



STAR-IDAZ
International Research
Consortium on Animal Health

Existing Initiatives in IRC Working Group Fields 2018/19

Secretariat of the
STAR-IDAZ International
Research Consortium
on Animal Health,
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Introduction

This document is produced by the Secretariat of the STAR-IDAZ International Research Consortium on Animal Health (SIRCAH) for the task: T3.3.2 - Map existing initiatives in Working Group (WG) fields with input from IRC members and stakeholders. The aim is to gather and compile the documents produced by IRC members, research consortia, learned societies and other relevant stakeholders relating to existing initiatives in the fields of the WGs. The lists will be fed into the working groups and disseminated publicly via the STAR-IDAZ databases.

This task relates to three milestones: MS19: Existing initiatives in WG fields mapped (I, ii and iii) (BBSRC, September 2017, 2018 and 2019).

Definition

Initiatives in this case refer to existing research networks/alliances which enables research teams to successfully work together and facilitate communication/collaboration/sharing reagents and resources. It provides a platform to identify common approaches and areas of collective interest.

Background

SIRCAH is supported, since 2016, by a European H2020 contract – Secretariat for the International Research Consortium on Animal Health (SIRCAH). The overall objective is to facilitate the STAR-IDAZ International Research Consortium on Animal Health (STAR-IDAZ IRC) achieving its objectives by establishing a secretariat to provide organisational and communication support to the STAR-IDAZ IRC and its various members and assisting with the development of focused research roadmaps. This will contribute to accelerating research on animal health and at reinforcing international research cooperation.

The agreed aim of the STAR-IDAZ IRC is to coordinate research at international level to contribute to new and improved animal health strategies for at least 30 priority diseases/infections/issues. The deliverables will include candidate vaccines, diagnostics, therapeutic, procedures and key scientific information/tools to support risk analysis and disease control.

Several diseases and issues, listed below, have initially been identified for action where it is hoped coordination of research will help better achieve the overall objectives of STAR-IDAZ IRC.

- African Swine Fever
- Bovine TB
- Brucellosis
- Corona viruses
- Diagnostics
- Emerging issues
- Epidemiology
- Foot and Mouth Disease
- Genetics and genomics for animal health
- Helminths (including anthelmintic resistance)
- Influenza
- Integrated pathogen control for the reduction of resistance
- Mastitis
- One Health (including food-borne pathogens)
- Porcine Reproductive and Respiratory Syndrome
- Porcine respiratory disease
- Pox virus infections
- Rift Valley Fever
- Vaccinology
- Vector-borne diseases

The following pages describe existing networks and included are additional networks which are either species specific, and related to infrastructure and technologies.

African Swine Fever

Global African Fever Research Alliance (GARA)¹

GARA's mission is to establish and sustain global research partnerships that will generate scientific knowledge and tools to contribute to the successful prevention, control and where feasible eradication of African Swine Fever (ASF).

Strategic Goals of GARA

- Goal 1. Identify research opportunities and facilitate collaborations within the Alliance
- Goal 2. Conduct strategic and multi-disciplinary research to better understand ASF
- Goal 3. Determine social and economic drivers and impact of ASF
- Goal 4. Develop novel and improved tools to support the prevention and control of ASF
- Goal 5. Determine the impact of ASF prevention and control tools
- Goal 6. Serve as a communication and technology sharing gateway for the global ASF research community and stakeholders

Understanding and Combating African Swine Fever in Europe (AFS-STOP)^{2, 3}

OBJECTIVE The main objective is to stop African Swine Fever from spreading further in Europe and protecting the European pig industry by combating ASF through a comprehensive, multi- and interdisciplinary approach.

African swine fever (ASF) is a viral haemorrhagic fever of domestic pigs and wild boar. The disease causes massive loss of animals due to mortality and the essential eradication control policies which give rise to animal welfare problems as well as further economic loss from trade restrictions. There are no vaccines for ASF. ASF has been present in Russia and neighbouring countries since 2007 and recently the disease has entered the EU. This Action tackles the main challenge of stopping ASF from further spread in Europe and protecting the European pig industry. Specifically, how to: -better manage and control wild boar populations given their importance in ASF spread and maintenance -develop methods of surveillance to increase the early detection of ASF incursion into new areas -understand the epidemiology of ASF in the unique European context; to determine the epidemiological role of wild boar, ticks vectors of the virus, and the environment -develop and improve management tools; such as an ASF vaccine and novel diagnostics, determine how to involve stakeholders and the general public in preventing ASF spread and determine how policy and legislation can contribute to prevention, control and eradication of ASF. This Action aims to bring together the leading European teams in these fields to improve the knowledge, diagnosis, surveillance and management of ASF. The Action by supporting the reduction of overlap and identification of knowledge gaps will facilitate a shared European vision and innovative approaches to an ASF free domestic pig sector and wild boar population in Europe.

¹ <https://www.ars.usda.gov/GARA/>

² <https://www.asf-stop.com/>

³ http://www.cost.eu/COST_Actions/ca/CA15116

Addressing the dual emerging threats of African swine fever and lumpy skin disease in Europe (Defend)⁴

The DEFEND consortium will target two viral diseases of livestock which are emerging into Europe – African swine fever (ASF) and lumpy skin disease (LSD).

African swine fever virus (ASFV) is the causative agent of ASF, a highly contagious disease of domestic pigs which causes a haemorrhagic syndrome with up to 100% mortality. ASF is endemic in sub-Saharan Africa and on the Italian island of Sardinia. In 2007 the disease was reported in Georgia. Since then it has spread to Russia, Ukraine, Poland and neighbouring countries. In 2017 outbreaks were reported in the Czech Republic and Romania. Wild boar are susceptible to ASFV and facilitate the continuing spread of the disease in Europe with regular spill-over into in-contact domestic pigs.



⁴ <https://defend2020.eu/about-us/>

Bovine TB

Global Research alliance for Bovine TB (GRAbTb)

It is a coordinated global research alliance enabling improved understanding and control of bovine TB. The strategic goals include:

- Goal 1. Identify research opportunities and facilitate collaborations within the Alliance
- Goal 2. Conduct strategic and multi-disciplinary research to better understand TB
- Goal 3. Develop and share novel and improved tools to control TB
- Goal 4. Serve as a communication and technology sharing gateway for the global bovine TB research community and stakeholders
- Goal 5: Promote collaboration with the human TB research community

The Roadmap for Zoonotic TB⁵

The four partners in health, OIE, WHO, FAO and International Union against Tuberculosis and Lung disease have joined forces to develop the roadmap and address the major health and economic impact of disease



⁵ http://www.oie.int/fileadmin/Home/eng/Our_scientific_expertise/docs/pdf/Tuberculosis/Roadmap_zoonotic_TB.pdf

Brucellosis

DBT – Network Project on Brucellosis⁶

The Department of Biotechnology, Ministry of Science and Technology, Government of India has initiated a Network Project on Brucellosis. The project aims at studying the epidemiological status of *Brucella* infections in India and to develop novel diagnostics and vaccines.

Objectives

- Epidemiology of *Brucella* species and biotypes across the country.
- Creation of a National Repository of *Brucella* strains
- Whole -genome sequencing and annotations of *Brucella* strains
- Creation of a Genome Repository of *Brucella* strains
- Development of affordable diagnostics for Brucellosis.
- Novel vaccine design, trial and validation for Brucellosis

Brucella Bioinformatics Portal⁷

This BBP website is dedicated to becoming a bioinformatics resource portal for the *Brucella* research community to facilitate *Brucella* research and includes a list of programs for analysis of *Brucella* and host-*Brucella* interactions.

Brucellosis Society (Bruce)⁸

This electronic mailing is intended only for researchers and clinicians engaged in the fields of science and medicine relevant to brucellosis. Its purpose is to exchange scientific information, engage in scientific discussions, announce meetings and positions for employment, or news concerning brucellosis research workers. It is not intended for commercial advertisements not specifically relevant to brucellosis research.

Brucellosis Annual Conference

Annual conference provides best networking opportunity. Every third year there is an international meeting. The other two years meeting is in December in Chicago as part of the Conference of Research Workers in Animal Disease (CRWAD)⁹. Between 100-120 researchers from across the globe share their research and discuss current issues at the domestic meetings. Attendance at the international meetings may vary from 150 -350.

New vaccine for a paradigm shift in Brucellosis¹⁰

Funded through Horizon 2020, this project coordinated by Brucella Green Vac SL aims at developing BGV1, a patented vaccine that has the potential of allowing, for the first time, mass vaccination of any animal at any time (including pregnant and lactating animals), which is a radical paradigm shift in Brucellosis control and eradication. It also simplifies existing vaccine management systems as it can be used without interfering standard diagnostic techniques. In our 5-year forecast, we estimate accumulated revenue and net profits of €58.29m and €15.13m, a conservative projection by just reaching 86.02m animals that represent only 3.92% of our TAM, generating 1.76bn economic benefits to our users.

⁶ <http://www.dbtbrucellosis.in/>

⁷ <http://www.phidias.us/bbp/>

⁸ <https://list.umass.edu/mailman/listinfo/bruce>

⁹ <https://crwad.org/>

¹⁰ <https://cordis.europa.eu/project/rcn/218932/factsheet/es>

Coronavirus

Towards Control of Avian Coronaviruses: Strategies for Diagnosis, Surveillance and Vaccination^{11, 12}

For several decades, poultry production worldwide has been struggling with severe diseases and huge economic losses caused by Avian Coronavirus (AvCoV) infections. Control of the disease is hampered by the variations within this virus family. As a result of its variability, the nomenclature as well as detection methods and classification of the virus strains are not consistent. This Action creates a network between scientists with expertise in AvCoV. It stimulates cooperation between researchers, fosters harmonization of nomenclature and classification, and facilitates surveillance. In order to achieve this and to cover all important aspects, five interlinked Working Groups are established which deal with Molecular Virology, Serology and Immunology, Clinic and Pathology, Epidemiology and conceptualizing an infrastructure for collaborative research, respectively. Furthermore, a joint website is created where general information on AvCoV, notifications of outbreaks and research results are shared between the COST members. COST is the ideal platform to accomplish the described aims as different research projects concerning AvCoV are currently funded. The COST Action provides the possibility to connect researchers working on the topic and thereby enabling them to use their resources more efficiently. European poultry producers, industry, veterinarians and consumers will benefit from results generated in the course of this Action.



¹¹ http://www.cost.eu/COST_Actions/fa/FA1207

¹² <http://cost-controllingaviancoronaviruses.org/>

Diagnosics

Swine diseases field diagnostics toolbox¹³

The increased population density in modern animal production systems has made them vulnerable to various transboundary infectious agents & diseases. During the last decades in the developed world, a reduction in the direct burden of livestock diseases has been observed, because of more effective drugs & vaccines. However, the total impact may actually be increasing, because in a highly-interconnected world, the effects of diseases extend far beyond animal sickness & mortality. Therefore, early diagnosis and establishment of reliable countermeasures to infectious disease outbreaks is essential to limit severe biophysical and socio-economic consequences.

To date, the time between initial disease outbreak and laboratory confirmation of the etiologic infectious agent can be up to several weeks. Reliable & simple diagnostic testing directly on site would enable rapid local decision making, which is crucial to prevent further spreading of the disease.

Silicon-based Photonic Integrated Circuits (PIC) have been demonstrated as a powerful platform for biosensing systems. In combination with integrated monoclonal antibodies, they can provide portable multiplex detection of proteins with sensitivity & specificity previously not realized. SWINOSTICS addresses the sector needs, by developing a novel field diagnostic device, based on advanced, proven, bio-sensing technologies to tackle viruses causing epidemics in swine farms and leading to relevant economic damages, complying to the objectives of the STAR-IDAZ. The diagnostic device will allow threat assessment at the farm level, with the analytical quality of commercial laboratories. The device will be developed for a panel of 6 important swine diseases. The device will be portable & will provide results in 10 minutes for 5 samples simultaneously, making it highly suitable for field use. It is based on 3 lab-verified concepts: a) PIC technology, b) Label-free optical detection, c) patented nano-deposition technology. (November 2017- April 2021).

Veterinary Validation of Point-of-Care Detection Instrument (VIVALDI)¹⁴

In the VIVALDI project the consortium will validate new equipment (the VETPOD platform) for rapid on-site detection of zoonotic pathogens in industrial food and animal production chains.

The coordinator Technical University of Denmark (DTU) has developed the VETPOD platform based on Loop mediated isothermal amplification (LAMP) technology and optical read-out to a user interface, with disposable plastic cartridges (Lab-on-Chip, LOC) that can be adapted to an infinite number of assays for almost all pathogens.

The Foundation for Innovative New Diagnostics – FIND¹⁵

FIND is an international non-profit organisation that enables the development and delivery of much needed diagnostic tests for poverty-related diseases, including tuberculosis. FIND acts as a bridge between experts in technology development, policy and clinical care, reducing barriers to innovation and effective implementation of diagnostic solutions in low- and middle-income countries. It has active collaborations with more than 200 partners including research institutes, academia, health ministries and disease control programmes, commercial partners, the World Health Organisation, bilateral and multilateral organisations and clinical trial sites.

¹³ https://cordis.europa.eu/project/rcn/212392_en.html

¹⁴ https://cordis.europa.eu/project/rcn/212396_en.html

¹⁵ <https://www.finddx.org/>

Early warning system for enteropathies in intensive broiler farming¹⁶

Coordinated by Bloomvet SRL, Italy

BloomVet developed a new disruptive Volatile Organic Compounds (VOCs) analysis technology called EnteroDetectAVI able to early identify in the environmental air any early signs of enteric disease. BloomVet has also developed Prediction Service for farmers, offering them a valid alternative to traditional diagnostic methods. The promising approach of VOCs analysis is emerging as a new frontier in both human and veterinary medicine, because it is non-invasive and affordable, since odours reflect animal health status and, in particular, enteric problems are characterised by peculiar odour properties. EnteroDetectAVI is easily installable in poultry sheds, monitors animal health status 24/7, is affordable, reliable, and fast. EnteroDetectAVI warns the farmer as soon as the first signs of enteropathy appear, allowing him to treat animals timely. Early warning means a tangible advantage for farmers, as the yearly economic loss for enteric disease could be up to 18.000 €/shed. EnteroDetectAVI will be commercialised through a Business to Business (B2B) approach targeting farmers through Meat Groups in Italy and worldwide through a Company producing additives for animal feed.

Antibiotics control for all¹⁷

Coordinated by ZEULAB SL, Spain, €1.14M, 1 April 2018 – 31 March 2020

The World Health Organization considers the antibiotic resistance as one of the three greatest threats to human health for the next decades. The farm sector is the major user of these medicines due to the great benefits for animal production. Therefore, there is a high risk to find contaminated food with antibiotic residues. The impact of misuse and wrong control of antibiotics constitutes a great social, economic and technological burden for the UE. Antibiotic resistance causes 25.000 deaths per year in Europe.

According to EU legislation all food operators are responsible for food safety. Current antibiotic detection systems in milk are designed for qualified analysts and are manually operated. Test4all is a simple, automatic and an affordable system which makes milk testing accessible to all operators. Test4all, developed by ZEULAB, is the first automatic system that makes the results available in real time. These unique features will allow farmers to do easy self-controls before supplying the milk and dairies to screen antibiotics during the milk transport in trucks. Test4all is based on the combination of high sensitive biological test with a portable device controlled by a smartphone App that transfer the results to a secure cloud network. Farmers and dairies will check data anytime anywhere.

¹⁶ <https://cordis.europa.eu/project/rcn/218966/factsheet/en>

¹⁷ <https://cordis.europa.eu/project/rcn/217543/factsheet/en>

Emerging diseases

Global Early Warning System (GLEWS+)¹⁸

The ultimate goal of GLEWS+ is to inform prevention and control measures, through the rapid detection and risk assessment of health threats and events of potential concern at the human-animal-ecosystems interface. This goal is critical to attaining the vision of FAO, OIE and WHO of *'a world capable of preventing, detecting, containing, eliminating, and responding to animal and public health risks attributable to zoonoses and animal diseases with an impact on food security through multi-sectoral cooperation and strong partnerships'*.

GLEWS¹⁹ was established in 2006 and has since evolved into GLEWS+

In addition to the activities of the existing GLEWS, the proposed system – GLEWS+ – will provide a unique cross-sectoral mechanism for conducting robust and timely joint risk assessments, aimed at formulating risk management options for health events at the human-animal-ecosystems interface. These options will then be communicated in a timely, coordinated and relevant way within the three international organizations, hereby contributing to risk communications of the three organizations to relevant stakeholders, the public and the international community. GLEWS+ will:

- systematically link to areas such as wildlife health, food and biological threats;
- drive more advanced and cross-sectoral risk assessment when a need is identified; and
- provide more opportunities for participation by a broader range of stakeholders via specific working groups established on priority areas.

GLEWS+ contributes to the tripartite continued work to advance from reactive to proactive preparedness and prevention, through joint risk assessment for targeted and timely action.

Emergency Preventions System for Animal Health (EMPRES)²⁰

The mission of the programme is to promote the effective containment and control of the most serious epidemic livestock diseases/Transboundary Animal Diseases (TAD) as well as newly emerging diseases by progressive elimination on a regional and global basis through international cooperation involving early warning, early reaction, enabling research and coordination.

¹⁸ <http://www.fao.org/3/a-i3579e.pdf>

¹⁹ <http://www.glews.net/>

²⁰ <http://www.fao.org/ag/againfo/programmes/en/empres/home.asp>

World Animal Health Information Database (WAHIS) Interface²¹

The WAHIS Interface provides access to all data held within OIE's new World Animal Health Information System. Information included in the database: immediate notification and follow-up reports submitted by Country/Territory Members notifying exceptional epidemiological events current in their territory; six monthly reports stating the health status of OIE-listed diseases in each country/territory; annual reports providing health information and information on the veterinary staff, laboratories and vaccines etc.

FAO Global Information and Early Warning System (GIEWS)²²

The Global Information and Early Warning System on Food and Agriculture (GIEWS) continuously monitors food supply and demand and other key indicators for assessing the overall food security situation in all countries of the world. It issues regular analytical and objective reports on prevailing conditions and provides early warnings of impending food crises at country or regional level. At the request of national authorities, GIEWS supports countries in gathering evidence for policy decisions, or planning by development partners, through its Crop and Food Security Assessment Missions (CFSAMs), fielded jointly with WFP. In country-level application of tools for earth observation and price monitoring, GIEWS also strengthens national capacities in managing food security related information.

Ontario Animal Health Network (OAHN)²³

OAHN's mission is to coordinate preparedness, early detection, and response to animal disease, through sustainable cross-sector networks. The Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA) and the Animal Health Lab (AHL), University of Guelph are forming the Ontario Animal Health Network (OAHN), comprised of species-specific expert networks with a focus on animal health, disease surveillance and improving the industry. Funding is from federal and provincial grants.

National Animal Health Laboratory Network (NAHLN)²⁴

The NAHLN supports U.S. animal agriculture by developing and increasing the capabilities and capacities of a national veterinary diagnostic laboratory network to support early detection, rapid response, and appropriate recovery from high-consequence animal diseases. It is a nationally coordinated network and partnership of Federal, State, and university-associated animal health laboratories. NAHLN veterinary diagnostic laboratories provide animal health diagnostic testing to detect biological threats to the nation's food animals, thus protecting animal health, public health, and the nation's food supply. They provide the capability to diagnose both endemic and high-consequence livestock pathogens in animals, food, and environmental samples and are likely to be the first-line laboratories for recognition of an intentionally or accidentally introduced agent in animals.

²¹ http://www.oie.int/wahis_2/public/wahid.php/Wahidhome/Home

²² <http://www.fao.org/giews/en/>

²³ <http://oahn.ca/what-is-oahn/>

²⁴ https://www.aphis.usda.gov/aphis/ourfocus/animalhealth/lab-info-services/nahln/ct_about_nahln

Caribbean Animal Health Network (CaribVET)²⁵

CaribVET works in close collaboration with national surveillance networks to promote international standards and regional harmonisation with respect to animal health and veterinary public health issues. CaribVET aims to improve animal and veterinary public health in all the countries and/or the territories of the Caribbean.

CaribVET is a collaborative network involving veterinary services from 34 Caribbean countries/territories as well as veterinary services laboratories, research institutes, veterinary faculties, CARICOM Secretariat and regional and international organizations.

The Laboratories Emergency Animal Disease Diagnosis and Response (LEADDR) Network²⁶

The network aims to standardise, or otherwise harmonise, routine frontline testing platforms (such as serology and rapid molecular testing) for a number of targeted terrestrial and aquatic EADs through ANQAP or its own programs.

Animal Health and Welfare Network²⁷

EFSA networks with Member States to build a mutual understanding of risk assessment principles in the area of animal health and welfare, to promote harmonisation of animal health and welfare risk assessment practices and methodologies and to reduce the duplication of activities by identifying and sharing current and upcoming priorities.

Emerging Risks Exchange Network (EREN)²⁸

The role of the network is to provide a platform for the scientific cooperation between risk assessors of the EU Member States and EFSA in collaboration with the European Commission (EC), and to enhance risk assessment practices in the area of emerging risk identification methodologies.

²⁵ <https://www.caribvet.net/>

²⁶ <http://www.agriculture.gov.au/animal/health/system/lab-network#the-laboratories-emergency-animal-disease-diagnosis-and-response-leaddr-network>

²⁷ <https://www.efsa.europa.eu/en/animal-health-and-welfare/networks>

²⁸ <https://www.efsa.europa.eu/en/cross-cutting-issues/networks>

The EWDA Wildlife Health Network²⁹

The EWDA wildlife health network was initiated in October 2009 at an EWDA meeting in Brussels, Belgium, attended by representatives from 25 countries. The long-term goals of this network are to improve exchange of information among wildlife health surveillance programmes in Europe; develop standard operating procedures for diagnostic investigation; develop common criteria for diagnosis of wildlife disease; share specialist expertise; and provide training opportunities for wildlife health surveillance.

One of the first initiatives is an “EWDA wildlife health network” website that set up within Google groups. This website allows members to share information and exchange views on wildlife disease issues. EWDA members who are involved in or want to start up a wildlife disease surveillance scheme in Europe may apply for membership of this EWDA network by visiting the website: <http://groups.google.com/group/ewda-network>.

One of the goals of the EWDA wildlife health network is to produce “diagnosis cards” (fact sheets with emphasis on diagnosis of diseases in wildlife) and “species cards” (fact sheets with emphasis on methods for abundance and estimation of wild hosts).

Advancing European Research infrastructure on Highly Pathogenic Agents

Coordinated by Belgium, 1 Jan 2019 – 31 December 2021, €3,246,804

One of the great challenges of the 21st century is to develop the capacity to prevent and react to outbreaks caused by highly pathogenic human and animal microorganisms, which are generally characterized by a high mortality rate, unavailability of prophylactics or effective therapeutic treatment and high human-to-human transmission.

ERINHA AISBL (European Research Infrastructure on Highly Pathogenic Agents), a pan-European Research Infrastructure (RI) dedicated to the study of high-consequence pathogens of Risk Group 4 (RG4), entered into implementation phase in July 2017. It now aims to ensure its long-term sustainability to better answer societal challenges in the field of Science, Health and Security.

The overall aim of the ERINHA-Advance project is to implement actions that will contribute to the long-term sustainability of the ERINHA RI, through enlargement of its membership and partnership and strengthening the overall services offer and framework by fostering the innovation potential of the RI.

To reach these goals, the RI will focus on the following specific objectives:

1. Enlarge ERINHA’s membership and research capacities (WP2)
2. Improve users services (WP3)
3. Stimulate the innovation potential of ERINHA and identify the co-innovation opportunities with industry (WP4)
4. Strengthen the overall services framework through long-term data-management and data sharing rules, clarification of IPR regimes and definition and implementation of the quality assurance system of the RI and its national nodes (WP5)
5. Reinforce ERINHA’s European and International cooperation with relevant countries, initiatives and networks (WP2 and WP6).

By achieving these objectives, ERINHA-Advance will largely contribute to providing access to larger number of high containment facilities to European and international scientists and foster research and innovation in the field of highly infectious diseases.

²⁹ <http://ewda.org/ewda-network/>

Epidemiology

CLINF³⁰ (Climate change effects on the epidemiology of infectious diseases and the impacts on Northern Societies)

The overall objective is to identify and investigate the effects of climate change on the geographic distribution and epidemiology of human and animal infectious diseases throughout the Nordic region and Russia. Particularly, CLINF will study such climate change effects on northern animal husbandry households in the light of socio-economic and managerial conditions.

To turn new understanding, regarding climate change effects on the geographic distribution and epidemiology of climate sensitive infections, into practical tools for decision-makers responsible for the development of northern societies, both by providing relevant data in an accessible form, and by developing an early warning system for climate sensitive infections at the local level.

Participatory Epidemiology Network for Animal and Public Health (PENAPH)³¹

Initiated in 2007, the Participatory Epidemiology Network for Animal and Public Health (PENAPH) connects groups and individuals who apply PE methods in controlling emerging and existing diseases. The concept arose as a result of applying participatory epidemiology to some of ILRI's projects which bridge human and livestock health. The main objective of PENAPH is to maintain a network for participatory epidemiology engaging diverse stake holders in identifying and solving the world's most pressing health challenges. The ten PENAPH partners are the World Organisation for Animal Health (OIE), Food and Agriculture Organisation of the United Nations (FAO), African Union Inter-African Bureau for Animal Resources (AU-IBAR), International Livestock Research Institute (ILRI), Royal Veterinary College of London University (RVC), Vétérinaires Sans Frontières-Belgium (VSF-B) and Veterinarians Without Borders-Canada (VWB-VSF-C), US Centers for Disease Control and Prevention (US-CDC), the African Field Epidemiology and Laboratory Network (AFENET) and Tufts Cummings School of Veterinary Medicine (TCSVM)

³⁰ <https://clinf.org/>

³¹ <https://penaph.net/about/>

Developing the predictive ecology of plant-animal interactions across space and time

Hosted by EIDGENOESSISCHE FORSCHUNGSANSTALT WSL, Switzerland, 10 Oct 2018- 30 September 2023, €2.5M

In the face of the alarming pace of recent environmental change we lack the tools to accurately predict how biodiversity and ecosystem services will respond. One key gap in knowledge that limits our predictive ability is uncertainty concerning how the biotic interactions will change. Developing a predictive science of species interactions requires integrating evolutionary, biogeographic and ecological mechanisms acting at different spatial and temporal scales. We will use a hierarchical cross-scale approach, combining phylogeography, network ecology, statistical modelling and experiments, to disentangle the mechanisms governing species richness and mutualistic interactions in tropical hummingbirds and their food plants. Hummingbirds and their food plants are an excellent model system because they are highly diverse, highly specialized, and logistically feasible to study. Our objectives are to (1) evaluate the influence of factors, such as trait-matching, environmental conditions and relatedness, on network structure; (2) quantify how and why interaction beta-diversity (i.e., reflecting the change in both species composition, and in interacting partners) changes across elevation gradients in each of three biogeographic regions with distinct evolutionary histories (mountain regions in Costa Rica, Ecuador, Brazil); (3) evaluate the importance of multiple factors, such as trait-matching, environmental conditions, relatedness and abundance, on species interactions and network structure; and (4) develop a predictive model of species interactions and evaluate its performance using cross-validation and experimentation. Together, these tasks will provide new insight into one of the central enigmas in ecology, namely, why species diversity and its interaction architecture change across space and time. We will also be able predict how species interactions will change from present to the future, which is essential for the conservation of biodiversity and ecosystem services.

Society for Veterinary Epidemiology and Preventive Medicine (SVEPM)³²

SVEPM was founded in 1982 and comprises approximately 250 veterinary and non-veterinary members from 24 countries. Their mission is to enable professionals to meet and share knowledge to improve the health of animals, humans and the environment.

Veterinary Epidemiology, Economics and Public Health³³

The RVC Veterinary Epidemiology, Economics and Public Health (VEEPH) group is a thriving body with over fifty academic staff, contract researchers, PhD students and Senior Clinical Training Scholars conducting research with a direct impact on shaping policy both at national and international level.

The VEEPH group is a FAO Reference Centre in Veterinary Epidemiology (one of only four such centres in the world). In this role we provide advice and expertise on risk-based animal disease surveillance to the FAO (the Food and Agriculture Organization of the United Nations) and its member countries, to help achieve FAO's goal of food security for all.

³² <https://www.svepm.org.uk/home.html>

³³ <https://www.rvc.ac.uk/research/research-centres-and-facilities/veterinary-epidemiology-economics-and-public-health>

International Society of Veterinary Epidemiology and Economics³⁴

It is part of the World Veterinary Association organizing regular global symposia.

Global Burden of Animal Diseases (GBADS)

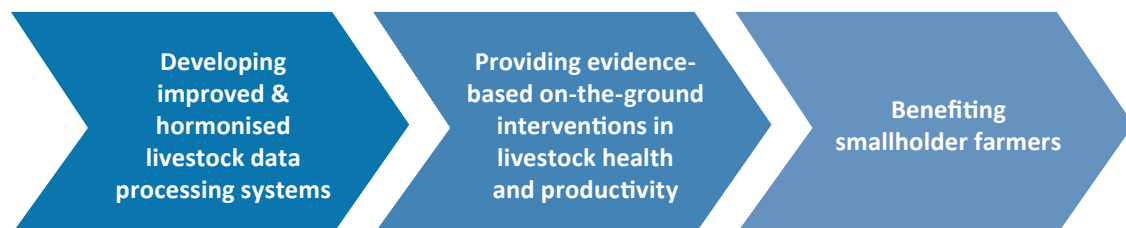
A workshop, led by the University of Liverpool and the N8 Agrifood Resilience Programme, was held to initiate a programme for the Global Burden of Animal Diseases (GBADS). It was hosted by the World Organisation for Animal Health (OIE), convened by the Bill & Melinda Gates Foundation, and brought together experts in animal health and livestock production data collection and analysis, and information generation.

Six key components of a GBADS programme were identified: disease classification, data collection, disease losses, animal health expenditure, sustainability, and equitability. Disease classification involves key areas of case definition, applicability in the field and with existing data, and engagement with animal owners and health-care advisers. For data collection, there was agreement on the importance of clarity on the types of data to be collected from the public and private sectors and that ownership and commercial sensitivities are thought through and treated with transparency. Disease losses covers the need for a framework that captures what losses will be included, how they will be measured, and how they will be reported. For animal health expenditure, public and private costs need to be separated and costs for different disease issues need to be attributed. In terms of sustainability, we identified the need for a mapping exercise to determine who should be linked to a process of defining the outcomes of GBADS in a structured and timely way. To ensure equitability, impacts in low-income countries must be presented in a way that is comparable to impacts in high-income countries.

Supporting Evidence-based Interventions (SEBI)³⁵

The overall purpose of SEBI is to improve the livelihoods of poor livestock farmers in developing countries.

This mission will be progressed by



³⁴ <https://uia.org/s/or/en/1100042319>

³⁵ <https://www.ed.ac.uk/vet/research/sebi>

Foot and Mouth disease

Global Foot and Mouth Disease Research Alliance³⁶

GFRA aims to expand FMD research collaborations worldwide and maximize the use of resources and expertise to achieve its five strategic goals (see below).

Several research programs are currently active in Europe, North America, South America and South-East Asia. GFRA programs will continue to expand the alliance in these areas and will actively reach out to new areas of the world that have a stake in the progressive control and eradication of FMD.

- Goal 1. Facilitate research collaborations and serve as a communication gateway for the global FMD research community
- Goal 2. Conduct strategic research to better understand FMD
- Goal 3. Development of the next generation of control measures and strategies for their application
- Goal 4. Determine social and economic impacts of the new generation of improved FMD control
- Goal 5. Provide evidence to inform development of policies for safe trade of animals and animal products in FMD-endemic areas

The European Commission for the control of Foot-and-mouth disease (EUFMD)³⁷

EuFMD is one of FAO's oldest Commissions, came into being on the 12th June 1954, with the pledge of the sixth founding member state to the principles of a coordinated and common action against foot-and-mouth disease at a time when the disease was ravaging the continent.

The Three Pillars of the EuFMD strategy to counter the threat of the disease, have been since 2013 to work simultaneously with member countries on their preparedness, with European neighbours to put in place sustainable control programmes, and to support and promote the progressive control of FMD in all regions under the Global FMD Control Strategy of FAO and OIE.

OIE/FAO FMD Reference Laboratory Network³⁸

This Network arose from a meeting of the OIE ad hoc group of Antigen and Vaccine Banks (in Paris 2004) where it was decided to generate two forums to coordinate international activities: a vaccine bank network (now the IVSRN), and this Foot-and-Mouth Disease Reference Laboratory Network. Attendance at the meeting by delegates from affiliate Foot-and-Mouth Disease laboratories is an essential component of the Network and provides an approach to ensure that the most relevant data is collected regarding FMD outbreaks and surveillance.

³⁶ <https://www.ars.usda.gov/gfra/>

³⁷ <http://www.fao.org/ag/againfo/commissions/eufmd/en/>

³⁸ <https://www.foot-and-mouth.org/Ref-Lab-Network>

Genetics and Genomics

A Global Network – Functional Annotation of Animal Genomes” (FAANG) initiative³⁹

A coordinated international action to accelerate genome to phenome. It aims to standardize core assays and experimental protocols, coordinate and facilitate data sharing, establish an infrastructure for analysis of these data and provide high quality functional annotation of animal genomes.

FAANG-Europe (Functional Annotation of Animal Genomes - European network)^{40, 41}

Research on domesticated animals has important socio-economic impacts, including underpinning improvements in the livestock sector, contributions to medical research, animal health and welfare, the evolution of domestication and the understanding of natural animal populations.

Whilst progress has been made with the identification of genome sequences, which determines the proteins encoded by farm and domesticated animal genomes, there is little information on the sequences that are transcribed but not coding, and in particular sequences that regulate gene expression. Thus, although the genomes of the major domesticated animal species have been sequenced, significant investment is now required in order to identify the functional elements within these genomes, especially the regulatory sequences.

The recently launched “Functional Annotation of Animal Genomes” (FAANG) initiative aims to improve the functional annotation of animal genomes. This FAANG - Europe COST Action will facilitate the aims of the FAANG project through coordination, development of agreed standards for experiments, data and metadata, training and dissemination of standards and results.

³⁹ <https://www.animalgenome.org/community/FAANG/index>

⁴⁰ <http://faang-europe.org/>

⁴¹ http://www.cost.eu/COST_Actions/ca/CA15112

Helminths (including anthelmintic resistance)

BUG (Building Upon the Genome) Consortium⁴²

The mission of the research alliance is to develop sustainable effective helminth control strategies and promote their implementation by the livestock industry. Its objectives are to generate a globally leading research alliance in the field of livestock helminth infections, simulate collaborative research by enabling exchange of ideas and mobility of young researchers and by promoting mutual research project, initiate/foster research initiatives by promoting helminth research at international and national funding authorities, facilitate knowledge exchange with the livestock industry to respond to their needs and constraints and identify areas for future research, have the ability to respond to global changes that impact on livestock farming practices and helminth infection and establish a network of standardised diagnostic parasitology labs and to standardize field trial and monitoring approaches throughout Europe.

Combatting anthelmintic resistance in ruminants⁴³ (COMBAR)

Helminth parasitic pathogens cause severe disease and are amongst the most important production limiting diseases of grazing ruminants. Frequent anthelmintic use to control these infections has resulted in the selection of drug resistant helminth populations. Anthelmintic resistance (AR) is today found in all major helminth species across Europe and globally. The COST Action COMBAR will advance research on the prevention of anthelmintic resistance in helminth parasites of ruminants in Europe and disseminate current knowledge among all relevant stakeholders. By gathering parasitologists, social scientists and agricultural economists, COMBAR brings together a multi-disciplinary blend of scientists that do normally rarely interact. Inclusion of SMEs and industry in the consortium facilitates the dissemination of knowledge and novel technologies to the animal health playing field. COMBAR will integrate novel developments in the field of (i) diagnostic tests; (ii) vaccines to protect animals from infection; (iii) antiparasitic forages, (iv) selective treatment strategies and (iv) decision support tools. By evaluating those novel technologies and assessing their economic trade-offs and barriers to uptake in a European coordinated approach, COMBAR will tackle AR.

COST COUNTRIES Main Proposer: BE Network of Proposers: BE, CH, CZ, DE, DK, ES, FR, IT, NL, PL, SE, SK, UK (ITC share: 23%) Participants: 32% ECI/32% Women INDUSTRIAL DIMENSION SMEs: Belgium, United Kingdom.

⁴² <https://bugconsortium.wordpress.com/>

⁴³ www.combar-ca.eu

European Network on Taeniosis/Cysticercosis^{44, 45}

Taenia solium (pork tapeworm) and *T. saginata* (beef tapeworm) cysticercosis (CC)/taeniosis are zoonoses of public health importance, with significant economic impacts on the health and meat (pork and beef) sectors within and outside the EU. Despite increased research efforts, an important number of gaps remain. For more than one third of the member states, data on occurrence of porcine/bovine/human CC and taeniosis are missing. Many questions remain on transmission dynamics, infection development/course and clinical manifestations. An improved knowledge on host-parasite interactions will create opportunities for new diagnostic targets, and vaccine candidates. The main objective of this Action is to build a strong, extensive, multi-disciplinary scientific network to induce sustainable collaborations with the aim to advance knowledge and understanding of these zoonotic disease complexes. Specific objectives include the development of innovative diagnostic and cost-efficient control tools, assessments of disease burden and economic impact, as well as the development of harmonized reporting and management procedures. Intra-European collaboration is essential to stop the development of these diseases within the EU. The Action is aimed at both European economical/societal needs and scientific/technological advances.

Livestock Helminth Research Alliance (LiHRA)⁴⁶

The mission of the research alliance is to develop sustainable effective helminth control strategies and promote their implementation by the livestock industry. Its objectives are to generate a globally leading research alliance in the field of livestock helminth infections, simulate collaborative research by enabling exchange of ideas and mobility of young researchers and by promoting mutual research project, initiate/foster research initiatives by promoting helminth research at international and national funding authorities, facilitate knowledge exchange with the livestock industry to respond to their needs and constraints and identify areas for future research, have the ability to respond to global changes that impact on livestock farming practices and helminth infection and establish a network of standardised diagnostic parasitology labs and to standardize field trial and monitoring approaches throughout Europe.

Neglected Tropical disease NGO Network^{47, 48}

The Neglected Tropical Disease NGO Network (NNN) was established in October 2009 to create a global forum for non-governmental organisations working to control onchocerciasis, lymphatic filariasis, schistosomiasis, soil transmitted helminths, and trachoma. Other diseases including leprosy and podocniosis have since joined the forum. These Neglected Tropical Diseases (NTDs) share common strategies including community-based health interventions that can be integrated to strengthen health care systems^{TRA}.

Paragone⁴⁹

The development of subunit vaccines for multicellular parasites has proved a real challenge to the global research community. This is due to the complexity of these organisms and their ability to modulate host immune responses.

Recently, subunit vaccines designed to control a number of globally important worms of ruminants have shown promise. These parasite vaccines mostly comprise cocktails of several worm proteins. In PARAGONE, the partners took a number of these prototypes and tested them in further trials, as well combine some to make multivalent vaccines. For parasites for which vaccines have proved difficult to develop, fundamental studies were performed to inform on the type of host response that needs to be stimulated to obtain protection. This fed into the selection of appropriate novel adjuvant systems with which to deliver the vaccines. By bringing these streams together, PARAGONE took the current best multicellular parasite vaccine prototypes forward to practical outcomes for use on farms in the EU and beyond. (Apr 15- Mar 19; ~9 mm Euro).

⁴⁴ <http://www.cystinet.org/>

⁴⁵ http://www.cost.eu/COST_Actions/fa/TD1302

⁴⁶ <http://www.lihra.eu/>

⁴⁷ <http://www.ntd-ngonetwork.org/about-us>

⁴⁸ <http://www.ntd-ngonetwork.org/content/schistosomiasis>

⁴⁹ www.paragoneh2020.eu

Influenza

CEIRS⁵⁰ (Centers of Excellence for Influenza Research and Surveillance)

The National Institute of Allergy and Infectious Diseases (NIAID) Centers of Excellence for Influenza Research and Surveillance (CEIRS) program is an integrated network of centers designed to bring together multidisciplinary teams of researchers that perform surveillance related research integrated with research on host immune response, viral pathogenesis, and the factors that control the emergence and transmission of influenza viruses. The main areas of focus are:

- To provide the information and public health tools needed to control the impact of epidemic influenza and the threat of pandemic influenza
- To conduct prospective international and/or domestic animal influenza surveillance for the rapid detection and characterization of influenza viruses with pandemic potential
- To conduct research to enhance understanding of the molecular, ecological, and/or environmental factors that influence pathogenesis, transmission, and evolution of influenza viruses; and characterize the protective immune response

OIE and FAO Network of expertise on animal influenza - Offlu⁵¹

Main objectives includes to share and offer technical advice, training and veterinary expertise to international organisations and Member Countries to assist in the prevention, diagnosis, surveillance and control of animal influenza; exchange scientific data and biological materials (including virus strains) within the network, to analyse such data, and to share such information with the wider scientific community; collaborate with the WHO on issues relating to the animal-human interface, including pandemic preparedness for early preparation of human vaccine and highlight influenza surveillance and research needs, promote their development and co-ordination.

⁵⁰ <https://www.niaid.nih.gov/research/influenza-research-surveillance>

⁵¹ <http://www.offlu.net/>

Dynamics of avian influenza in a changing world⁵²

Coordinated by Friedrich Loeffler Institut- Bundesforschungsinstitut fuer Tiergesundheit, Germany, 1 June 2017- 31 May 2022, €5.5M

DELTA-FLU aims to determine the key viral, host-related, and environmental factors that determine the dynamics of avian influenza (AI) in poultry and other host species, with the goal of improving prevention and control strategies against this disease. As a result of rapidly changing dynamics, AI continues to cause unexpected and devastating outbreaks in poultry in the EU, as well as world-wide. Its potential to become pandemic is also of great concern to public health. The key viral, host-related, and environmental factors that drive AI dynamics are poorly understood, which currently impedes the development of effective control and prevention strategies. As the problems caused by AI require global solutions, DELTA-FLU is a consortium with top-level experts from Europe, North America, and Asia. Through interdisciplinary research focused on key questions of AI, DELTA-FLU will determine 1) potential for some highly pathogenic avian influenza viruses (HPAIV, e.g. H5N8 clade 2.3.4.4) to be maintained in wild bird populations and spread over long-distances, 2) key viral, host, and environmental factors for incursion of HPAIV from wild birds into poultry holdings, 3) roles of viral, host, and environmental factors in the transition of low pathogenic avian influenza virus to HPAIV in poultry, 4) effect of flock immunity against AI on early detection and viral genetic drift, and 5) viral genetic factors that allow reassortants of avian and mammalian influenza viruses to transmit efficiently among pigs. Primary sectors and end-users are involved through participation in the Multi-Actor Panel, which will also play an important role in the translation of the results into effective prevention and control strategies. As such, DELTA-FLU will make significant advances in knowledge of AIV dynamics and provide the evidence base for improved diagnosis, prevention, and control strategies for AI in poultry, as well as for reducing the possible risk of AI to become potentially pandemic.



⁵² <https://delta-flu.fli.de/de/home/>

Integrated Pathogen Control for the Reduction of Resistance

European Network on the Factors Affecting the Gastro-Intestinal Microbial Balance and the Impact on the Health Status of Pigs (PiGutNet)⁵³

The “hoped for” reduction in the use of antibiotics in pig by EU producers has not materialized as they are still being widely used for the control of enteric infectious diseases. This practice can spread antibiotic resistance in the farm environment and poses a threat to consumer health. Whilst it is widely recognized that a diversified gastro-intestinal tract (GIT) microbiota is essential for optimal health and performance, the underlying factors favoring the development and maintenance of a balanced intestinal microbiota are not fully understood. PiGutNet will establish the first European network focused on this topic, joining specialists in all research areas. It will define both environmental and host genetic factors affecting the GIT microbiota and the complex interactions between microbiota and gut maturation, to maintain a healthy gut throughout life. The network will coordinate databases and unravel innovative tools to define the status of intestinal eubiosis in pigs. The most important outcomes will be genome/metabolome-wide association studies and the provision of a road map to increase pig resistance against GIT infections. This will have an important translational potential, being the foundation for European companies to develop strategies in the areas of feed additives and animal husbandry, resulting in improved animal health and welfare, consumer protection and competitive advantage for the European agriculture. Scientists and researchers from the 36 COST Member Countries and the Cooperating State participate in PiGutNet COST Action.

Interagency Coordination Group on Antimicrobial Resistance⁵⁴

In UN General Assembly Resolution A/RES/71/3, Member States requested “the Secretary-General to establish, in consultation with WHO, FAO and OIE, an ad hoc interagency coordination group, cochaired by the Executive Office of the Secretary-General and WHO, drawing, where necessary, on expertise from relevant stakeholders, to provide practical guidance for approaches needed to ensure sustained effective global action to address AMR”.

In response to this request, the Secretary-General convened a group of 28 organizations (note that UNITAID was added by the Secretary-General after the first meeting) and experts to carry out this work on his behalf. This Ad Hoc Interagency Coordination Group on Antimicrobial Resistance (the IACG) is co-chaired by the Deputy Secretary-General and the WHO Director-General. At the request of the Secretary-General, the tripartite Secretariat of FAO, OIE and WHO is hosted in Geneva. The IACG’s work is directed by three conveners: Professor Junshi Chen, Professor Dame Sally Davies, and Ms Martha Gyansa-Lutterodt. The objective of the Group will be to provide practical guidance for approaches needed to ensure sustained effective global action to address antimicrobial resistance, including options to improve coordination, taking into account the Global Action Plan on Antimicrobial Resistance.

⁵³ <http://www.pigutnet.eu/>

⁵⁴ <http://www.who.int/antimicrobial-resistance/interagency-coordination-group/en/>

The OIE Ad Hoc Group on Prioritisation of Diseases for Which Vaccines Could Reduce Antimicrobial Use in Animals⁵⁵

The OIE brought together an ad hoc group to address requests from several countries and organisations for information on where to invest to reduce the use of antimicrobials in animals, especially in view of the projected production growth for poultry, pig and fish which is most likely to happen in intensive production settings with the accompanying challenges. The outcome of the Group's work aimed to provide direction to policy makers on where to invest in research to reduce the need for antimicrobial use in animals with a focus on vaccines.

Alternative to Antibiotics Resource Center⁵⁶

It is a USDA website that provide information on alternative to antibiotics.

International Symposium on Alternatives to Antibiotics (ATA)⁵⁷

In view of the emerging global concerns with antibiotic resistance, there is a pressing need to have a scientific forum to discuss alternatives to antibiotics in food-animal production. The focus of international symposium jointly funded by OIE/USDA is not intended to be a forum to eliminate the use of antibiotics in food animal production as there is a specific need for antibiotics to treat diseases that impact the health and welfare of animals. Rather, new strategies for preventing and treating diseases that do not result in the creation of selection pressure favoring the development of antimicrobial resistance. Previous two symposium were held in 2012 and 2016. The next one is planned for in 2018.

Agricultural Research Service AgAR Network⁵⁸

Develop practical tools and protocols to measure antibiotic drugs, resistant bacteria and resistance genes in agriculturally-impacted soil, water, air, and food; design and evaluate agricultural best management practices to limit the persistence and spread of antibiotic resistance from agroecosystems; facilitate sharing of ideas and resources among ARS scientists by establishing an agency-wide network of researchers with the common goal of conducting science based research on AgAR topics.

Connect ARS researchers at multiple locations in order to develop, assess and share methods for measuring resistance that are robust and that are validated across production systems and geographical area.

European Antimicrobial Resistance Surveillance Network (EARS-Net)⁵⁹

EARS-Net is based on routine clinical antimicrobial susceptibility data from local and clinical laboratories reported to ECDC by appointed representatives from the Member States.

⁵⁵ http://www.oie.int/fileadmin/SST/adhocreports/Diseases%20for%20which%20Vaccines%20could%20reduce%20Antimicrobial%20Use/AN/AHG_AMUR_Vaccines_Apr2015.pdf

⁵⁶ <https://www.ars.usda.gov/alternativestoantibiotics/index.html>

⁵⁷ <https://www.ars.usda.gov/alternativestoantibiotics/>

⁵⁸ <https://www.ars.usda.gov/alternativestoantibiotics/ResearchCenter/AgAR%20Network.pdf>

⁵⁹ <https://ecdc.europa.eu/en/about-us/partnerships-and-networks/disease-and-laboratory-networks/ears-net>

Joint Programming Initiative on Antimicrobial Resistance (JPIAMR)⁶⁰

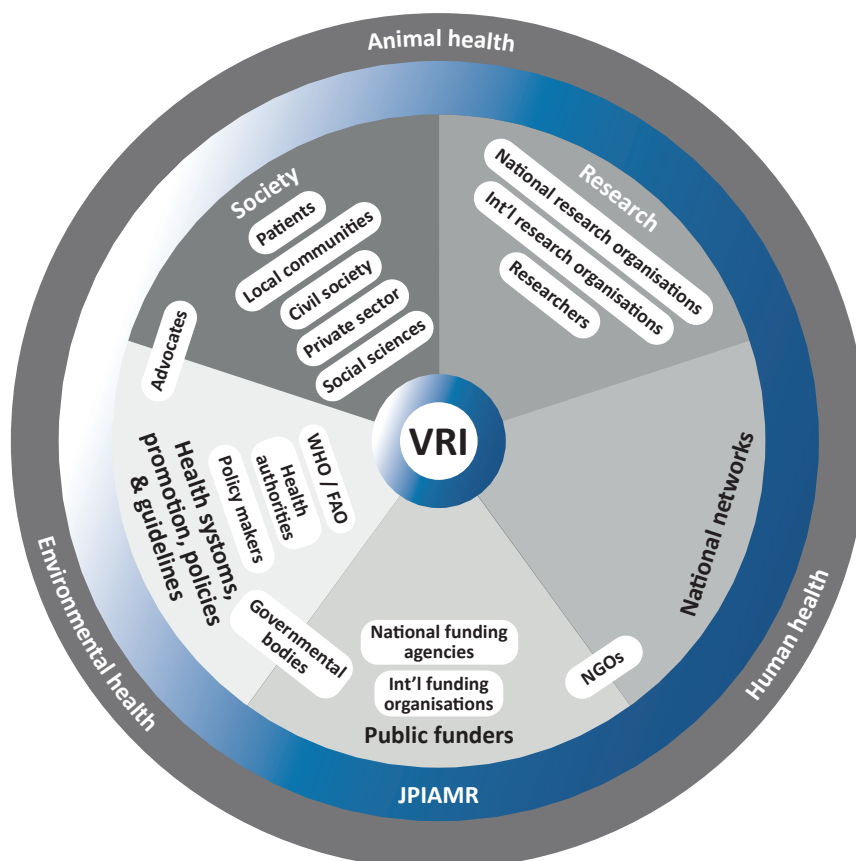
The Joint Programming Initiative on Antimicrobial Resistance (JPIAMR) was formed 2011 by 15 European Countries with the support of the European Commission and now comprise 26 countries globally. It is funding 65 M Euros of basic and exploratory research on new antibiotics, stewardship of existing antibiotics, and studies and control of the spread of antibiotic resistance between humans, animals, and the environment in a One Health perspective. It also supports research through several activities such as the establishment of a Virtual Research Institute. JPIAMR coordinate national research programmes on AMR through its Strategic Research Agenda and with input from the IMI and a network of non-governmental stakeholders.

JPIAMR Virtual Research Institute⁶¹

The JPIAMR Virtual Research Institute (VRI) will be a dynamic network of AMR research facilities and groups providing a global platform for scientific interaction and build research capacity. It will be a global AMR scientific platform to:

- Jointly address big research questions/projects;
- Facilitate research and training on AMR (knowledge, expertise and funding);
- Stimulate networks from currently independent research communities in a One Health approach;
- Change the way resources are shared and used between AMR stakeholders for more impactful outcomes.

JPIAMR Virtual Research Institute (VRI)



⁶⁰ <https://www.jpiamr.eu/>

⁶¹ <https://www.jpiamr.eu/activities/jpiamr-virtual-research-institute/>

Disseminating Innovative Solutions for Antibiotics Resistance Management⁶²

The DISARM thematic network (Disseminating Innovative Solutions for Antibiotic Resistance Management) is focused on disseminating best practices from innovative farms and research on how to reduce antibiotic resistance in livestock farming. Antibiotic resistance management is not only important to farming, it can also lead to reduced effectiveness of antibiotics in treating humans. Tackling antibiotic resistance is a major strategic challenge for European livestock farmers, an industry worth over 145 billion euros. Evidence shows that rates of antibiotic use and resistance vary greatly from farm to farm and, that with the adoption of appropriate innovative on farm management practices that both the use of antibiotics and the development of resistance can be reduced. Disseminating these effective management practices is at the heart of the DISARM project, which will work with farmers, vets, advisors, industry and researchers to identify and disseminate widely the most cost effective and beneficial strategies. This will be delivered by:

- Developing a 600 member multi-actor Community of Practice to share, debate and disseminate the most promising strategies to reduce antibiotic resistance in livestock farming;
- Producing 10 best practice guides, supported by 100 best practice abstracts and 100 short videos to explain how farms have successfully adopted innovative practices to reduce antibiotic resistance;
- Working with 40 farms (in 8 countries) to develop multi-actor farm health plans with at least 30 of these being used as case studies to show other farms how working with their vet, feed or equipment suppliers and advisory services can help them adopt a set of best practices suited to their farm;
- Run 80 events to disseminate best practices, hosted by farmers or research centres, and speak at 60 further industry events;
- Deliver 3 annual reports on the remaining challenges with antibiotic resistance which research or policy developments need to address.

InnoVet-AMR: Innovative Veterinary Solutions for Antimicrobials⁶³

InnoVet-AMR is a four-year, Canadian \$27.9 million partnership between International Development Research Centre and the UK government's Global AMR Innovation Fund (GAMRIF) which is part of the Department of Health and Social Care (DHSC).

InnoVet-AMR is aimed at reducing the emerging risk that antimicrobial resistance (AMR) in animals poses to global health and food security.

The initiative responds to a need identified by the international scientific and development communities. It is supported with high-level policy processes, including the UN political declaration on AMR (2016), G7/20, Global Health Security Agenda and Action Plan, as well as Global Action Plans of the World Health Assembly and the World Organization for Animal Health

InnoVet-AMR will fund research to develop new animal vaccines and other innovations to fight AMR in livestock and aquaculture production, particularly in LMICs.

⁶² <https://cordis.europa.eu/project/rcn/218068/factsheet/en>

⁶³ <https://www.idrc.ca/en/initiative/innovet-amr-innovative-veterinary-solutions-antimicrobial-resistance>

UN Interagency Coordination Group on Antimicrobial Resistance (IACG)⁶⁴

The September 2016 Political Declaration of the High-level Meeting on Antimicrobial Resistance (Resolution A/RES/71/3) called for the establishment of the Interagency Coordination Group on Antimicrobial Resistance (IACG), in consultation with the World Health Organization (WHO), the Food and Agriculture Organization (FAO), and the World Organisation for Animal Health (OIE). The IACG's mandate is to provide practical guidance for approaches needed to ensure sustained effective global action to address antimicrobial resistance; and to report back to the UN Secretary-General in 2019.

The IACG Secretariat is hosted by WHO, with contributions from FAO and OIE.

CGIAR and Denmark Partner in the Fight against Antimicrobial Resistance⁶⁵

CGIAR, the world's largest global agricultural innovation network, and the Government of Denmark have signed a Memorandum of Understanding (MoU) to cooperate on contributing interdisciplinary solutions to antimicrobial resistance (AMR). This partnership aims to provide evidence and research on AMR, and support the development and implementation of context-specific solutions for AMR elimination with a particular focus on low- and middle-income countries as the prevalence of drug resistance generally is higher in these countries than in most industrialized countries.



⁶⁴ <https://www.who.int/antimicrobial-resistance/interagency-coordination-group/en/>

⁶⁵ <https://www.cgiar.org/news-events/news/cgiar-denmark-partner-fight-antimicrobial-resistance/>

One Health (including food-borne pathogens)

Network for evaluation of One Health (NEOH) COST ACTION TD1404⁶⁶

Human health and well-being are increasingly affected by global challenges such as malnutrition, emerging and endemic zoonotic diseases, antimicrobial resistance and climate change. A One Health approach has been proposed to tackle the challenges through accepting that their complexity requires interdisciplinarity.

Several One Health initiatives have been implemented, such as the establishment of cross-sectoral coordination, communication and data sharing mechanisms, but no standardised methodology exists for quantitative evaluation of One Health activities. Therefore the Network for Evaluation of One Health (NEOH) aims to enable future quantitative evaluations of One Health activities and to further the evidence base by developing and applying a science-based evaluation protocol in a community of experts.

A European Network for Foodborne Parasite (Euro-FBP)^{67, 68}

The main objective of EURO-FBP is to decrease the impact on human health from foodborne parasites (FBP), through establishing a risk-based control programme for FBP containing robust and appropriate protective strategies. EURO-FBP will use an interdisciplinary, One Health perspective to assimilate information, coordinate research and harmonize diagnostics, surveillance, analytical methods, potential interventions and mapping of global trends regarding FBP. The Action will determine those FBP of greatest regional importance, pinpoint knowledge gaps, and focus resources strategically for control of FBP. FBP include protozoa, nematodes, cestodes and trematodes. Although a significant public health issue, FBP have been neglected compared with other foodborne pathogens such as viruses or bacteria. Furthermore, globalisation and changes in climate, agricultural practices, and human behaviour and lifestyles all contribute to emergence of FBP in new settings, with new hosts and transmission routes. Previously associated with specific regions, FBP are now spreading. FBP research is fragmented and groups often focus on a single genera or group of parasites. The agenda will focus on how to address FBP, optimising efforts and resources in order to control FBP in Europe - and globally.

⁶⁶ <http://neoh.onehealthglobal.net>

⁶⁷ <https://www.euro-fbp.org/>

⁶⁸ http://www.cost.eu/COST_Actions/fa/FA1408

Targeted chemotherapy towards diseases caused by endoparasites⁶⁹

Advances in the chemotherapy against human and animal parasitic diseases remain limited largely because drug candidates have low specificity and show poor in vivo bioavailability. The Action aims at uniting scientists with different backgrounds to create synergistic interactions paving the way for antiparasitic drug discovery for diseases caused by protozoa and helminths. The scientific aim is to bundle together the identification and validation of parasite drug targets based on the established genomes, medicinal chemistry including structure-based drug design, crystallography, bioinformatics, and drug targeting using chemical and nanotechnological approaches to improve drug performance. Also, rational assessment of the potential of natural product and other compound libraries will be used to identify new leads. Crucially, the Action will create an unprecedented combined forum for human health scientists and veterinarians, because of the enormous unmet needs in treating human and animal parasitic diseases and due to methodological homogeneity of their drug design strategies. The most promising compounds and formulations will be tested in established infection models before further preclinical and clinical development with emphasis on drug safety. (4 years, from 12/3/2014 - 12/3/2018).

EJP One Health⁷⁰

Promoting One Health in Europe through joint actions on foodborne zoonoses, antimicrobial resistance and emerging microbiological hazards.

The aim of the One Health EJP is to create a sustainable European One Health framework by integration and alignment of medical, veterinary and food institutes through joint programming of research agendas matching the needs of European and national policy makers and stakeholders. In the Netherlands these organisations are already collaborating closely to counteract the threat of emerging zoonoses and antimicrobial resistance. The Dutch One Health approach can now also be deployed at EU level.

MED-VET-NET – A Network of Excellence on Foodborne Zoonoses⁷¹

MED-VET-NET is a Network of Excellence that aims to consolidate, at European level, expertise in veterinary sciences, public health and research on food, so as to strengthen the prevention and control of zoonoses, including those transmitted by food.

It is 15 member institutions, half in the veterinary field and half in public health, represent ten different countries, and are coordinated by ANSES. As a European project selected by the European Commission in 2003, Med-Vet-Net received significant funding under the 6th European Framework Programme for Research & Technological Development (FP6) for the period 2004-2009. In 2010 Med-Vet-Net became a non-profit Association under the French Act of 1901, which has established a legal framework enabling it to pursue its activities at European level.

⁶⁹ <http://www.costcm1307.org/CM1307/Home.html>

⁷⁰ <https://www.era-learn.eu/network-information/networks/one-health-ejp>

⁷¹ <https://www.anses.fr/en/content/med-vet-net>

European Food-and Waterborne Diseases and Zoonoses Network (FWD-Net)⁷²

In 2007, the EU-funded dedicated surveillance network for enteric pathogens – *Salmonella*, *E. coli* and *Campylobacter* (Enter-net) was transferred to ECDC from the Health Protection Agency in the United Kingdom. Subsequently, the scope of the disease network was broadened to cover 21 food- and waterborne diseases and zoonoses, and nomination of disease experts followed the ECDC policy on Coordinating Competent Body (CCB).

FWD-Net also collaborates with partners, such as European Food Safety Authority (EFSA), World Health Organisation, relevant European Union Reference Laboratories and public health authorities of non-EU countries, e.g. US CDC. Furthermore, ECDC is actively collaborating with PulseNet International, the global network of public health laboratory networks, to ensure comparability of data and linkage to the global public health community.

Epizone⁷³

Epizone European Research Group is the international network of veterinary research institutes working on epizootic animal diseases including those which may have zoonotic potential. It plays a key role in research on prevention, detection and control of animal diseases and zoonoses in order to reduce the risks and harm to animal health and the risks to public health in the EU and beyond.

One Health Global Network (OHGN)⁷⁴

The One Health Global Network aims at facilitating coordination and providing linkages; offering a global geographic dimension and optimal complementarity between initiatives.

SAPUVETNET⁷⁵

It is a veterinary public health network. The acronym comes from a project supported by the ALFA program of the European Union, aimed to strengthen and extend networks between Latin American and European faculties of Veterinary Medicine to support and improve education in the field of veterinary public health and food safety.

Partners include Italy, Netherlands, Portugal, Spain, and United Kingdom. In Latin America we have representatives from Argentina, Brazil, Chile, Colombia, Costa Rica, Cuba, Mexico, Nicaragua, Peru, and Uruguay.

The SAPUVETNET III project has, as its general objective, the contribution to the development of higher education in the field of Veterinary Public Health (VPH) through cooperation between the European Union and Latin America. Through these collaborations, this network aims to contribute to the training of professionals more adequately prepared to evaluate situations, and find proper solutions, for public health-related problems within the concept of “One Health”.

⁷² <https://ecdc.europa.eu/en/about-us/partnerships-and-networks/disease-and-laboratory-networks/fwd-net>

⁷³ <https://www.epizone-eu.net/en/Home/About-us.htm>

⁷⁴ <http://www.onehealthglobal.net/>

⁷⁵ http://www.fao.org/ag/againfo/home/en/news_archive/2011_FAO_supports_SAPUVETNET.html

One Health Regional Network (HORN)⁷⁶

HORN, funded by UK Research and Innovation (UKRI) and the Global Challenges Research Fund, is a multidisciplinary, international partnership of the following organisations: the University of Liverpool, and Liverpool School of Tropical Medicine, United Kingdom; University of Nairobi, and International Livestock Research Institute, Kenya; University of Addis Ababa, and the International Livestock Research Institute, Ethiopia; iGAD Sheikh Technical Veterinary School, Somaliland; Hamelmalo Agricultural College, Eritrea; and other national and international organisations and NGO's.

HORN's mission is to improve the health and wealth of the people of the Horn of Africa by developing a One Health Regional Network – a network of individuals and organisations across the Horn of Africa – that can undertake high quality research into the link between people's health and wealth and that of livestock and the environment.

A cost-effective solution for controlling Salmonella and Escherichia coli in poultry production⁷⁷

The Phagovet project is devised to satisfy market demand for a more secure and reliable solution to control Salmonella and E. coli infections in poultry farms. With more than 40,000 poultry farms, the European Union (EU-28) is the fourth world's top producers in poultry meat (13.1 million tons, 2014) and the second largest egg producer (>11 million tons, 2014). The European poultry industry employs 302,000 staff across Europe and has an annual turnover of €30 B, being then of significant economic importance. To date, avian colibacillosis and salmonellosis are considered the main bacterial infections in the poultry sector having an important economic impact worldwide. Furthermore, EFSA estimated overall economic burden of human salmonellosis at €3B/year. Finally, the overuse of antibiotic in farming has caused a rise in antimicrobial resistance 700,000 people die annually from drug resistant infections and it is estimated that this number will rise to 10 million by 2050. In response to the unmet need, Phagovet proposes a cost-effective alternative to antibiotics against Salmonella and E. coli. Phagovet consists of a biocide and two technological food additive products based on selected bacteriophages able to kill the target bacteria. Phagovet will be the first phage-based solution to naturally and effectively control both bacteria in poultry production while avoiding side effects and residues associated to antibiotic use. It will reduce Sallmonella infections by 20% and reduce the use of antibiotics on E. coli by 50%. Thus, Phagovet provides a promising effective control measure for a concerning problem for poultry farmers and for human health. The successful market launch of Phagovet will enable members of the Consortium to consolidate their position in the Animal Health, Food Safety and Environmental Control markets and commercialize the product worldwide, reaching €17.76M profit at the end of 2026.

⁷⁶ <http://onehealthhorn.net/>

⁷⁷ <https://cordis.europa.eu/project/rcn/218055/factsheet/en>

Global Challenges Research Fund One Health Poultry Hub⁷⁸

Funded by the Global Challenges Research Fund1 (GCRF) of UK Research and Innovation (UKRI), this interdisciplinary Hub will address the need to meet rising demand for poultry meat and eggs in developing countries, while minimising risk to international public health. Population growth is driving continually increasing demand for poultry meat and egg production. However, rapid intensification creates conditions for diseases to emerge and spill over to people ('zoonoses'). These include bacterial food poisoning and strains of avian influenza with epidemic or pandemic potential. Increased antimicrobial resistance due to misuse of antibiotics in poultry farming is also a major global threat. The need for safe, sustainable poultry production is most urgent in South and Southeast Asia and the GCRF One Health Poultry Hub will work in Bangladesh, India, Sri Lanka and Vietnam. The Hub is led by the Royal Veterinary College (RVC), London, and comprises partners in Asia, Australia, Europe and the UK. The Hub brings teams of laboratory, clinical, veterinary and social scientists together to take a 'One Health' 4 approach to the challenge of providing safe, secure food. It will investigate how and why intensification of poultry production increases risk of infectious disease, and will identify high-risk behaviours, process and environments. It will also test and evaluate novel interventions for disease control.

EcoHealth Alliance⁷⁹

It is a global environmental health non-profit organization dedicate to protecting wildlife and public Health from the emergence of disease. It is an international nonprofit dedicated to a 'One Health' approach to protecting the health of people, animals and the environment from emerging infectious diseases. The organization formed with the merger of two highly respected organizations, Wildlife Trust and the Consortium for Conservation Medicine. The urgent concern for wildlife conservation and the overall health of our planet has led EcoHealth Alliance to become an environmental science and public health leader working to prevent pandemics in global hotspot regions across the globe and to promote conservation.

⁷⁸ <https://www.ids.ac.uk/wp-content/uploads/2019/01/One-Health-Poultry-Hub-Press-Release-2.pdf>

⁷⁹ <https://www.ecohealthalliance.org/about>

Pox Virus

Addressing the dual emerging threats of African swine fever and lumpy skin disease in Europe (Defend)⁸⁰

The DEFEND consortium will target two viral diseases of livestock which are emerging into Europe – African swine fever (ASF) and lumpy skin disease (LSD).

African swine fever virus (ASFV) is the causative agent of ASF, a highly contagious disease of domestic pigs which causes a haemorrhagic syndrome with up to 100% mortality. ASF is endemic in sub-Saharan Africa and on the Italian island of Sardinia. In 2007 the disease was reported in Georgia. Since then it has spread to Russia, Ukraine, Poland and neighbouring countries. In 2017 outbreaks were reported in the Czech Republic and Romania. Wild boar are susceptible to ASFV and facilitate the continuing spread of the disease in Europe with regular spill-over into in-contact domestic pigs.

The capripoxvirus Lumpy Skin Disease virus (LSDV) causes a classic systemic poxvirus disease in cattle and spreads rapidly in warm humid conditions, most likely due to insect-borne transmission. LSDV entered Europe, the Balkans and Caucasus for the first time in 2015. The ongoing epidemic has caused the deaths of thousands of cattle through mortality and eradication campaigns.

ASFV and LSDV represent an immediate and serious threat to the pig and cattle industries in Europe and eastern and central Asia. The aim of the consortium is to control the growing LSD and ASF epidemics in Europe and neighbouring countries by understanding the drivers of LSDV and ASFV emergence, and generating research outputs which underpin novel diagnostic tools and vaccines and authenticate appropriate and rapid responses by decision-makers. A multi-actor approach will be incorporated as a central tenant of the project, with collaborations between experts from academia, industry, and government bodies including EU and non-EU partners from countries affected or threatened by ASF and LSD.



⁸⁰ <https://defend2020.eu/about-us/>

Vaccinology

AfvaNet

An initiative started to stimulate vaccine research in Africa with the following goals

- Bring together all stakeholders in vaccinology and related sciences in Africa;
- Identify and prioritise vaccine gaps in Africa;
- Promote vaccine research and development in Africa; and
- Promote sound ethics, biosafety and biosecurity in Africa.

Department of Biotechnology Translational Centres for Vaccines and Diagnostics⁸¹

Five centres will be established in Veterinary Universities through an inter-disciplinary & public-private partnership mode.

European Network of Vaccine Adjuvants⁸²

This Action aims to bring together experts and stakeholders from the three main areas of vaccine research: human infectious disease, cancer, and animal disease in order to address one of the most critical steps in vaccine development: the use of adjuvants in vaccine formulations. The ultimate goal is to establish a platform to discuss, share and synergize available knowledge on adjuvants and vaccine formulation, and to coordinate their translation into successful, safe and innovative vaccines. Significant effort will be placed on bridging these three separated vaccine fields. This network will significantly strengthen ongoing EC-funded activities and provide a platform for accelerating the development of affordable and effective vaccines in Europe. In addition, as well as sharing their experiences with each other, the Action participants will also engage the general public, providing impartial, balanced and scientific information on adjuvants and vaccines. This Action will contribute to the strengthening of Europe's position as a global leader in vaccinology, and will increase knowledge across the currently separated fields of vaccine development, as well as providing a repository of information for the European public about vaccines and vaccination.

⁸¹ <http://www.dbtindia.nic.in/animal-health/#>

⁸² http://www.cost.eu/COST_Actions/ca/CA16231

European Network of Vaccine Research and Development (TRANSVAC2)⁸³

TRANSVAC2 builds upon the success of TRANSVAC, the European Network of Vaccine Research and Development funded under the EC's previous Framework Programme (FP7). TRANSVAC made significant contributions to the European vaccine development landscape, providing scientific-technical services to more than 29 vaccine projects and developing a roadmap for the establishment of a sustainable European vaccine R&D.

TRANSVAC2 will support innovation for both prophylactic and therapeutic vaccine development. High-quality technical services across four different service platforms will be offered: Technology (for process development and GMP production), Immunocorrelates & Systems Biology, Animal models, and support for Clinical Trials. Academic and non-academic research groups, including SMEs, can apply to benefit from the expertise, reagents, and facilities offered by TRANSVAC2 to accelerate the development of their vaccines. The call for applications is planned to be launched in October 2017. TRANSVAC2 will further accelerate vaccine development by applying cutting-edge technologies to address critical issues in modern vaccine development and thereby increase the quality of services provided. Additionally, TRANSVAC2 will continue the efforts to establish a sustainable vaccine development infrastructure in Europe. (May 2017 – May 2022).

Flanders Vaccine⁸⁴

Flanders Vaccine is a non-profit, strategy-driven platform for academic, industrial and public stakeholders with relevant expertise in human and animal immunotherapeutics and vaccines. Flanders Vaccine brings together universities, public and private hospitals, research centres, SMEs, pharma, competence providers, patient organisations, and government bodies to develop novel immunological health solutions and the vaccines of the future.

Flanders Vaccine supports the development of immunotherapeutics and vaccines for both prophylactic and therapeutic targets in humans and animals by facilitating the exchange of know-how and complementary innovative technologies between academia and industry. The Flanders Vaccine platform can be seen as an integrated tool that gives rise to more and better partnerships.

International Veterinary Vaccinology Network⁸⁵

To establish a network of UK and LMIC-based researchers that could form collaborations to address the challenges that are impeding vaccine development for major livestock and zoonotic diseases affecting agriculture in LMICs. This includes all species that are of agricultural significance in LMICs including (but not limited to) poultry, aquaculture, ruminants and swine with an emphasis on molecular and cellular biology work relevant to vaccine development. Key aims of the Network are to bring together partners from academia, industry and other sectors.

The BactiVac Network⁸⁶

The BactiVac network was established in August 2017 following the award of £2.2m funding under the MRC's GCRF Networks in Vaccines Research and Development initiative.

This funding will support the establishment of a global bacterial vaccinology network, BactiVac, to accelerate the development of vaccines against bacterial infections relevant to low and middle-income countries (LMICs). The BactiVac network will deliver this through catalyst project and training awards to encourage cross-collaboration between academic and industrial partners in developed and developing nations.

⁸³ <http://www.euvaccine.eu/portfolio/project-index/transvac2>

⁸⁴ <http://flandersvaccine.be/>

⁸⁵ <https://www.intvetvacnet.co.uk/>

⁸⁶ <https://www.birmingham.ac.uk/research/activity/immunology-immunotherapy/research/bactivac/index.aspx>

Zoonoses Anticipation and Preparedness Initiative (ZAPI)⁸⁷

Part of the IMI public-private partnership, aims to enable swift response to major new infectious disease threats in Europe and throughout the world by designing new manufacturing processes (up to large scale) for delivering effective control tools against (re)-emerging zoonotic diseases with pandemic potential within a few months after the occurrence of first cases. (End date: 01/03/2020).

Strengthening Animal Production and Health through the Immune Response (SAPHIR)⁸⁸

SAPHIR aims to develop innovative, safe, affordable and effective vaccine strategies effective against endemic pathogens responsible for high economic losses in livestock. It brings together interdisciplinary expertise from fourteen academic institutes including a Chinese partner, five SMEs, one pharmaceutical companies and a forum of animal breeders.

US Veterinary Immune Reagent Network⁸⁹

A major obstacle to advances in veterinary immunology and disease control is the lack of sufficient immunological reagents specific for ruminants, swine, poultry, equine, and aquaculture species. A broad community plan to begin to systematically address the immunological reagent gap has been initiated with a goal of 20 reagents per species group. The reagents produced will include bioactive recombinant cytokines and chemokine proteins (expressed using mammalian cells, *Pichia pastoris* or *E. coli* systems) as well as polyclonal Ab and mAb to them, their receptors, as well as mAb to Ig isotypes, T cell receptors (TCR), Toll like receptors (TLR), and other CD molecules. Our goal is to produce antibodies that function in Elisa and ELISpot assays, for intracellular staining, for blocking function and signaling, and that are useful in flow cytometric applications as well as in fixed tissue sections. Products developed in this proposal will benefit a large group of researchers, including veterinary immunologists, pathologists, and microbiologists.

Immuno Valley⁹⁰

Immuno Valley match business and science to build, nurture and manage lasting partnership in human and animal health research focussing on diagnostics, prevention and treatment of inflammatory and infectious diseases in humans and animals.

American Association of Veterinary Immunologists⁹¹

The American Association of Veterinary Immunologists (AAVI) is dedicated to the development, promotion, and dissemination of knowledge in veterinary immunology. This includes immunology of livestock and poultry, companion animals, fish and marine mammals. The AAVI was formed in 1979 by a group of veterinary immunologists assembled at the annual Conference of Research Workers in Animal Diseases (CRWAD). The AAVI is open to all veterinary immunologists internationally. The AAVI holds an annual business and scientific meeting in conjunction with CRWAD each year as well as an annual symposium in conjunction with the American Association of Immunologists (AAI).

⁸⁷ www.zapi-imi.eu

⁸⁸ <http://www.h2020-saphir.eu/>

⁸⁹ <http://www.vetimm.org/>

⁹⁰ <http://www.immunovalley.nl/>

⁹¹ <http://www.theaavi.org/about.htm>

International Union of Immunological Societies (IUIS)⁹²

IUIS is an umbrella organisation for many of the regional and national societies of immunology throughout the world. The objectives of IUIS are:

- To organise international co-operation in immunology and to promote communication between the various branches of immunology and allied subjects
- To encourage within each scientifically independent territory co-operation between the Societies that represent the interests of immunology
- To contribute to the advancement of immunology in all its aspects.

There are currently 73 Member Societies of IUIS, many of which belong to one of the four Regional Federations encompassing Europe, Latin America, Africa and Asia-Oceania.

International Congresses of Immunology are held every three years under the auspices of IUIS. IUIS also contributes to the staging of regular congresses and conferences by each of the four Regional Federations.

Veterinary Immunology Committee (VIC)⁹³

VIC promotes and coordinates the interests of the international immunology community. It is composed of 5-8 veterinary immunologists, co-opted with the aim of achieving equitable representation for different regions of the world. As a scientific discipline, veterinary immunology traverses topics ranging from fundamental studies on how the immune system functions to more applied areas such as production of vaccines and clinical applications of immunology.

The British Society of Immunology (BSI)⁹⁴

The BSI's main objective is to promote and support excellence in research, scholarship and clinical practice in immunology for the benefit of human and animal health and welfare. The BSI seeks to help British immunology accomplish the highest possible goals. To meet this objective, the BSI undertakes the following:

- Running innovative events in research, public engagement and education
- Promoting and disseminating research and good practice in immunology, translational medicine and vaccination
- Working with its members to develop the benefits of membership and the relevance of the Society
- Providing bursaries and grants
- Enhancing public awareness of immunology
- Influencing policy and decision makers
- Working with other societies

⁹² http://www.iuisonline.org/index.php?option=com_content&view=frontpage&Itemid=1

⁹³ http://www.iuisonline.org/index.php?option=com_content&view=article&id=74&Itemid=70

⁹⁴ <https://www.immunology.org/about-us>

SyrinJector, the first smart device for livestock mass vaccination⁹⁵

Farm animals are susceptible to different diseases caused by bacteria, viruses, fungi and parasites, just like people. Vaccination protects the welfare of livestock by preventing or reducing disease. These vaccines are licensed and produced under strict regulatory conditions ensuring their safety, efficacy and quality. The administration of these vaccines is currently using mechanical syringe with needle, an outdated method to deliver vaccines to billions of animals per year. Livestock vaccination is normally performed by hand. However, the accuracy of the operator administering the vaccine decreases significantly after a couple of hours of automatic and repetitive job, due to the large number of animals injected per hour. This way, up to 70% of dairy herds are inadequately vaccinated simply because of improper management, according to a study done by the Veterinary Teaching Hospital- Colorado State University. Particularly, the livestock industry requires a higher levels of vaccination quality to keep up with the growing global demand for higher quantities along with safe and quality products. Vaccination's efficacy is dependent on the correct dosage being administered to every single animal, in order to create a high and uniform immune reaction.

SyrinJector is the first smart syringe gun for the mass vaccination of livestock. The device is fully automated (no mechanical hand trigger), portable, and works with a software for rapid, controlled and traceable mass vaccination. SyrinJector is safety conscious (anti-stabbing and needle disinfection mechanisms), and highly accurate, making it a must for livestock farmers.

SyrinJector allows high repeatability and reduces human factor and fatigue. Our solution will gradually replace the current process of steel/plastic syringe guns and off-line paper certifications, creating a fully interconnected database system (Cloud) that smartly aggregates and manages the data coming from our digital syringe gun, right from the field.

Vaccines as a remedy for antimicrobial resistant bacterial infections⁹⁶

Antimicrobial Resistance (AMR) is perhaps the most emerging alarm in health. It already causes 700,000 deaths per year and the forecast for 2050 is 10 million deaths, more than cancer today. WHO, UN General Assembly, World Bank, G20, EU, UK and USA governments call for new antibiotics, but the pipeline for new antibiotics is not very promising. Here we propose to use new technologies to develop human monoclonal antibodies and vaccines against three AMR bacteria such as gonococcus, pneumococcus and E.coli. The technology defined as reverse vaccinology 2.0, already successful for viral infections, will be used for bacterial vaccines. Taking advantage of the recent possibility of high throughput cloning of human B cells from convalescent or vaccinated people we aim to find targets difficult or impossible to be discovered using conventional technologies. B cells will be cloned from people convalescent from target infections and from people vaccinated with Men B vaccine which confers some protection against gonococcus. The antibodies produced by the clones will be screened for their ability to bind, intoxicate or kill bacteria using a novel high-throughput microscopy platform that rapidly captures digital images and also with conventional, lower throughput technologies such as bactericidal, opsono-phagocytosis and FACS assays. The selected antibodies, will be expressed as full length and used for passive immunization in animal models and tested for protection in vivo. Finally, those antibodies that will provide the best protection in the above assays, will be used to identify the recognized antigens. Selected antigens will be expressed and tested in vaccine formulations. Fab fragments can be used to make co-crystals with the antigen and determine the crystal structure of the new antigens, for the development of structure-based antigen design. In conclusion we expect to enable development of human monoclonal antibodies and vaccines against AMR.

⁹⁵ <https://cordis.europa.eu/project/rcn/219772/factsheet/en>

⁹⁶ <https://cordis.europa.eu/project/rcn/217960/factsheet/es>

Coalition for Epidemic Preparedness Innovations (CEPI)⁹⁷

CEPI is a global alliance financing and coordinating the development of vaccines against infectious diseases. It was launched in Davos in 2017 to develop vaccines to stop future epidemics.

CEPI's mission is to stimulate and accelerate the development of vaccines against emerging infectious diseases and enable equitable access to these vaccines for people during outbreaks.

Vaccine Safety Net (VSN)⁹⁸

VSN is a global network of websites, verified by the World Health Organization, that provides reliable information on vaccine safety.

The Global Vaccine and Immunization Research Forum (GVIRF)⁹⁹

The GVIRF is a unique Forum in the field of vaccines & immunization. It is the central discussion platform of all research aspects related to the Global Vaccine Action Plan (GVAP), which was developed in the context of the Decade of Vaccines Collaboration and endorsed by the 2012 World Health Assembly. The GVIRF is co-hosted by WHO, the National Institute of Allergy and Infectious Diseases, and the Bill & Melinda Gates Foundation. Gathering leading experts from public health, academia, government, civil society and private sector, the forum is held every second year.

The overall objective of the GVIRF is to serve as a forum to:

- track progress and discuss obstacles related to priority vaccine research and development;
- identify gaps, opportunities and actions for the research and development (R&D) community in the areas of vaccines and immunization;
- create an opportunity for networking and collaboration among the vaccine R&D and immunization communities; and
- review progress towards GVAP research and development strategic objectives and goals.

⁹⁷ <https://cepi.net/>

⁹⁸ <https://www.vaccinesafetynet.org/vsn/vaccine-safety-net>

⁹⁹ https://www.who.int/immunization/research/forums_and_initiatives/gvirf/en/

Vector-borne Diseases

European Network for Neglected Vectors and Vector-Borne Infections – EURNEGVEC¹⁰⁰

The main objective of the Action is to establish a powerful transboundary network of partner institutions across Europe that are involved in education and research related to arthropod-transmitted infectious diseases of man and animals, a network addressing the growing importance of vector-borne diseases at a time of Global Change, all integrated under the One Health concept, and reflecting the complexity and demands of current high-end research.

Currently, the MC of the TD1303 COST Action consists of 63 MC Members and 33 MC Substitutes, from 34 participating countries. Additionally, EurNegVec is officially collaborating with 6 Institutions from NNC and 4 Institutions from IPC

ANTI-VeC: Application of Novel Transgenic technology & inherited symbionts to Vector Control¹⁰¹

A major goal for the scientific community working on vector borne diseases is to develop novel strategies and tools for effective vector control. The network will address the challenge of better integrating these efforts, with a specific focus on two approaches widely considered to be the most promising novel strategies: genetic modification and the use of heritable endosymbionts. Both approaches require the rearing and release of insect disease vectors with the aim of suppressing their populations or blocking the transmission of pathogens. They are highly targeted, species specific strategies, which (depending on the specific form employed) may only require one short intervention phase rather than repeated applications, thus providing major advantages over insecticides in terms of environmental impact and cost effectiveness. The Network will draw together individuals from a broad range of scientific disciplines engaged in developing and deploying these approaches to foster knowledge exchange, methodological and technological sharing, and stimulate innovative collaborative research projects that will lay the foundation for new approaches or more effective implementation.

¹⁰⁰ <http://www.eurnegvec.org/>

¹⁰¹ www.anti-vec.net

The Gnetwork: building capacity for research on neglected tropical vectors¹⁰²

The Gnetwork brings together researchers from around the world to address technical issues that arise when working on small biting flies. Biting midges, sandflies and blackflies transmit internationally important pathogens of humans, livestock and companion animals. While highly divergent in lifecycle, ecology and the pathogens they transmit, these vector groups share the similarity of extremely small adult body size, with wing lengths of <2 mm in most species. This seemingly minor trait imposes a significant constraint on almost every aspect of research within these groups. When combined with fluctuations in funding that follows disease impact, this creates a significant challenge in retaining a critical mass of researchers on each group, particularly in countries where medical and veterinary priorities change rapidly. By creating a community of scientists around the world where research is relevant to development, we can make significant progress in translating techniques across all three vector groups, develop new ones and build a more resilient research base for these neglected vector groups.

European network for sharing data on the geographic distribution of arthropod vectors, transmitting human and animal disease agents (VectorNet)¹⁰³

It is a joint initiative of the European Food Safety Authority (EFSA) and the European Centre for Disease Prevention and Control (ECDC). VectorNet supports the collection of data on vectors and pathogens in vectors related to both animal and human health.

VectorBite Research Coordination Network¹⁰⁴

The goal of the Vector Behavior in Transmission Ecology Research Coordination Network (VectorBiTE RCN) is to increase interaction between researchers in the diverse fields studying VBDs, to encourage collection and consolidation of key data, and to encourage development of analytical tools to better understand the role of vector behavior in transmission ecology.

The RCN will meet the overall goal by pursuing four main objectives:

1. The development of theoretical models that include more details of vector behavior and heterogeneity;
2. Improved data collection and statistical methods to enable such models to be confronted with data;
3. Development of comprehensive and freely available parameterization and validation datasets to allow testing of methods and comparison between proposed models in a transparent fashion;
4. Training young researchers to apply these new tools and models as they are developed.

Medilabsecure: One Health network for the prevention of vector-borne diseases around the Mediterranean and Black Sea regions¹⁰⁵

MediLabSecure is a European project (2014-2018) aiming to: Create a framework for collaboration to improve surveillance and monitoring of emerging vector borne viral diseases (arboviruses); Provide training for public health experts in participating countries to increase the communicable disease control in the Mediterranean and Black Sea region and promote knowledge development and transfer of biosafety best laboratory practices.

¹⁰² www.gnetwork.ac.uk

¹⁰³ <https://ecdc.europa.eu/en/about-us/partnerships-and-networks/disease-and-laboratory-networks/vector-net>

¹⁰⁴ <https://vectorbite.org/about-rcn/ourgoals/>

¹⁰⁵ <http://www.medilabsecure.com/>

Improving current understanding and research for sustainable control of the poultry red mite *Dermanyssus gallinae* (COREMI)¹⁰⁶

Poultry ectoparasites are of particular concern for the European Industry. The poultry red mite (PRM), *Dermanyssus gallinae*, is the most significant pest of laying hens in Europe. A relationship between infestation and hen mortality exists and at a sub-lethal level causes significant stress to birds and a decline in egg quality and production.

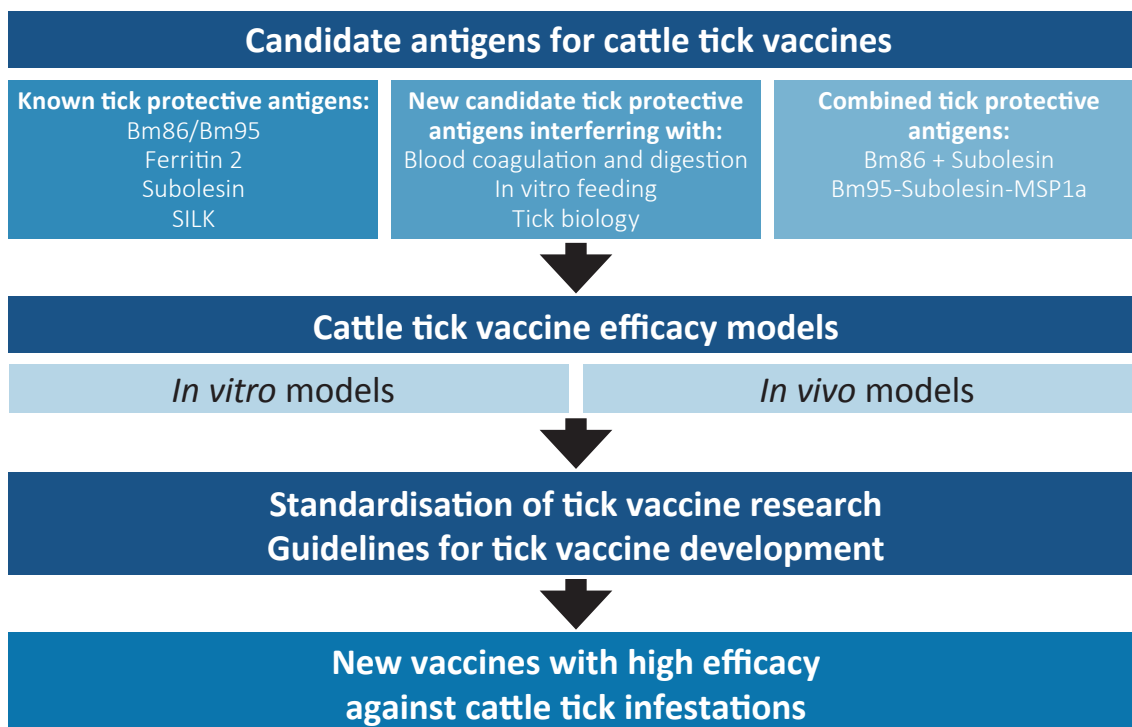
The current norm of 50,000 PRM/hen, rising to 500,000 in extreme circumstances, and >80% PRM prevalence in most European countries cannot be considered acceptable, and must be reduced. This holds especially true as recent and impending legislation to improve hen welfare in this region will exacerbate the negative impact of this pest, compromising production and potentially exposing such legislation as counterintuitive in terms of overall hen health and welfare.

COREMI looked to advance and disseminate comprehensive Integrated Pest Management (IPM) for PRM by collating knowledge of mite biology, the mite-host relationship and novel control and coordinating further research work in the area. This information will feed into developing industry 'Gold Standards' for PRM prevention and control, tailored to individual countries and production systems.

November 2014 - November 2018.

Cattle Tick Vaccine Consortium (CATVAC)¹⁰⁷

The Cattle Tick Vaccine Consortium (CATVAC) was created at a meeting sponsored by the Bill & Melinda Gates Foundation, which was held in Morocco, 2015. The consortium is guided by a Steering Committee formed by Christine Maritz-Olivier, José de la Fuente and Theo Schetters (Chair) who will drive the project and take responsibility to realize the action points listed below:



¹⁰⁶ <http://www.coremi.eu/index.php?id=3234>

¹⁰⁷ <https://parasitesandvectors.biomedcentral.com/articles/10.1186/s13071-016-1386-8>

Infrastructure

VetBioNet – Veterinary Biocontained facility Network for excellence in animal infectious disease research and experimentation¹⁰⁸

The principal aim of the VetBioNet infrastructure project is to establish and maintain a comprehensive network of pre-eminent high-containment (BSL3) research facilities, academic institutes, international organisations and industry partners that is dedicated to advance research on epizootic and zoonotic diseases and to promote technological developments.

Microbial Resource Research Infrastructre (MIRRI)¹⁰⁹

Launched in 2012, the pan-European Microbial Resource Research Infrastructure (MIRRI) is part of the BioMedical Science Research Infrastructure (BMS RI) ESFRI landscape. Currently more than 40 public biorepositories and research institutes from 19 European countries collaborate to establish MIRRI as an European Research Infrastructure Consortium (ERIC) under EU law.

The vision of MIRRI is to be a unique pan-European high-performance platform adding value to known and yet unknown microbial biodiversity and exploiting novel sources and knowledge to discover and disclose for the bioeconomy and bioscience. MIRRI will generate solutions to societal challenges by stimulating interaction between academia and bioindustry.

EVAg (European virus archive global)¹¹⁰

A unique biological resource in the field of virology. It is a non-profit organisation that mobilises a global network with expertise in virology to track, collect, amplify, characterise, standardise, distribute and authenticate viruses and derived products. It is an international group of 25 laboratories including 16 EU member state institutions and 9 non-EU institutions that represent extensive range of virological disciplines.

¹⁰⁸ <http://www.vetbionet.eu/>

¹⁰⁹ <http://www.mirri.org/home.html>

¹¹⁰ <https://www.european-virus-archive.com/partners>

Emerging Viral Diseases-Expert Laboratory Network (EVD-LabNet)¹¹¹

The EVD-LabNet (Emerging Viral Diseases-Expert Laboratory Network) is a European Network of Expert Laboratories supporting ECDC for early detection and surveillance of (re)emerging viral diseases in the EU/EEA, and for providing scientific advice.

This network is a follow-up of the Network for diagnostics of "imported" viral diseases (ENIVD) collaborative action. The EVD-LabNet provides support to EU Member States, EEA countries and EU Candidate Countries in the following areas:

- Identifying (early detection and surveillance) and assessing current and emerging threats to human health from communicable diseases, in particular (re-emerging) vector-borne and other viral infectious diseases. The network contributes to coordinated investigation and scientific expert interpretation.
- Conducting External Quality Assessment (EQA) on viral pathogens covered by the ECDC Emerging and Vector-borne Diseases programme.
- Providing short training courses and workshops to improve the diagnostic capability of EU expert laboratories

The EVD-LabNet is coordinated by Erasmus University Medical Centre with the support of a management team and a scientific advisory board composed of experts from 11 laboratories from 9 EU countries. It works in close collaboration with other European networks involved in emerging infectious disease preparedness and response.

Infravec2¹¹²

It is an international and interdisciplinary research project funded by the European Commission Horizon 2020 Research Infrastructure Program (INFRAIA)

The overall objective of the Infravec2 project is to integrate key specialized research facilities necessary for research excellence in insect vector biology, to open the infrastructure for access by researchers, and to develop new vector control measures targeting the greatest threats to human health and animal industries. Insect vectors transmit parasitic diseases such as malaria and leishmaniasis, and viral infections such as chikungunya, dengue, Zika, Japanese encephalitis and yellow fever. The 24 consortium partners hold the major European biosecure insectaries for experimental infection and containment of insect vectors under Containment Level 2 and 3 (CL2/CL3) conditions, other key insect vector facilities, and include front-line field sites in Africa, the Pacific, and the Americas. Infravec2 will improve the exploitation of European vector infrastructures for research and public health, and will develop other innovative methodologies and technologies.

¹¹¹ <https://www.evd-labnet.eu/>

¹¹² <http://infravec2.eu/partners/>

Collaborating Veterinary Laboratories CoVetLab¹¹³

CoVetLab is a partnership of national veterinary public health institutes from Denmark, France, The Netherlands, Sweden and the United Kingdom.

All the members of CoVetLab carry out research and surveillance and act as national and international reference laboratories for various animal diseases. Together they advance high quality veterinary science by the dissemination of knowledge, sharing of experience and the transfer of skills and technology to safeguard animal and public health.

T Network Laboratories¹¹⁴

The EUCAST Network Laboratories form two separate loosely constructed networks of microbiology laboratories with particular expertise and training in EUCAST Antimicrobial Susceptibility Testing (AST) for bacteria and EUCAST Antifungal Susceptibility Testing (AFST) methods, respectively.

EUCAST Network Laboratories are committed to help develop, validate and troubleshoot EUCAST AST/AFST methods and/or to help train and educate other laboratories in EUCAST methods. These laboratories will also play an important role in the development of improved methods and/or assist clinical breakpoint development by providing species-specific MIC datasets.

SmartCow¹¹⁵: an integrated infrastructure for increased research capability and innovation in the European cattle sector

SmartCow integrates key European cattle research infrastructures to promote their coordinated use and development and thereby help the European cattle sector face the challenge of sustainable production. Covering all the relevant scientific fields and the diversity of cattle types and production systems, SmartCow will provide the academic and private research communities with easy access to 11 major research infrastructures from 7 countries (18 installations) of high quality services and resources. These are needed to develop innovative and ethical solutions for efficient use of animal and feed resources that promote animal welfare and healthy livestock, as well as sustainable competitiveness. SmartCow combines strong scientific and technical skills in animal nutrition (in vivo methods for nutrient utilization and emissions measurements), genetics (genotyped animals, phenotyping capabilities), health and welfare (sensors and automatic recordings of physiological and behavioural traits) and ethics in animal experimentation.

¹¹³ <http://www.covetlab.org/>

¹¹⁴ http://www.eucast.org/fileadmin/src/media/PDFs/EUCAST_files/Network_labs/EUCAST_Network_Laboratories_April_2016.pdf

¹¹⁵ <http://www.smartcow.eu/>

Technologies

Collaborative Management Platform for detection and Analyses of (Re-) emerging and foodborne outbreaks in Europe (COMPARE)¹¹⁶

COMPARE is a multidisciplinary research network that is set up with the common vision to become the enabling analytical framework and globally linked data and information sharing platform system for the rapid identification, containment and mitigation of emerging infectious diseases and foodborne outbreaks. The system sets out to integrate state-of-the-art strategies, tools, technologies and methods for collecting, processing and analyzing sequence-based pathogen data in combination with associated (clinical, epidemiological and other) data, for the generation of actionable information to relevant authorities and other users in the human health, animal health and food safety domains.

AgResults – Innovation in Research and Delivery¹¹⁷

AgResults is a \$122 million multi-donor, multi-lateral initiative incentivizing and rewarding high-impact agricultural innovations that promote global food security, health, and nutrition through the design and implementation of pull mechanism pilots.

AgResults originated at the June 2010 G20 Summit in Toronto, when a group of G20 leaders committed to explore innovative, results-based methods of leveraging private sector innovation to increase agricultural productivity and food security in developing countries. Two years later, at the G20 Summit in Los Cabos Mexico, the governments of Australia, Canada, the United Kingdom, and the United States, in partnership with the Bill & Melinda Gates Foundation pledged \$118 million to establish AgResults through a Financial Intermediary Fund operated by the World Bank. In 2016, the Department of the Foreign Affairs and Trade (DFAT) in Australia, pledged an additional US \$4 million, making the total AgResults Fund \$122 million.

The objectives of AgResults are to:

1. Overcome market failures impeding agricultural innovations by offering results-based economic incentives (known as “pull” mechanisms) to competing private actors for the adoption of new agricultural technologies; and to
2. Test the effectiveness and efficiency of pull financing in comparison with traditional approaches to the promotion and adoption of innovative agricultural technologies.

Pilot Thematic Groups

- Inputs Increasing Yields
- Outputs Post-Harvest Management
- Livestock
- Nutrition

¹¹⁶ <http://www.compare-europe.eu/about>

¹¹⁷ <http://agresults.org/index.php>

Artificial Intelligence for Livestock Health Management¹¹⁸

SERKET is an innovative and disruptive Animal Recognition Software for Livestock able to collect data using standard security cameras, analyze the data by a proprietary Artificial Intelligence algorithm that detects behavioural pattern anomalies and automatically define the best strategy for the livestock health management.

The main benefits are: 1) Reduction of Antibiotics Usage - instead of treating all the animals with drugs and antibiotics, SERKET can early detect the ailments and focus only on the animals that need the treatment; 2) Reducing Mortality Rate - SERKET solution can lessen the livestock mortality rate from 16% to 8%, thanks to the automatic behaviour recognition system; 3) Optimize the livestock management - SERKET is capable of counting animals, of determining feed requirements and automatically adjusting liquid feeding systems.

The uniqueness and innovativeness of SERKET solution is: 1) it is the only technology in the market able to perform a real behavioural tracking and to anticipate dangerous situations for the animals; 2) it is simultaneously non-invasive (needing only standard cameras) and accurate; 3) it leads to a huge saving for farmers, thanks to the accuracy and to the support on livestock management (from a preliminary evaluation, a large pig farm owner will save 5.3 €/pig against a SERKET full-service fee of 2.2 €/pig).

SERKET intercepts the Livestock market trends, driven by the continuous growth of livestock population, the more and more stringent regulations on antibiotics over-use and the imperative need to enhance the productivity by employing efficient systems to simplify the management of large volumes of animals, which is leading to a booming growth of the Livestock Monitoring & Management Market (\$4.84 Billion by 2021 with a CAGR of 17.8% from 2016 to 2021).

The AI-based intelligent assistant for dairy farmers¹¹⁹

Milk is an important nutrient globally: 6bn+ people worldwide consume milk and milk products. In Europe milk provides 11-14% of dietary fat supply. Today we already have 274m+ dairy cows, doubling their headcount to serve the global need for milk is not sustainable.

Health & well-being of cows are the main factors responsible for the difference in cow's milk production. However, to improve the cattle health, the dairy farmer has to watch every single animal non-stop, 24x7, which means an unaffordable increase of at least 30% in labour costs. To address this challenge we have developed Ida, the world's first dairy farmer's assistant that uses artificial intelligence (AI) to learn the behaviour of cows & generate useful operational insights for the farmer.

¹¹⁸ <https://cordis.europa.eu/project/rcn/217892/factsheet/en>

¹¹⁹ <https://cordis.europa.eu/project/rcn/216748/factsheet/en>

AFarCloud: Aggregate farming in the Cloud¹²⁰

Farming is facing many economic challenges in terms of productivity and cost-effectiveness, as well as an increasing labour shortage partly due to depopulation of rural areas. Furthermore, reliable detection, accurate identification and proper quantification of pathogens and other factors affecting both plant and animal health, are critical to be kept under control in order to reduce economic expenditures, trade disruptions and even human health risks.

AFarCloud will provide a distributed platform for autonomous farming that will allow the integration and cooperation of agriculture Cyber Physical Systems in real-time in order to increase efficiency, productivity, animal health, food quality and reduce farm labour costs. This platform will be integrated with farm management software and will support monitoring and decision-making solutions based on big data and real time data mining techniques.

The AFarCloud project also aims to make farming robots accessible to more users by enabling farming vehicles to work in a cooperative mesh, thus opening up new applications and ensuring re-usability, as heterogeneous standard vehicles can combine their capabilities in order to lift farmer revenue and reduce labour costs.

The achievements from AFarCloud will be demonstrated in 3 holistic demonstrators (Finland, Spain and Italy), including cropping and livestock management scenarios and 8 local demonstrators (Latvia, Sweden, Spain and Czech Republic) in order to test specific functionalities and validate project results in relevant environments located in different European regions.

AFarCloud outcomes will strengthen partners' market position boosting their innovation capacity and addressing industrial needs both at EU and international levels. The consortium represents the whole ICT-based farming solutions' value chain, including all key actors needed for the development, demonstration and future market uptake of the precision farming framework targeted in the project.

SWINOSTICS¹²¹

SWINOSTICS is a European project, funded within the framework of EU's Horizon 2020 Programme. The project is coordinated by CyRIC, Cyprus Research and Innovation Center Ltd and will run for three and a half years, to allow enough time for the development and real-world validation of the technology.

The main aim is to develop a device for early, field-based, detection of important swine diseases (ASFV, PRRSV, H1N1, PPV, PCV2 and CSF). The device will use swine oral fluid samples as its main input, even though, it will be compatible with the use of other types of samples, such as faeces, blood or nasal swabs.

The project is funded by Horizon 2020, the EU Framework Programme for Research and Innovation for 2014-2020 under grant agreement No 771649.

DBT's Smart Agriculture Conclave: Farm Zone¹²²

The Indian Department of Biotechnology (DBT), under the Ministry of Science and Technology, is convening Smart Agriculture Conclave in New Delhi from 29th to 31st August 2017, in partnership with the UK's Biotechnology and Biological Sciences Research Council (BBSRC) and Research Councils UK (RCUK) India.

The objective of this conclave is to create "Farm Zone" a collective open-source for smart agriculture data platform to use biological research and data to improve the lives of small and marginal farmers. It is envisaged that "Farm Zone" will help cater to all needs of the farmer, from dealing with climate change, weather predictions and soil, water, seed requirements to providing market intelligence.

¹²⁰ <https://cordis.europa.eu/project/rcn/216117/factsheet/en>

¹²¹ <http://swinostics.eu/>

¹²² <http://www.dbtindia.nic.in/dbts-smart-agriculture-conclave/>

Other Networks

AITVM (Association of Institutions for Tropical Veterinary Medicine)¹²³

AITVM is a foundation of 24 veterinary faculties and livestock institutes based in Africa, Asia and Europe. Its mandate is to improve human health and quality of life by means of increased and safe food production in tropical regions through enhancement of research, training and education in veterinary medicine and livestock production within the framework of sustainable development.

DISCONTTOOLS¹²⁴

DISCONTTOOLS identifies the gaps in the knowledge to speed up the development of new DISEase CONTROL TOOLS and reduce the burden of animal diseases. It's mission is to be a critical resource for funders of animal health research including the European Commission, member states, foundations, trusts along with private industry to prioritise research.

The public and private sector in the EU together spend around € 1 billion per year on animal health and welfare related research. By identifying the gaps in knowledge and available control tools, we help to prioritise research and speed up the development of new diagnostics, vaccines and pharmaceuticals to reduce the burden of animal diseases.

We deliver on our mission by:

- Providing an open-access database with research gaps to improve infectious disease control in animals
- Supporting the development of strategic research agendas by public and industry bodies
- Communicating on the identified research gaps to animal health research decision makers, researchers, industry and students

Overall, this improves animal health and welfare and provides benefits in terms of public health and a safe and secure food supply.

SCAR Collaborative Working Group – Animal Health and Welfare¹²⁵

The Collaborative Working Group on European Animal Health & Welfare Research (CWG) was formed in response to an initiative of the EU Standing Committee on Agricultural Research (SCAR). It includes 28 partners from 20 countries. The goal is to establish a durable and focused network of research funders from Member and Associated States of the EU – providing a forum leading to improved collaboration on research prioritisation and procurement, creating the necessary critical mass and focus to deliver the animal health and welfare research needs of our policy makers and the European livestock industry.

CWG Objectives:

- Share information on research projects
- Coordinate research activities
- Work towards a common research agenda
- Work towards mutual research funding activities, in the field of animal health, fish health and those conditions which pose a threat to human health

Other activities include mapping the landscape in relation to provisions of research facilities, including expertise and micro-organism collection.

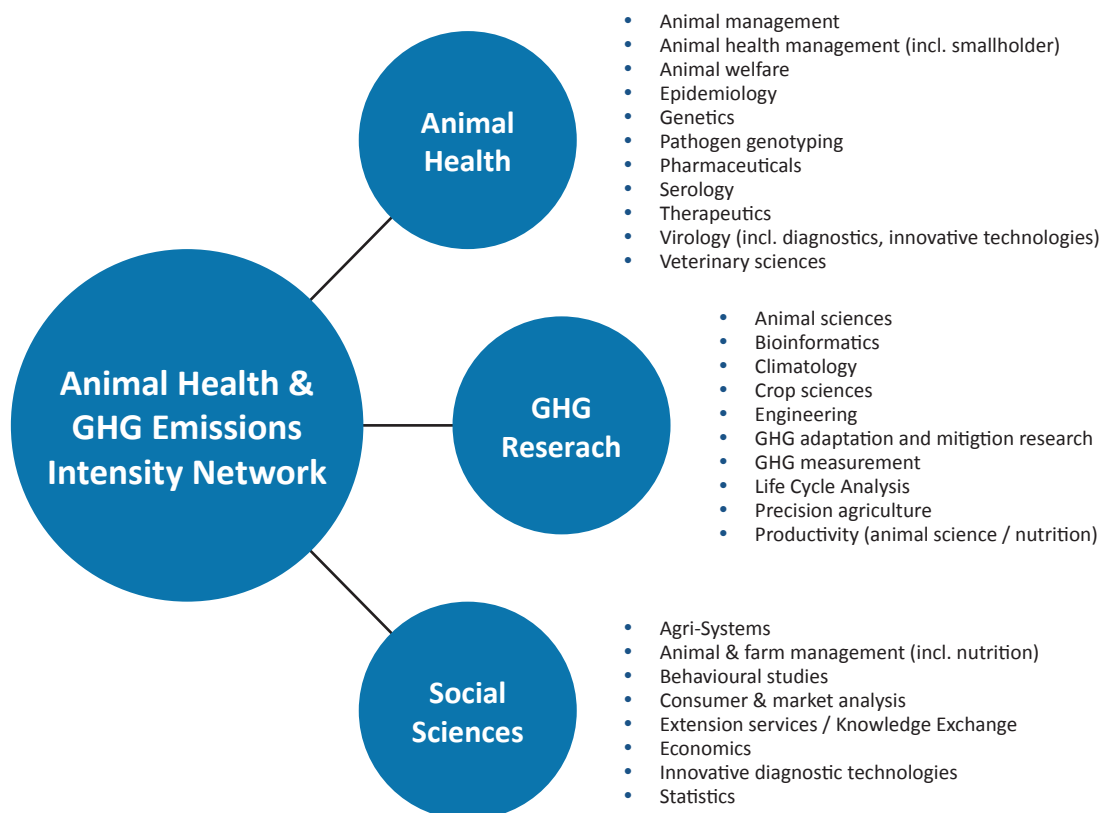
¹²³ <http://www.aitvm.org/>

¹²⁴ <https://www.discontools.eu/about.html>

¹²⁵ <https://www.scar-cwg-ahw.org/>

Animal Health and GHG Emissions Intensity Network¹²⁶

The Animal Health & GHG Emissions Intensity Network is a UK led initiative of the Livestock Research Group of the Global Research Alliance on Agricultural Greenhouse Gases. The aim of the Network is to bring together researchers from across the world to investigate links and synergies between efforts to reduce livestock disease and GHG emissions intensity reductions.



Global Alliance for Research on Avian Diseases (GARAD)¹²⁷

and exchange latest research advances, promote collaborations and to maximise the use of resources and expertise to progressively control of avian diseases around the world. The main objectives include to share best practice in avian disease control to the global research community and stakeholders; identify collaborative research opportunities and secure funding for multi-disciplinary research to better understand the transmission of avian diseases in production animals and the wildlife; provide social and economic information to support international policy for disease control; assess the impact of prevention and control tools in the management of disease.

¹²⁶ <https://globalresearchalliance.org/dashboard/animal-health-and-ghg-emissions-intensity-network/>

¹²⁷ <http://garad.org/>

Global Peste des Petits Ruminants (PPR) Research Alliance¹²⁸

NEAT: Networking to enhance the use of economics in animal health education, research and policy making in Europe and beyond¹²⁹

NEAT, consortium funded by the EU's Lifelong Learning Programme aimed to strengthen and enhance the use of economics in animal health in higher education and professional environments by creating a wider cadre of people to teach economics and to create educational materials, which are widely available at all levels of the livestock sector and animal health professionals. The NEAT consortium was coordinated by the RVC and has representatives from academia, research institutes, public and government agencies and other organisations such as non-governmental organisations (NGOs), student associations and consultant companies. NEAT included 60 partners from Europe, Australasia, Latin America and Africa and over 200 NEAT friends.

REMESA – Mediterranean Animal Health Network¹³⁰

REMESA was formed in 2009 by the chief veterinary officers of 10 Western Mediterranean Countries (Algeria, Egypt, France, Italy, Libya, Morocco, Mauritania, Portugal, Spain and Tunisia). Its aims is to create common framework for work and cooperation, having the necessary capabilities to assist and coordinate the development and implementation of animal health regional projects and programs: the Mediterranean Animal Health Network (*REseau MEditerranéen de Santé Animale* – REMESA).

In 2013, the chief veterinary officers of Malte, Chypre and Greece joined the Network. Jordan and Lebanon joined the Network in 2014.

The specific objective of REMESA is the improvement of prevention and control against the major transboundary animal diseases and zoonoses through the strengthening of the national and regional resources and capacities, the harmonization and coordination of surveillance and control activities.

Four thematic sub-networks have been set up: laboratories (RELABSA), epidemiology (REPIVET), communication (RECOMSA) and socioeconomics (RESEPSA).

Centre for Tropical Livestock Genetics and Health¹³¹

Funded by BMGF and DFID in 2015, CTLGH supports programs that improve livestock-based livelihoods in the tropics. It is a strategic alliance of the Roslin Institute, Scotland's Rural College and the International Livestock Research Institute.

Nigeria Animal Health Research Network

Nigeria Animal Health Research Network is a network of Researchers working on various priority diseases identified in the National Veterinary Research Institute; National Animal based Production Research Institute and the Faculties of Veterinary Medicine in Nigerian Universities.

¹²⁸ <https://www.youtube.com/watch?v=OpEsgJdmiD4>

¹²⁹ <https://www.rvc.ac.uk/research/research-centres-and-facilities/veterinary-epidemiology-economics-and-public-health/projects/neat>

¹³⁰ <http://www.fao.org/remesanetwork/remesa/en/>

¹³¹ <http://www.ctlgh.org/>

STVM¹³² (Society for Tropical Veterinary Medicine)

The Society for Tropical Veterinary Medicine (STVM) is a non-profit organization whose purpose is the advancement of tropical veterinary medicine, hygiene and related disciplines. The activities of the Society focus scientific interest on strategies to deal with established and changing patterns of diseases affecting animals in the tropics. Tropical Veterinary Medicine has become an area of global importance as world trade continues to expand and the challenge of future research is to develop better diagnosis, treatment and control methods for tropical diseases of all livestock species. Significantly, a part of this is to understand the environmental variables which affect the host and disease interactions as well, and ultimately to support increased food production in the tropics.

The STVM is made up of scientists, veterinarians and students from more than 40 countries with common interests in tropical veterinary medicine. The primary activity of STVM is to sponsor a scientific meeting every 2 years at which time the latest advances in all aspects of tropical veterinary medicine, from treatment and control of animal diseases to trade regulations, are presented to an international audience. The meetings also promote international information exchange and collaboration. Meetings are held in different locations around the world and hosted locally by national agricultural organizations. The Society also maintains links with other organizations involved in tropical veterinary medicine.

Membership is open to anyone with an interest in tropical veterinary medicine and related disciplines.

Infectious Diseases of East African Livestock¹³³

This study involves intensive monitoring of a cohort of 500 calves for the first year of life. Any signs of infection will be noted and provisional diagnoses will be made. Samples of blood and other tissues will be taken and used to apply state-of-the-art diagnostic techniques for identifying infections. The study will generate data on thousands of cases of infection, records of the clinical signs shown by the animals and of any impact on their health and growth, together with information on genetics, immunity and nutritional status. These data will be analysed statistically to rank different infections in order of their importance and to identify factors which predispose some cattle to a high burden of infectious diseases. The data will also be used to develop simple practical tools to help diagnose infections in the field where most animal health workers do not access to sophisticated laboratory facilities.

Heartwater

The USDA in collaboration with CIRAD, CaribVet, and PROCINORTE completed a gap analysis workshop for Heartwater (a tick transmitted disease endemic in Africa and some islands of the Caribbean) last month in Guadeloupe. A gap analysis report should be completed early 2019. One of the expected outcomes of the workshop and report is the establishment of new research collaborations between North America (Caribbean countries, Mexico, and U.S), Europe, and Africa.

¹³² <https://www.omicsonline.org/societies/society-for-tropical-veterinary-medicine/>

¹³³ <https://www.ilri.org/ideal>

Programme for preventions of Streptococcus suis¹³⁴

Streptococcus suis is an endemic porcine disease causing significant economic losses to the pork meat production industry in all countries where pigs are reared on a large scale. In some countries S. suis is the primary cause of mortality and morbidity in young pigs and the most frequent reason to prescribe antibiotics of the amino-penicillin group as a preventative measure. S. suis is also a zoonotic pathogen of humans and infections reported worldwide has increased significantly in the past years.

Within S. suis many different types (serotypes, genotypes, pathotypes) exist causing problems in the development of control strategies targeting all types. Asymptomatic carriage in adult pigs is common and combined with a lack of knowledge on the host-pathogen-environment interactions, are the main reasons for failure to control the endemic nature of this pathogen. The project outputs will impact on an understanding host-pathogen-environment interactions of S. suis infections through the genome sequencing of 1200-1500 S. suis isolates from representative geographic areas of the major pork producing countries and performing genome-wide-association studies with invasive disease and asymptomatic carriage. New diagnostic methods will be developed for global monitoring of infection risk and tested on case-farms. Epidemiology studies will determine risk factors for invasive S. suis disease, including the role of co-infections, and for the first time properly assess the dynamics of the disease on a representative farm. We will increase our understanding of the virulence mechanisms involved in pathogenesis including interactions of S. suis with the innate immune system. The project outputs will strengthen the evidence base for prevention and control strategies through testing of novel conserved vaccine antigens in pigs and prevention strategies based on manipulation of the microbiota and stimulation and maturation of the innate immune system.

PROCINORTE¹³⁵

The Cooperative Program in Research and Technology for the Northern Region –PROCINORTE is a network of national agricultural research bodies in the three countries of North America: Canada, USA and Mexico. It supports agricultural trade through sound science and knowledge-sharing in areas of trilateral relevance.

Agricultural Biosecurity Coordination Network¹³⁶

NIFA recently announced a new funding opportunity for establishing an agricultural biosecurity coordination network as part of the request for applications (RFA) for the AFRI Foundational & Applied Science Program. The program anticipates that one project will be supported during FY2018, with a maximum total budget of \$1 million for up to five years.

The program area priority is for tactical sciences (as defined by NIFA) that are scientific assets that protect the integrity, reliability, and sustainability of the U.S. food and agriculture system from an array of known and potential threats from pests and diseases impacting plants and animals. Current tactical science efforts are supported and conducted by a variety of public and private organizations, and NIFA provides research, extension and education support in three broad areas:

- Detection and diagnostics;
- Regulatory systems; and
- Development and deployment of new tools and management strategies for crop and animal protection

¹³⁴ <https://www.pigss-horizon2020.eu/>

¹³⁵ <https://www.procinorte.net/>

¹³⁶ <https://www.asas.org/taking-stock/blog-post/taking-stock/2018/06/24/agricultural-biosecurity-coordination-network-funding>

