. If successful, this project could pave the way for breeding flu resistant chickens.



Professor Satya Parida has received £172,000 as part of an Innovate UK award, led by Biogene, to develop a molecular diagnostics approach for in-field animal testing capable of differentiating peste des petits ruminants virus (PPRV) from foot-and-mouth disease virus (FMDV), which cause similar clinical signs in small ruminant livestock.

Professor Munir Iqbal has received £167,000 from BBSRC UKRI Zoonoses and Emerging Livestock Systems (ZELS) programme to develop tailor-made vaccines and diagnostics that target avian influenza viruses.



Dr Toby Tuthill has been awarded around £78,000 in funding from Genomia for further development of a validated universal test to ensure production of effective foot-and-mouth disease (FMD) vaccines. The goal is to develop this test into a commercial product.

Diseases of poultry have a major impact on the farming industry and animal health. Our research is helping to prevent avian disease through vaccine development and a better understanding of the viruses that cause these diseases



WORKING WITH INDUSTRY

PATENTS AIDING AVIAN VACCINE DEVELOPMENT

Pirbright has been granted two patents to develop vaccines to protect against infectious bronchitis virus (IBV). Every 10% reduction in the incidence of IBV would be worth an estimated £654 million to the global poultry industry. Patent one, which was granted in both Europe and the USA, is for research that has led to the ability to grow IBV in cell lines rather than eggs. This will facilitate rapid production of many IBV vaccine viruses in large volumes, thereby lowering production costs. Granted in the USA, patent two, results from research funded by BBSRC UKRI and Zoetis, and will aid the development of an IBV vaccine that can be delivered into the egg (*in ovo*) thus protecting the chicks before they hatch.

Another patent has been granted in both Europe and the USA for a novel way to enhance the growth of vaccines using editing technology. Pirbright scientists working closely with Horizon Discovery Group plc, a global leader in gene editing and gene modulation technologies, have shown that removal of the IFITM gene from chickens allows researchers to develop cell lines that grow viruses to higher yields. Developed with funding from BBSRC UKRI and the International Development Research Centre (IDRC), this project will make vaccines for diseases such as influenza cheaper to produce and more accessible to livestock owners in developing nations.

Advances in vaccine development are enabling a reduction in the use of eggs in vaccine production



Collaborations around the world are a priority for Pirbright. We teamed up with eight industrial partners, which included vaccine developers, biotech companies, global disease networks and other international organisations and academic institutes on 19 projects. We also filed three new patent applications and our researchers disclosed three new inventions.



Sheep and goats are susceptible to peste des petits ruminants virus, costing the agricultural economy billions of dollars

NEW PATENTS FOR AFRICAN SWINE FEVER AND FOOT-AND-MOUTH DISEASE VACCINES

Pirbright has been granted a patent in Africa for a vaccine against African swine fever virus (ASFV). To develop the vaccine our scientists deleted an ASFV gene that codes for a protein thought to play a role in suppressing the pig immune system. This resulted in a weakened strain of ASFV that does not cause severe disease or death in pigs and protects them against natural strains of ASFV.

Indonesia is the latest country to grant a patent for Pirbright's virus-like particle (VLP) capsid vaccine for foot-and-mouth disease. Patents have already been granted in major markets including Europe, USA, China and Korea.

PROTECTING GOATS AGAINST PESTE DES PETITS RUMINANTS

Peste des petits ruminants (PPR), a viral disease that mainly infects goats and sheep across Africa, Middle East and India, currently costs the agricultural economy between US\$1.4 billion and US\$2.1 billion per year. Pirbright scientists have filed a patent application for a vaccine that will protect against PPR. The new vaccine is the first that will enable differentiation between infected animals and vaccinated animals with a simple test (DIVA). This validated test will verify whether

an animal has PPR disease or whether it has been vaccinated, enabling livestock owners to continue to trade and protect animals. To further enhance disease control for PPR, an Innovate UK-funded collaboration has been established to develop new diagnostic methods for PPR with Biogene Ltd and the Royal Veterinary College (RVC).

DEVELOPING VACCINES FOR MULTIPLE BIRD DISEASES

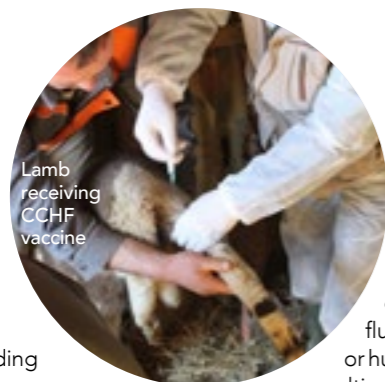
Many poultry vaccines currently use a modified herpesvirus of turkeys (HVT) to induce protection against a number of different poultry diseases including Marek's disease (MD) and infectious bursal disease (IBD). Our scientists have successfully shown that they can complement HVT vaccines with a licensed vaccine strain for MD that also protects against IBD. This MD vaccine vector offers the scope for developing commercial vaccines capable of giving protection against three or more avian diseases in a single dose. A 'triple insert' HVT vaccine is also in development to combat multiple diseases in a single vaccine. Pirbright scientists are working with several major vaccine manufacturers to develop bespoke vaccines for them.

GLOBAL COLLABORATIONS

We are proud of the fact that we share our knowledge and expertise globally to advance scientific solutions in the fight against infectious viral diseases of livestock.

SUCCESSFUL OIE TWINNING PROJECT WITH AU-PANVAC

Pirbright is proud to be involved in twinning projects with multiple partners through the World Organisation for Animal Health (OIE), including the African Union Pan-African Veterinary Vaccine Center (AU-PANVAC). As part of this project we supplied training and other operational assistance to further knowledge and expertise. Following an audit at the Center conducted by experts from Pirbright, AU-PANVAC was later granted ISO/IEC 17025 accreditation, which is the accreditation given to organisations that can demonstrate testing competence, testament to the success of Pirbright's involvement.



known to be high risk for the disease. CCHF affects livestock animals but can also be transmitted to humans through the bites of infected *Hyalomma* ticks or contact with blood or fluids from infected animals or humans, with 10-40% of cases resulting in death.

Results from this study will show whether the vaccine, developed by Public Health England (PHE), is able to prevent infection after the animals are exposed to a natural variant of the virus under field conditions. Protecting susceptible animals will prevent CCHF from spreading between herds and reducing the risk to people. If successful, this could pave the way for the first licensed vaccine effective against CCHF.

A 'ONE HEALTH' VACCINE TRIAL FOR RIFT VALLEY FEVER

A trial of a vaccine for Rift Valley fever (RVF) designed to protect both animals and humans is under way in Kenya. RVF is a mosquito-borne disease that has spread to many African countries and the Arabian Peninsula, causing disease outbreaks affecting millions of livestock and hundreds of thousands of humans. Madeleine Clark (Pirbright student) and George Warimwe, (Group Leader, KEMRI-Wellcome Trust Research Programme, Kenya and Associate Professor, Centre for Tropical Medicine & Global Health, University of Oxford) have been conducting the trial at the International Livestock Research Institute (ILRI) Kapiti farm with a vaccine strain already proved to be safe for use against human diseases such as influenza, malaria, and Ebola. By developing a cross-species vaccine the researchers are adopting a 'One Health' approach to vaccine design.

COMBATting CRIMEAN-CONGO HAEMORRHAGIC FEVER

Pirbright's Dr Nick Lyons and Dr Georgina Limon-Vega, together with veterinarians from the Bulgarian Food Safety Agency, have begun a Crimean-Congo haemorrhagic fever (CCHF) vaccine trial in an area of Bulgaria



Delegates from BBSRC UKRI institutes come together for the Inter-Institute Imaging Network

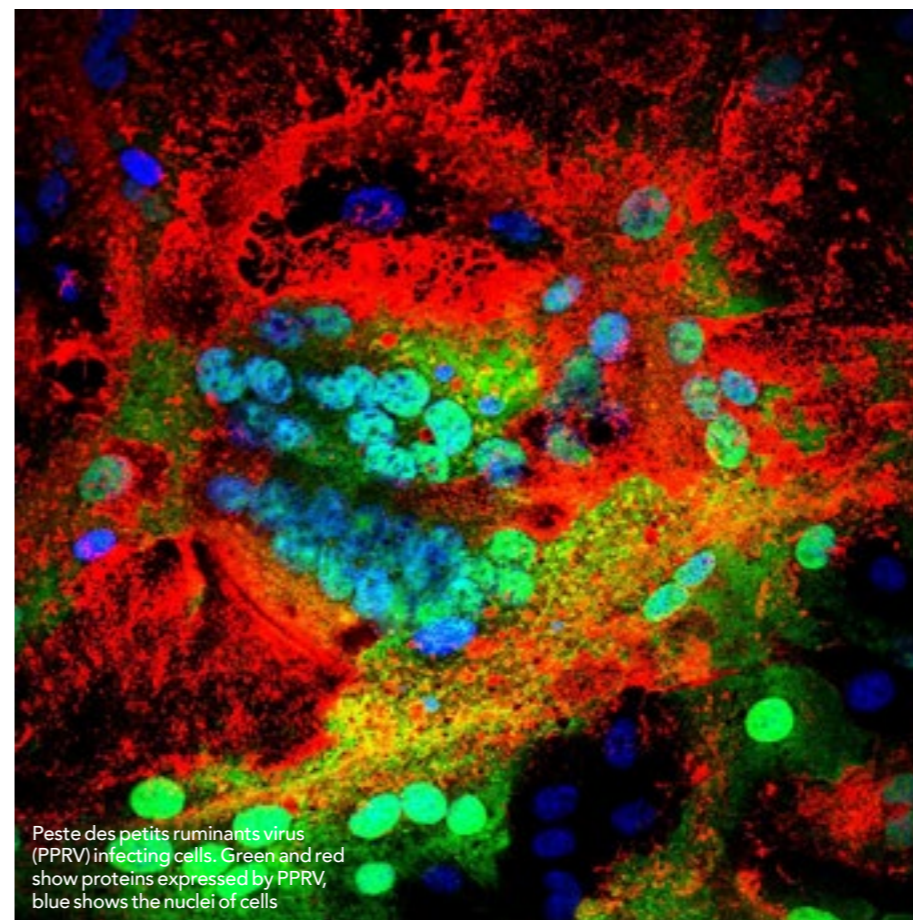
Pirbright scientists along with 40 vets co-ordinated a PPR vaccination campaign in a small village in India, where over 400 sheep and goats were vaccinated in a day. Farmers and local vets were also provided with expert guidance on diagnosing clinical signs of PPR and the measures they could take to reduce its spread. The initiative was funded by BBSRC UKRI and the Indian Government's Department of Biotechnology.

NETWORK GOES GLOBAL

The Veterinary Vaccinology Network (VVN) officially handed over operations to the International Veterinary Vaccinology Network (IVVN) after its final annual conference in January 2019. Previous work undertaken by the VVN will continue through IVVN on an international scale. The IVVN, a partnership between Pirbright and The Roslin Institute funded by Medical Research Council (MRC) and BBSRC UKRI will provide conferences, workshops, funding, lab exchanges and scholarships, with a remit to address specific challenges in vaccinology for priority livestock and zoonotic diseases impacting low- and middle-income countries.

POOLING EXPERTISE IN BIOIMAGING

Delegates from BBSRC UKRI institutes and close collaborators attended the first meeting of the Inter-Institute Imaging Network (IIIN) at Pirbright in November 2018. New technologies have rapidly improved the



Peste des petits ruminants virus (PPRV) infecting cells. Green and red show proteins expressed by PPRV, blue shows the nuclei of cells

precision and functionality of the tools that can be offered to scientists to answer their biological research questions, which is an essential tool for researchers across multiple fields of biology. However, many research institutes have unique bioimaging challenges due to the type of research they conduct. The network has been set up to promote collaboration and encourage discussion on the challenges and solutions of working in bioimaging and increasing the resources available across the network.

A PARTNERSHIP FOR CONTROLLING LIVESTOCK DISEASE IN MONGOLIA

Pirbright researchers have partnered with scientists in Mongolia in order to improve their ability to assess the effectiveness of livestock vaccines. A series of workshops were held to help Mongolian scientists develop a progressive control pathway for foot-and-mouth disease, sheeppox and goatpox, a series of incremental steps that will help better manage these diseases. The workshops entailed setting up models for the study of vaccines used in the field to show whether they have been effective at protecting the animals. The results of these tests inform national control plans for these diseases.

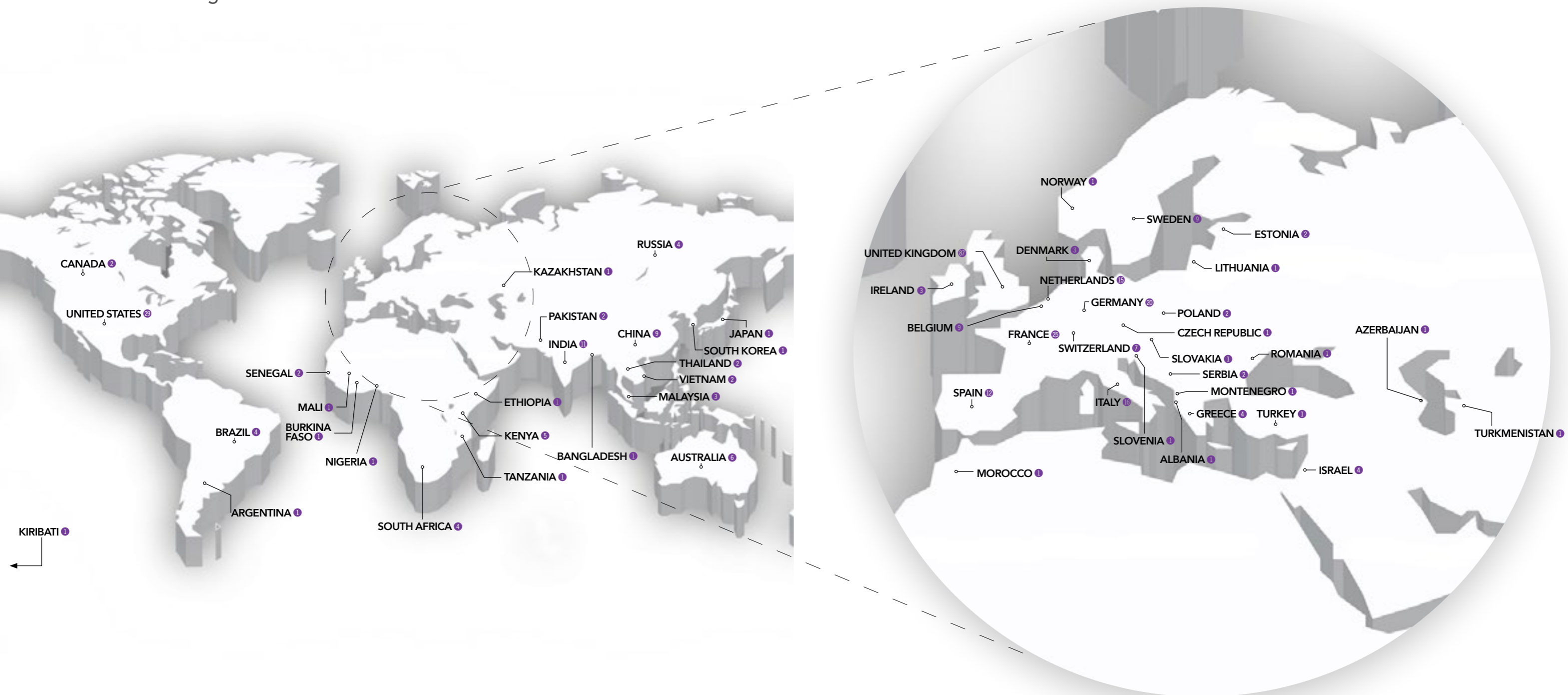
PIRBRIGHT JOINS NEW 'ONE HEALTH' POULTRY HUB

The potential for new animal diseases to emerge and 'spill over' into humans continues to cause global concern. To combat the increasing risk from viral diseases that spread from animals to humans Pirbright is among the international experts that have formed the 'One Health' Poultry Hub. The 'One Health' approach taken by the Hub, which is funded by UK Research and Innovation (UKRI) through the Global Challenges Research Fund (GCRF), recognises that human, animal and environmental health are inter-related, and so collaborative, interdisciplinary efforts in research, policy and management of zoonoses are needed.



Human, animal and environmental health are closely connected. A global 'One Health' Poultry Hub is designed to combat the risk of diseases spreading between species and improve animal and human health

Pirbright has established partnerships all over the world and was involved in 154 projects with both commercial and academic partners and collaborators in 53 countries during 2018-19.



OUR SUCCESS STORIES

Our staff have been recognised for their successes, both within the Institute through our staff awards and by external stakeholders and partners, reinforcing the value placed on Pirbright's role in preventing and controlling viral disease.



Professor Bryan Charleston, Director and CEO of The Pirbright Institute, has been awarded an Honorary Professorship from the University of Edinburgh.



Dr Claire Colenutt received the Innovation in Animal Healthcare award at the 2018 Guildford Innovation Awards. Dr Colenutt won the award for the creation of a new foot-and-mouth disease virus (FMDV)

field test, which improves disease surveillance and alleviates the burden that it places on many smallholders and subsistence farmers who are reliant on foot-and-mouth disease (FMD) susceptible livestock.



PhD student **Veronica Martini** received the *In Vivo* Skills Award from BBSRC UKRI. The £17,600 funding will give Veronica the opportunity to learn new skills to progress her swine influenza research.



Professor Satya Parida, who leads the Vaccine Differentiation Group has been awarded an Honorary Professorship from the Royal Veterinary College.



Dr James Kelly was elected to sit on the Microbiology Society Policy Committee from January 2019. This committee is responsible for overseeing the development and delivery of the policy

framework to support the Society's strategic objectives.



At the European foot-and-mouth disease (EuFMD) open session conference in October 2018 research assistant **Emma Brown** won best poster prize for her poster 'Evaluating the efficiency of environmental sampling methods for the detection and quantification of foot-and-mouth disease virus'.



Dr Britta Wood, a postdoc at the Institute in the World Reference Laboratory for Foot-and-Mouth Disease (WRLFMD) and Deputy of the WRL Virology Section, won best oral

presentation at the European Association of Veterinary Laboratory Diagnosticians 2018 conference.



Animal Technician **Louise Carder** won Pirbright's 3Rs award for her invaluable work in training pigs in order to reduce stress in a high containment laboratory environment. The annual

Pirbright 3Rs Award aims to highlight an outstanding contribution to the 3Rs animal research framework at the Institute (Reduction in numbers, Refinement of procedures, Replacement with laboratory procedures) by recognising an individual, team or group who have implemented alternative approaches with a direct benefit to the 3Rs.

Students **Rachel Nash**, **Matthew Edmans** and **Fatoumatta Jobe** won the best talk prizes at Pirbright's Student Day, while **Lucy Gordon**, **Matthew Brownsword** and **Veronica Martini** were awarded prizes for their poster presentations. Prizes were also awarded for public engagement to **Abigail Hay**, **David King** and **Sofia Riccio**.



From left to right: Fatoumatta Jobe, Matthew Edmans, Lucy Gordon, Matthew Brownsword, Rachel Nash

CELEBRATING 60 YEARS OF THE WRLFMD

The World Reference Laboratory for Foot-and-Mouth Disease (WRLFMD) celebrated its 60 Year Anniversary in November 2018 with a two-day symposium which brought together leading scientists from around the globe. The milestone was marked with the erection of 'The Bull', a complete replica of the original brick bull that was set into the brickwork of the original reference laboratories in 1967, that could not be saved during demolition of the labs in 2018. The WRLFMD provides the UK with its capability to respond and control any potential outbreak of FMD as well aiding its prevention by offering diagnostics and surveillance services and advice to countries worldwide.



Stairwell in the BBSRC National Virology Centre: The Plowright Building, an award-winning high containment laboratory

DEVELOPING OUR CULTURE AND WORKFORCE

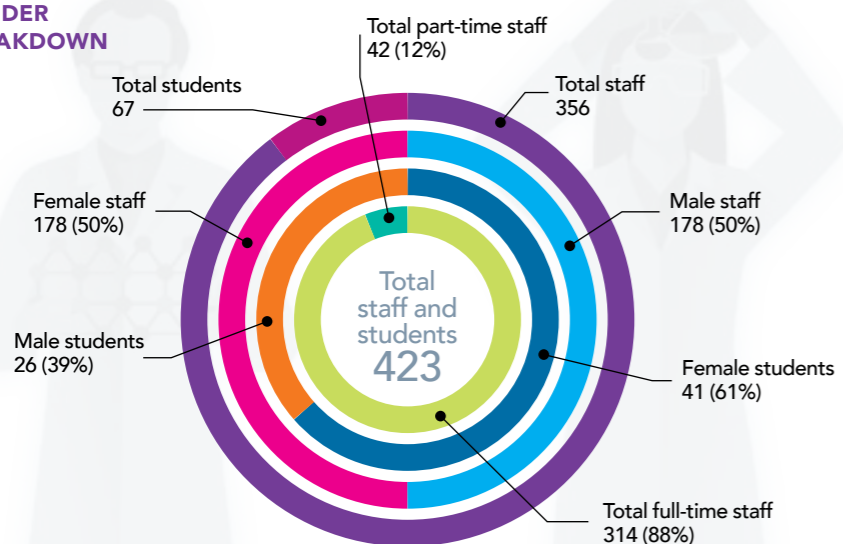
Pirbright's people are passionate about delivering outstanding scientific research and operational support, and we are committed to making Pirbright a fantastic place to work and one where our staff can choose to develop their careers. Pirbright's PRIDE values (Passion, Reliability, Innovation, Dignity and Respect, Excellence) underpin all aspects of the culture at Pirbright and promoting equality, inclusion and valuing diversity is fundamental to Pirbright's mission and goals.

CELEBRATING DIVERSITY

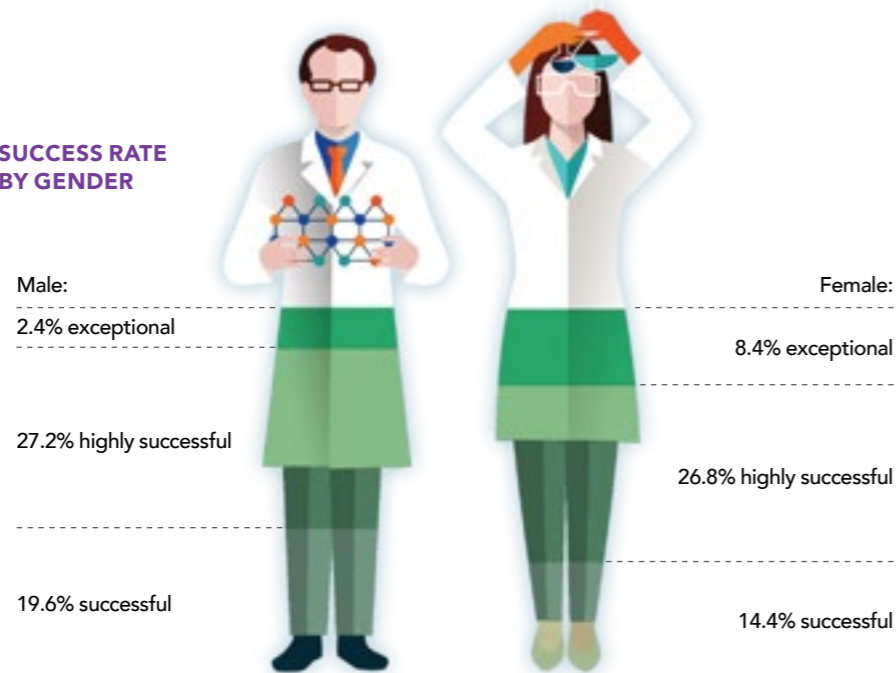
We continue to enjoy success in recruiting talent from around the globe with new starters joining last year from 18 different countries. These employees enrich the community within the Institute by bringing diverse experiences and view-points, helping us attract the best staff and building our reputation in the UK and globally. To further enhance this, we provide unconscious bias training and ensure that our interview panels are diverse.

We take our commitment to Equality and Diversity seriously and this remains integral to how we develop and improve our people

GENDER BREAKDOWN



SUCCESS RATE BY GENDER



Managing performance is a key management priority, in terms of supporting people to meet organisational objectives and their own personal development objectives. Females outperformed their male colleagues in the 'exceptional' performance category last year, with other ratings being relatively evenly split.

practices and ensure that everyone has access to the same opportunities and fair treatment. We support a range of different working patterns to provide flexibility and are pleased that a number of people have taken advantage of shared parental leave. We are committed to reducing the gender pay gap at Pirbright and in our pay award in 2018 58.2% of female employees and 47.4% of male employees received a bonus performance reward. Our gender pay gap report is published annually on our website. We are working hard to address our gender pay gap through ensuring that our processes and approaches align to our equality, diversity and inclusion (EDI) culture.

In 2018-19 an extensive programme of training and development for our employees

was delivered, and a comprehensive e-learning portfolio is available to all. In addition, the apprenticeship programme has provided opportunities in a range of functions.

During the year our leaders and managers have all participated in a leadership training programme which will be followed up with a practical management skills programme to ensure that our managers continue to grow their capability and competence to support and encourage our people to reach their full potential.

LOOKING AFTER OUR PEOPLE

Employee wellbeing is hugely important and increasingly our focus is on holistic wellbeing (mind and body). We provide a comprehensive health surveillance programme, monthly occupational health clinics, and a free, confidential Employee Assistance Programme. We ran a Wellbeing Day in November 2018 where a range of health and wellbeing benefits were provided – over 150 people were involved. We regularly promote health awareness topics and have trained a number of our staff as mental health first aiders to provide a first line of peer support to those who may need it. We also provide workshops for managers to give guidance and support in managing absences.

All of these initiatives signal our desire to provide our employees with the best opportunities and environment to reach their personal and professional fulfilment and take pride in contributing to our world-leading, ground-breaking research and the positive impact we create.

WORLD-CLASS EXPERTISE

Pirbright prides itself in attracting top talent, whether it be scientists, technical biosafety experts or skilled engineers. By attracting the best people, we continue to deliver leading-edge research to combat the spread of devastating diseases.



ISABELLE DIETRICH
Isabelle joined Pirbright in 2018 as a Fellow heading up the Mosquito Immunology Group. Isabelle

studied mosquito immune responses to Rift Valley fever virus (RVFV) at the University of Glasgow before moving to the University of Oxford to study immune recognition of RNA viral genome composition and structure. With the emergence of arboviruses such as Zika, chikungunya and RVF and the associated significant threat to public and animal health and local economies, Isabelle's work aims to identify novel strategies to control arbovirus replication and transmission by their mosquito vectors.



ERICA BICKERTON
Originally joining Pirbright in 2006 as a PhD student,

Erica has recently become a Group Leader of Coronaviruses following a successful fellowship. Erica's work utilises molecular virology, next generation sequencing and reverse genetics to characterise the pathogenicity determinants of the gammacoronavirus, infectious bronchitis virus (IBV). The aim of this research is to develop new vaccines for better control of IBV and other coronaviruses.



CHRIS OVERTON
Chris joined the Institute in 2019 as Head of Information Services to provide

strategic oversight of all information technologies and oversee the IT department. Chris has over 25 years of experience in information technology across a diverse range of sectors, 18 years of which have been in a management position. Chris has a keen interest in cloud technology and will be exploring ways to develop and utilise emerging technology at Pirbright.



JAROSLAW KRZYWINSKI

Jarek's research focuses on the molecular systemics and genomics of mosquitoes. He heads up Pirbright's Vector Molecular Biology Group which explores novel ways, rather than insecticides, to control mosquito-borne diseases. His group's research is designed to gain a greater understanding of the basic biology of mosquitoes, particularly the mechanisms of sex determination and sperm production in *Anopheles gambiae* and how this can be applied to controlling mosquito populations, thus preventing the spread of disease.

OBJECTIVES

FROM 2019/20 PIRBRIGHT'S PRINCIPAL OBJECTIVES ARE:

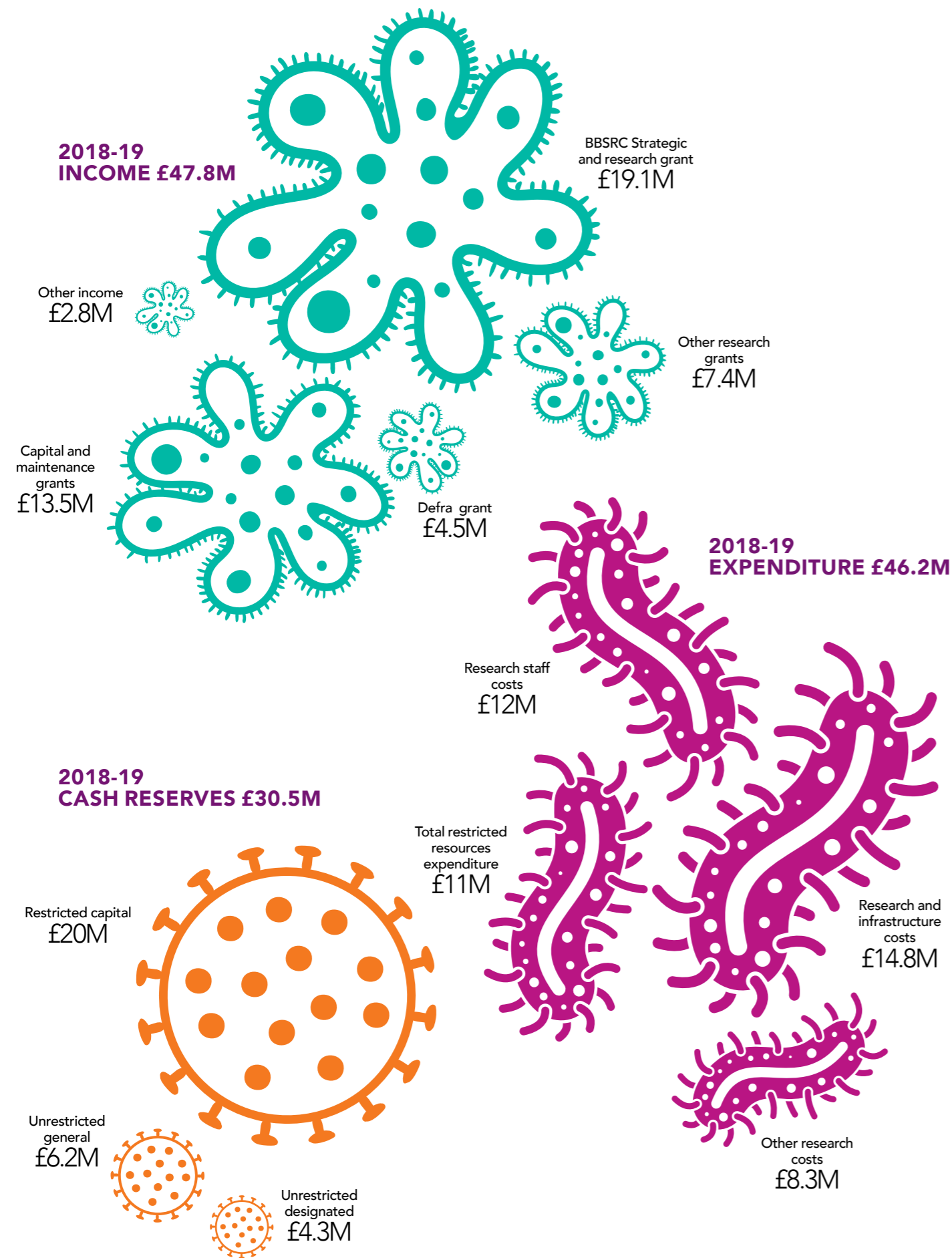
- 1 To continue a world leading research programme by publishing groundbreaking scientific research, winning research funding and recruiting and retaining the brightest and the best staff and students.
- 2 To further develop the Pirbright long term vision of scientific research with impact, in particular enhancing our collaborations with agencies improving disease control in low and middle-income countries.
- 3 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.
- 4 To develop strong strategic collaborations with other global centres of excellence to support the Institute science programme grants.
- 5 To diversify our funding through greater collaboration with international partners via various new funding opportunities.
- 6 To maintain our 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 postdoctoral scientist per year
- Submission levels and success rates for research grant proposals; going from 25% to 30% over the next five years
- Recruitment and retention of high-quality staff and students; to achieve less than 15% 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 2018-19:

- We published 131 papers in a range of high-impact journals achieving an average 1.05 publications per post-doc in the year
- Grant application success rates for 2018-19 were 58%, the average success rate over the past three years was 46%
- The annual grant income for 2018-19 was £17 million, exceeding the £11 million target by over 50%



INCOME

Total incoming resources, amounted to £47.8m (2018: £46.5m). Investment in tangible fixed assets in the year totalled £13m (2018: £12.9m). 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) plus from Defra and other grant awarding bodies. The change relates to both a fall in capital funding (£1.7m) and increase in non-capital income being £35.2m in 2019 compared to £32.1m in 2018.

EXPENDITURE

Recurrent expenditure for the year amounted to £46.2m (2018: £45.6m) This small rise relates to the increased capital activity supporting the ongoing development of the Pirbright site. Staff costs accounted for £16.3m (35%) (2018: £16.2m; 35%) of expenditure. The slight rise in staff costs from 2018 relates to the pay award for the year offset by a higher than expected level of vacancies at the start of the year.

CASH AND TERM DEPOSITS

Cash at March 2019 was £30.5m (2018: £27.9m). Pirbright deposits its cash with UK registered financial institutions. Investment income from cash deposits in the year was £208k (2018: £169k).

GRANT PROPOSALS

During the year, Pirbright researchers submitted grant proposals with a sponsor value of £32m (2018: £67.5m) and were awarded grants with a value of £12.6m (2018: £20.5m).

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 received its five-year strategic grant funding from BBSRC UKRI, £15m per annum, which was started on the 5 April 2017 and runs to March 2020 with a further provisional award for the subsequent two years to March 2022. 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. The Trustees are not expecting any change to the Core Capability Grant (CCG) now that BBSRC has merged in to UKRI.

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 £0.8m. (2018: net decrease £1.1m) The reason for the movement being the better operating performance and that the designated reserve had no material alteration. Due to the phasing of the Pirbright Development Programme, the restricted reserves increased by £0.9m. (2018: £1.9m) Capital expenditure in the year was £13.0m (2018: £12.9m) 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 £1.7m in the year to £283.5m (2018: £0.8m to £281.8m). Restricted reserves increased by £0.9m (2018 £1.9m) to £274.3m (2018: £273.4m), of which £274.3m relates to capital reserve in connection with funding received from BBSRC UKRI (2018: increased by £1.9m to £273.4m). Unrestricted reserves increased by £0.8m (2018: £1.1m decrease) in the year to £9.1m (2018: £8.3m), of which £4.6m relates to a designated reserve to support ongoing non-operational activity and £4.5m 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 2019 unrestricted general funds showed a surplus of £4.5m (2018: surplus of £3.8m) 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. In addition, the level of funding expected to be provided by BBSRC UKRI for the next five-year funding cycle is considered by the Trustees to be sufficient to ensure the Institute has the ability to manage any such fluctuations or pressures. 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 of 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 £266.6m. 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, the legislation defines fundraising as “soliciting or otherwise procuring money or other property for charitable purposes”. We have received no such income during the year.

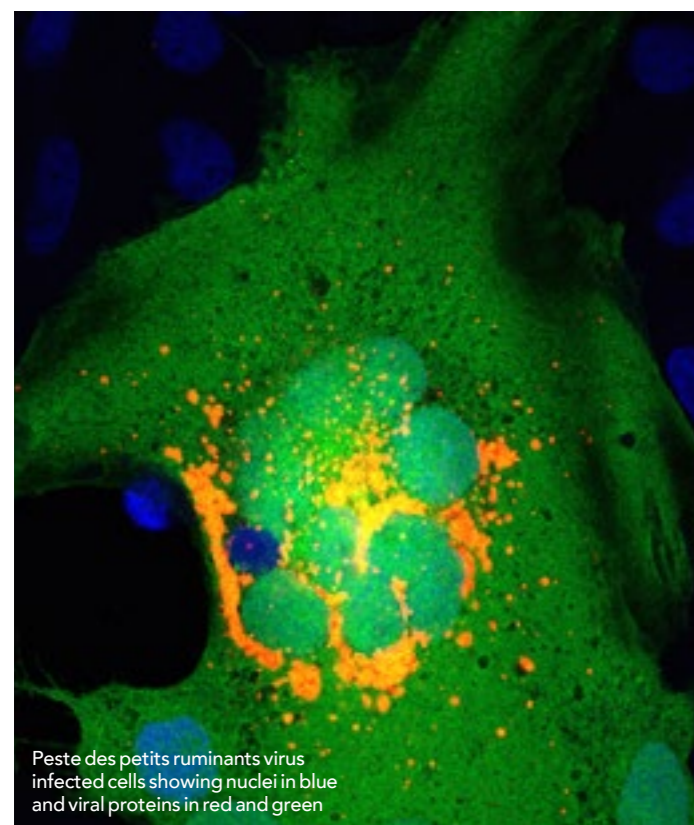
RISK MANAGEMENT

Pirbright's risk management system is broadly aligned to ISO 31000 and HM Treasury Orange Book. A Risk Policy is in place incorporating the High Reliability Organisation model and Human Factors Management into a risk management framework. A risk assessment process identifies and analyses operational, continuity and strategic risks, and delineates and monitors treatment of those risks. A range of insurance policies are in place.

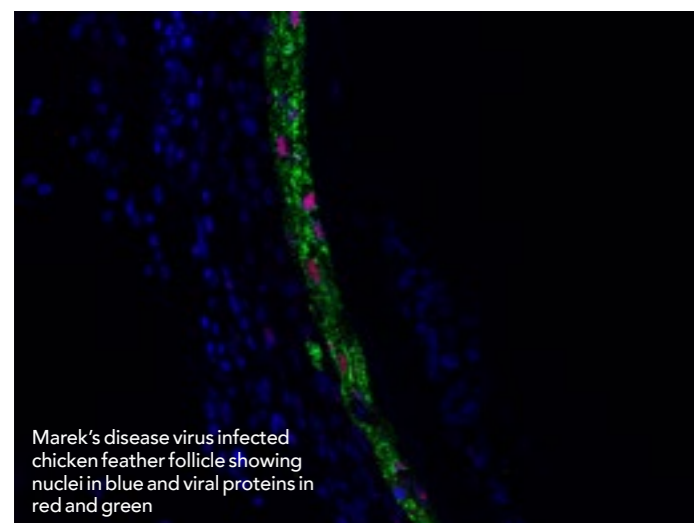
A risk register is maintained in conjunction with risk owners, supplemented by satellite risk registers in each business area. An internal audit programme provides stakeholders with objective evidence of conformity to systems and effective management of risk. A training programme supports all of this. A Risk & Assurance Directorate provides specialist practitioners to develop and support the risk management system and processes.

Senior Leadership Team take oversight of risk management by regular review of the risk register, relevant leading and lagging metrics, benchmarks and performance indicators, and outcomes of audits and investigations. Trustee Board have established a Risk & Assurance Committee to take similar oversight on their behalf.

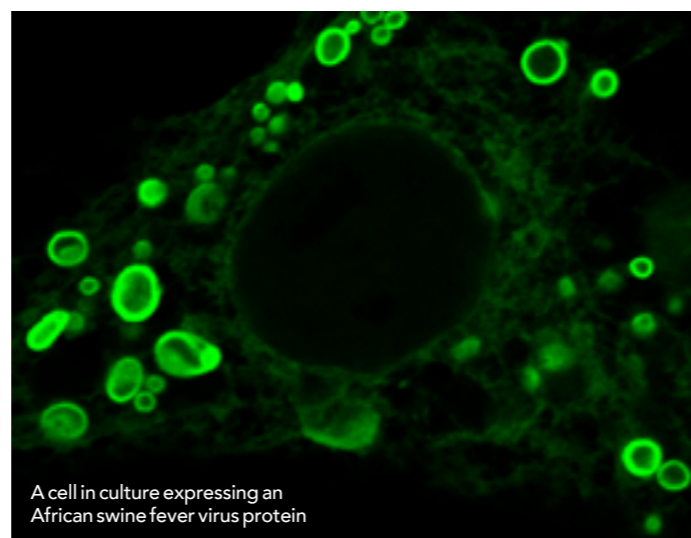
Key risks are summarised in the table on the right:



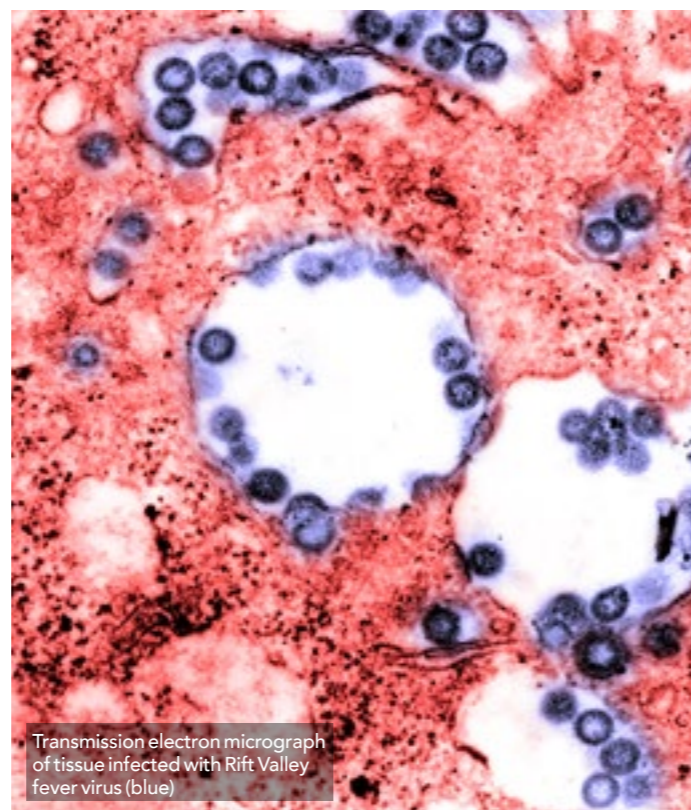
Peste des petits ruminants virus infected cells showing nuclei in blue and viral proteins in red and green



Marek's disease virus infected chicken feather follicle showing nuclei in blue and viral proteins in red and green



A cell in culture expressing an African swine fever virus protein



Transmission electron micrograph of tissue infected with Rift Valley fever virus (blue)

Credit: F. Murphy and J. Dalrymple

RISK	CONTEXT	CONTROL / MITIGATION
BIOSAFETY (UNINTENTIONAL RELEASE OF OR EXPOSURE TO HIGH CONSEQUENCE PATHOGEN)	Pirbright is classified by the Health & Safety Executive (HSE) as a Major Hazard Site, because release of the high consequence viral pathogens of livestock animals that the Institute works with (such as foot-and-mouth disease virus) could cause a serious disease outbreak, leading to destruction of many animals, extensive national disruption and severe economic loss.	Physical, engineering, operational and management measures for biological containment in compliance with relevant UK legislation (Specified Animal Pathogens Order 2008, Control of Substances Hazardous to Health Regulations 2002, Genetically Modified Organisms (Contained Use) Regulations 2014) and associated Approved Codes of Practice and guidance, in alignment to ISO 9001 and ISO 45001, HSE Major Hazard Intervention Plan, and a staff cohort of competent biorisk advisers.
BIOSECURITY (DELIBERATE RELEASE OF HIGH CONSEQUENCE PATHOGEN)	Some of the pathogens are also zoonotic, i.e. can infect humans and cause serious illness.	Physical, operational and management measures for security in conformity with requirements of the UK National Counter Terrorism Security Office, oversight by regional Counter Terrorism Security Adviser, 24 hour guard force, background screening of new starters, travel safety and security process.
QUALITY	As well as being a leading research institute, Pirbright provides diagnostic reference laboratories for a range of pathogens for the UN Food & Agriculture Organization (FAO) and the World Organisation for Animal Health (OIE), and is funded by BBSRC UKRI as a National Capability to provide diagnostic capacity in the event of disease outbreaks. Quality of Pirbright's scientific output is therefore critical, and FAO, OIE and Her Majesty's Government (HMG) require the reference laboratories to be accredited to the ISO/IEC 17025 international quality standard.	Accreditation of the reference laboratories to ISO/IEC 17025, by the UK Accreditation Service (a UKAS accredited testing laboratory No 4025) development and implementation of a quality management system across the Institute, internal audit, and alignment to ISO 9001 in key operational areas.
ANIMAL WELFARE	Research with animals is an integral part of the research programmes at Pirbright, and is carried out to UK standards of ethics and animal welfare, which are the most stringent in the world, and this is a critical reputational risk.	Physical, operational and management measures for animal welfare in compliance with relevant UK legislation (Animal Scientific Procedures Act 1986) and associated Approved Codes of Practice and guidance, oversight by UK Home Office, application of 3Rs (Replace, Refine, Reduce) and ARRIVE guidance (Animal Research: Reporting <i>In Vivo</i> Experiments).
CYBERSECURITY		Technical counter measures for cybersecurity in conformity with requirements of HMG Cyber Essentials Plus and HSE OG86, and segregation of critical resource from network and staff training.
CONTINUITY	Pirbright also faces the cybersecurity, continuity, people and financial risks that most organisations must manage, and the potential consequences of these are amplified because of possible effects on biological and quality risks, eg, a power failure could cause biological containment plant to fail, difficulty with recruitment could lead to an inadequate staff skill base, insufficient budget for planned preventative maintenance could lead to lower reliability of biological containment plant or scientific equipment.	Major Incident Plan, Business Continuity Planning in alignment with ISO 22301, backups and contingencies for critical services and supplies, contingency plans for the reference laboratories for disease outbreaks, all plans regularly tested by exercises.
PEOPLE		Talent management framework, recruitment and retention and responsibility allowances, training and development programme, career pathways, performance and personal development reviews.
FINANCIAL		Rigorous systems for financial control, risk management, and quality management, processes and support to facilitate preparation and submission of competitive funding applications, business development programme, fraud policy.
BREXIT	Brexit is a significant risk as EU funding of the reference laboratories will end, EU sources of research funding may no longer be available, collaborations with EU partners may be jeopardised, EU nationals on staff may leave, and the UK economic situation may be adversely affected.	Factored into business planning through planned increases in income from competitive funding sources, provision of support for staff who are EU nationals, and political and strategic mitigation.
INFLATION	Inflation is another significant risk as core funding 2017-2022 does not include an allowance for inflation.	Factored into business planning through planned increases in income from competitive funding sources and savings from improved procurement and 'spend-to-save' capital works.

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 Quintin McKellar – Chair (resigned 31.12.2018)
Dr Theo Kanellos (resigned 31.12.2018)
Mr Roger Louth
Dr Vanessa Mayatt OBE
Sir Bertie Ross
Professor David Rowlands
Mr Mike Samuel
Professor John Stephenson - Chair (from 1.1.2019)
Mr Jon Coles (appointed 1.1.2019)
Dr Sandy Primrose (appointed 1.1.2019)
Professor Vince Emery (appointed 1.1.2019)
Jane Tirard (appointed 1.1.2019)
Mr Ian Black (appointed 1.1.2019)
Mr Ian Bateman (appointed 1.1.2019)

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

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. The Trustee Board and its committee structure work closely with the Director and senior management of the Institute and are responsible for corporate governance and for the Institute's scientific strategy and strategic plans.

The Trustee Board has appointed a Scientific Advisory Board, to provide advice and recommendations to the Trustee Board and the Director regarding the scientific strategy and activities of the Institute.

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 £8,288 (2018: £8,140). 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 Trustee training. Trustees are encouraged to attend appropriate external training events where these will facilitate the undertaking of their role.

SENIOR LEADERSHIP TEAM

The Trustee Board consider that the Senior Leadership Team (SLT) is accountable for Institute strategy, risk mitigation and governance of day-to-day operational delivery, 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 SLT is based on the agreed and recognised salary banding for the Institute and reviewed and agreed annually via the Senior Remuneration Committee, comprising of the Chair Trustee Board, Institute Director and Head of HR. The Senior Remuneration Committee operates independently on issues relating to senior managers' salaries and benefits and is responsible for considering and recommending the remuneration package for the SLT and senior management members.

In fulfilling these responsibilities, the Senior Remuneration Committee will seek relevant and appropriate information to support its activities and also obtain external independent professional advice as necessary.

APPROACH TO EQUALITY, DIVERSITY AND INCLUSION (EDI)

The Institute takes its commitment to Equality, Diversity and Inclusion (EDI) very seriously and this remains integral to how it develops and improves its people practices and ensures that everyone has access to the same opportunities and the same, fair treatment. The EDI agenda is driven by the Equality, Diversity and Inclusion Steering Group, with cross Institute representation.

The Institute currently holds bronze status from the Athena Swan Charter and is working on maintaining this and aspiring towards silver status. A number of employees are Athena Swan ambassadors and help promote and monitor EDI activities. The Institute is also a member of the Employers Network for Equality & Inclusion (ENEI) and uses its insights to further improve what we do and how we do it.

The Institute is committed to reducing the gender pay gap at Pirbright and in our pay award in 2018, 58.2% of female colleagues and 47.4% of male colleagues received a bonus performance reward. The gender pay gap report is available on the Pirbright website www.pirbright.ac.uk. The main reason for the gap is an imbalance of male and female colleagues at senior levels, which is actively being addressed.

There is continued success in recruiting talent from around the globe with new starters coming from 18 different countries across Europe, Asia, Africa, and North and South America. The diversity profile of these employees enriches the cultural tapestry within the Institute and helps in bringing together the best scientists from across the world as well as building our reputation in the UK and globally.

The wellbeing of all our people is of huge importance and increasingly the focus is on total wellbeing (mind and body). A comprehensive health surveillance programme is provided for all staff with many events taking place during the year.

TRADES UNION ENGAGEMENT

The Institute has formal trade union recognition representing employees on BBSRC terms and conditions at the Institute. Trade union recognition does not apply to employees on Pirbright terms and conditions.

The key union relationship is with Prospect and quarterly meetings are held with their lead negotiator. These meetings provide the opportunity for both parties to share information and discuss any key issues with members. The Institute recognises local union representation on a number of committees within the Institute, including the Health & Safety Consultative Committee and Redeployment Committee and it is also involved, on request by members, in formal employee relations procedures e.g. capability or redundancy consultations. Prospect attended site in November 2018, during union week, to meet members and disseminate information.

RELATED PARTIES

The Institute's subsidiary undertaking, 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).

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.

During 2018 the Trustees undertook a retendering of the appointment of the auditor and as a result BDO were successful and started in January 2019 and undertook the 2018/19 audit.

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

Professor John Stephenson
Trustee Director

Approved by the Board of Trustees on
18 September 2019

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

OPINION

We have audited the financial statements of The Pirbright Institute for the year ended 31 March 2019 which comprises the principal 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).

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 2019 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.

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

We have nothing to report in respect of the following matters in relation to which the ISAs (UK) require us to report to you where:

- the Trustees' use of the going concern basis of accounting in the preparation of the financial statements is not appropriate; or
- the Trustees have not disclosed in the financial statements any identified material uncertainties that may cast significant doubt about the Charitable Company's ability to continue to adopt the going concern basis of accounting for a period of at least twelve months from the date when the financial statements are authorised for issue.

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. The Trustees are responsible for the other information.

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.

In connection with our audit of the financial statements, 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 audit or otherwise appears to be materially misstated. If we identify such material inconsistencies or apparent material misstatements, we are required to determine whether there is a material misstatement in the financial statements or a material misstatement of the other information. 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.

OPINIONS ON OTHER MATTERS PRESCRIBED BY THE COMPANIES ACT 2006

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.

MATTERS ON WHICH WE ARE REQUIRED TO REPORT BY EXCEPTION

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 Trustees' 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.

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
18 September 2019

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 2015) - (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).

The prior year figures have been restated to:

- Reflect the incorrect treatment of land being depreciated.
- Correct the treatment of cash deposits of over 3 months being incorrectly included in cash & cash equivalents in the statement of cash flows.
- Correctly present core funding from BBSRC UKRI as restricted income rather than unrestricted.

Further details are given in Note 17 to the financial statements.

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 received its five-year strategic grant funding from BBSRC UKRI, £15m per annum, which was started on the 5 April 2017 and runs to March 2020 with a further provisional award for the subsequent two years to March 2022. 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, Avrico 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 companies, as detailed in note 10, have also been excluded from the consolidation on the grounds of these 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 20, there is a contingent liability to account to the 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. The current lease for the Pirbright North site ended in May 2016 and the lease for the Pirbright South site ended in March 2015. The South site lease for the main campus has been renewed for a term of 99 years. Currently the Institute is negotiating the terms for the North site lease and expects it to be concluded soon. 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.

INVESTMENTS

Quoted investments are valued at market value. Investments in subsidiary undertakings are carried at the lower of cost and net realisable value. The policy of the Institute is to write down investments where a permanent diminution in value is deemed to have occurred.

STOCK

Laboratory supplies 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 2018, 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 2019

Note	Unrestricted Funds £'000	Restricted Funds £'000	2019 Total Funds £'000	2018 Restated Total Funds £'000
<i>Income from Donations</i>				
Core strategic grant	1	-	15,451	15,351
<i>Charitable activities</i>				
Grants and contracts	2	17,002	12,620	29,622
Research farm operation	2	-	-	1
Other charitable income	2	1,797	-	1,408
<i>Investment income</i>	3	975	-	975
Total		19,774	28,071	47,845
<i>Expenditure on</i>				
<i>Raising funds</i>				
Rental income and tenant services		345	337	682
Investment management costs		16	-	16
<i>Charitable activities</i>				
Scientific research		33,254	9,737	42,991
Rental income and tenant services		1,100	911	2,011
Other charitable activities		437	56	493
Total	4	35,152	11,041	46,193
Net gains on investments		9	-	9
Net (expenditure)/income before tax		(15,369)	17,030	874
Tax payable		-	-	40
Transfers between funds	15	16,147	(16,147)	-
Net movement in funds		778	883	834
Balances brought forward		8,349	273,453	281,802
Balances carried forward	16	9,127	274,336	281,802

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 2019. Company Number 00559784

	Note	2019		2018 restated	
		£'000	£'000	£'000	£'000
<i>Fixed assets</i>					
Tangible fixed assets	9		256,731		254,489
Investments	10		160		151
			<u>256,891</u>		<u>254,640</u>
<i>Current assets</i>					
Stocks	11	158		153	
Debtors	12	8,851		9,683	
Cash at bank and in hand		30,474		27,928	
		<u>39,483</u>		<u>37,764</u>	
Creditors: amounts falling due within one year	13	<u>(12,911)</u>		<u>(10,602)</u>	
Net current assets			26,572		27,162
Total assets less current liabilities			<u>283,463</u>		<u>281,802</u>
Net assets			<u>283,463</u>		<u>281,802</u>
Financed by					
Unrestricted funds	16		9,127		8,349
<i>Restricted</i>					
Fixed asset fund (including revaluation reserve of £16,917k (2018: restated: £17,592k))	15		266,596		264,926
Other restricted reserve	16		7,740		8,527
Total funds	16		<u>283,463</u>		<u>281,802</u>

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 18 September 2019 and signed on their behalf on 18 September 2019.

Professor John Stephenson
Trustee Director

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

Roger Louth
Trustee Director

STATEMENT OF CASH FLOWS

For the year ended 31 March 2019

	2019		2018 restated	
	£'000	£'000	£'000	£'000
<i>Net cash provided by operating activities</i>				
Net movement in funds	1,661		874	
Interest and rent receivable	(975)		(819)	
Depreciation charged	10,753		11,106	
Corporation tax paid	–		(40)	
Revaluation gain on investments	(9)		(18)	
Increase in stocks	(5)		(57)	
Decrease in debtors	832		1,315	
Increase in creditors	788		2,342	
Net cash provided by operating activities		13,045		14,703
<i>Cash flows from investing activities:</i>				
Interest and rents received	975		819	
Increase in cash deposits > 3 months	(2,545)		(6,031)	
Purchase of property, plant and equipment	(11,474)		(12,927)	
Net cash used in investment activities		(13,044)		(18,139)
Change in cash and cash equivalents in the reporting period		1		(3,436)
Cash and cash equivalents at the beginning of the reporting period		9,866		13,302
Cash and cash equivalents at the end of the reporting period		9,867		9,866
Cash and cash equivalents as above		9,867		9,866
Cash placed on term deposits longer than 3 months		20,607		18,062
Cash at bank and in hand per the balance sheet		30,474		27,928

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 2019

1 INCOME FROM DONATIONS

	2019	2018
	£'000	£'000
BBSRC UKRI – core strategic grant	15,451	15,351
All income from donations in the current and prior year was restricted.		

2 INCOME FROM CHARITABLE ACTIVITIES

	2019	2018
	£'000	£'000
<i>Grant income</i>		
BBSRC UKRI – research grants	3,646	3,973
BBSRC UKRI – other grants	14,016	14,539
Other research grants	11,960	10,360
	<u>29,622</u>	<u>28,872</u>
Research farm operation	–	1
Other charitable activities	1,797	1,408
	<u>31,419</u>	<u>30,281</u>

Income from charitable activities includes restricted income from grants and contracts of £12,620k (2018: £14,316k)
All other income from charitable activities in the current and prior year was unrestricted.

The analysis by region is set out below:

	2019	2018
	£'000	£'000
United Kingdom	27,049	27,669
Europe	979	1,313
North America	2,283	1,103
Others	1,108	196
	<u>31,419</u>	<u>30,281</u>

INCOME FROM CHARITABLE ACTIVITIES (CONT)

	Unrestricted	Unrestricted	2019	2018
	£'000	£'000	Total	Total
			£'000	£'000
<i>Analysis of grant income</i>				
BBSRC UKRI				
- Competitive Project Grant – research grants	3,646	–	3,646	3,973
- Other grants	1,396	12,620	14,016	14,539
Total BBSRC UKRI	5,042	12,620	17,662	18,512
Defra “Umbrella” commission projects	2,493	–	2,493	2,641
Defra Surveillance	2,018	–	2,018	1,726
European Union	979	–	979	958
Industry, levy boards	874	–	874	956
Trusts, foundations, charities	3,429	–	3,429	2,852
Other research grant income	2,167	–	2,167	1,227
Total incoming resources – grants including research	17,002	12,620	29,622	28,872

Ancillary trades and activities

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

	Unrestricted	Restricted	2019	2018
	£'000	£'000	Total	Total
			£'000	£'000
Royalties	357	–	357	317
Diagnostic kits	29	–	29	46
Other	1,411	–	1,411	1,045
	<u>1,797</u>	<u>–</u>	<u>1,797</u>	<u>1,408</u>

3 INVESTMENT INCOME

	2019	2018
	£'000	£'000
Rental income and tenant services	767	650
Bank interest	208	169
	<u>975</u>	<u>819</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	2019 Total £'000	2018 Total restated £'000
Unrestricted funds					
<i>Costs of raising funds</i>					
Rental income and tenant services	-	-	345	345	300
Investment management costs	-	7	9	16	15
<i>Charitable expenditure</i>					
Grants for scientific research	12,015	8,110	13,129	33,254	31,270
Rental income and tenant services	-	(15)	1,115	1,100	923
Other charitable activities	-	214	223	437	376
Total unrestricted resources expended	12,015	8,316	14,821	35,152	32,884
Restricted funds					
Cost of raising funds	-	-	337	337	356
Charitable expenditure	-	-	10,704	10,704	12,355
Total restricted resources expended	-	-	11,041	11,041	12,711
Total resources expended	12,015	8,316	25,862	46,193	45,595
Total resources expended – 2018 restated	11,359	8,735	25,501	45,595	

Included in allocated support costs are normal staff costs of £3,429,887 (2018: £2,911,630).

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 and nursery £'000	Other charitable activities £'000	Total 2019 £'000	Total 2018 restated £'000	Basis of allocation
Unrestricted									
Premises	203	-	8,765	1,017	76	-	10,061	8,464	% of floor area
Financial costs	24	9	532	41	24	24	654	579	time spent
Management	41	-	989	17	19	11	1,077	722	time spent
Human resources	59	-	427	-	18	-	504	542	time spent
Information technology	9	-	1,882	21	10	21	1,943	1,880	time spent
Purchasing and procurement	6	-	462	18	12	6	504	542	time spent
Governance	3	-	72	1	1	1	78	61	time spent
	345	9	13,129	1,115	160	63	14,821	12,790	
Restricted									
Depreciation	335	-	9,466	896	56	-	10,753	11,107	
Repairs / compliance	2	-	271	15	-	-	288	1,604	
	337	-	9,737	911	56	-	11,041	12,711	
	682	9	22,866	2,026	216	63	25,862	25,501	

6 OPERATING COSTS

	2019 £'000	2018 restated £'000
<i>Operating costs stated after charging:</i>		
Auditor's remuneration		
- audit services	43	49
- non-audit services	-	23
Depreciation	10,753	11,107
Loss on foreign exchange translations	(35)	-
Hire of plant and machinery	32	5
Rental of land and buildings	440	219

Operating costs are stated net of laboratory supplies carried forward in stock amounting to £158,158 (2018: £153,166).

7 REMUNERATION OF THE MEMBERS OF THE TRUSTEE BOARD

None (2018: none) of the members of the Trustee Board received any remuneration from the Institute during the year. Five members (2018: seven members) of the Trustee Board had travel expenses of £3,934 (2018: £7,196) 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	
	2019	2018
Office, management and estate support	116	114
Scientific	228	208
	344	322

The aggregate payroll costs of these persons were as follows:

	2019 £'000	2018 £'000
Wages and salaries	12,547	12,557
Social security costs	1,276	1,236
Other pension costs	2,456	2,375
	16,279	16,168

**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 £1,287,414 (2018: £1,577,799). 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 £1,105,958 (2018: £748,051).

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 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 UKRI 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 Team 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 £544,440 (2018: £534,070).

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

	2019 Number	2018 Number
£60,000 – £69,999	7	11
£70,000 – £79,999	7	6
£80,000 – £89,999	4	2
£90,000 – £99,999	1	2
£100,000 – £109,999	1	-
£130,000 – £139,999	1	-
£140,000 – £149,999	-	1

The number of staff earning over £60,000 for whom retirement benefits are accruing under defined benefit schemes amounted to twelve (2018: eight) and the amounts paid in the year were £233,970 (2018: £152,130).

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 2018	244,321	18,677	1,283	34,281	298,562
Additions	-	613	-	12,382	12,995
Disposals	-	(37)	-	-	(37)
At 31 March 2019	244,321	19,253	1,283	46,663	311,520
Depreciation					
At 1 April 2018 restated	29,027	13,763	1,283	-	44,073
Charge for year historic	7,941	1,808	-	-	9,749
Charge for year revaluation	1,004	-	-	-	1,004
Disposals	-	(37)	-	-	(37)
At 31 March 2019	37,972	15,534	1,283	-	54,789
Net book value at 31 March 2019	206,349	3,719	-	46,663	256,731
Net book value at 31 March 2018 restated	215,294	4,914	-	34,281	254,489

Land and buildings include land with a book value of £13,749k.

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 current lease for the Pirbright North site ended in May 2016 and the lease for the Pirbright South site ended in March 2015. The South site lease for the main campus has been renewed for a term of 99 years. Currently, we are negotiating the terms for the North site lease and expect it to be concluded in the next period. 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.

10 INVESTMENTS

	2019 £'000	2018 £'000
<i>UK listed investments held as fixed assets</i>		
Market value at 1 April 2018	151	133
Unrealised profit	9	18
Market value at 31 March 2019	<u>160</u>	<u>151</u>
<i>Represented by:</i>		
Genus plc	86	90
Dairy Crest	74	61
Total	<u>160</u>	<u>151</u>

Investment in subsidiary undertaking

Avrico Limited, which is incorporated in England and Wales, 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:

	2019 £'000	2018 £'000
<i>Current assets</i>		
Creditors: amounts falling due within one year	<u>(8)</u>	<u>(8)</u>
Net liabilities	<u>(8)</u>	<u>(8)</u>
Aggregate share capital and reserves	<u>(8)</u>	<u>(8)</u>

The Institute has provided for the deficit shown by the subsidiary undertaking by writing off the amount owed to it by Avrico 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 2019 was £185,000 (2018: £280,000) and its net assets as at 31 March 2019 were £170,000 (2018: £157,000).

11 STOCKS

	2019 £'000	2018 £'000
Laboratory supplies	<u>158</u>	<u>153</u>

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

12 DEBTORS: AMOUNTS FALLING DUE WITHIN ONE YEAR

	2019 £'000	2018 £'000
Trade debtors	1,219	1,068
Prepayments	1,333	1,569
Accrued income	3,968	3,306
Other debtors	2,331	3,740
	<u>8,851</u>	<u>9,683</u>

13 CREDITORS: AMOUNTS FALLING DUE WITHIN ONE YEAR

	2019 £'000	2018 £'000
Trade creditors	2,219	4,110
Taxation and social security	555	583
Other creditors	194	508
Accruals	3,259	1,250
Deferred income	6,170	3,708
Short-term compensated absences	514	443
	<u>12,911</u>	<u>10,602</u>

14 RECONCILIATION OF MOVEMENT IN ACCRUED AND DEFERRED GRANT INCOME

	2019 £'000	2018 £'000
Accrued income	3,968	3,306
Deferred income	(6,170)	(3,708)
	<u>(2,202)</u>	<u>(402)</u>
Net deferred research grant income at the beginning of the year	(402)	(943)
Research grant income received during the year	(18,802)	(14,015)
Research grant money released to SOFA during the year	17,002	14,556
	<u>(2,202)</u>	<u>(402)</u>

15 FUNDS

	Restated Balance April 1 2018 £'000	Net incoming/ (outgoing) resources £'000	Transfer between funds £'000	Balance March 31 2019 £'000
<i>Unrestricted funds:</i>				
General	3,807	(15,427)	16,147	4,527
Designated	4,542	58	-	4,600
<i>Restricted non endowment funds:</i>				
Fixed Asset Fund	264,926	1,670	-	266,596
<i>Other restricted funds:</i>				
Fixed Asset Project Support Costs	3,043	-	300	3,343
DP2 phase 2 occupation	4,707	(92)	(300)	4,315
IS4L Interim Insectary	6	-	-	6
BBSRC UKRI core grant funding	-	15,451	(15,451)	-
Hostel	696	-	(696)	-
Other	75	1	-	76
	<u>281,802</u>	<u>1,661</u>	<u>-</u>	<u>283,463</u>

Movement in funds 2017/18 Restated:

	Restated Balance April 1 2017 £'000	Net incoming/ (outgoing) resources £'000	Transfer between funds £'000	Balance March 31 2018 £'000
<i>Unrestricted funds:</i>				
General	4,081	(15,336)	15,062	3,807
Designated	5,328	(786)	-	4,542
<i>Restricted non endowment funds:</i>				
Fixed Asset Fund	262,831	2,002	93	264,926
<i>Other restricted funds:</i>				
Fixed Asset Project Support Costs	3,043	-	-	3,043
Equipment	596	-	(596)	-
BCIC Projects	2	-	(2)	-
DP2 phase 2 occupation	3,961	(53)	799	4,707
IS4L Interim Insectary	-	6	-	6
Innovation at Pirbright	209	(359)	150	-
BBSRC UKRI core grant funding	-	15,351	(15,351)	-
Hostel	851	-	(155)	696
Other	66	9	-	75
	<u>280,968</u>	<u>834</u>	<u>-</u>	<u>281,802</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 £nil for change management (2018: £92k), £2,750k for occupation costs relating to capital projects (2018: £2,768k), £400k to maintain scientific equipment capacity and capability (2018: £nil), £306k for IT resilience (2018: £nil), £143k for additional car parking at the Pirbright campus (2018: £nil), £nil for decommissioning (2018: £271k), £nil for spoil clearance (2018: £355k), £862k for group leaders (2018: £862k) and £139k for other projects (2018: £194k).

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.

	2019 £'000	2018 Restated £'000
<i>Fixed Asset Fund</i>		
Balance brought forward	264,926	262,831
Grants received	12,607	13,190
Depreciation/impairment (Note 6)	(10,753)	(11,107)
Revenue spend	(184)	(81)
Transfers	-	93
Balance carried forward	<u>266,596</u>	<u>264,926</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 charity and amounts received for capital but not yet spent.

The unexpended balance of unrestricted designated funds and restricted funds is invested in temporary 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 DP2 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.

The Hostel funds were received from BBSRC UKRI to cover the cost of the rents payable at the Compton site.

Transfers between funds

	Unrestricted general funds £'000	Unrestricted designated funds £'000	Restricted funds £'000
Transfer of funds to general reserves	<u>16,147</u>	<u>-</u>	<u>(16,147)</u>

The transfers during the year are as follows:

- The Hostel restricted fund transfer of £696k has been made to set rents paid in the year against the restricted grant received for this purpose.

- The BBSRC UKRI core grant funding restricted fund transfer of £15,451k has been made to set overhead expenditure incurred in the year against the restricted grant received for this purpose.

16 ANALYSIS OF NET ASSETS BETWEEN FUNDS

	Fixed assets £'000	Net current assets £'000	Total £'000
Unrestricted funds	160	8,967	9,127
Restricted funds			
Capital fund	239,814	9,865	249,679
Revaluation reserve	16,917	-	16,917
Other restricted funds	-	7,740	7,740
	<u>256,891</u>	<u>26,572</u>	<u>283,463</u>
	Fixed assets £'000	Net current assets £'000	Total £'000
Prior year restated			
Unrestricted funds	151	8,198	8,349
Restricted funds			
Capital fund	236,897	10,437	247,334
Revaluation reserve	17,592	-	17,592
Other restricted funds	-	8,527	8,527
	<u>254,640</u>	<u>27,162</u>	<u>281,802</u>
			£'000
Revaluation reserve - restated			
Revaluation reserve brought forward			17,592
Depreciation charged (Note 9)			(675)
Revaluation reserve carried forward			<u>16,917</u>

17 PRIOR YEAR ADJUSTMENT

Prior year results have been restated to reflect the correction of the incorrect depreciation rate being used for leasehold land. Previously, leasehold land was being depreciated incorrectly over a period of 17 years (in line with the associated leasehold properties) rather than over the period of the lease agreement (99 years).

Restated position:

	2018 £'000	2017 £'000
Original funds c/fwd 31 March	279,086	278,904
Adjustment to depreciation charge – prior periods	2,064	1,411
Adjustment to depreciation charge – current year	652	653
Restated funds 31 March	<u>281,802</u>	<u>280,968</u>

The Statement of Cash Flows has been restated to remove term deposits of greater than 3 months from the cash and cash equivalent figures. Previously, such deposits had incorrectly been treated as cash for the purposes of the cash flow statement.

Restated position:

	2018 £'000	2017 £'000
Original Cash & Cash Equivalents reported	27,928	25,332
Deduct Term deposits of more than 3 months included above	18,062	12,030
Restated Cash & Cash Equivalents	<u>9,866</u>	<u>13,302</u>

The split of prior year income between restricted and unrestricted funds has been restated to reflect the conditions attached to the core funding received from the BBSRC UKRI. This funding had previously been incorrectly treated as unrestricted in the statement of financial activities. As the Institute had fully utilised all core funding received in the year, this prior year adjustment has had no impact on the results for the year ended 31 March 2018 or total assets (in aggregate and by fund) at 31 March 2018.

18 FINANCIAL INSTRUMENTS

	2019 £'000	2018 £'000
Financial assets measured at amortised cost	3,550	4,808
Financial liabilities measured at amortised cost	(2,968)	(5,201)
	<u>582</u>	<u>(393)</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.

19 COMMITMENTS

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

	2019 £'000	2018 £'000
Authorised but not contracted for	5,639	7,774

The capital commitments of £5,639k (2018: £7,774k) will be significantly funded by the BBSRC UKRI.

(b) Operating lease commitments

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

	2019 £'000	2018 £'000
Land and buildings		
Within one year	57	363
In two to five years	235	1,302
In over five years	445	906
Plant and Machinery		
Within one year	39	39

20 CONTINGENT LIABILITIES

There is a contingent liability to account to the 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 2019 or 31 March 2018.

21 RELATED PARTY TRANSACTIONS

Biotechnology and Biological Sciences Research Council (BBSRC UKRI)

BBSRC UKRI provides substantial funding to the Institute. The Institute is affiliated with the BBSRC UKRI along with seven other institutes. Details of grants received from BBSRC UKRI are detailed in Notes 1 and 2. During the year, the BBSRC UKRI charged the Institute £35,957 (2018: £45,318) for other costs.

REFERENCE AND ADMINISTRATIVE DETAILS

Trustees:

Professor John Stephenson: Chair
 Mr Roger Louth
 Dr Vanessa Mayatt OBE
 Sir Bertie Ross
 Professor David Rowlands
 Mr Jon Coles
 Dr Sandy Primrose
 Professor Vince Emery
 Jane Tirard
 Mr Ian Black
 Mr Ian Bateman

Auditor:

BDO LLP
 2 City Place,
 Beehive Ring Road,
 Gatwick
 West Sussex, RH6 0PA

Bankers:

Lloyds Bank plc,
 5 High Street,
 Swindon, SN1 3EN

Solicitors:

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

Director of the Institute:

Professor Bryan Charleston MRCVS

Secretary:

Mr Keith Simpson BA ACMA


Registered office:

Pirbright Laboratory, Ash Road,
 Pirbright, Woking, Surrey, GU24 0NF

Penningtons Manches LLP,
 9400 Garsington Road,
 Oxford Business Park,
 Oxford, OX4 2HN



The plant room is the heart of the BBSRC National Virology Centre and contains complex systems including HEPA air filtering units necessary to operate under the highest level of containment



Scanning electron micrograph of
Crimean-Congo haemorrhagic
fever (CCHF) viral particles (green)
budding from the surface of cultured
epithelial cells from a patient



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