The One Health European Joint Programme

Strategic Research Agenda

July 2019

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The challenge

To enhance the prevention, detection and control of zoonoses and antimicrobial resistance

Threat of zoonoses and antimicrobial resistance

Diseases that are transmitted directly or indirectly between animals and humans (zoonoses), as well as antimicrobial resistance (AMR), pose major risks for public health. Zoonoses and AMR have a significant social and economic impact, and especially when transmitted via food, they need to be addressed by all actors in the farm-to-fork continuum.

Societal and environmental changes, including changes in land use, operation of large terrestrial and aquaculture food production units, and microbial pollution of land and water sources, have created new threats to public health. Among these threats, illness and death from consumption of unsafe food pose a considerable burden. Food imports and exports in Europe have doubled since 2005, and the consequences of increasing global food chains have tremendous consequences for food safety.

The emergence of major zoonotic diseases and AMR in Europe and globally has led to continuous adjustments to the way authorities address these threats. The European agricultural sector has been at the forefront in the control of many zoonotic pathogens as close to the source as possible, sometimes even stamping out the disease in the full production system (e.g. *Brucella* in cattle in some countries). It is highly likely that a number of other zoonotic pathogens can be addressed in this way, but the pre-condition is typically good scientific cross-sectoral work and preparedness in line with the "Prevent-Detect-Respond" concept.

A holistic approach to prevention, detection and control

A transdisciplinary approach is needed to better understand the processes behind the emergence and spread of foodborne zoonoses and AMR, including their routing in the animal-human-environment triangle. This is possible with a One Health approach involving synergies amongst human, animal and environmental health. Indeed, the One Health concept recognizes that human health is tightly connected to the health of animals and the environment, i.e. that animal feed, human food, animal and human health, and environmental contamination are closely >>

linked. Therefore, the study of infectious agents that may cross species and environmental barriers to move between these compartments is key within the One Health concept.

Action is needed at the European level to identify and characterize existing and emerging risks, particularly in the field of food safety, by building capacity to collect and analyse information, and supporting application of state-of-the-art reference and surveillance tools, considering the harmonization of existing and new diagnostic tests. Clearly, national research agendas need to be integrated and aligned. There is also a need for research-based recommendations to various stakeholders (e.g. policy-makers, industry, citizens). In addition, the need for Europe to extend such standardization and novel food-chain thinking to the rest of the world links to both better and more sustainable food production, benefiting world and European consumers alike.

One Health
Having noted the limitations of conventional approaches to prevention and control of infectious diseases, in 2004, the Wildlife Conservation Society proposed a coherent, comprehensive and preventive approach to protect human health, initially known as 'One World-One Health', which aimed to strengthen links between human health, animal health, and management of the environment, particularly biodiversity and ecosystem services. This integrated health approach, now called One Health, is mainly based on strengthening collaboration amongst the human, animal and environmental health fields.

One Health EJP

Collaboration and integration across Europe

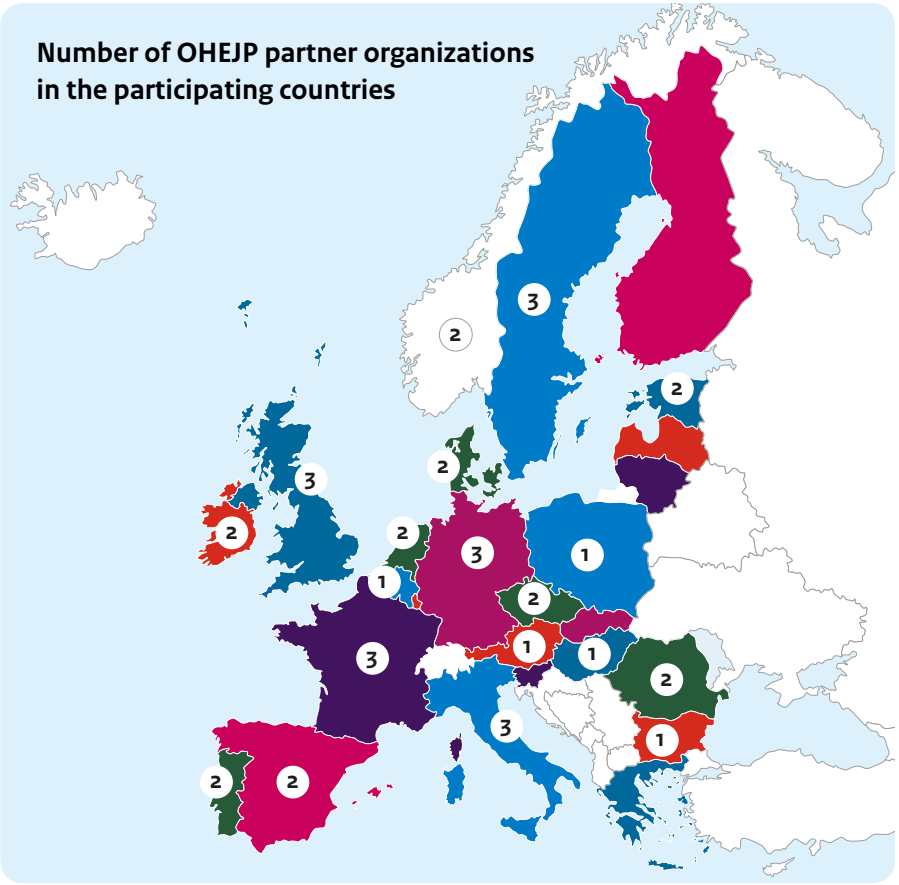
The One Health European Joint Programme (OHEJP) is an exemplar of the One Health concept and boasts a landmark partnership of 38 acclaimed food, veterinary and medical laboratories and institutes across 19 member states in Europe, and the Med-Vet-Net-Association.

The OHEJP recognizes that an interdisciplinary, integrative and international approach to One Health is essential to address the existing and emerging threats of zoonotic disease and antimicrobial resistance. Most of the 38 institutes have reference responsibilities, representing a sustainable framework for an integrated research community.

Pursuing common goals

The OHEJP is to set up a common strategic research agenda among the partners, taking into account the needs of key European Union (EU) stakeholders, especially EFSA and ECDC, and strategic links with other EU initiatives. Moreover, through the existing links with the Programme Owners (national authorities and policy makers), national priorities are also taken into account of in the OHEJP strategy. The main focus of the new OHEJP is therefore to reinforce collaboration between institutes by enhancing transdisciplinary cooperation, integration of activities, and training in the fields of foodborne zoonoses (FBZ), antimicrobial resistance (AMR) and emerging threats (ET).

The OHEJP offers opportunities for harmonization of approaches, methodologies, databases and procedures for the prevention, detection and control of FBZ, AMR and ET across Europe, which will improve the quality and compatibility of information for decision making. The joint research projects (JRPs) and joint integrative projects (JIPs) are key instruments to facilitate partner organizations working together. To complement these research and integrative activities, PhD and other training opportunities are provided to develop the next generation of One Health scientists.



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The vision

Towards a shared landscape

Medical, veterinary, food, and environmental sciences are separate fields of expertise at the institutional level in most countries, being often located in different institutes and funded by different ministries, resulting in inefficient exploitation of new techniques, redundant or overlapping research activities, and suboptimal systems for risk assessment and management of emerging threats, possibly missing important opportunities for solutions. This fragmented landscape, in a timeframe of new scientific developments and reduced research budgets will benefit from the implementation of a One Health approach.

The overarching ambition

Following a One Health approach, the OHEJP aims to create a sustainable European framework through integration and alignment of medical, veterinary, and food institutes with reference laboratory functions. These organizations unite forces through joint prioritization and conduction of research and integrative activities, as well as training and education exercises in the domains of foodborne zoonoses (FBZ), antimicrobial resistance (AMR), and emerging threats (ET), thus matching the needs of European and national policy makers and stakeholders.

Specific objectives

1. ***To bring together the major representatives of the European scientific community in the fields of FBZ, AMR and ET.*** The target scientists are mainly those dealing with national mandates of reference and performing official research programmes in these three domains.

2. ***To implement scientific projects related to the prevention and control of foodborne zoonoses, antimicrobial resistance, and emerging threats.*** The joint programme encompasses research activities proposed by partners in the different member states. In addition, integrative activities will be strengthened by creating synergies between the five thematic areas of expertise: detection and analytical methods, host-microbe interaction, epidemiology, risk assessment and intervention in synergy with the three domains: FBZ, AMR and ET.

3. ***To stimulate scientific excellence by co-funding dedicated joint research projects.*** These projects will have the potential to enhance the scientific evidence base useful in the preparation of tools for surveillance and reference activities at the national and European levels in the field of FBZ, AMR and ET. >>

4. ***To foster the harmonization and standardization of the reference methods and tests by bringing together scientific and technical expertise in the field of FBZ, AMR and ET.*** This will deliver standards and materials of reference such as biological archives including collections of strains and DNA libraries.

5. ***To exchange and communicate with all national and international stakeholders.*** Strong interaction with ECDC and EFSA is crucial. Stakeholder liaison actions consist of i) developing liaisons with EFSA and ECDC to ensure that the objectives of the consortium are in accordance with the overarching policies and mandates of the respective agencies, ii) maintaining current links and developing new ones with related networks in the EU.

6. ***To promote and develop food safety research in the EU by training, education and communication.*** The research findings and identified new research topics are presented to the scientific community by designed scientific meetings and workshops. The agreed sphere of integrated scientific activities represent the themes of the joint training courses. By short-term missions, staff exchanges and target training, the scientific community has the opportunity to improve its skills in new techniques. The activities of the consortium are promoted through a series of public engagement activities involving both national and international policymakers and the general public.

Priority Research and Integrative Topics

Priority research topics and priority integrative topics are the result of a structured prioritisation process and formed the basis for launching the internal calls for proposals for joint research projects, joint integrative projects, and PhD projects within the 5-year period of the OHEJP.

Priority Integrative Topics

Analytical methods

Host-microbe interaction

Epidemiology

Risk assessment

Intervention

Priority Research Topics

Analytical Methods: *State of the Art*

Methods used to detect zoonotic agents, emerging threats and AMR are often cumbersome and do not necessarily cover the entire spectrum of threats. Delayed responses to crises negatively affect the management of human infections, trade, food chain sustainability, and food security. The rapid growth of nucleotide sequencing technologies promises to deliver analytical tools for rapid identification of pathogens and AMR determinants based on characterisation of the agents and their genomes, as well as culture-independent strategies such as metagenomics.
At the same time, phenotypic methods are still of utmost importance in routine practice and numerous emerging phenotypic technologies are continuously proposed to physicians and vets without robust validation. Rapid reliable tests for antimicrobial susceptibility testing and/or pathogen identification would be of help in saving antibiotics in all sectors.

Progress beyond the state of the art >>

Priority Research Topics

Analytical Methods: *Progress Beyond the State of the Art*

Foodborne zoonoses

- Development and harmonisation of NGS-based methods for detection and tracing of FBZ agents, ET and AMR determinants.
- Better tools for detection and investigation of foodborne outbreaks, including antimicrobial resistant pathogens, as well as economic assessments of potentially increased cluster detection through whole genome sequencing.
- Hepatitis E virus: Development of efficient and optimized cell culture methods and virus inactivation studies in food and food production/processing environments.

Antimicrobial resistance

- Development and harmonisation of phenotypic methods.
- Metagenomics and bioinformatics for detection and surveillance of AMR pathogens and determinants.
- Development of new tools for early (real-time) detection of resistant pathogens in humans and animals, as well as new diagnostic tools, in particular on-site tests for humans and animals.
- Development of NGS-based tools for surveillance of AMR in Enterobacteriaceae in animals, humans and the environment.

Emerging threats

- Development and harmonisation of non-NGS-based methods for detection of FBZ agents and emerging threats.
- Development of a toolkit to characterize emerging threats by combining genomic and phenotypic information.
- Development and harmonization of NGS and non-NGS methods (e.g. pheno-genotypic and histochemical methods) for the detection of foodborne parasites.
- Evaluation of early detection methods for emerging threats.

Priority Research Topics

Host-microbe Interaction: *State of the Art*

The elements defining host specificity of microbes are poorly understood. Crossing of the species barriers represents a crucial event in emergence of known and novel diseases. Understanding the host factors that determine the flow between carriage, persistence and disease represents a major challenge to the development of effective control measures of given pathogens.
Recent evidence suggests that the microbiota may be involved in host specificity. Both *in vivo* and *in vitro* model systems are crucial to understanding the pathogenesis, emergence and spread of infectious diseases. Identification of virulence factors can lead to the construction of avirulent mutants and their use as new vaccines, like the novel European TB vaccine. Mathematical models increase our ability to understand, and ultimately predict, the behaviour of pathogens in their hosts, as well as the spread of contamination throughout the food chain and the geographic distribution of spread of disease.

Progress beyond the state of the art >>

Priority Research Topics

Host-microbe Interaction: *Progress Beyond the State of the Art*

Foodborne zoonoses

- Model Systems (*in vitro* and *in vivo*) to study host/food – microbe interactions.
- Development and validation of new *in vivo* models to study interactions between host, foodborne pathogens and the microbiota for investigating infection dynamics.

Emerging threats

- Host factors associated with colonization, persistence and disease.
- Host factors associated with increased susceptibility to infection and disease of emerging threats with undefined routes of transmission.

Priority Research Topics

Epidemiology: *State of the Art*

Current EU surveillance systems for foodborne zoonoses, antimicrobial resistance, and emerging threats are focused on selected risks and areas. Globalization, however, requires broader and flexible actions to detect hazards, reservoirs, vectors, trends, and transmission routes, as well as common approaches, timely data analysis and sharing. Moreover, in order to prevent and control emerging zoonotic pathogens, more insight into the ecology is needed, including knowledge about disease dynamics within populations and at the interface between populations (human, livestock, or wildlife) and the environment. There are still knowledge gaps and inconsistencies in the epidemiology of antimicrobial resistance, i.e. its selection and spread under antimicrobial use pressure in different ecological settings.

Geographical differences, temporal trends, effects of farming, environmental reservoirs, wildlife, farm and companion animals, as well as humans, on resistance in the environment, and factors mitigating resistance transmission need systematic studies.

Progress beyond the state of the art >>

Priority Research Topics

Epidemiology: *Progress Beyond the State of the Art*

Foodborne zoonoses

- Improved surveillance system and harmonized data analyses.
- Source attribution and transmission routes.
- Epidemiological studies: risk factors and dynamics.
- Source attribution of bacterial foodborne zoonoses and antimicrobial resistance considering also the environment and non-livestock reservoirs (e.g. pets and wildlife) as sources.
- Source attribution and transmission routes of foodborne pathogens other than bacteria, with emphasis on *Toxoplasma gondii*.
- Determinants of the reversal of the decreasing trend in *Salmonella* incidence in humans and poultry in the EU.
- Epidemiology of foodborne yersiniosis, including biotype and serotype data.
- Global epidemiology of Shiga toxin-producing *Escherichia coli* (STEC): infections in humans and occurrence in foods and, as well as emergence of hybrid STEC strains.
- Hepatitis E virus: Determining the level of contamination in foods of animal origin other than pig liver products and risk of transmission from contaminated water to food.

Antimicrobial resistance

- Epidemiological studies into the dynamics of AMR in human and animal populations and the environment including horizontal gene transfer and selection of AMR.
- Dynamics of AMR selection, clonal spread and horizontal gene transfer in humans, animals and the environment, including epidemiology of resistant microorganisms and antimicrobials in the environment and their (environment-mediated) spread.

Emerging threats

- Ecology of emerging pathogens.
- Identification of key determinants of spread and persistence of foodborne zoonoses from wildlife.
- Factors associated with emergence of antimicrobial resistant strains in the food supply chain.
- The role of wildlife in the ecology of potentially zoonotic emerging threats.

Priority Research Topics

Risk Assessment: *State of the Art*

In the past decades, risk assessment modelling has been developed and applied in a number of European countries, mainly for microbial hazards like *Salmonella*, *Campylobacter* and *Listeria*. As a next step, it is important to further develop and apply risk assessment methods for a broader range of foodborne microbiological hazards and antimicrobial resistant bacteria. One major challenge is to determine the contribution of the livestock sector and the environment to the overall burden of AMR. Currently, disease burden is increasingly studied, particularly to inform risk management strategies. The recent publications on the global disease burden of foodborne disease have shown the relevance and potential of quantitative disease burden estimation, among others, as a basis for risk prioritisation. These latest developments also highlighted current challenges in estimating the burden of some foodborne diseases, particularly associated with AMR and other emerging threats. The need to extend estimates of the current burden of disease by incorporating socio-economic consequences is widely recognized.

Furthermore, in the past decades, a large number of predictive modelling and risk assessment models, software tools and databases has been developed, but their maintenance is not always guaranteed and exchange of information between these resources is currently difficult and time consuming, which limits their application.

Progress beyond the state of the art >>

Priority Research Topics

Risk Assessment: *Progress Beyond the State of the Art*

Foodborne zoonoses

- Frameworks and systems for sharing tools and data for risk assessment and effective decision making.
- Rapid risk assessment tools for introduction of zoonotic and foodborne diseases.
- Development of a risk assessment and management tool to prevent zoonotic bacteria, viruses and parasites in production and processing of pig meat.
- Development of new tools, e.g. machine learning, to support risk assessment of STEC, (*Salmonella*, *Listeria* or *Campylobacter*).
- The impact of changing food consumption habits on the risk of transmission of foodborne zoonoses and AMR.
- Disease burden assessment of toxin producing bacteria.

Antimicrobial resistance

- Risk assessment of AMR.
- Disease burden, socio-economic consequences and risk ranking.
- Development of new economic models, exploring and analyzing incentives to boost the development of new therapeutics, alternatives, vaccines and diagnostics for AMR.
- Risk assessment of ESBL transmission to humans from food and the environment.

Emerging threats

- Applying risk assessment/modelling methodologies to support decisions for the control of emerging threats, foodborne zoonoses and antimicrobial resistance.

Priority Research Topics

Intervention: *State of the Art*

Due to globalization and various selective pressures, pathogens in the European market are likely to have changed in recent years, and changing production systems create new challenges relating to pathogens in locally and globally produced food. Intervention strategies are primarily focused within either the food, animal or medical domains. The growing concern about increased antimicrobial resistance requires a stronger stewardship with regard to antimicrobial usage in both humans and animals. The development of robust, evidence-based interventions and guidelines in animals is however not as advanced as in humans. As not all relevant pathogens can be removed before they reach the consumers, intervention options at consumer level are required and education of consumer about possible risks is of growing importance.

Progress beyond the state of the art >>

Priority Research Topics

Intervention: *Progress Beyond the State of the Art*

Foodborne zoonoses

- Biosecurity and other interventions.
- Risk communication and consumer targeted intervention strategies.
- Optimizing options for risk management and enforcement in feed and food production and processing.
- Benchmarking biosecurity practices for pig farming across Europe using national surveillance data and management standards for identifying best practice to prevent biological hazards, particularly *Salmonella* and hepatitis E virus, from entering the food supply chain.
- Intervention studies to determine the effectiveness of preventing exposure to risk factors for *Toxoplasma gondii* infection.
- Developing targeted and effective communication strategies to reduce risk behaviour and change attitudes of consumers concerning food borne zoonoses.

Antimicrobial resistance

- Communication and stewardship AMR.
- Improving preparedness and response.
- Strengthened infection prevention and control measures, including development and assessment of interventions that prevent the development and spread of AMR.
- Evaluating the best practice for communication and stewardship of antibiotic prescribing in humans and animals.
- Development of technologies that enable efficient and rapid degradation of antimicrobials in wastewater and the environment and reduce the spread of AMR.

Priority Integrative Topics

Integrative Activities: *State of the Art*

More or less formalised collaborations and networks exist within the three domains of the OHEJP already today, both nationally and internationally, largely driven by the strong legislative framework on food safety and the corresponding dynamic policy environment that all institutes working within the field have to relate to. This includes, but is not limited to, networks set up by the European Commission, ECDC and EFSA such as the network of EU Reference Laboratories, the European Food- and Waterborne Diseases and Zoonoses Network, the European Antimicrobial Resistance Surveillance Network, the Emerging Viral Diseases-Expert Laboratory Network, VectorNet, the Animal Health and Welfare Network, and the networks for zoonoses monitoring data collection and analysis, as well as for BSE-TSE and microbiological risk assessment. Although most of these networks are established within their respective sectors (public health vs vet-food) the strategies of both EFSA and ECDC aim towards an improved inter-sectoral integration (ECDC strategic multi-annual programme (2014 – 2020). Examples are AMR surveillance in food-borne pathogens where an integrated EU system will be jointly developed, and the rapid detection and investigation of food- and waterborne outbreaks through linkage of strains through molecular typing data, with cluster analyses on anonymised data performed in a joint database.
An ambition to link human data collection with baseline surveys in the food and animal sector with the aim to produce better public health risk assessments and broader scientific epidemiological overviews is also an area where the EU institutions can pave the way for an improved national integration of surveillance activities.
Both EFSA and ECDC also have ambitions in the field of harmonised methodologies and in building capacity in scientific assessment, investigation and knowledge. Another example of an international inter-institutional collaboration that serve integration across the public health-animal health interface is the Med-Vet-Net Association, an organisation established to maintain the collaborations developed as a result of the Med-Vet-Net network of excellence. There are also professional networks that are more tied to specific thematic expertise (microbiology, epidemiology, risk assessment), but even these tend to exist within sectors rather than across.

Progress beyond the state of the art >>

Priority Integrative Topics

Integrative Activities: *Progress Beyond the State of the Art*

Design and implementation of surveillance activities

TOPIC 1
Use of common frameworks for design and methods to assess equivalence between surveillance and control activities.

Laboratory methods

TOPIC 2
Harmonised protocols and common and applied best practice.

Reference materials and data

TOPIC 3
For all hazards and methods of importance, there are well defined and relevant reference materials/data for proficiency testing and test development.
Hazard data (typing results incl. genomic data, metadata) are available for surveillance at EU level.

Interpretation of surveillance data

TOPIC 4
Standardised data formats and ontologies, common tools and procedures for data analyses, incl interpretation of sequence data.

Communication of surveillance data

TOPIC 5
Common reporting and signalling procedures, joint platform for sharing surveillance data and their interpretation, incl. risk assessments.

Action (prevention and response)

TOPIC 6-7
Mentoring (twinning) system for sharing of best intervention practice. Aligned use of experimental facilities and models (of transmission, ecology, risk assessment etc).

The activities

Research activities

Research activities are conducted through Joint Research projects (JRP) and PhD projects on foodborne zoonoses (FBZ), antimicrobial resistance (AMR), and emerging threats (ET), as related to five thematic areas, i.e. analytical methods, host-microbe interaction, epidemiology, risk assessment, and intervention.

For FBZ, the research scope includes bacterial, viral, prionic, fungal and parasitic pathogens, as well as toxins produced by foodborne pathogens. AMR concerns both pathogenic and commensal bacteria. Research on ET is focused primarily on threats emerging from 2017 with a suspected zoonotic potential or improvement of early warning, preparedness or response.

Integrative activities

Integrative activities are conducted through Joint Integrative Projects (JIP) with the aim of developing joint platforms, such as infrastructures (e.g. pipelines, biobanks, etc.) and work processes, across the three domains and the five themes of the OHEJP, involving all consortium partners.

These activities will serve to strengthen both the scientific capacity within the OHEJP and also future prevention, preparedness, detection and response of the EU to foodborne and other emerging threats. We envisage primarily 7 general types of integrative activities, including:

1) training and capacity building;
2) experimental facilities/models;
3) detection-/typing methods/protocols;
4) strain collections/reference materials/biobanks;
5) digital infrastructures/data sharing protocols/bioinformatics;
6) surveillance strategies/reporting/signalling;
7) legal/policy aspects. >>

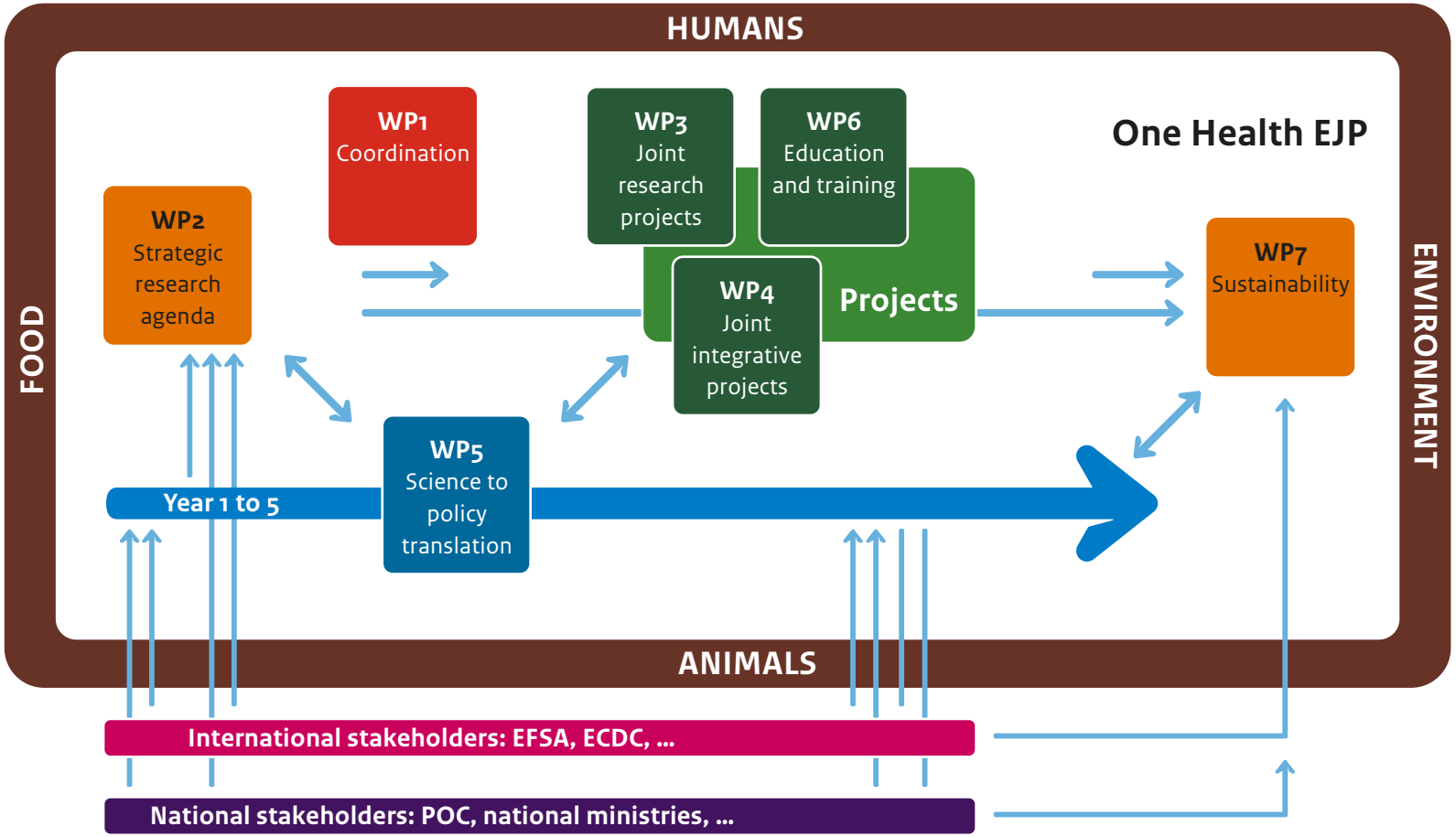
Education and training

To complement the research and integrative activities, PhD research and other training activities will also be developed in the three research domains.
PhD projects provide excellent added value, including improved integration (both geographical and interdisciplinary), and an opportunity to develop the next generation of scientists in One Health. There is significant scope for inter-disciplinary and inter-sector working bringing physical, biological and social sciences together. The multi-country and inter-disciplinary approaches will also help to inform on market viability and EU policy relevance of project outputs. PhD topics do not need to be directly linked to JRPs to allow wider participation, but must be within scope of OHEJP priorities. Furthermore, training opportunities are provided for undergraduates through summer schools, and established researchers through continuing professional development, workshops and knowledge exchange visits.

Strategic interactions with European stakeholders and other EU-funded projects and initiatives

The OHEJP aims to establish strategic interactions with pre-existing EU-funded projects and initiatives and relevant international stakeholders and statutory bodies to avoid redundancy, create synergies and maximize the benefits from EU resources.
Links have been established with other funded EU research projects and actions, such as COMPARE, EFFORT, ENGAGE and NEOH, and will take into account the results of past EU projects. Synergies are developed with COMPARE because it aims to harness the rapid advances in Whole Genome Sequencing (WGS)/ Whole Community Sequencing (WCS) technologies to improve identification and mitigation of emerging infectious diseases and foodborne outbreaks. Links have also been established with European initiatives such as JPIAMR, JAMRAI and STAR-IDAZ International Research Consortium (IRC), as well as with the SCAR collaborative working group on Animal Health & Welfare (AHW). Objectives and research needs of EU stakeholders have been taken into account in the development of the EJP strategic research agenda. Indeed, links have been established with EFSA and ECDC, to further explore the possibilities for strategic collaboration with these organisations. Strategic research agendas and reference documents of other international stakeholders, such as WHO, FAO and OIE, have also been taken into account.

The One Health EJP structure



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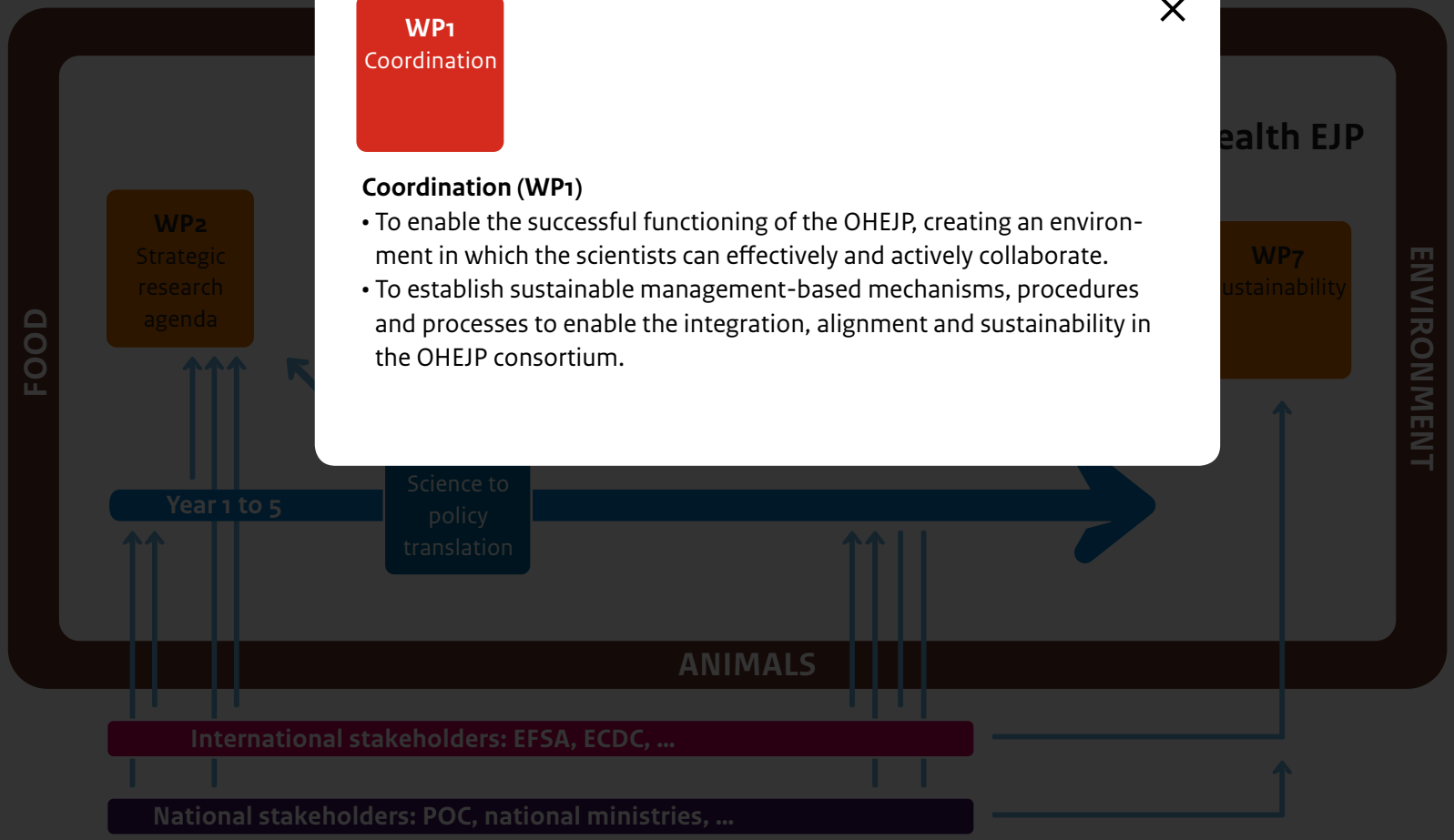

Coordination (WP1)

- To enable the successful functioning of the OHEJP, creating an environment in which the scientists can effectively and actively collaborate.
- To establish sustainable management-based mechanisms, procedures and processes to enable the integration, alignment and sustainability in the OHEJP consortium.

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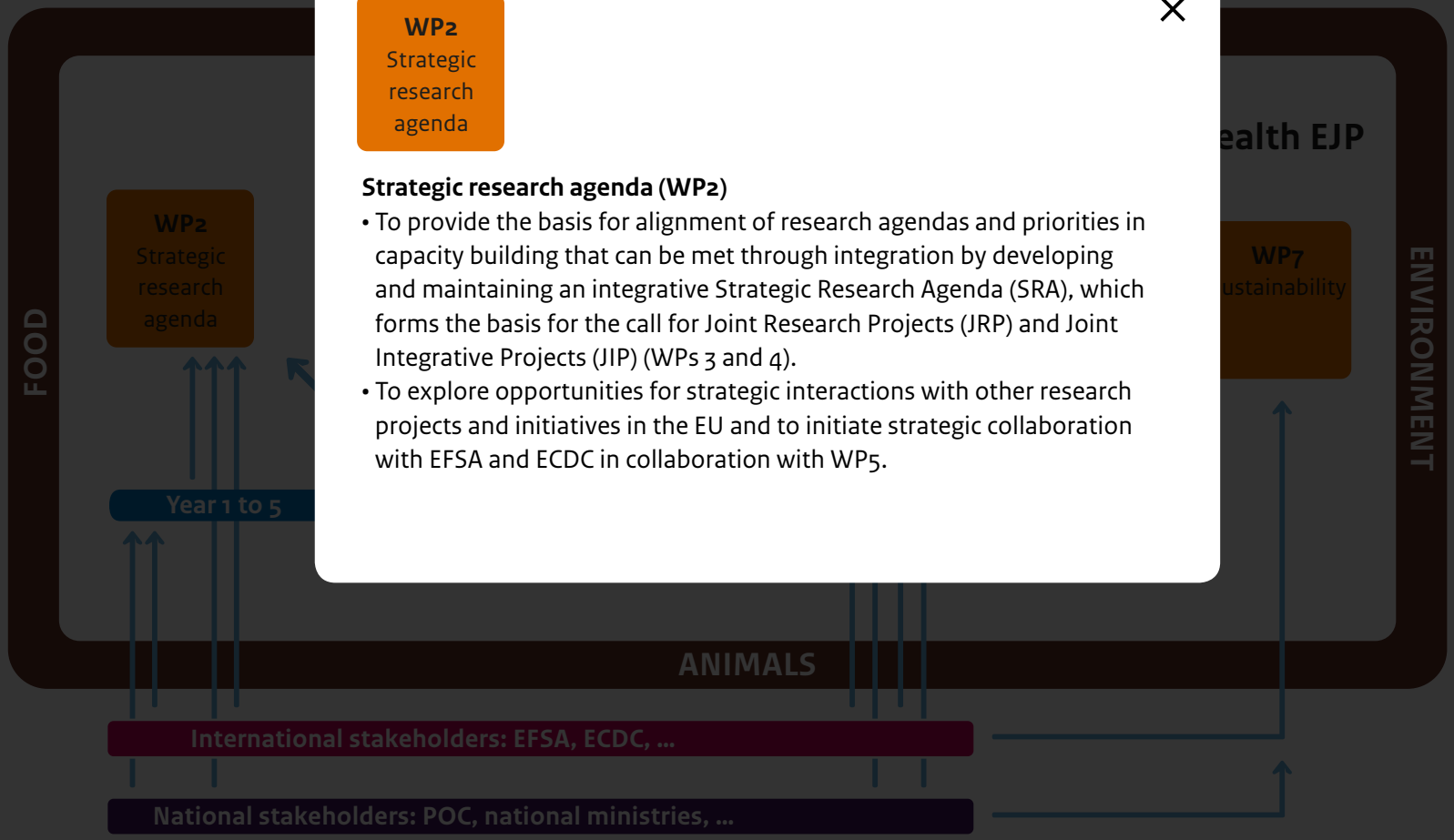
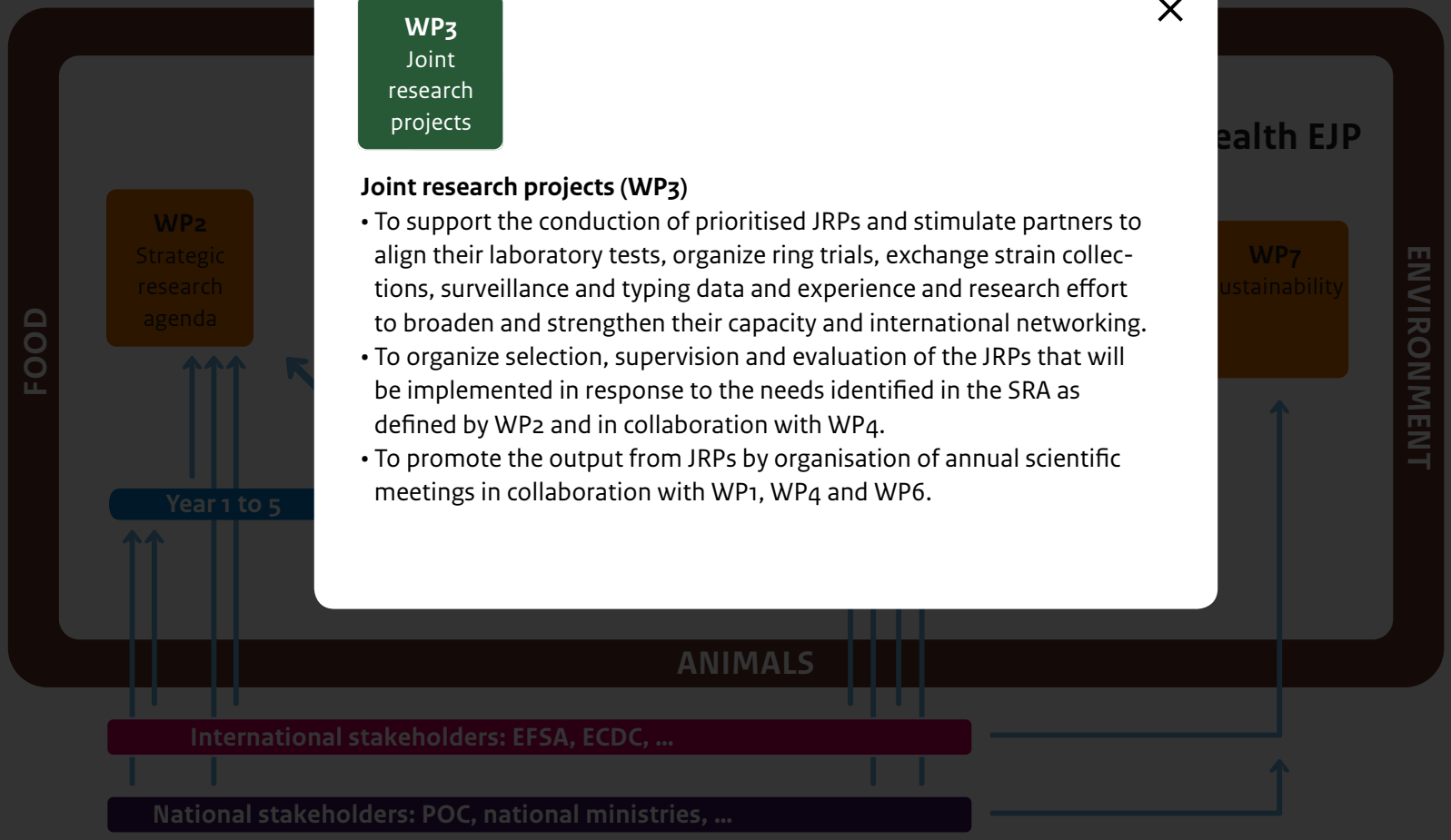


WP2
Strategic research agenda

Strategic research agenda (WP2)

- To provide the basis for alignment of research agendas and priorities in capacity building that can be met through integration by developing and maintaining an integrative Strategic Research Agenda (SRA), which forms the basis for the call for Joint Research Projects (JRP) and Joint Integrative Projects (JIP) (WPs 3 and 4).
- To explore opportunities for strategic interactions with other research projects and initiatives in the EU and to initiate strategic collaboration with EFSA and ECDC in collaboration with WP5.

The One Health EJP structure

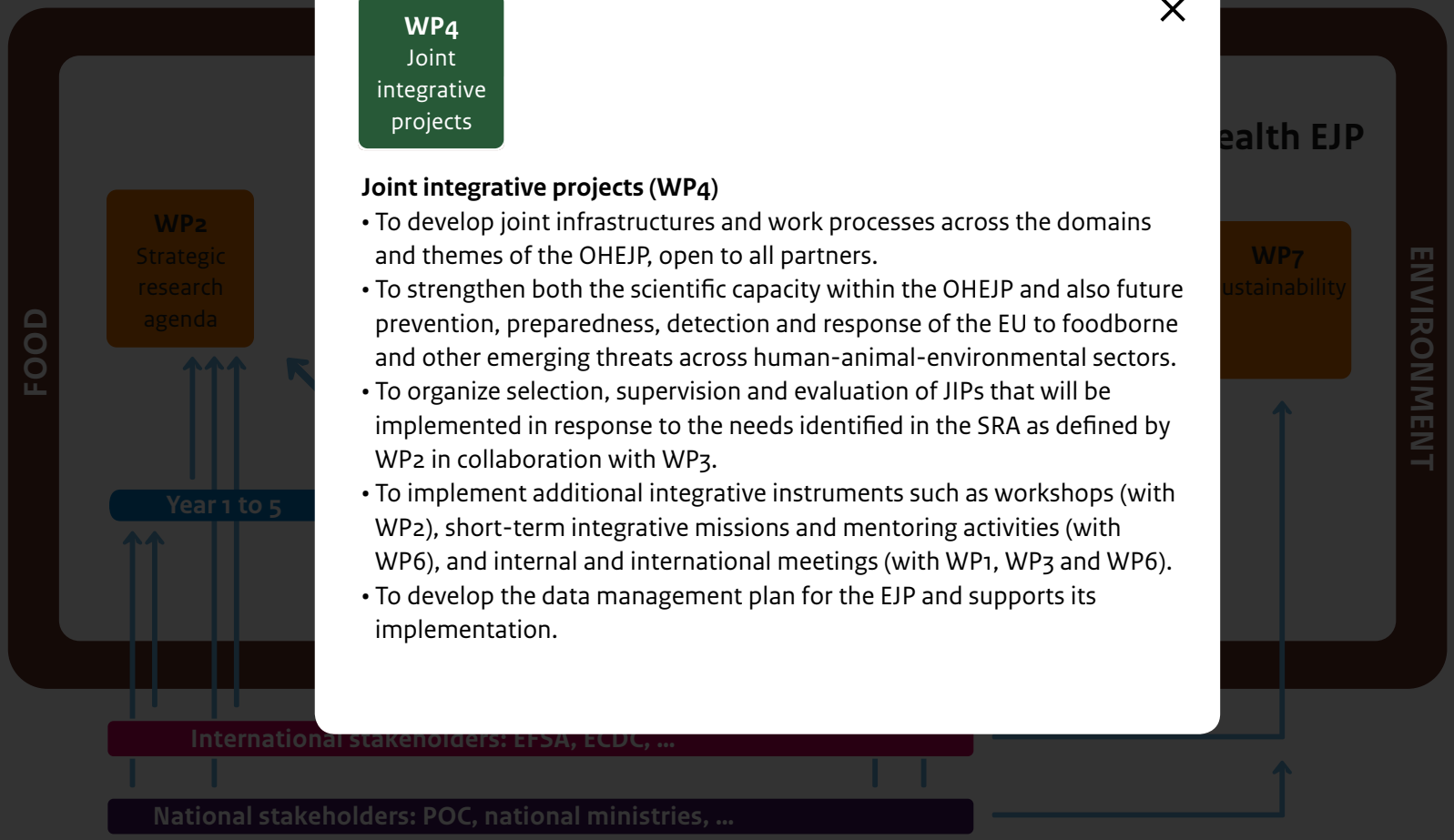


WP3
Joint research projects

Joint research projects (WP3)

- To support the conduction of prioritised JRPs and stimulate partners to align their laboratory tests, organize ring trials, exchange strain collections, surveillance and typing data and experience and research effort to broaden and strengthen their capacity and international networking.
- To organize selection, supervision and evaluation of the JRPs that will be implemented in response to the needs identified in the SRA as defined by WP2 and in collaboration with WP4.
- To promote the output from JRPs by organisation of annual scientific meetings in collaboration with WP1, WP4 and WP6.

The One Health EJP structure

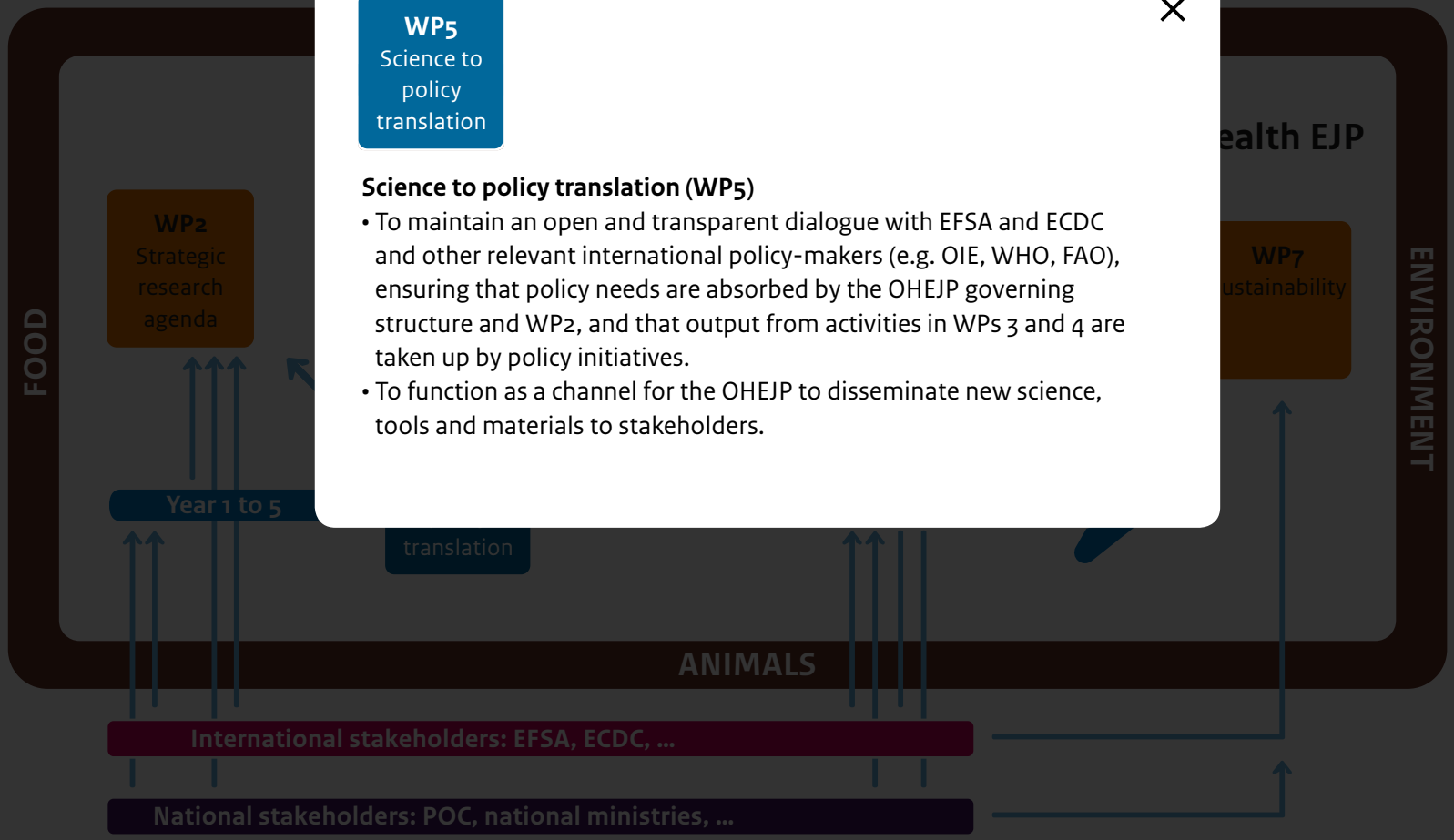


WP4
Joint integrative projects

Joint integrative projects (WP4)

- To develop joint infrastructures and work processes across the domains and themes of the OHEJP, open to all partners.
- To strengthen both the scientific capacity within the OHEJP and also future prevention, preparedness, detection and response of the EU to foodborne and other emerging threats across human-animal-environmental sectors.
- To organize selection, supervision and evaluation of JIPs that will be implemented in response to the needs identified in the SRA as defined by WP2 in collaboration with WP3.
- To implement additional integrative instruments such as workshops (with WP2), short-term integrative missions and mentoring activities (with WP6), and internal and international meetings (with WP1, WP3 and WP6).
- To develop the data management plan for the EJP and supports its implementation.

The One Health EJP structure

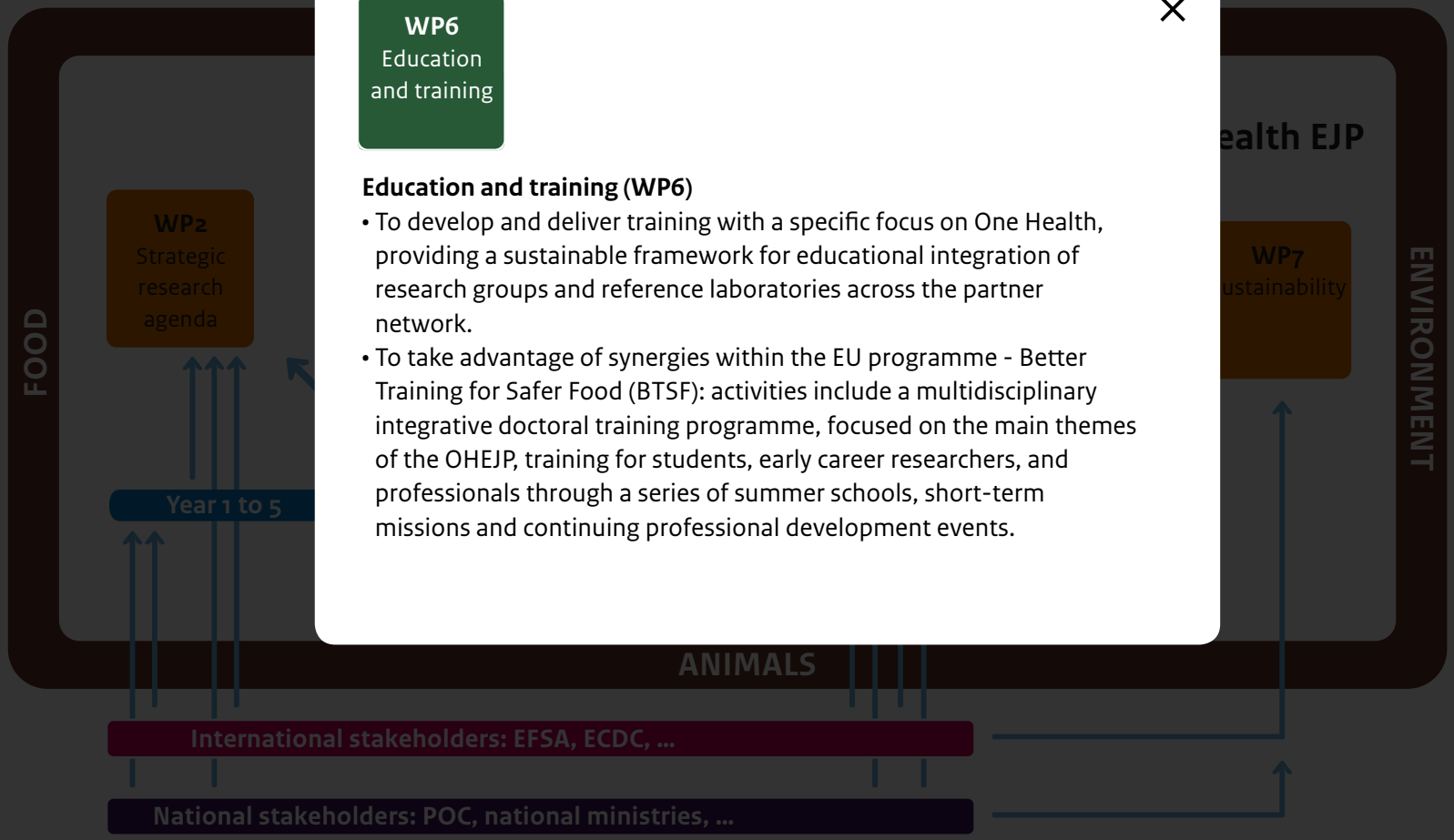


WP5
Science to policy translation

Science to policy translation (WP5)

- To maintain an open and transparent dialogue with EFSA and ECDC and other relevant international policy-makers (e.g. OIE, WHO, FAO), ensuring that policy needs are absorbed by the OHEJP governing structure and WP2, and that output from activities in WPs 3 and 4 are taken up by policy initiatives.
- To function as a channel for the OHEJP to disseminate new science, tools and materials to stakeholders.

The One Health EJP structure

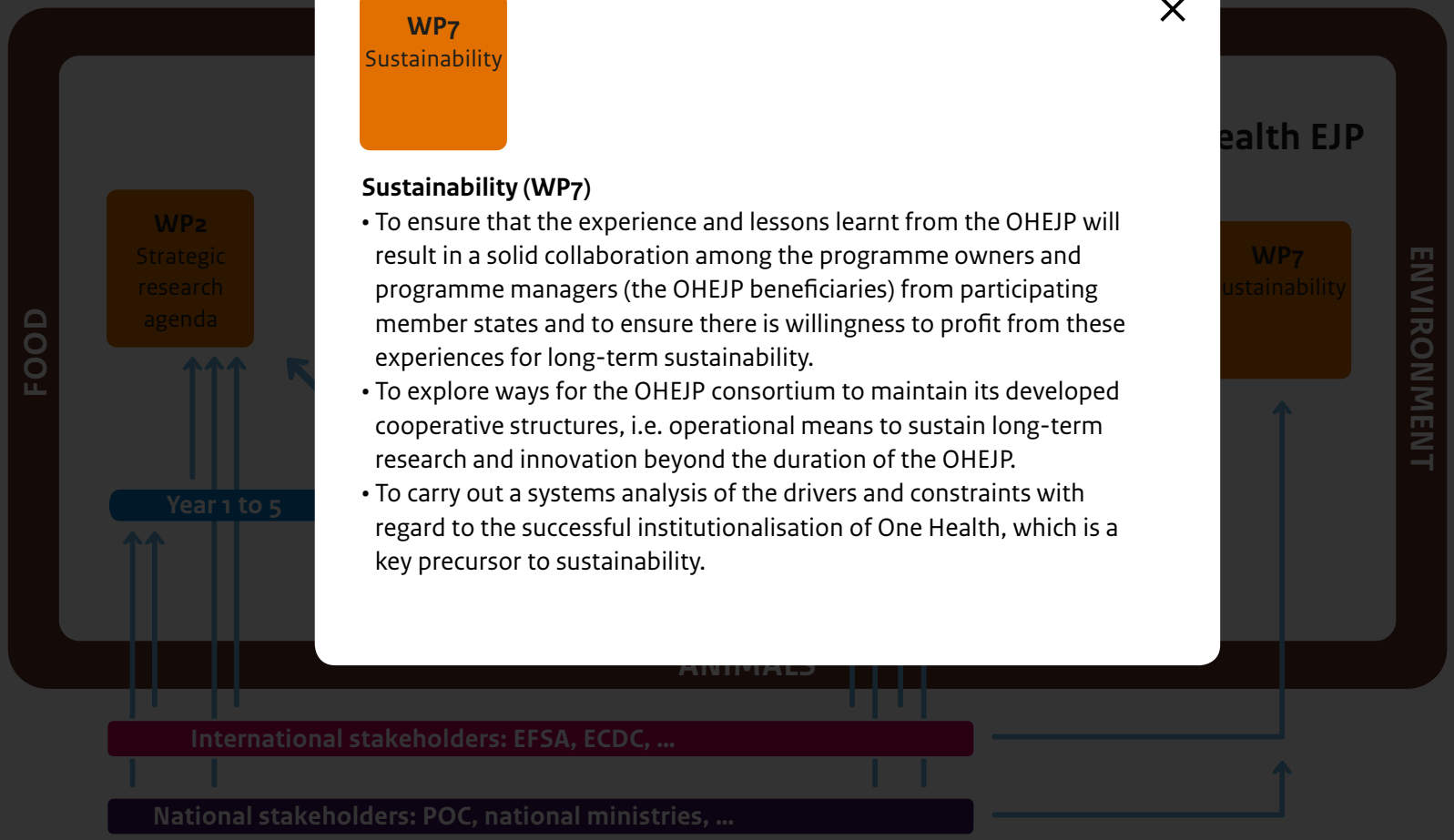


WP6
Education and training

Education and training (WP6)

- To develop and deliver training with a specific focus on One Health, providing a sustainable framework for educational integration of research groups and reference laboratories across the partner network.
- To take advantage of synergies within the EU programme - Better Training for Safer Food (BTSF): activities include a multidisciplinary integrative doctoral training programme, focused on the main themes of the OHEJP, training for students, early career researchers, and professionals through a series of summer schools, short-term missions and continuing professional development events.

The One Health EJP structure



WP7
Sustainability

Sustainability (WP7)

- To ensure that the experience and lessons learnt from the OHEJP will result in a solid collaboration among the programme owners and programme managers (the OHEJP beneficiaries) from participating member states and to ensure there is willingness to profit from these experiences for long-term sustainability.
- To explore ways for the OHEJP consortium to maintain its developed cooperative structures, i.e. operational means to sustain long-term research and innovation beyond the duration of the OHEJP.
- To carry out a systems analysis of the drivers and constraints with regard to the successful institutionalisation of One Health, which is a key precursor to sustainability.

The way forward

Joint research and integrative activities

Joint research projects are an instrument to carry out jointly prioritized research and also stimulate partners to align their research efforts to broaden and strengthen their capacity and international networking. Complementary to this, joint integrative projects aim to develop joint infrastructures (e.g. pipelines, biobanks, etc.) and work processes across the domains and themes of the OHEJP to strengthen the prevention, preparedness, detection and response capacities of the EU to foodborne and other emerging threats across human-veterinary-environmental sectors.

The process →

The making of the Strategic Research Agenda →

Research Strategy Matrix →

Integrative Strategy Matrix →

The process

Input	Actors providing input	Processing input and prioritizing topics	Output
Research topics	National experts from partner countries	Experts meetings	Ranked priority topics
Integrative topics	Strategic interactions with other projects	Multi-criteria decision analysis (MCDA)	Calls for proposals
	EU stakeholders		

(Input provided in a structured way based on strategy matrices)

(Topics selected by the SSB to be included in the calls for projects)

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The making of the Strategic Research Agenda

The first round

The Strategic Research Agenda (SRA) of the OHEJP is the product of a structured prioritisation process aiming at identifying priority topics for research and integrative activities for JRPs, JIPs, and PhD projects within the 5-year period of the OHEJP. To provide a basis for the SRA, a strategy matrix was developed consisting of the three domains, i.e. foodborne zoonoses (FBZ), antimicrobial resistance (AMR), and emerging threats (ET); and five themes, i.e. analytical methods, host-microbe interaction, epidemiology, risk assessment, and intervention, resulting in 15 research areas. In the preparatory phase of the OHEJP in 2016, the partner institutions were invited to nominate national experts to suggest a top three research topics for each research area, as well as three integrative activities. Similar research topics were then grouped into broader topics. An experts meeting was then held at the ANSES, Paris, to identify priority research topics and priority integrative topics following a Multi-Criteria Decision Analysis (MCDA) procedure. Final ranking and selection of priority topics for the first internal call for project proposals were done by the OHEJP's Scientific Steering Board (SSB) in June 2016. The SSB selected the four highest ranked research topics in the FBZ domain, the three highest ranked research topics in the AMR domain, the first ranked topic in the ET domain, and the two highest ranked integrative topics. The first internal call for project proposals was launched in June 2016 and final selection of JRPs and JIPs was done by the SSB in November 2016. This resulted in eleven research and two integrative projects granted.

The second round

The provisional SRA, which formed the basis of the first internal call for project proposals, was updated in the first year of the OHEJP to launch the second internal call in October 2018. The first step of the procedure for updating the SRA were a gap analysis to identify priority topics insufficiently covered by the projects granted in the first round. In June 2018, an experts meeting was held at the RIVM in Bilthoven, the Netherlands, to narrow down the first round research >>

topics (i.e. to give them more focus) and to prioritize the narrowed down research, as well as integrative, topics for the second internal call. Both the narrow down and prioritization procedures were based on an established protocol that guaranteed consideration of:

1) national priorities (i.e. individual topics proposed by the OHEJP partners in 2016 and by newly joined partners, reflecting the importance of specific topics in the whole consortium);
2) European stakeholders' research needs (from EFSA, ECDC, and DG SANTE);
3) gaps in the current work plan (i.e. results from the gap analysis of first round topics);
4) strategic interactions with other EU projects and initiatives. After the prioritization, a Stakeholders Committee (SC) meeting was organized to discuss the preliminary lists of priority research topics and priority integrative topics, obtaining guidance for the detailed description of these topics and verifying whether any newly emerged needs were to be considered, as well as exchanging mechanisms for interaction to avoid duplication of work and identify strategic synergies.

In October 2018, the SSB selected the research and integrative topics for launching the second call for project proposals. In total, nine research topics (five for FBZ, two for AMR, and two for ET) and four integrative topics were selected by the SSB for the second round.

Research Strategy Matrix

	Foodborne zoonoses	Antimicrobial resistance	Emerging threats
	• bacterial, viral, prionic, fungal and parasitic pathogens; • toxins produced by foodborne pathogens; • foodborne transmission, including drinking water and the environment as far as it is linked to foodborne transmission.	• related to pathogenic and commensal bacteria.	• related to foodborne zoonoses and antimicrobial resistance in humans, animals and the environment • the focus is primarily on threats emerging from 2017, with a suspected zoonotic potential
Analytical methods Go to topics	• analytical methods for detection, identification and typing including omics methods (e.g. NGS) • innovative methods for evaluation of virulence • quality assurance, harmonization, protocol and data sharing	• analytical methods for detection and typing, including omics methods (e.g. NGS) • innovative methods for AMR measurement • quality assurance, harmonization, protocol and data sharing	• analytical methods for detection and typing, including omics methods (e.g. NGS) • quality assurance, harmonization, protocol and data sharing
Host-microbe interaction Go to topics	• determinants of virulence • microbial ecology (including phages, plasmids) • host-food-pathogen interactions • dose-response relationship • pathogenesis and host response	• mechanism of resistance • ecology of mobile genetic elements • dose-response relationship • carriage-disease relationship • fitness trade-off and AMR	• determinants of virulence • microbial ecology (including phages, plasmids) • host-(food)-pathogen interactions • dose-response relationship • pathogenesis and host response

Table continued

	Foodborne zoonoses	Antimicrobial resistance	Emerging threats
Epidemi-ology Go to topics	• design and evaluation of integrated surveillance programs • risk factor identification • reservoirs and routes of transmission • modelling of transmission dynamics • source attribution • drivers of change, including socio-economic drivers • storing and sharing of data, definition of metadata	• design and evaluation of integrated surveillance programs • risk factor identification • reservoirs and routes of transmission, resistance gene dissemination • modelling of transmission dynamics • source attribution • interaction between ecosystems • drivers of change, including socio-economic drivers • storage and sharing of • data, definition of metadata	• harmonized systems for signalling / early warning of emerging zoonoses • design and evaluation of integrated surveillance programs • risk factor identification • source tracking methods • reservoirs and routes of transmission • modelling of transmission dynamics • horizon scanning, drivers of change including socio- economic drivers • storage and sharing of data
Risk assessment Go to topics	• risk modelling • exposure assessment • hazard characterization • risk characterization • risk ranking / disease burden estimation • predictive microbiology • cost-benefit analysis • socio-economic impact, legal and policy aspects • development of methods for decision support	• risk modelling • exposure assessment • hazard/risk characterization • risk ranking / disease burden estimation • cost-benefit analysis • socio-economic impact, legal and policy aspects • development of methods for decision support	• scenario studies • risk modelling • exposure assessment • hazard characterization • risk characterization • risk ranking / disease burden estimation • cost-benefit analysis • socio-economic impact, legal and policy aspects • development of methods for decision support
Intervention Go to topics	• tools for intervention including biosecurity, vaccination, treatment options, etc. • strategies for communication, prevention and control • behavioural intervention approaches, e.g. nudging • cost-effectiveness of • interventions	• tools for intervention • strategies for communication, prevention and control • behavioural intervention approaches, e.g. nudging • cost-effectiveness of interventions	• tools for preparedness • tools for intervention • strategiesfor communication, prevention and control • cost-effectiveness of interventions

Integrative Strategy Matrix

Prevent, detect and respond

	Design and implementation of surveillance activities	Laboratory methods	Reference materials and data
Vision A European surveillance community	Surveillance activities are designed and evaluated using common frameworks that lead to cost-efficient implementation.	Laboratory methods are efficient and harmonised and there is agreed best practice	For all hazards and methods of importance, there are well defined and relevant reference materials/ data for proficiency testing and test development. Hazard data (typing results, metadata) are available for surveillance at EU level.
Researchable issues Knowledge gaps that prevent us from providing data for decision making in a correct and timely manner	Development of generic frameworks for surveillance design and evaluation and methods that allows comparison of surveillance output. Digital approaches to capture surveillance data.	Better tests (faster, higher performance (Se, Sp), better logistics, more information for same or lower price)	Understanding of representativity and relevance to hazard situation. Best characterisation methods, incl genetic markers.
Integrative issues • Accessible to all • All has necessary skills • Everyone uses the same • Solutions should be sustainable	Use of common frameworks for design and methods to assess equivalence between surveillance and control activities.	Harmonised protocols and common and applied best practice	Joint databases of reference materials and data, incl. metadata

Table continued

Table continued

	Interpretation of surveillance data	Communication of surveillance data	Action (prevention and response)
Vision A European surveillance community	Methods for interpreting data are rapid, labour-saving, harmonised and extract relevant information for decision making	High quality surveillance information reaches those who need it in a timely manner	Interventions are cost-efficient and acceptable by all stakeholders, and capacity to intervene is the same in all MS
Researchable issues Knowledge gaps that prevent us from providing data for decision making in a correct and timely manner	Interpretation of bioinformatic data (technical and biological), methods to approach big data, algorithms for detection of aberrations in data streams	New methods for visualisation of surveillance data, and their usefulness to relevant stakeholders	Identification of optimal targets and methods for cost-efficient intervention along the food chain, incl. digital approaches. Understanding socio-economic feasibility and impact.
Integrative issues • Accessible to all • All has necessary skills • Everyone uses the same • Solutions should be sustainable	Standardised data formats and ontologies, common tools and procedures for data analyses, incl interpretation of sequence data	Common reporting and signalling procedures, joint platform for sharing surveillance data and their interpretation, incl. risk assessments	Mentoring (twinning) system for sharing of best intervention practice. Aligned use of experimental facilities and models (of transmission, ecology, risk assessment etc)

List of Abbreviations

- **AMR**
  Antimicrobial Resistance
- **COMPARE**
  Collaborative Management Platform for detection and Analyses of (Re-) emerging and foodborne outbreaks in Europe
- **DNA**
  Deoxyribonucleic Acid
- **ECDC**
  European Centre for Disease Prevention and Control
- **EFFORT**
  Ecology from Farm to Fork Of microbial drug Resistance and Transmission
- **EFSA**
  European Food Safety Authority
- **ENGAGE**
  Establishing Next Generation sequencing Ability for Genomic analysis in Europe
- **ET**
  Emerging Threat
- **EU**
  European Union
- **FAO**
  Food and Agriculture Organization of the United Nations
- **FBZ**
  Foodborne Zoonosis
- **JAMRAI**
  European Union Joint Action on Antimicrobial Resistance and Healthcare-Associated Infections
- **JIP**
  Joint Integrative Project
- **JPIAMR**
  Joint Programming Initiative on Antimicrobial Resistance
- **JRP**
  Joint Research Project
- **MCDA**
  Multi-Criteria Decision Analysis
- **NEOH**
  Network for Evaluation of One Health
- **NGS**
  Next Generation Sequencing
- **OHEJP**
  One Health European Joint Programme
- **OIE**
  Office International des Epizooties (World Organisation for Animal Health)
- **PMT**
  Programme Management Team
- **SC**
  Stakeholders Committee
- **SCAR**
  Collaborative Working Group on European Animal Health & Welfare Research
- **SRA**
  Strategic Research Agenda
- **SSB**
  Scientific Steering Board
- **STAR-IDAZ**
  Global Strategic Alliances for the Coordination of Research on the Major Infectious Diseases of Animals and Zoonoses
- **WCS**
  Whole Community Sequencing
- **WGS**
  Whole Genome Sequencing
- **WHO**
  World Health Organization
- **WP**
  Work Package