



STAR-IDAZ
International Research
Consortium on Animal Health

Map Existing Initiatives in Working Group Fields

Secretariat of the
STAR-IDAZ International
Research Consortium
on Animal Health,
April 2018



The Secretariat for the STAR-IDAZ IRC (SIRCAH) is funded from the European Union's Horizon 2020 research and innovation programme under grant agreement No 727494



Contents

Introduction.....	4
African Swine Fever	6
Bovine Tb	7
Brucellosis	8
Coronavirus	9
Diagnostics	10
Emerging diseases	11
Epidemiology	15
Foot and Mouth disease	16
Genetics and Genomics.....	17
Helminth (including anthelmintic resistance)	18
Influenza.....	20
Integrated Pathogen Control for the Reduction of Resistance.....	21
One Health (including food-borne pathogens).....	25
Vaccinology.....	28
Vector-borne Diseases.....	33
Infrastructure	36
Technologies.....	39
Other Networks	40

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 Tuberculosis
- 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
- Porcine Reproductive and Respiratory Syndrome
- Porcine respiratory disease
- Pox virus infections
- One Health (including food-borne pathogens)
- 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

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



Brucellosis

DBT – Network Project on Brucellosis⁴

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 Portal⁵

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

Brucellosis Society (Bruce)⁶

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)⁷. 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.

⁴ <http://www.dbtbrucellosis.in/>

⁵ <http://www.phidias.us/bbp/>

⁶ <https://list.umass.edu/mailman/listinfo/bruce>

⁷ <https://crwad.org/>

Coronavirus

Towards Control of Avian Coronaviruses: Strategies for Diagnosis, Surveillance and Vaccination^{8,9}

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.



⁸ http://www.cost.eu/COST_Actions/fa/FA1207

⁹ <http://cost-controllingaviancoronaviruses.org/>

Diagnosics

Swine diseases field diagnostics toolbox¹⁰

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)¹¹

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 – FIND¹²

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.

¹⁰ https://cordis.europa.eu/project/rcn/212392_en.html

¹¹ https://cordis.europa.eu/project/rcn/212396_en.html

¹² <https://www.finddx.org/>

Emerging diseases

Global Early Warning System (GLEWS+)¹³

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'.

GLEWS14 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)¹⁵

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.

¹³ <http://www.fao.org/3/a-i3579e.pdf>

¹⁴ <http://www.glews.net/>

¹⁵ <http://www.fao.org/ag/againfo/programmes/en/empres/home.asp>

World Animal Health Information Database (WAHIS) Interface¹⁶

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)¹⁷

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)¹⁸

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)¹⁹

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.

¹⁶ http://www.oie.int/wahis_2/public/wahid.php/Wahidhome/Home

¹⁷ <http://www.fao.org/giews/en/>

¹⁸ <http://oahn.ca/what-is-oahn/>

¹⁹ https://www.aphis.usda.gov/aphis/ourfocus/animalhealth/lab-info-services/nahln/ct_about_nahln

Caribbean Animal Health Network (CaribVET)²⁰

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) Network²¹

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 Network²²

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)²³

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.

²⁰ <https://www.caribvet.net/>

²¹ <http://www.agriculture.gov.au/animal/health/system/lab-network#the-laboratories-emergency-animal-disease-diagnosis-and-response-leaddr-network>

²² <https://www.efsa.europa.eu/en/animal-health-and-welfare/networks>

²³ <https://www.efsa.europa.eu/en/cross-cutting-issues/networks>

The EWDA Wildlife Health Network²⁴

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).



²⁴ <http://ewda.org/ewda-network/>

Epidemiology

Participatory Epidemiology Network for Animal and Public Health (PENAPH)²⁵

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).

²⁵ <https://penaph.net/about/>

Foot and Mouth disease

Global Foot and Mouth Disease Research Alliance²⁶

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)²⁷

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 Network²⁸

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.

²⁶ <https://www.ars.usda.gov/gfra/>

²⁷ <http://www.fao.org/ag/againfo/commissions/eufmd/en/>

²⁸ <https://www.foot-and-mouth.org/Ref-Lab-Network>

Genetics and Genomics

A Global Network – Functional Annotation of Animal Genomes” (FAANG) initiative²⁹

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)^{30, 31}

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.

²⁹ <https://www.animalgenome.org/community/FAANG/index>

³⁰ <http://faang-europe.org/>

³¹ http://www.cost.eu/COST_Actions/ca/CA15112

Helminth (including anthelmintic resistance)

Livestock Helminth Research Alliance (LiHRA)³²

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.

COMBATING ANTHELMINTIC RESISTANCE IN RUMINANTS³³

Helminth parasitic pathogens cause severe disease and are amongst the most important productionlimiting 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. 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 will bring together a multi-disciplinary blend of scientists that do normally rarely interact. Inclusion of SMEs and industry in the consortium will facilitate 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.

³² <http://www.lihra.eu/>

³³ http://www.cost.eu/COST_Actions/ca/CA16230

Paragone³⁴

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 will take a number of these prototypes and test them in further trials, as well combine some to make multivalent vaccines. For parasites for which vaccines have proved difficult to develop, fundamental studies will be performed to inform on the type of host response that needs to be stimulated to obtain protection. This will feed into the selection of appropriate novel adjuvant systems with which to deliver the vaccines. By bringing these streams together, PARAGONE will take 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)

Neglected Tropical disease NGO Network^{35, 36}

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 podoconiosis 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.

European Network on Taeniosis/Cysticercosis^{37, 38}

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.

³⁴ www.paragoneh2020.eu

³⁵ <http://www.ntd-ngonetw.org/about-us>

³⁶ <http://www.ntd-ngonetw.org/content/schistosomiasis>

³⁷ <http://www.cystinet.org/>

³⁸ http://www.cost.eu/COST_Actions/fa/TD1302

Influenza

OIE and FAO Network of expertise on animal influenza – Offlu³⁹

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.



³⁹ <http://www.offlu.net/>

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)⁴⁰

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.

⁴⁰ <http://www.pigutnet.eu/>

Interagency Coordination Group on Antimicrobial Resistance⁴¹

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.

The OIE Ad Hoc Group on Prioritisation of Diseases for Which Vaccines Could Reduce Antimicrobial Use in Animals⁴²

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 Center⁴³

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

⁴¹ <http://www.who.int/antimicrobial-resistance/interagency-coordination-group/en/>

⁴² http://www.oie.int/fileadmin/SST/adhocreports/Diseases%20for%20which%20Vaccines%20could%20reduce%20Antimicrobial%20Use/AN/AHG_AMUR_Vaccines_Apr2015.pdf

⁴³ <https://www.ars.usda.gov/alternativestoantibiotics/index.html>

International Symposium on Alternatives to Antibiotics (ATA)⁴⁴

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 Network⁴⁵

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)⁴⁶

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.

Joint Programming Initiative on Antimicrobial Resistance (JPIAMR)⁴⁷

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 Institute⁴⁸

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:

⁴⁴ <https://www.ars.usda.gov/alternativestoantibiotics/>

⁴⁵ <https://www.ars.usda.gov/alternativestoantibiotics/ResearchCenter/AgAR%20Network.pdf>

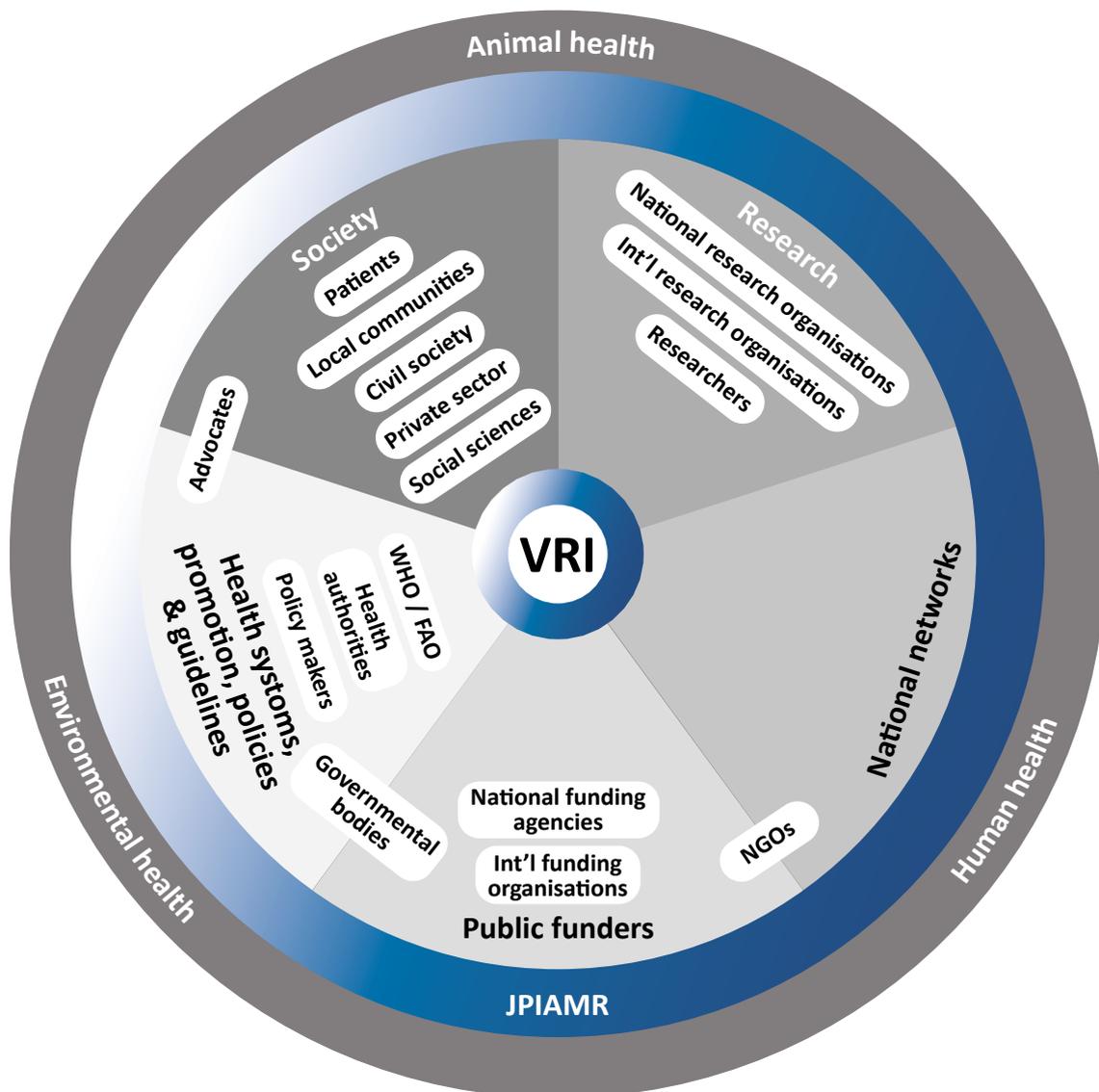
⁴⁶ <https://ecdc.europa.eu/en/about-us/partnerships-and-networks/disease-and-laboratory-networks/ears-net>

⁴⁷ <https://www.jpiamr.eu/>

⁴⁸ <https://www.jpiamr.eu/activities/jpiamr-virtual-research-institute/>

- 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)



One Health (including food-borne pathogens)

Network for evaluation of One Health (NEOH) COST ACTION TD1404⁴⁹

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)^{50, 51}

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.

⁴⁹ <http://neoh.onehealthglobal.net>

⁵⁰ <https://www.euro-fbp.org/>

⁵¹ http://www.cost.eu/COST_Actions/fa/FA1408

Targeted chemotherapy towards diseases caused by endoparasites⁵²

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 Health⁵³

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 Zoonoses⁵⁴

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.

⁵² <http://www.costcm1307.org/CM1307/Home.html>

⁵³ <https://www.era-learn.eu/network-information/networks/one-health-ejp>

⁵⁴ <https://www.anses.fr/en/content/med-vet-net>

European Food-and Waterborne Diseases and Zoonoses Network (FWD-Net)⁵⁵

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.

Epizone⁵⁶

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)⁵⁷

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

SAPUVETNET⁵⁸

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”.

⁵⁵ <https://ecdc.europa.eu/en/about-us/partnerships-and-networks/disease-and-laboratory-networks/fwd-net>

⁵⁶ <https://www.epizone-eu.net/en/Home/About-us.htm>

⁵⁷ <http://www.onehealthglobal.net/>

⁵⁸ http://www.fao.org/ag/againfo/home/en/news_archive/2011_FAO_supports_SAPUVETNET.html

Vaccinology

International Veterinary Vaccinology Network⁵⁹

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 Network⁶⁰

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.

European Network of Vaccine Adjuvants⁶¹

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.

⁵⁹ <https://www.intvetvaccnet.co.uk/>

⁶⁰ <https://www.birmingham.ac.uk/research/activity/immunology-immunotherapy/research/bactivac/index.aspx>

⁶¹ http://www.cost.eu/COST_Actions/ca/CA16231

Zoonoses Anticipation and Preparedness Initiative (ZAPI)⁶²

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)

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.

European Network of Vaccine Research and Development (TRANSVAC2)⁶³

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)

Strengthening Animal Production and Health through the Immune Response (SAPHIR)⁶⁴

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.

⁶² www.zapi-imi.eu

⁶³ <http://www.euvaccine.eu/portfolio/project-index/transvac2>

⁶⁴ <http://www.h2020-saphir.eu/>

Flanders Vaccine⁶⁵

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.

Department of Biotechnology Translational Centres for Vaccines and Diagnostics⁶⁶

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

US Veterinary Immune Reagent Network⁶⁷

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 Valley⁶⁸

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.

⁶⁵ <http://flandersvaccine.be/>

⁶⁶ <http://www.dbtindia.nic.in/animal-health/#>

⁶⁷ <http://www.vetimm.org/>

⁶⁸ <http://www.immunovalley.nl/>

Italian Network of Veterinary Immunology – RNIV⁶⁹

RNIV is an Italian network of scientists working in different fields of veterinary sciences on both farm animals and pets. that want to adopt an immunological approach to diverse issues of animal health and welfare. This way, veterinary immunologists share expertise with other research workers also at international level to achieve complementation and synergism in research projects.

American Association of Veterinary Immunologists⁷⁰

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).

International Union of Immunological Societies (IUIS)⁷¹

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)⁷²

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.

⁶⁹ www.immvet.it

⁷⁰ <http://www.theaavi.org/about.htm>

⁷¹ http://www.iuisonline.org/index.php?option=com_content&view=frontpage&Itemid=1

⁷² http://www.iuisonline.org/index.php?option=com_content&view=article&id=74&Itemid=70

The British Society of Immunology (BSI)⁷³

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

⁷³ <https://www.immunology.org/about-us>

Vector-borne Diseases

European Network for Neglected Vectors and Vector-Borne Infections – EURNEGVEC⁷⁴

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 Control⁷⁵

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

⁷⁴ <http://www.eurnegvec.org/>

⁷⁵ www.anti-vec.net

The Gnetwork: building capacity for research on neglected tropical vectors⁷⁶

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)⁷⁷

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.

Medilabsecure: One Health network for the prevention of vector-borne diseases around the Mediterranean and Black Sea regions⁷⁸

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.

⁷⁶ www.gnetwork.ac.uk

⁷⁷ <https://ecdc.europa.eu/en/about-us/partnerships-and-networks/disease-and-laboratory-networks/vector-net>

⁷⁸ <http://www.medilabsecure.com/>

Improving current understanding and research for sustainable control of the poultry red mite *Dermanyssus gallinae* (COREMI)⁷⁹

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.

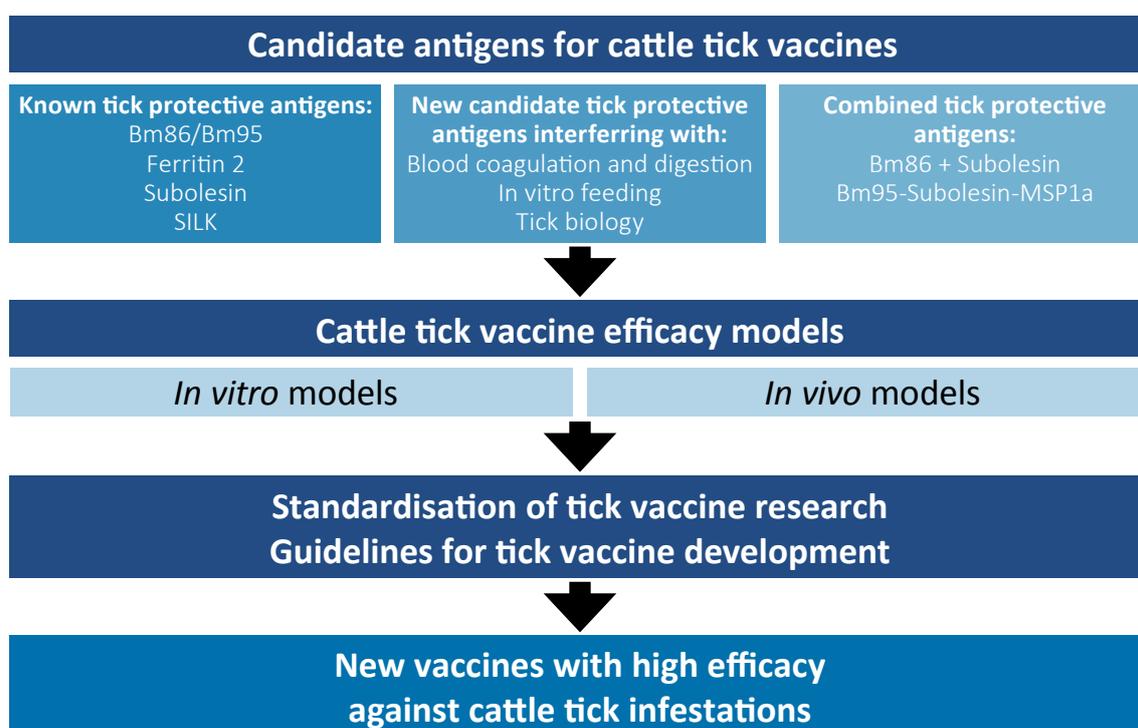
The current norm of 50,000 PRM/hen, rising to 500,000 in extreme circumstances, and >80% PRM prevalence in most European countries cannot be considered acceptable, and must be reduced. This holds especially true as recent and impending legislation to improve hen welfare in this region will exacerbate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

COREMI will look 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 be used to produce industry 'Gold Standards' for PRM prevention and control, tailored to individual countries and production systems. A more complete understanding of PRM impact to poultry and other sectors, including public health, will also be achieved through the Action.

November 2014 - November 2018.

Cattle Tick Vaccine Consortium (CATVAC)⁸⁰

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:



⁷⁹ <http://www.coremi.eu/index.php?id=3234>

⁸⁰ <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 experimentation⁸¹

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)⁸²:

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)⁸³

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.

⁸¹ <http://www.vetbionet.eu/>

⁸² <http://www.mirri.org/home.html>

⁸³ <https://www.european-virus-archive.com/partners>

Emerging Viral Diseases-Expert Laboratory Network (EVD-LabNet)⁸⁴

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.

Infravec2⁸⁵

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.

⁸⁴ <https://www.evd-labnet.eu/>

⁸⁵ <http://infravec2.eu/partners/>

Collaborating Veterinary Laboratories CoVetLab⁸⁶

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.

EUCAST Network Laboratories⁸⁷

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.

⁸⁶ <http://www.covetlab.org/>

⁸⁷ http://www.eucast.org/fileadmin/src/media/PDFs/EUCAST_files/Network_labs/EUCAST_Network_Laboratories_April_2016.pdf

Technologies

COllaborative Management Platform for detection and Analyses of (Re-) emerging and foodborne outbreaks in Europe (COMPARE)⁸⁸

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 Delivery⁸⁹

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:

- 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
- 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

⁸⁸ <http://www.compare-europe.eu/about>

⁸⁹ <http://agresults.org/index.php>

Other Networks

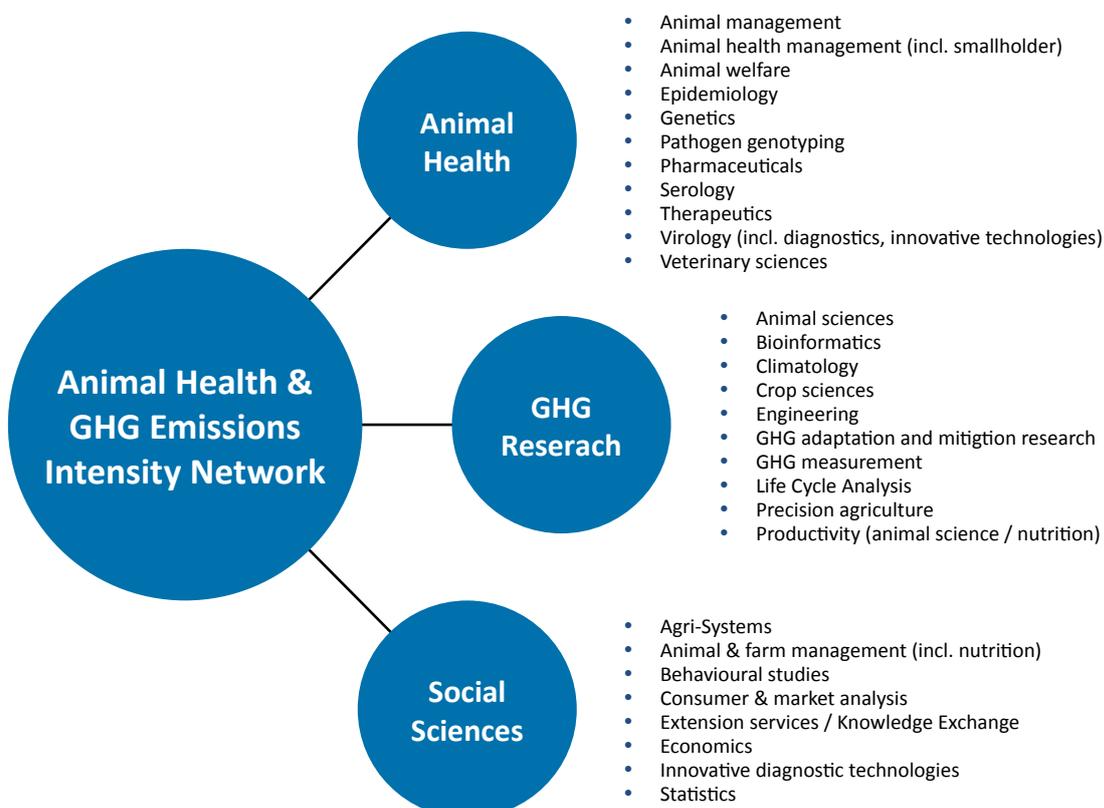
SCAR Collaborative Working Group – Animal Health and Welfare⁹⁰

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.



⁹⁰ <https://www.scar-cwg-ahw.org/>

Animal Health and GHG Emissions Intensity Network⁹¹

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)⁹²

GARAD aims to establish networking among avian researchers from all continents to share 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.

Global Peste des Petits Ruminants (PPR) Research Alliance⁹³

NEAT: Networking to enhance the use of economics in animal health education, research and policy making in Europe and beyond⁹⁴

NEAT is a consortium funded by the EU's Lifelong Learning Programme that aims 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 is 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 includes 60 partners from Europe, Australasia, Latin America and Africa and over 200 NEAT friends.

⁹¹ <https://globalresearchalliance.org/dashboard/animal-health-and-ghg-emissions-intensity-network/>

⁹² <http://garad.org/>

⁹³ <https://www.youtube.com/watch?v=OpEsgJdmiD4>

⁹⁴ <https://www.rvc.ac.uk/research/research-centres-and-facilities/veterinary-epidemiology-economics-and-public-health/projects/neat>

REMESA – Mediterranean Animal Health Network⁹⁵

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).

⁹⁵ <http://www.fao.org/remesanetwork/remesa/en/>



