

[Reproduced for educational purposes only. Fair Use relied upon.]



THE  **Pirbright**
INSTITUTE

PREVENTING AND CONTROLLING VIRAL DISEASES

CORPORATE
REPORT
2019

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

The Pirbright Institute

www.pirbright.ac.uk

@Pirbright_Inst

@ThePirbrightInstitute

The Pirbright Institute

REGISTERED CHARITY NUMBER: 228824
REGISTERED COMPANY NUMBER: 00559784

Director's Welcome	3
About Pirbright	6
Our Expertise	8
Scientific Impact	10
A Global Centre of Excellence	15
Science for Everyone	16
Investment in the Future	18
Working with Industry	21
Global Collaborations	22
Our Success Stories	26
Developing Our Culture and Workforce	28
World Class Expertise	29
Pirbright Performance	29
Financial Performance	30

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.



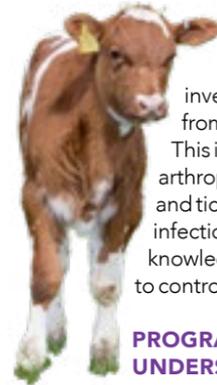
BBSRC National Vaccinology Centre: The Jenner Building

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.

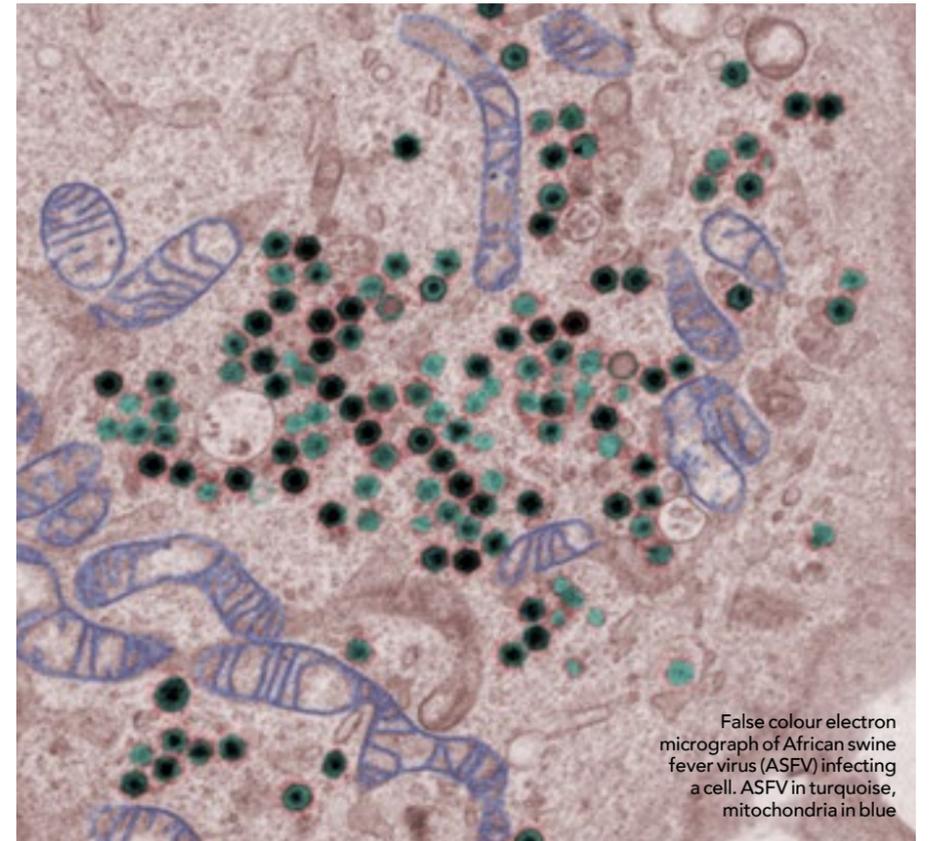


PROGRAMME 2: UNDERSTANDING AND PREVENTING VIRAL DISEASES

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

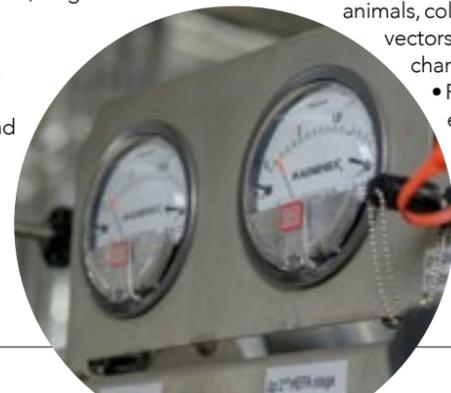


False colour electron micrograph of African swine fever virus (ASFV) infecting a cell. ASFV in turquoise, mitochondria in blue

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



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

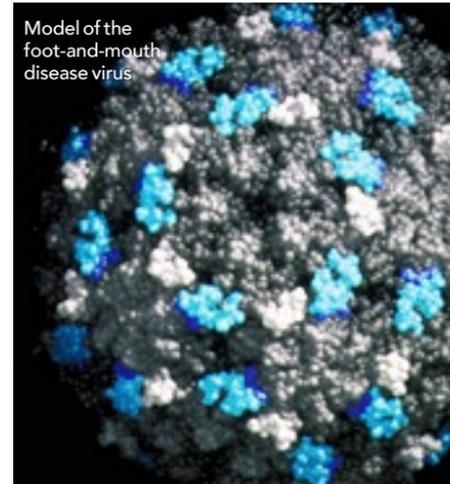
The *Culicoides* biting midge is responsible for the spread of several animal diseases



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.



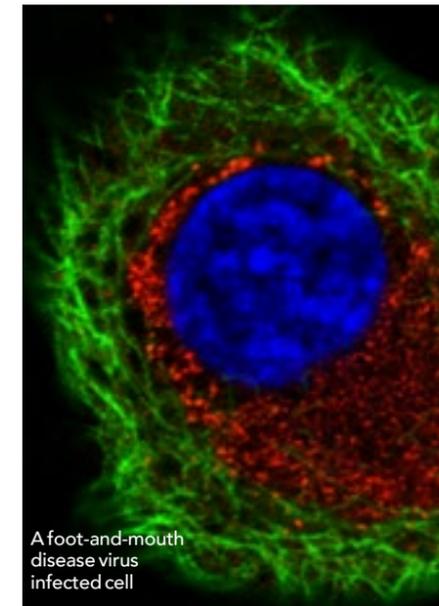
Model of the foot-and-mouth disease virus

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.

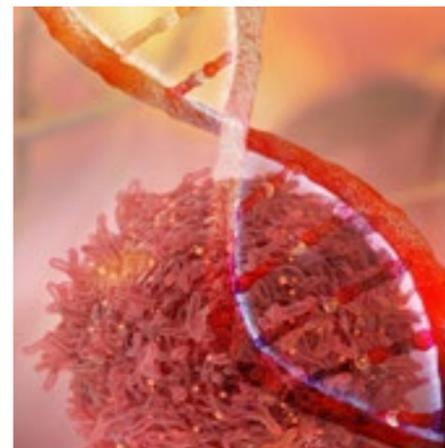
PIRBRIGHT HELPS THE UK REMAIN BLUETONGUE FREE

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.

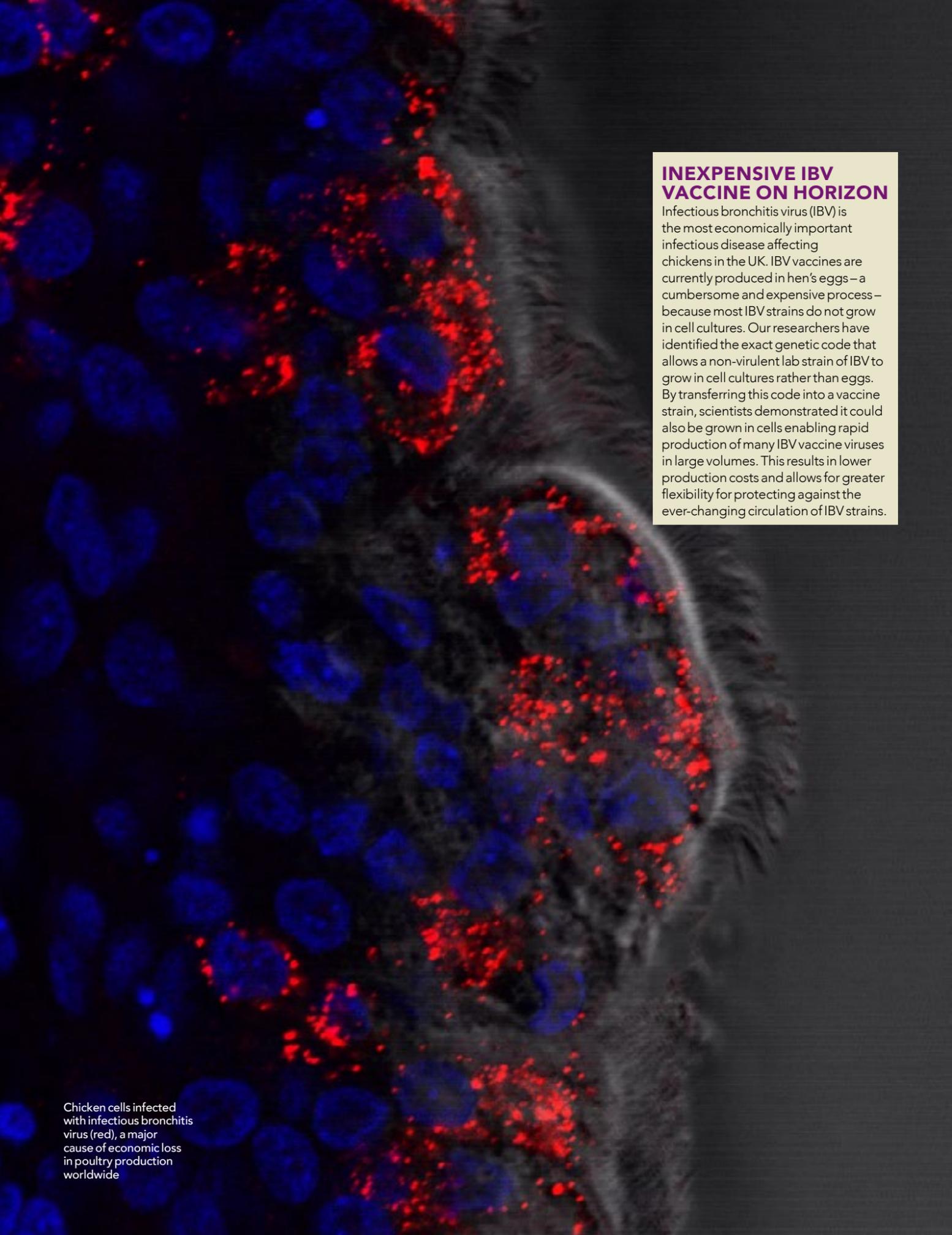
GROUND-BREAKING METHOD PINPOINTS HOW LIVESTOCK VIRUS COULD BECOME A ZOOZOSIS

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.

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.



VIRAL SURVIVAL

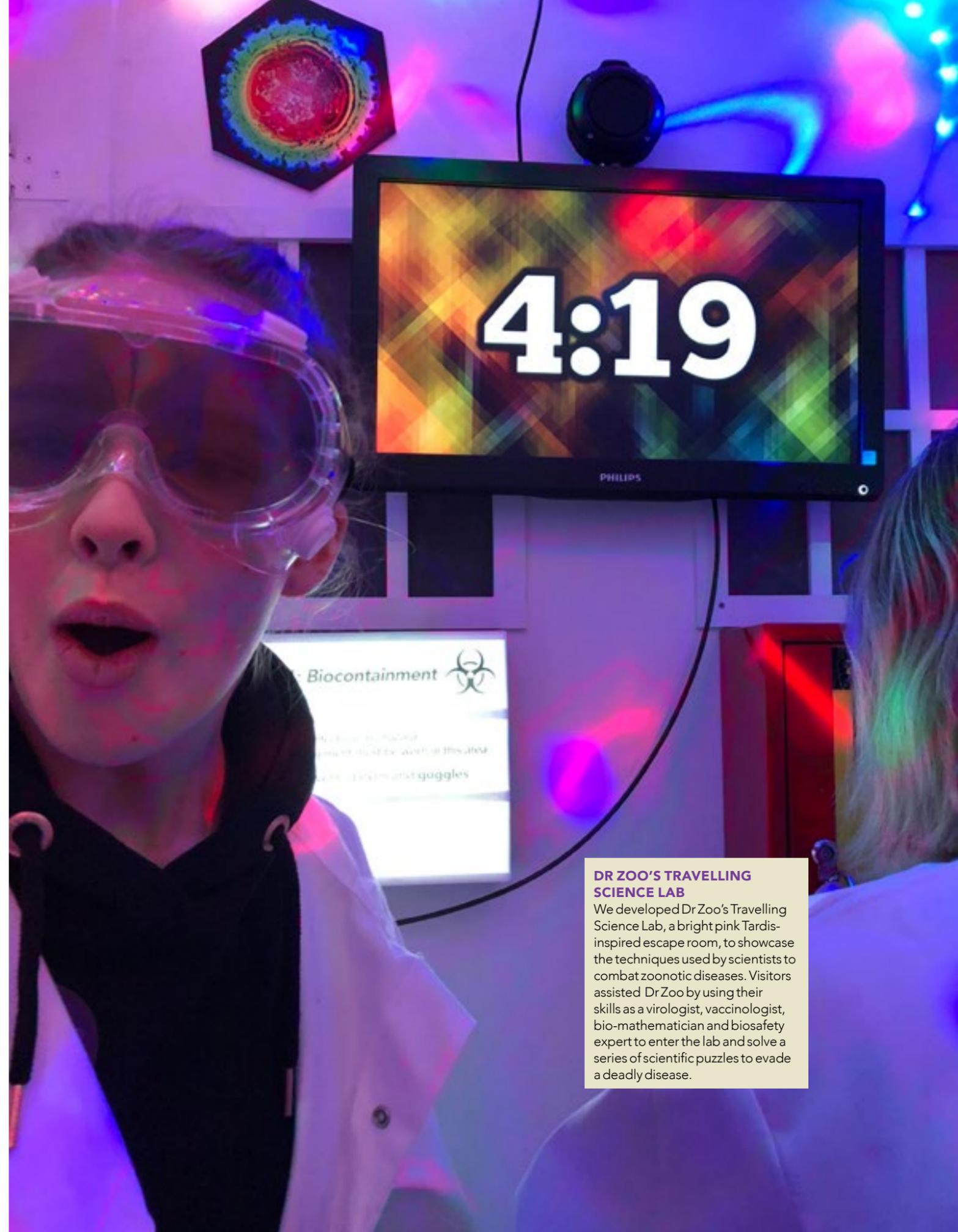
Innovate Guildford 2019, a local science and arts festival, saw the debut of Pirbright's 'Viral Survival' exhibit, which introduced zoonoses (diseases that spread from

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

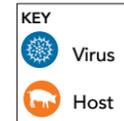


DR ZOO'S TRAVELLING SCIENCE LAB

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

NEXT STEP IN ERADICATION OF PESTE DES PETITS RUMINANTS

Peste des petits ruminants (PPR), also known as goat plague, is highly contagious and infects small ruminants such as sheep and goats, causing up to 90% mortality. The disease is prevalent across large parts of Africa, the Middle East, India and China and is estimated to cost between US\$1.4 billion and US\$2.1 billion globally each year. In 2017, a global eradication programme was introduced to reduce the devastating impact PPR has in affected countries.

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

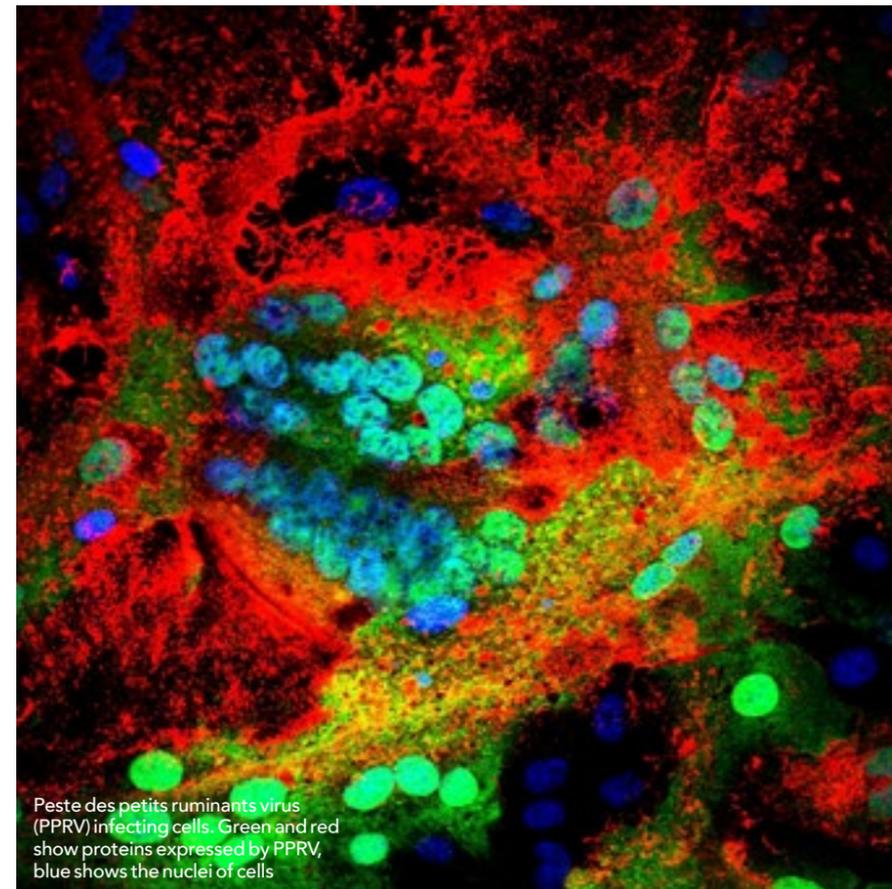
The Veterinary Vaccinology Network (VNV) officially handed over operations to the International Veterinary Vaccinology Network (IVNV) after its final annual conference in January 2019. Previous work undertaken by the VNV will continue through IVNV on an international scale. The IVNV, a partnership between 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



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



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.

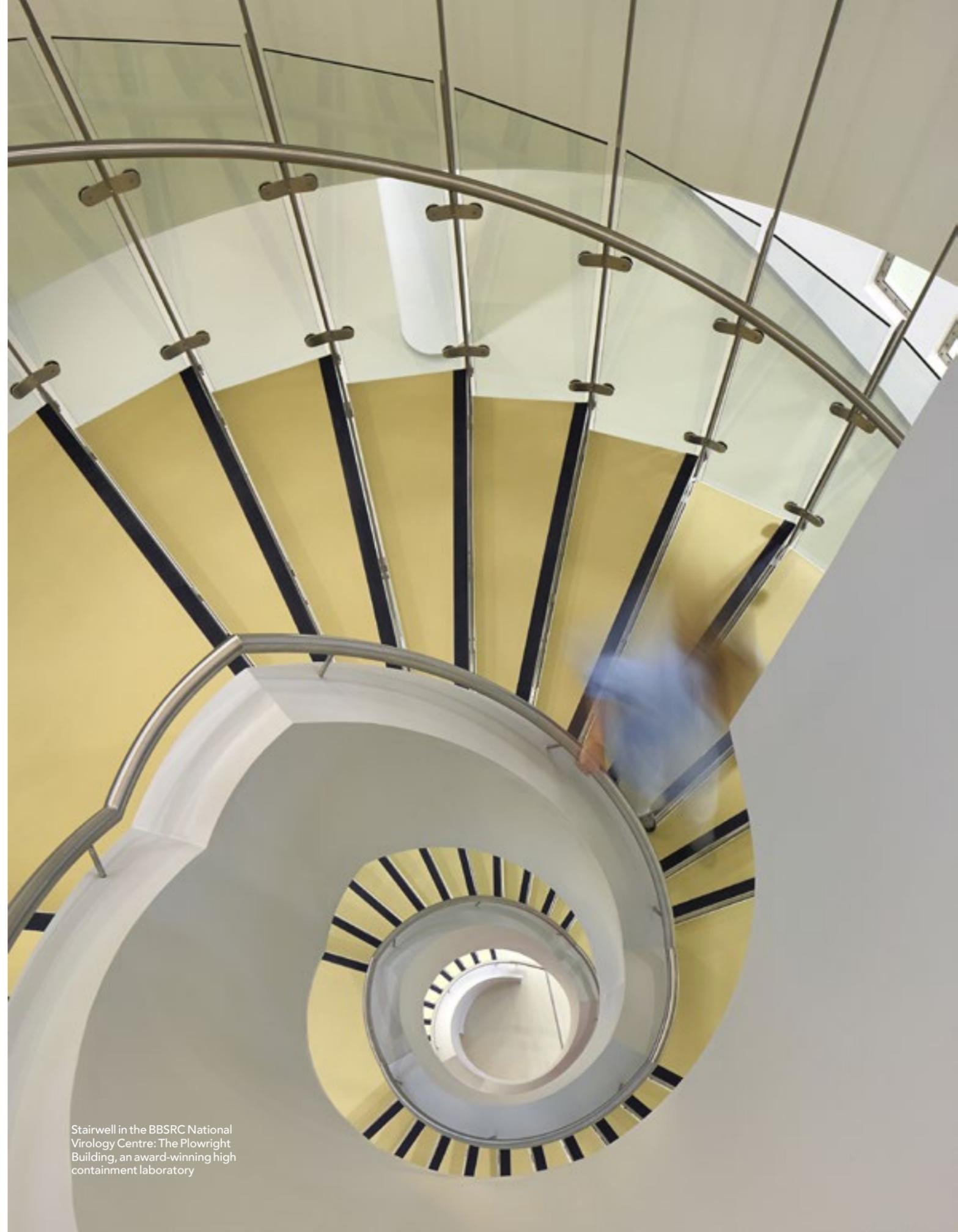
Students **Rachel Nash**, **Matthew Edmans** and **Fatoumatta Jobe** won the best talk prizes at Pirbright's Student Day, while **Lucy Gordon**, **Matthew Brownsword** and **Veronica Martini** were awarded prizes for their poster presentations. Prizes were also awarded for public engagement to **Abigail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

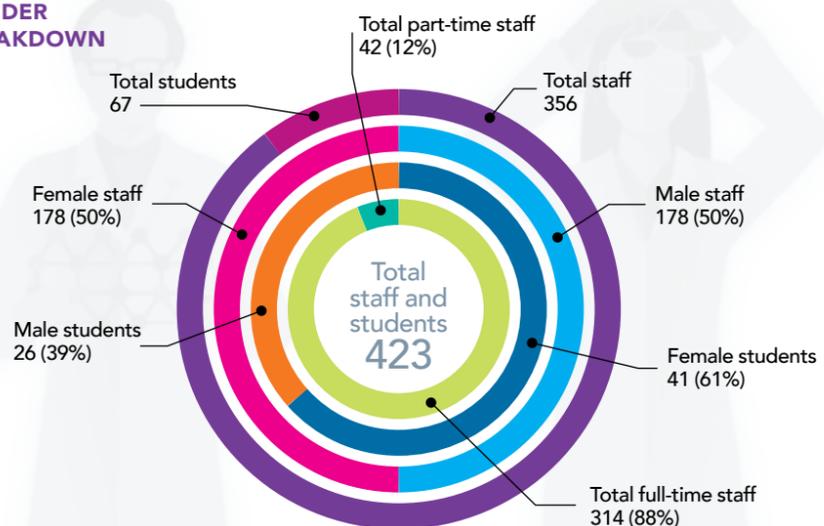
Pirbright's people are passionate about delivering outstanding scientific research and operational support, and we are committed to making Pirbright a fantastic place to work and one where our staff can choose to develop their careers. Pirbright's PRIDE values (Passion, Reliability, Innovation, Dignity 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

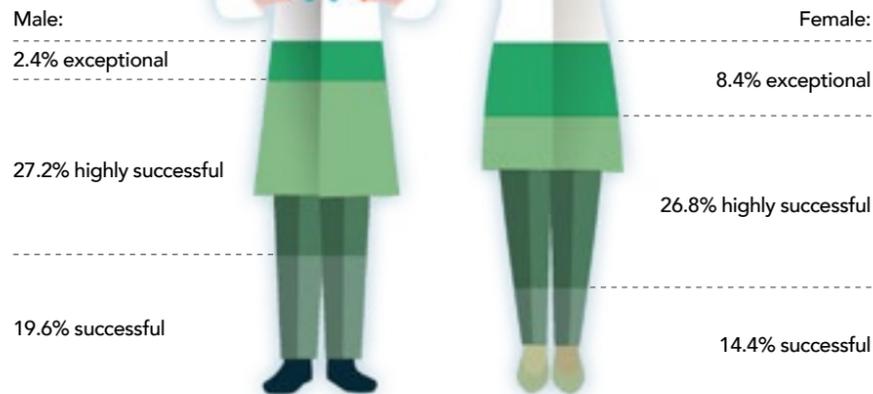
We continue to enjoy success in recruiting talent from around the globe with new starters joining last year from 18 different countries. These employees enrich the community within the Institute by bringing diverse experiences and view-points, helping us attract the best staff and building our reputation 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.

PIRBRIGHT PERFORMANCE

FROM 2019/20 PIRBRIGHT'S PRINCIPAL OBJECTIVES ARE:

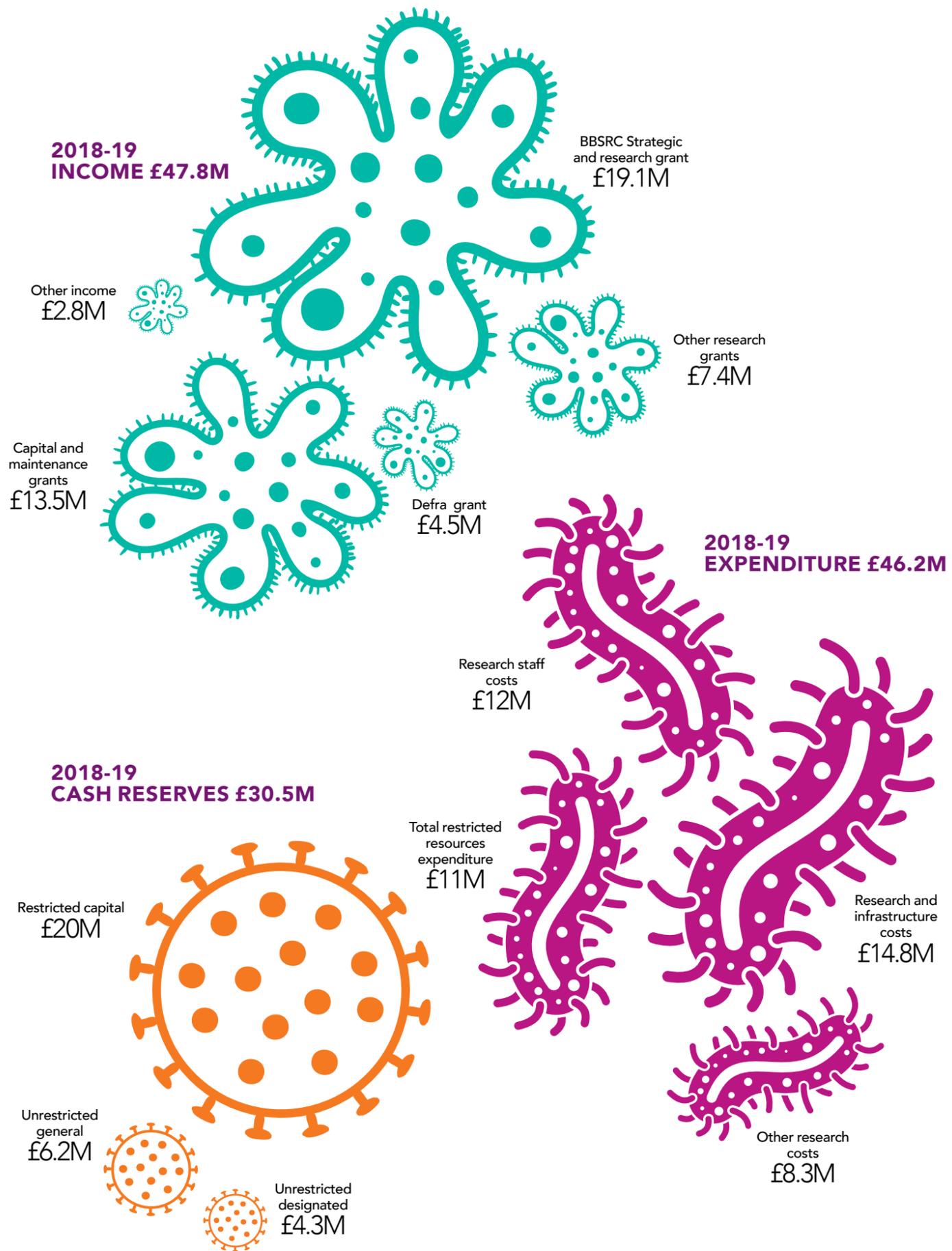
- 1 To continue a world leading research programme by publishing groundbreaking scientific research, winning research funding and recruiting and retaining the brightest and the best staff and students.
- 2 To further develop the Pirbright long term vision of scientific research with impact, in particular 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%



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



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



The Pirbright Institute
Ash Road, Pirbright, Surrey, GU24 0NF
Telephone: +44 1483 232441
Email: communications@pirbright.ac.uk
www.pirbright.ac.uk | [@Pirbright_Inst](https://twitter.com/Pirbright_Inst)



Patent eBusiness

- [+ Electronic Filing](#)
- [+ Patent Application Information \(PAIR\)](#)
- [+ Patent Ownership](#)
- [+ Fees](#)
- [+ Supplemental Resources & Support](#)

Patent Application Information Retrieval

[Global Dossier](#)
[What is a Certified Copy?](#)
[Order Certified Application As Filed](#)
[Order Certified File Wrapper](#)
[Shopping Cart](#)
[View Order List](#)

[Skip to Main Content](#)
Coronavirus **30699/51455** [\(/pair/PAIRPrintServlet\)](#)

[15/328,179](#)

[Select New Case](#)
[Application Data](#)
[Transaction History](#)
[Image File Wrapper](#)
[Patent Term Adjustments](#)
[Continuity Data](#)
[Foreign Priority](#)
[Fees](#)
[Published Documents](#)
[Address & Attorney/Agent](#)
[Supplemental Content](#)
[Assignments](#)
[References](#)

[Display](#)
[Download](#)

Patent Information

Patent Guidance and General Info (<http://www.uspto.gov/patents/index.jsp>)

- [+ Codes, Rules & Manuals](#)
- [+ Employee & Office Directories](#)
- [+ Resources & Public Notices](#)

Patent Searches

Patent Official Gazette (http://www.uspto.gov/news/og/patent_og/index.jsp)

- [+ Search Patents & Applications](#)
- [+ Search Biological Sequences](#)
- [+ Copies, Products & Services](#)

Other

- [Copyrights](#) (<http://www.uspto.gov/main/profiles/copyright.htm>)
- [Trademarks](#) (<http://www.uspto.gov/trademarks/index.jsp>)
- [Policy & Law](#) (<http://www.uspto.gov/main/policy.htm>)
- [Reports](#) (<http://www.uspto.gov/main/checkstatus.htm>)

Bibliographic Data

Application Number:	15/328,179	Correspondence Address Customer Number:	4743
Filing or 371 (c) Date:	01-23-2017	Status:	Patented Case
Application Type:	Utility	Status Date:	10-31-2018
Examiner Name:	LI, BAO Q	Location:  (http://www.uspto.gov/ebc/portal/info_location.htm)	ELECTRONIC
Group Art Unit:	1648	Location Date:	-
Confirmation Number:	6270	Earliest Publication No:	US 2017-0216427 A1
Attorney Docket Number:	30699/51455	Earliest Publication Date:	08-03-2017
Class / Subclass:	424/205.100	Patent Number:	10,130,701
First Named Inventor:	Erica Bickerton , Pirbright, Woking, (GB) all Inventors	Issue Date of Patent:	11-20-2018
First Named Applicant:	THE PIRBRIGHT INSTITUTE , Pirbright, Woking, (GB) all Applicants	International Registration Number (Hague):	-
Entity Status:	Undiscounted	International Registration Publication Date:	-
AIA (First Inventor to File):	Yes		
Title of Invention:	Coronavirus		

If you need help:

- Contact the Patent Electronic Business Center at (866) 217-9197 (toll free) or e-mail EBC@uspto.gov (<mailto:EBC@uspto.gov>) for specific questions about Patent Application Information Retrieval (PAIR).
- If you experience technical difficulties or problems with PAIR outside normal Patent Electronic Business Center hours (M-F, 6AM to 12AM ET), please call 1 800-786-9199.
- Send general questions about USPTO programs to the USPTO Contact Center (UCC) (<http://www.uspto.gov/web/menu/feedback.html>) .

(<http://www.uspto.gov/>)

BROWSE BY TOPIC

Patent eBusiness

- [+ Electronic Filing](#)
- [+ Patent Application Information \(PAIR\)](#)
- [+ Patent Ownership](#)
- [+ Fees](#)
- [+ Supplemental Resources & Support](#)

Patent Information

- [Patent Guidance and General Info \(http://www.uspto.gov/patents/index.jsp\)](http://www.uspto.gov/patents/index.jsp)
- [+ Codes, Rules & Manuals](#)
- [+ Employee & Office Directories](#)
- [+ Resources & Public Notices](#)

Patent Searches

- [Patent Official Gazette \(http://www.uspto.gov/news/og/patent_og/index.jsp\)](http://www.uspto.gov/news/og/patent_og/index.jsp)
- [+ Search Patents & Applications](#)
- [+ Search Biological Sequences](#)
- [+ Copies, Products & Services](#)

Other

- [Copyrights \(http://www.uspto.gov/main/profiles/copyright.htm\)](http://www.uspto.gov/main/profiles/copyright.htm)
- [Trademarks \(http://www.uspto.gov/trademarks/index.jsp\)](http://www.uspto.gov/trademarks/index.jsp)
- [Policy & Law \(http://www.uspto.gov/main/policy.htm\)](http://www.uspto.gov/main/policy.htm)
- [Reports \(http://www.uspto.gov/main/checkstatus.htm\)](http://www.uspto.gov/main/checkstatus.htm)

Patent Application Information Retrieval

[Global Dossier](#) [Order Certified Application As Filed](#) [Order Certified File Wrapper](#) [View Order List](#)

15/328,179

Coronavirus

30699/51455

[\(/pair/PAIRPrintServlet\)](#)

Select New Case	Application Data	Transaction History	Image File Wrapper	Patent Term Adjustments	Continuity Data	Foreign Priority	Fees	Published Documents	Address & Attorney/Agent	Supplemental Content	Assignments	Display References
-----------------	------------------	---------------------	--------------------	-------------------------	-----------------	------------------	------	---------------------	--------------------------	----------------------	-------------	--------------------

Assignments Data

Patent Assignment Abstract of Title

Total Assignments: 1

Application #:15328179 **Filing Dt:**01/23/2017 **Patent #:**10130701 **Issue Dt:**11/20/2018
PCT #:NONE **Intl Reg #:** **Publication #:**US20170216427 **Pub Dt:**08/03/2017
Inventors:Erica Bickerton, Sarah Keep, Paul Britton
Title:Coronavirus

Assignment: 1

Reel/Frame:043388 / 0258 **Received:** 08/24/2017 **Recorded:** 08/24/2017 **Mailed:** 08/25/2017 **Pages:** 7
Conveyance:ASSIGNMENT OF ASSIGNORS INTEREST (SEE DOCUMENT FOR DETAILS).
Assignors:BICKERTON, ERICA
 KEEP, SARAH
 BRITTON, PAUL
Assignee:THE PIRBRIGHT INSTITUTE
 333 H ROAD, WOKING
 PIRBRIGHT, UNITED KINGDOM GU24 0NF

Correspondent:

KATHERINE L. NEVILLE
 233 S. WACKER DRIVE
 SUITE 6300
 CHICAGO, IL 60606

Search Results as of: 01/28/2020 14:09:20 PM

Disclaimer:

Assignment information on the assignment database reflects assignment documents that have been actually recorded.
If the assignment for a patent was not recorded, the name of the assignee on the patent application publication or patent may be different.
If you have any comments or questions concerning the data displayed, contact OPR / Assignments at 571-272-3350

If you need help:

- Contact the Patent Electronic Business Center at (866) 217-9197 (toll free) or e-mail EBC@uspto.gov (<mailto:EBC@uspto.gov>) for specific questions about Patent Application Information Retrieval (PAIR).
- If you experience technical difficulties or problems with PAIR outside normal Patent Electronic Business Center hours (M-F, 6AM to 12AM ET), please call 1 800-786-9199.
- Send general questions about USPTO programs to the USPTO Contact Center (UCC) (<http://www.uspto.gov/web/menu/feedback.html>) .

(<http://www.uspto.gov/>)

Patent eBusiness

- [+ Electronic Filing](#)
- [+ Patent Application Information \(PAIR\)](#)
- [+ Patent Ownership](#)
- [+ Fees](#)
- [+ Supplemental Resources & Support](#)

Patent Information

- Patent Guidance and General Info
(<http://www.uspto.gov/patents/index.jsp>)
- [+ Codes, Rules & Manuals](#)
 - [+ Employee & Office Directories](#)
 - [+ Resources & Public Notices](#)

Patent Searches

- Patent Official Gazette
(http://www.uspto.gov/news/og/patent_og/index.jsp)
- [+ Search Patents & Applications](#)
 - [+ Search Biological Sequences](#)
 - [+ Copies, Products & Services](#)

Other

- Copyrights
(<http://www.uspto.gov/main/profiles/copyright.htm>)
- Trademarks
(<http://www.uspto.gov/trademarks/index.jsp>)
- Policy & Law
(<http://www.uspto.gov/main/policy.htm>)
- Reports
(<http://www.uspto.gov/main/checkstatus.htm>)

(<http://www.uspto.gov/>)

BROWSE BY TOPIC

ABOUT THIS SITE

Patent Application Information Retrieval

[Global Dossier](#) [Order Certified Application As Filed](#) [Order Certified File Wrapper](#) [View Order List](#)

15/328,179

Coronavirus

30699/51455

(/pair/PAIRPrintServlet)

Select New Case	Application Data	Transaction History	Image File Wrapper	Patent Term Adjustments	Continuity Data	Foreign Priority	Fees	Published Documents	Address & Attorney/Agent	Supplemental Content	Assignments	Display References
-----------------	------------------	---------------------	--------------------	-------------------------	-----------------	------------------	------	---------------------	--------------------------	----------------------	-------------	--------------------

Foreign Priority

Country	Priority	Priority Date
UNITED KINGDOM	1413020.7	07-23-2014

If you need help:

- *Contact the Patent Electronic Business Center at (866) 217-9197 (toll free) or e-mail EBC@uspto.gov (<mailto:EBC@uspto.gov>) for specific questions about Patent Application Information Retrieval (PAIR).*
 - *If you experience technical difficulties or problems with PAIR outside normal Patent Electronic Business Center hours (M-F, 6AM to 12AM ET), please call 1 800-786-9199.*
- Send general questions about USPTO programs to the USPTO Contact Center (UCC) (<http://www.uspto.gov/web/menu/feedback.html>).*

Patent eBusiness

- [+ Electronic Filing](#)
- [+ Patent Application Information \(PAIR\)](#)
- [+ Patent Ownership](#)
- [+ Fees](#)
- [+ Supplemental Resources & Support](#)

Patent Information

- Patent Guidance and General Info
(<http://www.uspto.gov/patents/index.jsp>)
- [+ Codes, Rules & Manuals](#)
 - [+ Employee & Office Directories](#)
 - [+ Resources & Public Notices](#)

Patent Searches

- Patent Official Gazette
(<http://www.uspto.gov/news/og/patentindex>)
- [+ Search Patents & Applications](#)
 - [+ Search Biological Sequences](#)
 - [+ Copies, Products & Services](#)

Other

- Copyrights
(<http://www.uspto.gov/main/profiles/copyright.htm>)
- Trademarks
(<http://www.uspto.gov/trademarks/index.jsp>)
- Policy & Law
(<http://www.uspto.gov/main/policy.htm>)
- Reports
(<http://www.uspto.gov/main/checkstatus.htm>)

Patent Application Information Retrieval

[Global Dossier](#) [Order Certified Application As Filed](#) [Order Certified File Wrapper](#) [View Order List](#)

15/328,179

Coronavirus

30699/51455

(/pair/PAIRPrintServlet)

Select New Case	Application Data	Transaction History	Image File Wrapper	Patent Term Adjustments	Continuity Data	Foreign Priority	Fees	Published Documents	Address & Attorney/Agent	Supplemental Content	Assignments	Display References
-----------------	------------------	---------------------	--------------------	-------------------------	-----------------	------------------	------	---------------------	--------------------------	----------------------	-------------	--------------------

Transaction History

Date	Transaction Description
11-20-2018	Sequence Moved to Public Database
11-20-2018	Recordation of Patent Grant Mailed
11-01-2018	Email Notification
10-31-2018	Issue Notification Mailed
11-20-2018	Patent Issue Date Used in PTA Calculation
10-05-2018	Dispatch to FDC
10-04-2018	Application Is Considered Ready for Issue
10-03-2018	Issue Fee Payment Verified
09-17-2018	Workflow - Drawings Finished
10-03-2018	Issue Fee Payment Received
07-11-2018	Sequence Forwarded to Pubs on Tape
07-17-2018	Email Notification
07-17-2018	Mail PUB other miscellaneous communication to applicant
07-13-2018	PUB Other miscellaneous communication to applicant
07-03-2018	Electronic Review
07-03-2018	Email Notification
07-03-2018	Mail Notice of Allowance
06-29-2018	Notice of Allowance Data Verification Completed
06-25-2018	Reasons for Allowance
06-02-2018	Date Forwarded to Examiner
05-18-2018	Response after Non-Final Action
02-20-2018	Electronic Review
02-20-2018	Email Notification
02-20-2018	Mail Non-Final Rejection
02-15-2018	Non-Final Rejection

[Privacy - Terms](#)

02-14-2018	Information Disclosure Statement considered
08-10-2017	Email Notification
08-03-2017	Application ready for PDX access by participating foreign offices
08-03-2017	PG-Pub Issue Notification
07-27-2017	Case Docketed to Examiner in GAU
07-26-2017	Email Notification
07-26-2017	Email Notification
06-26-2017	371 Completion Date
07-25-2017	Application Is Now Complete
07-25-2017	Application Dispatched from OIPE
07-25-2017	FITF set to YES - revise initial setting
06-26-2017	Patent Term Adjustment - Ready for Examination
07-26-2017	Notice of DO/EO Acceptance Mailed
07-26-2017	Filing Receipt - Updated
06-23-2017	Additional Application Filing Fees
06-26-2017	Preliminary Amendments
01-23-2017	Copy of the International Application
06-26-2017	A statement by one or more inventors satisfying the requirement under 35 USC 115, Oath of the Applic
04-24-2017	Information Disclosure Statements
04-24-2017	Information Disclosure Statement (IDS) Filed
04-24-2017	Electronic Review
04-24-2017	Email Notification
04-24-2017	Email Notification
04-24-2017	371 Supplemental Fees Missing - Form M923
04-24-2017	Filing Receipt
01-23-2017	PTO/SB/69-Authorize EPO Access to Search Results
01-23-2017	Applicants have given acceptable permission for participating foreign
01-23-2017	CRF Disk Has Been Received by Preexam / Group / PCT
02-01-2017	CRF Is Good Technically / Entered into Database
01-23-2017	Cleared by OIPE CSR
01-23-2017	ENTITY STATUS SET TO UNDISCOUNTED (INITIAL DEFAULT SETTING OR STATUS CHANGE)
01-23-2017	Initial Exam Team nn

If you need help:

- *Contact the Patent Electronic Business Center at (866) 217-9197 (toll free) or e-mail EBC@uspto.gov (<mailto:EBC@uspto.gov>) for specific questions about Patent Application Information Retrieval (PAIR).*
- *If you experience technical difficulties or problems with PAIR outside normal Patent Electronic Business Center hours (M-F, 6AM to 12AM ET), please call 1 800-786-9199.*
- *Send general questions about USPTO programs to the USPTO Contact Center (UCC) (<http://www.uspto.gov/web/menu/feedback.html>) .*

(<http://www.uspto.gov/>)

BROWSE BY TOPIC

ABOUT THIS SITE

USPTO BACKGROUND

FEDERAL GOVERNMENT

Federal Employee Profile — Bao Q. Li

Bao Q. Li

Title: Patent Examiner. (Job titles are sourced from the OPM. Keep in mind that the OPM has a limited set of job classifications with which to describe a wide variety of employees, so in some cases a generic job classification will be used if a more specific one is not available.)

Agency: Patent and Trademark Office

In 2018, Bao Q. Li was a Patent Examiner at the Patent and Trademark Office in Frederick, Maryland. As our dataset only goes as far back as 2004, it is likely that has worked in the federal government prior to 2004.

Bao Q. Li is a GS-14 under the general schedule payscale.

Year	Occupation	Paygrade	Base Salary	Bonus	Location
2018	Patent Examining	GS-14	\$140,666	\$3,067	Frederick, Maryland
2017	Patent Examining	GS-14	\$136,759	\$3,067	Frederick, Maryland
2016	Patent Examining	GS-14	\$135,405	\$4,013	Frederick, Maryland
2015	Patent Examining	GS-14	\$130,232	\$5,500	Frederick, Maryland
2014	Patent Examining	GS-14	\$128,941	\$5,369	Frederick, Maryland
2013	Patent Examining	GS-14	\$123,911	\$5,575	Frederick, Maryland
2012	Patent Examining	GS-14	\$123,911	\$6,490	Frederick, Maryland
2011	Patent Examining	GS-14	\$120,156	\$700	Alexandria, Virginia
2010	Patent Examining	GS-13	\$111,213	\$0	Alexandria, Virginia
2009	Patent Examining	GS-13	\$109,572	\$0	Alexandria, Virginia
2008	Patent Examining	GS-13	\$103,443	\$986	Alexandria, Virginia
2007	Patent Examining	GS-13	\$98,643	\$0	Alexandria, Virginia
2006	Patent Examining	GS-13	\$87,621	\$0	Alexandria, Virginia
2005	Patent Examining	GS-13	\$83,219	\$0	Arlington, Virginia
2004	Patent Examining	GS-13	\$78,652	\$0	Arlington, Virginia

FederalPay's Employee Information Policy

Federal employees' salaries are considered public information under 5 U.S.C. § 552, and in the interest of government transparency FederalPay publishes the salary information of all federal employees who earn more than \$100,000 per year, or who are in the highest paid 10% of their agency. This data is published unmodified, as provided by the OPM.

 Run a people search on Bao Q. Li 

Search Patent and Trademark Office Employees



Employee Statistics

Bao Q. Li's 2018 pay is

↑ 15%

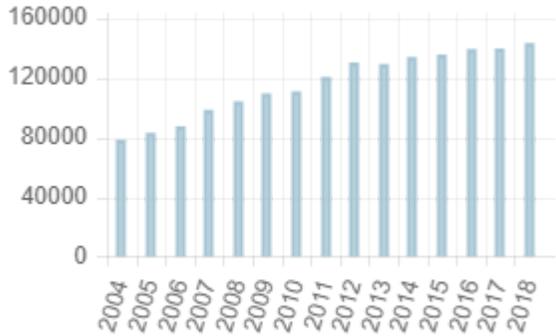
higher than the average Patent Examiner across all agencies.

Bao Q. Li's 2018 pay is

↑ 83%

higher than the average pay of a GS employee at the Patent and Trademark Office.

Bao Q. Li's pay trend during his or her government career in the Patent and Trademark Office:



Data Sources

The information provided on these pages is sourced from the Office of Personnel Management (OPM) [Enterprise Human Resources Integration \(EHRI\)](#) dataset. Postal Service data is managed exclusively by the USPS [USPS](#). All information is displayed unmodified and as provided by the source agency.

Federal employee salaries are public information under open government laws (5 U.S.C. § 552). FederalPay provides this data in the interest of government transparency — employee data may not be used for commercial soliciting or vending of any kind. [Learn more about the FederalPay Employees Dataset here.](#)

** This Document Provided By www.FederalPay.org - The Civil Employee's Resource **

Source: www.federalpay.org/employees/patent-and-trademark-office/li-bao-q

Examiner Bao Q Li

Employment Information

Group:	Immunology, Receptor/Ligands, Cytokines Recombinant Hormones, and Molecular Biology
Classes:	424 – Drug, bio-affecting and body treating compositions 435 – Chemistry: molecular biology and microbiology 506 – Combinatorial chemistry technology: method, library, apparatus 514 – Drug, bio-affecting and body treating compositions 530 – Chemistry: natural resins or derivatives; peptides or proteins; lignins or reaction products thereof 536 – Organic compounds -- part of the class 532-570 series 800 – Multicellular living organisms and unmodified parts thereof and related processes
Art Unit:	1648
Title:	Patent Examiner
Phone:	(571) 272-0904
Location:	Alexandria
Degree:	First Professional
Service:	19 years
Grade:	GS-14

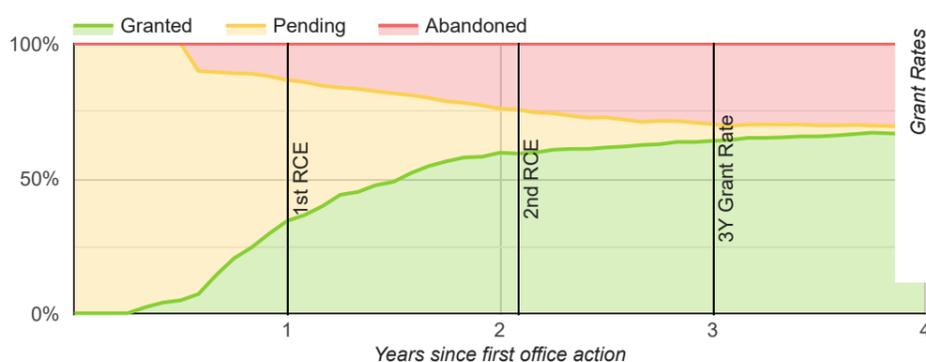
Grant Rate and Difficulty Ranking

3-Year Grant rate:	64% over 292 cases
Difficulty: 🌀	Medium
Difficulty Percentile: 🌀	50th 

With Examiner Li, you have a 64% chance of getting an issued patent by 3 years after the first office action. Examiner Li is a medium examiner and in the 50th percentile across all examiners (with 100th percentile most difficult).

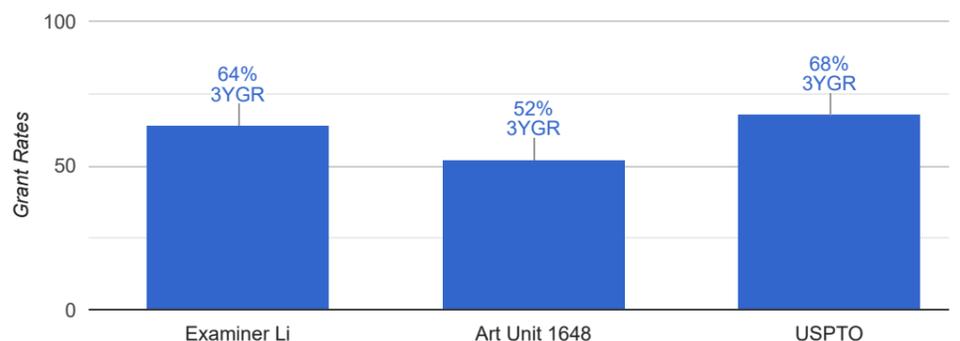
Grant Rate Timeline

Below is the grant rate timeline for Examiner Li, where the timeline is relative to the date of the first office action. The three-year grant rate is the percentage of applications granted at three years after the first office action.



Comparison with Art Unit 1648

Examiner Li's grant rate is higher than that of Art Unit 1648 and lower than that of the USPTO.



Grant Rate without Interview

Examiner Li has granted 106 of 187 cases without any applicant-requested interviews for a grant rate of 57%.

Loading...

Grant Rate with Interview

Examiner Li has granted 81 of 105 cases with at least one applicant-requested interview for a grant rate of 77%.

Loading...

Interview Benefit

With Examiner Li, conducting an interview increases your chance of getting a patent granted by 35%.

Loading...

Recent Dispositions

Loading...

Number	Title	Status	?
US20190248875A1	Zika Virus Vaccine Composition And Application Thereof	Patented	View
US20170340722A1	Novel Immunization Agents And Methods Of Use	Patented	View
US20180028833A1	Recombinant Self-Assembling Protein Comprising Target-Oriented Peptide And Use Thereof	Patented	View
US20180250385A1	Methods For Inducing Protective Immunity Against Human Immunodeficiency Virus Infection	Patented	View
US20170233450A1	Virus Like Particle Comprising Pd-1 Antigen Or Pd-1 Ligand Antigen	Patented	View
US20160022807A1	Methods And Compositions For In Vivo Immune Stimulation And Antigen Production	Patented	View
US20180127728A1	Baculovirus-Based Production Of Biopharmaceuticals Free Of Contaminating Baculoviral Virions	Patented	View
US20150306203A1	Synthetic Peptide-Based Emergency Vaccine Against Foot And Mouth Disease (Fmd)	Patented	View
US20170362278A1	Mammalian Cells Expressing Cytomegalovirus Antigens	Patented	View
US20180216201A1	Compositions And Methods For Detecting Human Papillomavirus Nucleic Acid	Patented	View
US20170326224A1	Compositions, Methods And Uses For Improved Human Papilloma Virus Constructs	Patented	View
US20180117104A1	Cancer Therapy With A Parvovirus Combined With A Bcl-2 Inhibitor	Patented	View
US20180155696A1	Methods And Compositions Relating To Viral Latency	Abandoned	View
US20170009284A1	Compositions And Methods For Detection Of Hepatitis A Virus Nucleic Acid	Patented	View
US20160200775A1	Virus Like Particle Comprising Modified Envelope Protein E3	Patented	View
US20170369931A1	Compositions And Methods For Detecting Zika Virus	Patented	View
US20160331832A1	Purification Of Herpes Virus	Patented	View
US20180127480A1	High Affinity Cd47 Analogs	Patented	View
US20170224807A1	Newcastle Disease Virus Vectored Avian Vaccines	Patented	View
US20170320918A1	Recombinant Proteins Of Parapoxvirus Ovis And Pharmaceutical Compositions Therefrom	Abandoned	View

Appeals Statistics Available with Subscription

We have history of 29 appeals for this examiner. Please [subscribe](#) for full access to appeals statistics.

Appeals Statistics Available with Subscription

We have history of 29 appeals for Examiner Li. Please [subscribe](#) for full access to appeals statistics.

See our [appeals statistics for this tech center](#) for an example of our appeals statistics.

Disclaimer: We do not provide any guarantees as to the accuracy of the statistics presented above and under no circumstances will we be liable for any outcome resulting from your reliance on the above statistics.