



Animal &  
Plant Health  
Agency

# Science Strategy 2021 to 2026

## Expertise with Impact

### Overview of scientific portfolio and discipline strategies

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## Introduction

APHA, as an Executive Agency of the Department for Environment Food and Rural Affairs (Defra), is responsible for responding to biosecurity threats to the UK from endemic or exotic animal diseases (including zoonotic diseases), pests and diseases of plants and bees, and invasive non-native species. We provide high containment laboratory and animal facilities, scientific expertise in a range of microbiological and analytical disciplines, research and test development functions to diagnose known diseases and develop tests and reagents to detect new diseases and support outbreak control measures.

Our Science Strategy 2021-26 underpins our APHA Mission Statement; **Safeguarding animal and plant health for the benefit of people, the environment and the economy.**

Our science is delivered through portfolios led by a Lead Scientist for that area. The science specialism and capability are within our science depts and these are underpinned by cross department disciplines. The following pages provide a top-level overview of each of the portfolio or discipline strategies. Please contact the relevant Lead Scientist for more information on that area.



## Portfolio: Animal and Zoonotic Viral Diseases

### Overview

Our mission is to conceive, develop and implement high impact investigative, translational and fundamental state-of-the-art research and development science on viral diseases of animals and those transmissible to/from people delivering to the UK science agenda. The purpose is to protect and mitigate viral pathogen (notifiable, reportable and endemic disease) infection and transmission in livestock, wildlife, companion animals and the public through improved biosecurity and biosafety from farm to fork, enable safe and secure trade (import/export) and to support domestic biodiversity.

### Main goals

- Provide knowledge, expertise and technology to address policy needs for Defra, across HMG, Scottish Government and Welsh Government.
- Maintain and develop future-proof science for Defra and non-Defra stakeholders; supported through diversification of funding.
- Innovation to ensure capability and capacity, and resilience and preparedness to control animal and zoonotic threats in support of the UK economy.
- Champion One Health and Disease-X; including vector borne diseases.
- Expand our National and International Science Centre, Trusted Partner and Global Influencer (OIE, FAO, WHO, ODA, UN SDGs) status.
- Explore Disease Syndromics (multi-pathogen, host responses and environmental circumstances) and intervention measures.
- Contribute to providing the scientists of the future via educating the next generation of researchers.

### How we achieve these goals

We provide integrated surveillance, veterinary services, diagnostics and under-pinning research and development to enable characterisation of animal and zoonotic viral diseases, both exotic and endemic, of production, reportable and notifiable categories. We hold reference laboratory status at three levels; Designated, National and International, including disease consultants and discipline champions, and maintain succession plans to support future requirements including a Disease Emergency Response Committee. The wider portfolio includes multi-disciplinary components from epidemiology and risk assessment, veterinary pathology, wildlife and animal

services allowing a holistic integrated team. Engagement with policy and evidence groups across government including public health, food production industries and specialist species interest groups provides a broad spectrum approach. Our experts are members of global scientific networks and committees ensuring that our contributions are impactful, timely, co-ordinated and value for money. Defra core research framework investments are complemented by non-Defra funded science, current funding streams will be consolidated and refined, and new avenues broadened for future scope. The latter including Innovate UK, Strategic Priorities Funds and UKRI with our newly acquired Public Research Sector Establishment status, Horizon Europe in the short term, ODA-FCDO, North American avenues, Commonwealth and other initiatives. This combination allows us to be responsive to current threats and undertake horizon scanning for new and re-emerging hazards in a unique way within the UK and internationally.

### **Strategic priorities for 2021-2026**

- Strengthen our exotic notifiable disease surveillance and responsiveness.
- Ensure robust high quality One Health approach (animals, human, and environmental factors).
- Harness our flexibility for Disease –X preparedness.
- Improve pathogen biosecurity – farm to fork, import/export and at the animal-human interface.
- Syndromics (microbiome / host responses) approach to integrated animal and zoonotic disease intervention and mitigation.
- Continue to innovate our sciences; facilities, technical equipment and data analyses.
- Sustainability of specialist subject expertise, skilled capability and capacity, networks and partnerships.

## Portfolio: Bacterial Diseases & Food Safety

### Overview

Our role is to provide scientific evidence, assurance, expert advice and laboratory services to Government regarding detection and control of notifiable and endemic bacterial diseases to protect animal health and to minimise the occurrence of zoonoses, toxins and antimicrobial resistance in livestock and the food chain, thereby protecting public health.

### Main goals

- Provide knowledge, expertise and technology to address policy needs.
- Maintain science to ensure that Defra and wider government has the capability and capacity to **prevent, detect** and **respond** to animal disease outbreaks.
- Support and improve statutory monitoring and surveillance.
- Collaborate with key partners to address national and global threats.

### How we will achieve these

We provide surveillance, veterinary and laboratory services to enable detection, characterisation and control of statutory bacterial diseases of livestock (excluding Bovine Tuberculosis for which there is a dedicated strategy), endemic zoonoses and antimicrobial resistance of veterinary pathogens. Our National and International Reference Centres play a key role in surveillance, incident investigation and control programmes and develop new tools for disease detection, definition and mitigation. Our national veterinary capability investigates and responds to potential food safety and public health threats supported by epidemiologists and risk analysts and our laboratory capability. We maintain a range of disciplines and skills to understand the epidemiology, pathogenesis and risks of bacterial threats and deploy our scientists flexibly improving our ability to respond to outbreaks and emerging threats. Effective integration of surveillance evidence and translational research drives ongoing innovation and improvement, maximising science impact. We work in partnership with policy teams, industry, academia and public health authorities. Our experts are members of networks and committees influencing development and adoption of new tools and best practice and ensuring our science is effectively focused and integrated. Our international outreach supports efforts to improve global health security and helps maintain our specialist expertise and awareness for disease threats coming closer to our borders.

### Strategic priorities for 2021-2026

- Strengthen exotic notifiable disease preparedness and surveillance.
- Strengthen new and emerging disease preparedness and surveillance.

- Food safety in primary production.
- Addressing the threat of antimicrobial resistance.
- Advanced technology and future diagnostics.
- International One Health co-operation.
- Expert specialists in core capabilities.

# Portfolio: Bovine Tuberculosis

## Brief description

Our role is to provide the highest quality evidence, capacity, expertise, analyses and advice to Government (Defra and the devolved administrations) regarding the detection, control and eradication of bovine TB across GB. Allowing government to meet statutory obligations to enable international trade; and supporting policy design to meet the specific eradication/ disease freedom strategies of the three administrations. The expertise which positions us to perform this role is underpinned through world class research and development across the portfolio.

## Main goals

- Maintain/improve statutory surveillance activities, providing adaptable capacity as policies evolve.
- Provide stable core expertise in key laboratory-based science disciplines to future proof [through innovation and adopting new technologies] scientific evidence provision for our policy customers.
- Provide bTB data-based science discipline capability, improving knowledge and analyses; to better understand the sources of cattle infection and enable disruption of infection pathways.
- Expand our international role through greater leverage of OIE reference laboratory status, maintaining strategic partnerships and forging key collaborations across sectors, national and internationally.
- Implement agreed Defra commitments to Godfray Review (England).
- To licence a deployable bTB vaccine and associated DIVA Skin Test for cattle before 2025.

## How we achieve these goals

- We provide integrated surveillance, diagnostic, laboratory and epidemiological analyses of the bTB epidemic in GB. Underpinned by multidisciplinary research in laboratory [microbiology, molecular biology, immunology, pathology, animal sciences]; field [veterinary, epidemiology, ecology] and data sciences [epidemiology, genomic analyses, movement data, risk analyses, modelling]; accelerates innovation, enabling rapid development and adoption of new tools.



- Working in close partnership with policy [with differing bTB epidemiology] allows specific; analyses, propose new tools, add value and enhance evidence, thus enabling rapid administration-specific policy development.
- Holding National and OIE reference laboratory status we maintain key collaborations with national and international partners; academic, governmental and NGO's. Our experts are members of global networks and committees ensuring contributions are impactful, timely, coordinated and effective.
- Primarily funded through core commission, Defra TB Programme-specific funding and GB TB R&D funding on behalf of England, Scotland and Wales. Complemented by UKRI/ Bill & Melinda Gates Foundation/FCDO. We plan to leverage APHA Public Research Sector Establishment status to add value and diversify science funding streams. Recent advancements are relevant in a global context for bTB, and we seek to build on this, exploiting IP through APHA Scientific™.

### **Strategic priorities for 2021-2026**

- Maintain and improve statutory surveillance and testing, providing increased capacity and better tests.
- Integrate diagnostics, surveillance and epidemiology to identify and control bTB faster.
- Deliver robust WGS, real-time bioinformatic analyses of breakdowns and integrated field tools.
- Sustain our critical specialist capacity in infection, diagnostics and vaccination research to deliver deployable cattle vaccine/DIVA test.
- Support changes in wildlife bTB control operationally and through research.
- Diversify our research portfolio and its funding base.
- Strengthen our reference laboratory capability and grow our global influence.

## Portfolio: International Science Development

### Overview

There is a need for further international engagement with a strategic goal of broadening the agency's funding base and utilising the unique assets within the agency to their full potential. Consequently, APHA will continue to engage fully with our principal sponsor, Defra. The International Development Strategy focuses on the opportunities available for the agency in pursuing a programme of international global outreach.

In the next five years, the principal goals will be to extend the range of strategic opportunities, international appointments, partnerships and funding sources across the entire remit of the agency.

The following benefits describe, the principal benefits of APHA's international core capabilities and functions and how APHA's international activities contribute to fulfil the corporate purpose and to meet the expectations of major customers and stakeholders.

These include

- Knowledge management.
- Influence development of policies on international level.
- Learning and promoting best practice.
- Personal development of people to become internationally recognized experts.
- Creating opportunities utilising unique capabilities and services.
- Access to scarce skills through international networks and collaborations.
- Benchmarking with 'peer organisations' in evaluating our own performance.
- Recognition, visibility and impact as an international organisation.

### Main goals

- Enhance the international engagement and influence worldwide.
- Strengthen strategic partnerships and collaborations.
- Support global scientific engagement.

- Facilitate future UK global trade deals.

### **How we achieve these goals**

- Work together internally to improve and develop international engagement.
- Develop, support and share approaches, expertise and information internally and externally.
- Provide opportunities for using 'soft power' to improve influence and impact.

### **Strategic priorities for 2021-2026**

- Develop internationally focused partnerships across the Defra Group.
- Extend the international funding opportunities with other government departments.
- Support a One Health programme for global scientific engagement.
- Develop international networks and improve international relationships.
- Support International Global Health Security projects.
- Enhance staff engagement for secondment positions and international studentships.
- Extend the range of international alliances and bilateral partnerships.
- Broaden our international 'soft power' influence and impact.
- Enrich international knowledge management.
- Develop a Commonwealth Laboratory Network.

## Portfolio: Plant and Bee Health

### Overview

Our Mission is to protect the UK and international plants and bees by providing world class inspection, quarantine and certification services across England and Wales and to continue to be internationally recognised as a gold standard for plant and bee health inspections.

The UK Plant Health Risk Register identifies in excess of 1,100 plant pests and diseases that could seriously damage crops and plants in the UK. By maintaining and promoting a high plant health status, we can reduce this biosecurity threat and protect the £9 billion annual value of our crops, horticulture and trees, which deliver benefits to our economy and society. APHA actions also maintain healthy honey bees; bee pollination services are critical for both ecosystem function and crop production and are estimated to be worth £690 million a year to UK agriculture.

Our science strategy underpins all aspects of our plant and bee health inspection work with the aim of improving efficiencies by identifying, researching, field testing, enabling and communicating latest technologies.

### Main goals

- Provide rapid and effective response to quarantine pests, diseases as well as to Genetically Modified Organisms (GMO) incidents.
- Support and improve through new technologies and research statutory monitoring, sampling methodologies and surveillance.
- Provide expert knowledge and advice to the office of the Chief Plant Health Officer on inspections, new outbreaks and policy.
- Train 200 additional inspectors and update existing workforce.
- Deliver outreach activities for new and emerging threats.
- Collaborate with key partners to address national and global threats.

### How we achieve these goals

We provide specialist inspection services for England and Wales. Research projects are primarily geared towards field testing new molecular tools, geographical information systems and sampling processes. We work in partnership with Defra, Welsh Government, Fera Science Limited and others to meet current and future needs including development of better diagnostics, risk analysis tools and advice. An annual programme of outreach and citizen science events is maintained, to ensure good engagement and networking with stakeholders and the general public and encourage

behavioural change to prevent incursions of plant and bee pests and diseases. External publications are primarily via blogs and grey literature. Within the Agency, inspectors are kept up to date with the latest developments through a series of internal communication tools.

### **Strategic priorities for 2021 – 2026**

- Strengthen our pest and disease preparedness.
- Enhance our in-field diagnostic capability including at future border control posts.
- Maintain and extend our ISO 17020 accreditation.
- Improve inspector knowledge and capability through external academic study and practical learning as opportunity arises.
- Build on our international reputation for enhancing public awareness about plant health biosecurity.

## Portfolio: Scanning Surveillance

### Overview

APHA's scanning surveillance mission is to enable timely detection, characterisation, assessment and mitigation of disease-related threats to livestock and wildlife through provision of veterinary and other scientific expertise in England and Wales, delivered by APHA's network of Veterinary Investigation Centres (VICs) and laboratories, in partnership with other providers, and the APHA Surveillance Intelligence Unit.

### Main goals

- Maintain an APHA laboratory and partnership network of expertise to detect disease threats that affect livestock and wildlife (and potentially people too).
- Systematically collect, analyse and interpret data generated from that network.
- Integrate alternative data sources that effectively complement the data currently generated from APHA's scanning surveillance programme.
- Interpret data and alerts from various sources to provide intelligence that can be acted upon to mitigate impact of disease-related threats.
- Communicate information to those who need to know in order to take action.
- Support current and new Government policies for Animal and Public Health and biodiversity.

### How we will achieve these

We will deliver a frontline diagnostic service through our own VICs and partner post mortem examination (PME) services, which is supported by access to appropriate tests, deploying new diagnostic technology where appropriate, and IT to enable detection and characterisation of disease-related threats. This will be supported by having veterinary and scientific staff with the appropriate expertise. We will continuously evaluate and characterise threats that have an impact on animal health and welfare, including (but not restricted to) diseases (including zoonoses), husbandry practices and environmental changes, evaluated through our networks of expertise, which are mainly delivered through the Species Expert Groups (SEGs). The SEGs provide a platform that enables effective joining up of government bodies and agencies, academia and industry, with APHA's science network, allowing rapid deployment of APHA's international experts and new diagnostic technologies developed at Weybridge. We will communicate this intelligence within and beyond Government to enable effective mitigation and policy development (e.g. to the Veterinary Risk Group and the Human Animal Infectious Risk Group (HAIRs)). We will seek to

continuously improve by applying recommendations from surveillance reviews, for example recognising that successful surveillance is dependent on engagement with appropriate scanning surveillance stakeholders at local and national levels.

### **Strategic priorities for 2021-2026**

- Strengthen the network of front line diagnostic services including accessibility through the free carcase collection service. From 2021 we will expand the partner post-mortem provider network to facilitate access to our pathology services.
- Maintain and develop a suite of tests, deploying new diagnostic technology where appropriate, including application of molecular tests to aid novel pathogen identification and characterisation.
- Invest in post-graduate training of our staff, including Master's Degrees and Diplomas in Conservation Medicine, Veterinary Parasitology, One Health and Animal Welfare.
- Develop and improve our data analytics tools, including making dashboard technology more widely available across our veterinary teams.
- Develop new technology to extract text data.
- Communicate intelligence from scanning surveillance and enhance our engagement with stakeholders; applying the outputs from a co-funded PhD student to our current communication activities; making more use of various social media channels and YouTube videos; representing APHA on new stakeholder surveillance groups.

# Portfolio: Transmissible Spongiform Encephalopathies (TSE)

## Overview

Our role is to maintain the ability to confirm existing and detect new and emerging (or re-emerging) Transmissible Spongiform Encephalopathy strains using biological, pathological and molecular methods and maintain the capability to characterise any resulting disease in an animal model. Function as National Reference Laboratory (NRL) for TSEs and for animal protein detection in feedstuffs and OIE reference laboratory for BSE and scrapie and to give disease advice on UK surveillance; effective response to outbreaks and potential risks to the food chain.

## Main goals

- Provide knowledge, expertise and technology to address policy needs, particularly in relation to UK surveillance, effective response to outbreaks and potential risks to the food chain.
- Maintain scientific expertise and capability to detect and characterise existing and novel TSE agents and to inform on preventive measures.
- Support and improve statutory surveillance and feed testing.
- Collaborate with national and international partners to address gaps in TSE research relevant to policy needs.

## How we achieve these goals

As NRL we provide surveillance for TSEs in food animals, including confirmatory diagnosis, and feed testing for animal protein as part of the surveillance contracts, which involves both laboratory staff and field service. Core capability is also maintained through research using specialist ACDP 3 biocontainment facilities and a multidisciplinary team of animal scientists, veterinary clinicians, pathologists and pathology research scientists, molecular biologists, geneticists, epidemiologists as well as data and risk analysts. This is key to respond to and advise on existing and novel TSE agents and their associated threats to animal and human health, both at national and international level (as OIE reference laboratory). A biological tissue archive with a large collection of tissues enables us to store and supply samples to comply with statutory requirements and to foster collaborations with other national and international research groups.

## Strategic priorities for 2021-2026

- Strengthen our TSE surveillance and preparedness for novel TSE agents.



- Ensure robust quality monitoring of animal feed to provide reassurance on the integrity of rations and feed ingredients for food producing animals.
- Contribute to reducing or eradicating existing TSEs.
- Continue to develop our science and scientific output utilising new technologies.
- Maintain capability and expertise in TSEs with skilled staff, excellent animal and laboratory facilities and equipment.
- Networking, partnership and collaboration with national and international expert.

## Portfolio: Wildlife (NWMC)

### Overview

The National Wildlife Management Centre (NWMC) provides evidence, impartial advice and services, primarily to Defra and the devolved governments, to resolve human-wildlife conflicts and to support policy development, evaluation and review, drawing on expertise in wildlife disease, wildlife management, animal ecology, invasive non-native species, population modelling, and animal welfare.

### Main goals

- Maintain a core capability and capacity to prevent, respond to, resolve and advise on human-wildlife conflicts to ensure Defra can respond to any such conflicts.
- Maintain and grow our national and international reputation for the quality and impact of our science.
- Be a central part of integrated national wildlife management functions to advise policy as required.
- Be innovators in wildlife science, nationally and internationally.

### How we achieve these goals

We provide an integrated end to end service for research, evaluation, analysis, contingency planning and delivery for human wildlife conflicts in the areas of wildlife diseases and non-native species. We host the non-natives species secretariat (NNSS) which acts as a hub for communication between government, key stakeholders and the general public. NWMC hosts the highest concentration of wildlife ecologists in the UK, with extensive experience in wildlife disease ecology and management, and have managed the Woodchester Park badger research site for 40 years. We have a specialist firearms team, specialist wildlife holding capacity, run the only Home Office accredited wildlife module for the Scientific Procedures Act and host the National Reference Laboratory for both *Trichinella* and *Echinococcus*.

### Strategic priorities for 2021-2026

- Broaden the wildlife disease capability to deal with new taxa and diseases to strengthen Defra's ability to respond to wildlife disease outbreaks.

- Strengthen the quality of non-native species management, with improved detection, integrated field management, robust contingency plans and to publish successful completions.
- Extend the work of the parasitology NRL for new species, and to maximise the benefit of the samples coming in, to ensure a critical mass of expertise.
- Sustain and grow our specialist expertise (particularly population control, sampling, and analysis and modelling) to help Defra deal with new and emerging wildlife management issues.

## Discipline: Animal Sciences

### Overview

Our role is to maintain capability in carrying out scientific studies in animals protected under the Animal Scientific Procedures Act (ASPA) 1986 to contribute to APHA's objective to safeguard animal health. This is in support of surveillance activities, research in animal diseases or diseases affecting human health caused by infectious agents as well as vaccine and diagnostic test development, validation or maintenance.

### Main goals

- To maintain capability and expertise in accommodating and caring for animals used for scientific experiments up to biocontainment level 3.
- To have competent and skilled staff to carry out procedures licenced under ASPA in animals on study and to fulfil the roles of named individuals under ASPA.
- To provide knowledge and advice to researchers aiming to use animals for research.
- To ensure that animal studies are undertaken only after ethical review and consideration of the 3Rs: alternatives (replacement), sample size (reduction) and methods to alleviate pain and suffering (refinement).
- To contribute to research on refining animal studies.

### How we achieve these goals

We provide animal science support to various science portfolios at APHA and national and international partners by providing animal husbandry and scientific staff, animal care and welfare officers and veterinarians with expertise in the relevant species, competence in carrying out procedures and training others, and ability to advise other researchers in the conduct of animal studies. We maintain animal facilities up to biocontainment level 3, overseen by staff with expert knowledge in biosecurity and biosafety. Our experts are members of various networks to foster collaboration, exchange knowledge and develop new techniques, and we draw on experts from other workgroups, such as statisticians and scientists, to conduct animal studies that cannot be replaced in the most ethical manner.

### Strategic priorities for 2021-2026

- Strengthen resilience to have a flexible workforce and the ability to carry out animal studies with appropriate personnel nominated and competent to fulfil their roles under ASPA.

- Strengthen animal species specialism and biosafety and biosecurity awareness.
- Ensure animal facilities are available and fit for purpose to support APHA's science strategy.
- Design of new *in vivo* building in the masterplan for APHA site development.
- Development of technologies for refinement of animal studies.
- Increase network, partnership and collaboration with other national or international research institutes.

## Discipline: Bacteriology

### Overview

Our role is to maintain and develop capabilities supporting the delivery of specialist diagnostics, surveillance, reference functions, consultancy and emergency response capabilities applicable to key veterinary and zoonotic bacterial pathogens, both endemic and exotic.

### Main goals

- Work across portfolios and departments to support delivery of diagnostics, surveillance, consultancy and emergency response on behalf of Defra and the devolved administrations related to bacterial diseases.
- Deliver an underpinning programme of applied research providing expert advice to support and shape policy and developing and implementing relevant new tools.
- Maintain a cadre of staff with core skills in Bacteriology, alongside supporting infrastructure, deployable to respond to any emerging bacterial threat supporting the strategic objectives of threat detection and mitigation.

### How we achieve these goals

- Design, plan and deliver applied research programmes.
- Deliver laboratory aspects of statutory surveillance programmes.
- Work with public health partners in outbreak investigations of zoonotic pathogens.
- Deliver National and International (OIE, FAO) Reference Laboratory functions.
- Enable evidence-based policy by delivery of authoritative reports, consultancy and publications.

### Strategic priorities for 2021-2026

- Engage with the SCAH programme to ensure facilities for Bacteriology are appropriate and future proofed and to maintain business as usual during a transition phase.
- Support the move to whole genome sequencing approaches for core diagnostic and epidemiological analysis particularly for bovine TB and *Salmonella* serotyping.

- Ensure we maintain, build and exploit reference laboratory activities promoting APHA visibility internationally.
- Strengthen activities in the strategically important area of bacterial AMR.
- Build strong leadership and succession and ensure that skills are developed and maintained in key areas (laboratory skills, writing skills and data analysis).
- Build a stronger and supportive Bacteriology community that cross-cuts departments and portfolios.
- Diversify funding base and exploit existing Intellectual Property through APHA Scientific.

## Discipline: Data Sciences

### Overview

Data sciences at APHA are the use of algorithms, processes and software to extract and analyse data from the surveillance of pathogens affecting livestock and wildlife. In the wider context this can also include data on climate, demographics and policy changes. This application of quantitative methods generates insights on changing patterns of animal disease which supports decision making and contributes to evidence for future policy. Data science and the communication of its outputs is a fundamental discipline within the Science portfolio.

### Main goals

- Building a community of data scientists to allow knowledge transfer of methodologies and datasets.
- Ensuring that IT systems and infrastructure are fit for purpose to enable effective delivery of data science.
- Development of training programmes to build data science expertise across the Science portfolio.
- Identification of and access to the best available data for analysis and interpretation.
- Use of data science outputs to generate high impact evidence and drive policy change.

### How we achieve these goals

- Identification of existing experienced data scientists to work alongside newer starters to build confidence and introduce techniques, approaches and datasets. Liaise with Centres of Excellence for Earth Observation and Data Science within Defra.
- Engagement with IT service providers to ensure data scientists have access to data and software promptly and encourage use of the APHA Scientific Computing Environment.
- Work with external data providers regarding provision of Earth Observation and climate data. Exert influence as a stakeholder to changing data systems such as the implementation of the Livestock Information Programme (LIP) to ensure continued effective data provision.
- Engage with policy customers to ensure outputs are fit for purpose and responsive to evolving evidence requirements.



## Strategic priorities for 2021-2026

- Interpretation of molecular data for use in epidemiology and outbreaks.
- Building capacity in analysis and application of climate and earth observation data.
- Building frameworks for the use of already developed transmission models to evaluate impacts of disease controls.
- Encourage transparent publication of UK surveillance outputs that were previously covered under EU surveillance.
- Adoption of [Aqua Book](#) or equivalent quality standards in ongoing and new data science analyses.
- Stakeholder in SCAH programme to ensure that digital vision and data provision provides an uplift to data science capability.

## Discipline: Epidemiology

### Overview

- Epidemiology is a critical discipline and skillset used across APHA including field operations, surveillance, research and policy advice.
- In this context, it includes a family of sub-disciplines, notably field and analytical epidemiology, qualitative risk assessment, data management and visualisation and epidemiological modelling.
- Our role is to provide epidemiological advice and assessment on the determinants, level and distribution of disease to inform disease control and prevention policy.

### Main goals

- Provision of high quality epidemiological assessment, analysis and advice.
- Ensure epidemiological capability to respond to outbreaks of exotic notifiable disease in animals.
- Provision of epidemiological expertise to other areas of animal health including bovine tuberculosis, zoonoses and new/emerging diseases to inform the identification of effective measures of disease control and prevention.
- Maintenance and development of our epidemiology network within and outside of APHA.
- Incorporation of new technologies such as whole genome sequencing to enhance the epidemiological evidence base.

### How we achieve these goals

- Integration of epidemiology activities across APHA to make best use of data and knowledge from surveillance activities, research and investigations.
- Co-ordination and delivery of outbreak investigations as well as input to the design and participation of outbreak simulation exercises.
- Designing, planning and carrying out statistically-valid research and surveillance studies.
- Regular engagement with other disciplines and across APHA epidemiology areas, including promotion of cross team working.

- Development and delivery of epidemiological training within and outside of APHA.
- Epidemiological input to the implementation and routine use of whole genome sequencing to enhance epidemiological understanding.

### **Strategic priorities for 2021-2026**

- Seek to raise awareness of the epidemiology discipline and its role with key internal and external stakeholders to maximise its use.
- Development of the pathway for career progression for roles associated with the epidemiology discipline.
- Establishment of a training plan to build expertise and capacity within APHA in the epidemiology disciplines.
- Maximise the opportunities arising from the joint APHA / RVC OIE Collaborating Centre for Risk Assessment and Modelling; raising the profile of APHA internationally.
- Incorporation of new technologies, tools and approaches in our ways of working to enhance the epidemiological evidence base.
- Seek to build on existing and develop new collaborations for epidemiological research and analysis.

## Discipline: Molecular Biology

### Overview

Molecular biology is the study of macromolecules in biological systems and in this context particularly nucleic acids. Our role is to promote and facilitate the use of molecular biology laboratory procedures for the detection and characterization of DNA and RNA to fulfil the strategic objectives of threat detection and mitigation. This involves both surveillance and research activities which are key to protecting animal and plant health. In addition, an expanding area is bioinformatics, the analysis of data-rich molecular biology outputs and therefore there are commonalities with Data Science and the outputs are used to inform epidemiological investigations.

### Main goals

- To ensure that molecular biology is utilized appropriately in all areas of APHA's remit.
- Effective and appropriate implementation of emerging technologies.
- Embedding bioinformatics into our Quality management system.
- Link with other disciplines and portfolios to enhance usage of molecular biology methodologies and ensure outputs are used to their full potential.

### How we achieve these goals

- Develop key strategic partnerships, across the Defra group, other government and devolved administrations and the wider scientific community.
- Facilitating discussion between molecular biology experts working in different portfolios, by highlighting best practice and new developments.
- Interact with other disciplines such as parasitology and vector-borne diseases to drive uptake of molecular biology in these areas.
- To undertake effective horizon scanning for emerging molecular biology technology which may benefit APHA (in terms of cost-effectiveness, speed, sensitivity, etc.).
- Work with Data Science and Epidemiology disciplines to develop efficient data analysis and interpretation of outputs.

## **Strategic priorities for 2021-2026**

- Ongoing programme of validation and external accreditation of appropriate molecular biology methods to support our testing portfolio.
- Participation in SCAH programme to ensure molecular biology and bioinformatics are appropriately provisioned.
- Develop highly automated processing and analysis of data-rich molecular biology outputs, such as high-throughput sequencing data.
- Validate bioinformatics workflows to aid the understanding of disease transmission and epidemiology.
- Ensure appropriate skills and resources for molecular biology and bioinformatics are maintained and enhanced where necessary.

## Discipline: Parasitology

### Overview

In the next five years it is important that the parasitology discipline continues to align with scanning surveillance objectives in detecting, monitoring, characterising and mitigating new and emerging parasitological threats.

These include:

- The high welfare and economic costs of endemic parasitological diseases.
- The risks to food security of antiparasitic treatment resistance.
- Increasing concerns of parasite treatment residues in the environment.
- Incursion of exotic parasites which may affect our ability to trade.
- Endemic and exotic parasites that have zoonotic potential.

We provide unique expertise in parasitology to other research collaborators both within APHA and externally.

### Main goals

- Develop and share expertise internally and externally.
- Strengthen collaborations.
- Develop testing portfolio.

### How we achieve these goals

- We provide training opportunities and job shadowing for veterinary and scientific staff.
- Publish widely and provide speakers on a range of parasitological topics, providing independent, unbiased scientific advice.
- Collaborate actively with key academic and industry partners and apply for and participate in research projects as appropriate.
- Constantly assess our testing portfolio, researching and validating new tests as appropriate.

### Strategic priorities for 2021-2026

- Increase the visibility of parasitology as a discipline within APHA.
- APHA be acknowledged as a source of independent expert parasitological advice to industry, government and outside academic organisations.
- Further develop leadership, succession planning, scientific potential and sufficient staffing within all groups involved in parasitology in APHA.
- Continue and drive forward scanning and targeted surveillance for parasitology.
- Maintain and develop the testing portfolio, to support surveillance requirements and expedite movements of animals.

## Discipline: Pathology

### Overview

Our role is to provide and maintain veterinary pathology expertise and capability at APHA to support the surveillance and diagnosis of notifiable, endemic, emerging or zoonotic diseases of livestock, poultry, wildlife and companion animals and the multidisciplinary *in vitro* and animal research programmes and activities carried out across APHA's science portfolios to protect animal and public health.

### Main goals

- To provide expertise and consultancy in the use and application of veterinary pathology in surveillance and research to address policy needs.
- To maintain capability and proficiency to conduct disease investigations and post mortem examinations of animals in biocontainment levels 2 and 3 (up to ACDP3/SAPO4).
- To develop specialist veterinary pathologists and pathology scientists and maintain core skills in specialised microscopy platforms and a suitable toolbox for the demonstration of pathogens and the study of host responses.
- To promote APHA's pathology capability and develop strategic partnership with key government agencies and academia in the UK and abroad.

### How we achieve these goals

We provide veterinary and scientific advice and consultancy underpinning research and surveillance, including gross pathology and disease investigation, histopathology, specialist microscopy and a variety of diagnostic methods for pathogen detection and host response investigations *in situ* across various portfolios at APHA and for external partners. We provide capability and support for emergency response and preparedness for notifiable and new and emerging diseases and the identification of new threats, including provision of suitable post-mortem facilities and trained staff. We are part of multi-disciplinary cross-cutting research teams delivering *in vitro* and animal studies that address policy relevant needs. We invest in the development of new technologies and tools to aid in the identification of pathogens and understanding of disease pathogenesis, tailored to current and future needs. We engage with stakeholders and policy makers to confirm aligned support and participate in scientific networks to increase the impact of our contributions.



## Strategic priorities for 2021-2026

- Expand our resilience and responsiveness to exotic notifiable and emerging diseases.
- Strengthen our pathology capability and specialism for endemic disease surveillance.
- Ensure development and application of new technologies.
- Maintain and expand *post mortem* biocontainment specialism and capability.
- Increase our visibility as a centre of excellence for surveillance and research pathology.
- Participation in SCAH programme to facilitate site development and ensure pathology capability is both maintained and developed.

## Discipline: Vector Borne Diseases

### Overview

Our strategy is to expand and develop the breadth of skills, testing capability and knowledge in vector borne diseases (VBDs) of livestock and plant pests. Consequently, APHA will develop and build collaborations with other government and non-government institutions, including academia and industry, to advance the detection of VBDs and enhance research. We will develop techniques for detecting VBDs in animals and plant pests and improve surveillance using advanced technologies, applying these in support of national and international disease monitoring and risk analysis.

### Main goals

- Identify gaps in expertise, tests and research in VBDs, with a focus on national capabilities.
- Strengthen national and international strategic partnerships and collaborations.
- Develop and design strategies for identifying and addressing emerging VBD threats in animals and plants.
- Provide advice and information on emerging VBD threats to policy customers and other stakeholders.

### How we achieve these goals

- Broadening expertise in VBDs of animals and plants, either through the APHA science network or by fostering new external collaborations.
- Developing a VBD surveillance strategy by integrating APHA groups specialising in research, molecular development, pathology, diagnostics, epidemiology, field investigation and disease mitigation and by applying advanced technology and climate monitoring techniques.
- Improving disease and vector threat identification by co-ordinating a network of national and international experts in VBDs and plant pests, working collegiately across government with national and international stakeholders.
- Assessing current and potential new VBD threats with a view to prioritising those of most significance to animal, plant and public health. Prioritisation of diseases will take into consideration a range of vectors and associated bacterial, viral and protozoal infections, with a focus on mosquito-borne and tick-borne diseases.

- Mosquito-borne viruses: Bovine Ephemeral fever virus, West Nile fever virus, Usutu virus, Rift Valley fever virus and Japanese encephalitis virus.
  - Tick-borne viruses: Tick-borne encephalitis virus, Louping Ill virus and Crimean-Congo haemorrhagic fever virus; Tick-borne bacteria: *Borrelia burgdorferi* and *Staphylococcus aureus*; Tick-borne rickettsia: Mediterranean spotted fever and other unrecognised agents of rickettsiosis.
  - Protozoa include: *Anaplasma phagocytophilum*, *Babesia canis* and *Babesia divergens*.
  - Plant pathogens include: *Xylella fastidiosa*.
  - Plant pests include: aphids in potato crops.
- Undertaking complimentary species identification, particularly for temperate and tropical mosquitoes and ticks, using host DNA Barcoding molecular techniques.
  - Increasing the number of diagnostic tests for detecting VBDs of animals and plant pests.
  - Establishing new methods of knowledge management by developing a VBD webpage on the APHA Vet Gateway and using social media outlets.
  - Attending national meetings and international conferences and by increasing the number of publications.

### **Strategic priorities for 2021 – 2026**

- Enhance capabilities to respond to priority VBDs and plant pests, addressing gaps, where appropriate.
- Co-ordinate expertise to identify priority animal pathogens and plant pests using a risk assessment approach.
- Identify and initiate new strategies for VBD surveillance.
- Establish a national expert group, for information sharing with other VBD teams.
- Implement and improve methods for VBD information dissemination and knowledge sharing.

## Discipline: Virology

### Overview

Virology supports a programme of work on viral pathogens that threaten animals and humans. By definition, the application of virology is interdisciplinary with relevance to protecting against notifiable, endemic and exotic viral pathogens causing disease, particularly in the livestock production sectors including equids and also threats from viruses of companion animals and wildlife. This includes maintaining a global awareness of the shifting landscape of viral diseases and the threat viral pathogens pose to national biosecurity. This work embraces surveillance, research and investigative diagnosis on viral pathogens of known importance. In particular, in preparing and responding to new and emerging viral zoonotic pathogens and developing novel methods for their detection with appropriate interventions, which are key to protecting animal and human health. The virology discipline is supported by reference laboratories in providing virology knowledge, educational support and technical assistance, both nationally and internationally.

### Main goals

- Apply new technologies in developing virology expertise and consultancy in support of surveillance, research and investigative diagnosis to address national and international policy requirements.
- Develop core virology skills by maintaining a cadre of specialist virologists.
- Provide virology preparedness and resilience through capacity and capability building to protect national biosecurity against animal viruses.
- Increase the number of Designated Laboratories, National and International Reference laboratories for reportable and notifiable viral pathogens.
- Strengthen strategic partnerships and collaborations with academia and other virology stakeholder groups.
- Enhance international virology engagement and influence worldwide.

### How we achieve these goals

These goals are delivered through the provision of an integrated scientific virology advice service which underpins surveillance, research, and investigative diagnosis. Engagement with key strategic partners and in scientific networks in the animal, human health and environmental sectors is particularly important in operationalising a 'One Health' approach in tackling new and emerging viral diseases. In supporting this approach, new technologies are utilised to undertake

interdisciplinary research in contributing to evidence-based policy for animal and zoonotic viral diseases.

### **Strategic priorities for (2021 – 2026)**

1. Expand our resilience and responsiveness to exotic, notifiable and newly emerging viral diseases.
2. Develop national and international virology programmes in support of a 'One Health' approach, particularly through partnerships in the human health sector.
3. Increase our visibility as a Public Sector Research Establishment and as a centre of excellence for virology research.
4. Strengthen capacity-building and the virology capabilities for endemic disease surveillance in the facilitation of disease mitigation for trade purposes.
5. Contribute to the 'National Science Centre for Animal Health' programme to ensure virology is strategically provisioned.

## APHA Scientific™

### Overview

APHA has a unique combination of veterinary scientific skills and laboratory facilities for safeguarding animal health. These are offered as commercial services both in the UK and worldwide through our APHA Scientific™ brand and supported by a bespoke website and cadre of business development managers. These activities shown below are closely aligned with, and support, our core science.

### Main goals

- **Scientific Services:** We provide a diverse range of specialist scientific services across our R& D portfolio while specialising in vaccine research and development and diverse applications of whole genome sequencing.
- **Diagnostic testing:** We offer a complete testing, advice and support service for the diagnosis, control and prevention of diseases in farm animals and for certain exotic diseases in pets.
- **Proficiency testing:** Provided under the VETQAS brand and accredited to the 17043 standard.
- **Diagnostic reagents:** Production of bespoke reagents for veterinary diagnostics sold through APHA Scientific and distributors.
- **Intellectual Property:** The exploitation, through patenting of technology and licencing, of APHA scientific innovations such those as TB and Brucella diagnostics and vaccines.

### How we achieve these goals

- Commercial scientific services closely support capability and capacity for our government policy customers. Our containment laboratories and animal facilities provide unique opportunities to customers seeking vaccine challenge studies particularly in large farm animals.
- Diagnostic testing is performed under a comprehensive quality assurance scheme, mostly covered by ISO17025. Key areas include animal feed testing, antimicrobial resistance, microbiology and virology, parasitology and rabies serology.
- VETQAS provides proficiency testing to 83 countries with over 100 different schemes on offer. We continually consult with our customers and other stakeholders on the development of new schemes.

- Bespoke reagents are sold worldwide through a network of distributors and our APHA Scientific website and sales desk with facilitation by business development managers.

### **Strategic priorities for 2021-2026**

- For VETQAS a strategic focus is on the development of proficiency schemes for tests based on whole genome sequencing and those related to antimicrobial resistance.
- We are exploiting new developments in diagnostics including whole genome sequencing for the development of rapid tests which provide better power and resolution for detection of pathogens and extraneous agents in biotechnology products.
- Develop closer working relationships with our distributors to increase reagent and VETQAS sales.
- We continue to develop new bespoke reagents for the veterinary diagnostic industry including Glanders antiserum and Marek's disease.

# Laboratory Testing

## Overview

APHA's laboratory testing function is delivered from 9 sites across England, Wales and Scotland. Our laboratory testing portfolio is extensive and includes over 600 tests across a very broad range of disease specialisms for both diagnostic and surveillance purposes. The team also plays a key role in delivering notifiable disease outbreak testing. The range of published tests include both traditional and the modern techniques plus a range of specialist veterinary and scientific services. We provide accurate and timely results and work within a quality system with the majority of tests accredited to ISO17025.

The APHA test portfolio includes testing for a number of reasons:

- Detection and confirmation of notifiable disease.
- Achieving statutory requirements for government.
- Facilitating International Trade.
- Diagnosis of endemic and zoonotic disease.
- Introducing, developing and validating new and improved testing methods as appropriate.
- Investigation of disease and animal welfare incidents.
- Providing testing data for analysis of trends and to guide policy.
- Adapting to the requirements for the detection of new and emerging disease.

## Main goals

- We provide unique expertise in laboratory testing and will adapt to meet the needs of government and our major customers.
- Develop and share expertise internally and externally.
- Strengthen collaborations.
- Review the testing portfolio to achieve maximum efficiency and effective utilisation of public funds.



## **How we achieve these goals**

- Respond to changes in requirement, assess our testing portfolio, and validating new tests as appropriate.
- Collaborate actively with key customers and stakeholders.

## **Strategic priorities for 2021-2026**

- Modernise our methods in genotyping pathogens including introduction of Whole Genome Sequence methods for Bovine TB and Salmonella, and development of specialist bioinformatic analysis pipelines.
- Introduce and develop the most appropriate testing methods to fulfil requirements, adapting to changing International trade and statutory needs following EU Exit.
- Organise testing to maximise efficiency and provide a cost effective service, making full use of automation and LIMS integration to handle sample and data flow.

Further develop leadership, succession planning, scientific potential and sufficient staffing across testing in APHA.

# Veterinary Advice Services

## Overview

Veterinary Advice Services brings together expertise from across the APHA portfolios and disciplines and beyond into properly informed and evidenced advice to Animal Health and Welfare policy makers allowing well informed policy intent to be turned into deliverable plans via the APHA Operational Manual Instructions and specific guidance to other Government bodies and to stakeholders.

Elsewhere in Government the team works closely with a large network of partners including Defra, Scottish Government, Welsh Government, Department of Agriculture, Environment and Rural Affairs Northern Ireland, PHE, FSA, Food Standards Scotland (FSS), Veterinary Medicines Directorate (VMD), Agriculture and Horticulture Development Board, Government Science and Engineering Profession, Scottish Epidemiology, Population Health and Infectious disease Control (EPIC), UK Border Force, Local Authorities, Science Advisory Council for Exotic Disease (SAC-ED) and the Cross Government Risk Assessment Network. Beyond Government, Veterinary Advice Services work with external suppliers listed on the Animal (and Plant) Health Modelling Framework, The Pirbright Institute, Met Office, with representative bodies such as the National Farmers' Union, assurance scheme operators (such as Red Tractor and the British Egg Industry Council (Lion Code eggs), the Royal College of Veterinary Surgeons, British Veterinary Association (and its specialist divisions) and industry organisations such as the Pet Food Manufacturers Association and sector groups such as the National Pig Association.

Veterinary Advice Services comprises of six teams each led by a vet and comprising vets, scientists and technical leads supported by a co-ordination unit that also manages the APHA contribution to inward missions from third countries:

1. Exotics and Welfare (policy specific)
2. One Health (policy specific)
3. TB: Policy facing (policy specific)
4. TB: Delivery facing (policy specific)
5. Epi-Risk (multiple policy areas)
6. Field Epidemiology (multiple policy area and provide operational support and advice to field teams)

The teams contribute and co-ordinate publications as well as publishing their own reports to inform colleagues, the public, farmers and veterinarians of current threats and progress on disease management.

Externally published reports include:

- Exotic disease outbreak epidemiology reports e.g. AIV 2019-01.
- Vet Record IDM Monthly Reports.
- Preliminary Outbreak Assessments – 60 published in 2020.
- The monthly publication of the Official Statistics of incidence and prevalence of bTB in cattle.
- Annual TB reports including England Surveillance, Low Risk and Edge Areas reports.
- Risk Assessments published by Human – Animal infection Risks Group (HAIRS).
- Reports by the Advisory Committee on the Microbiological Safety of Food (ACMSF).
- UK zoonoses annual report (aka Trends and Sources report) published by the European Food Safety Authority (EFSA).
- Annual report on progress towards implementation of the UK Multi-Annual National Control Plan (MANCP).
- Three HPAI outbreak-related Risk Assessments.

## Glossary

<b>Abbreviation</b>	<b>Description</b>
<b>ACDP</b>	Advisory Committee on Dangerous Pathogens
<b>AMR</b>	Antimicrobial Resistance
<b>ASPA</b>	Animal Scientific Procedures Act
<b>BSE</b>	Bovine Spongiform Encephalopathy
<b>bTB</b>	bovine Tuberculosis
<b>Cefas</b>	Centre for Environment, Fisheries and Aquaculture Sciences
<b>Defra</b>	Department for Environment, Food and Rural Affairs
<b>DERC</b>	Disease Emergency Response Committee
<b>DIVA</b>	Differentiating Infected from Vaccinated Animals
<b>DSTL</b>	Defence Science and Technology Laboratory
<b>FAO</b>	Food and Agriculture Organization
<b>FCDO</b>	Foreign, Commonwealth & Development Office
<b>Fera</b>	Food and Environment Agency
<b>FSA</b>	Food Standards Agency
<b>HAIRS</b>	Human Animal Infections and Risk Surveillance
<b>HMG</b>	Her Majesty's Government
<b>LIMS</b>	Laboratory Information Management System
<b>LIP</b>	Livestock Information Programme
<b>NAP</b>	National Action Plan
<b>NNSS</b>	Non-Natives Species Secretariat
<b>NRL</b>	National Reference Laboratory
<b>NSCAH</b>	National Science Centre for Animal Health
<b>NWMC</b>	National Wildlife Management Centre
<b>ODA</b>	Official Development Assistance
<b>OIE</b>	World Organisation for Animal Health
<b>PHE</b>	Public Health England
<b>PME</b>	Post-Mortem Examination

<b>Abbreviation</b>	<b>Description</b>
<b>PSRE</b>	Public Sector Research Establishment
<b>RVC</b>	Royal Veterinary College
<b>SAPO</b>	Specified Animal Pathogens Order
<b>SCAH</b>	Science Capability in Animal Health
<b>SCE</b>	Scientific Computing Environment
<b>SEG</b>	Species Expert Group
<b>TSE</b>	Transmissible Spongiform Encephalopathy
<b>UKRI</b>	United Kingdom Research and Innovation
<b>UN SDGs</b>	United Nations Sustainable Development Goals
<b>VIC</b>	Veterinary Investigation Centre
<b>VMD</b>	Veterinary Medicines Directorate
<b>VRG</b>	Veterinary Risk Group
<b>WGS</b>	Whole Genome Sequencing
<b>WHO</b>	World Health Organisation



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Data Protection:

For information on how we handle personal data visit [www.gov.uk](http://www.gov.uk) and search Animal and Plant Health Agency Personal Information Charter.

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[www.gov.uk/apha](http://www.gov.uk/apha)

APHA is an Executive Agency of the Department for Environment, Food and Rural Affairs and also works on behalf of the Scottish Government, Welsh Government and Food Standards Agency to safeguard animal and plant health for the benefit of people, the environment and the economy.