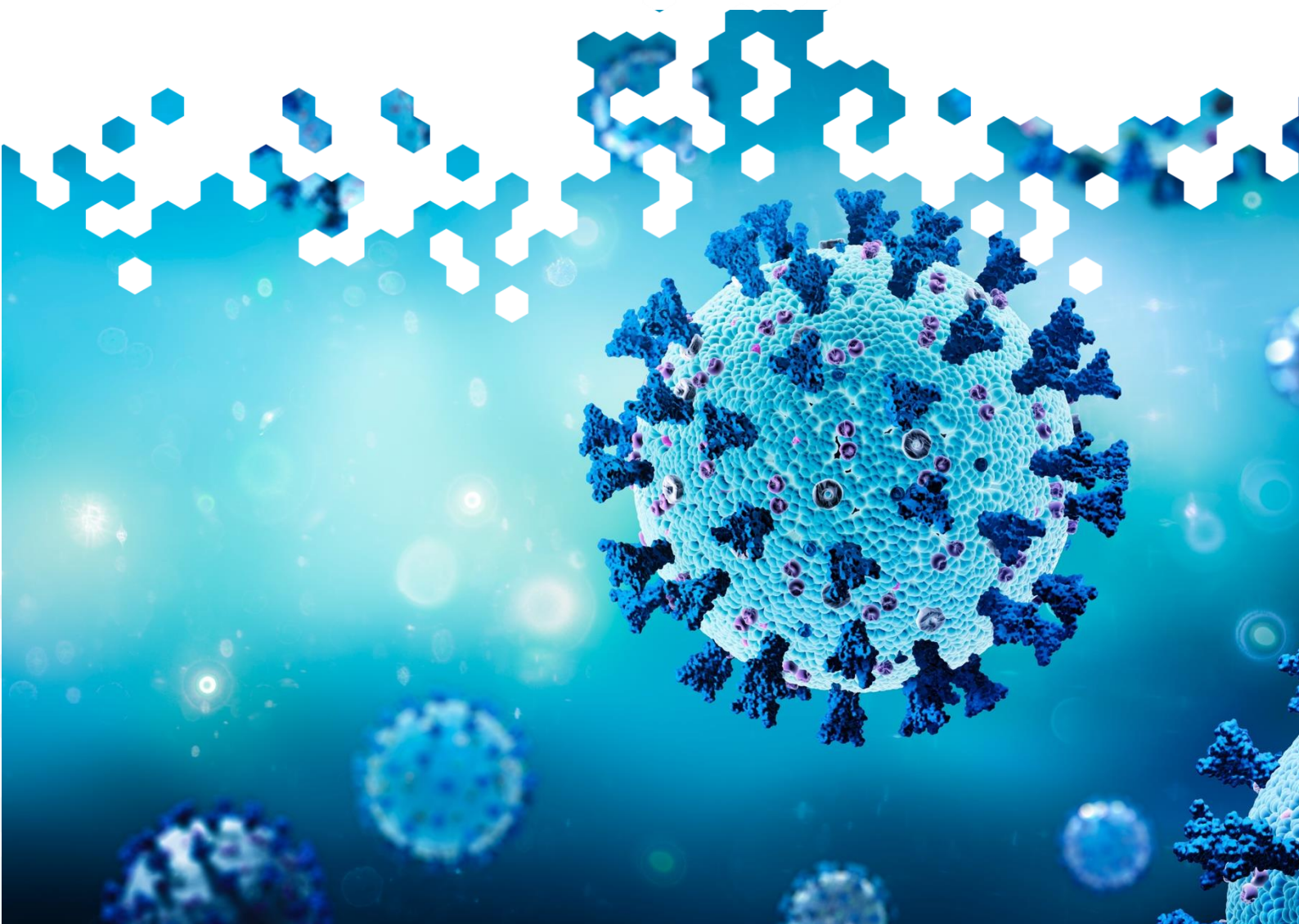# STAR IDAZ | International Research Consortium on Animal Health

Executive summary of research gaps: Coronaviruses

October 2024

STAR IDAZ IRC is the 'Global Strategic Alliances for the Coordination of Research on the Major Infectious Diseases of Animals and Zoonoses - International Research Consortium'. It is a global consortium that brings together funders and programme owners for research on animal health to maximise funding for coordinated animal health research. To achieve its aim, STAR IDAZ facilitates networking among funders, researchers, industry experts, policymakers and other stakeholders to collaborate on research and innovation in the field of infectious animal diseases. This document was published by SIRCAH, the Scientific Secretariat of the STAR IDAZ IRC.

More information on STAR IDAZ IRC can be found at www.star-idaz.net

Research gaps for coronavirus

STAR-IDAZ IRC in collaboration with UK-ICN has developed research roadmaps on coronaviruses to highlight areas where research effort needs to be focused in order to speed up the delivery of improved control methods for coronavirus outbreaks for the benefit of both human and animal health. In the development of research roadmaps for 1) epidemiology and disease control strategies, 2) diagnostic tests development, and 3) candidate vaccines development, working groups of international experts identified the areas shown in Table 1 as the most critical.

Table 1: Main research gaps identified for coronavirus

Topics:	Research priorities
Disease control strategies	• Understanding socio-economic drivers for disease emergence • Understanding the effect of climate change, landscape change and wild animal trade for disease emergence in wildlife and spillover to livestock/humans • Increase understanding of species susceptibility • Identification of cost-effective control strategies, considering multi-stakeholder acceptance • Determine effective and affordable vaccination strategies linked with surveillance system and testing • Develop sensitive and specific diagnostic tools fit for purpose, including diagnostic tools for wildlife surveillance • Progress global surveillance campaigns for early warning and monitoring • Risk mapping of the wildlife-livestock-human interface • Develop early warning systems, particularly for spillover event detection • Foster a One Health approach • Social studies on human behaviour and interaction at the wildlife-livestock-pet interface, impacts/benefits and acceptability of control measures including development of appropriate communication strategies
Diagnostic development	• Development and validation of panCoV detection assays (virus and antibody-based) and standardization of protocols across laboratories • Species-independent serological test platforms (multi-species diagnostics), either surrogate neutralization test or C-ELISA • Enhanced sequencing technology to generate sequence on low copy or poor-quality samples • Point-of-care test for both antigen and antibody detection • Standardization of reagents and proficiency panels, potentially via an international biobanking system • Standardization of sequencing and bioinformatic pipelines • Investigate the needs and feasibility of commonly agreed and acceptable guidelines and policy for safe sample collection, effective transportation, sharing and biobanking, including virtual biobanking • Develop an in vitro and organoid model for characterization of novel CoVs

	- Establish models for key animal species and CoV strains for reagent generation and better understanding of stage-specific immune responses - Increase understanding of host responses in different species, including T-cell reactivity - Identify entry receptors of different CoV in different hosts - Understand the possibility of coronaviruses recombination in different hosts, including increasing understanding of the nature of the immune response
Vaccine development	- Improve affordability, delivery methods and long-term immunity of next generation vaccines (e.g. mRNA and viral vector vaccines) - Optimise mucosal delivery systems, as vaccines delivered via mucosal routes provide localized immunity and are key to preventing viral transmission - Concentrated work on antigen design and new technologies to replace Modified Live Vaccines (MLVs) to improve safety - avoiding possible reversion of virulence, efficacy and scalability of vaccines - Develop improved animal health coronavirus vaccines based on new Platform Technologies - Test and validate novel adjuvants that can be used across different species and vaccine platforms - Examine multivalent vaccines exploring combinations of structural proteins e.g. nucleocapsid (N), membrane (M) and envelope (E) proteins rather than spike (S) protein alone - Improve understanding of protective immunity and protection against infection using different immune biomarkers that cover both B - and T-cell responses - Optimize animal models and in vitro systems to evaluate virally encoded immunomodulators and virulence factors - Development and standardization of animal challenge models for vaccine testing in natural settings (e.g. field testing), including challenge studies in wildlife reservoirs - Improved adoption of genotype to phenotype work to better understand mechanisms of attenuation, including species-specific mechanisms - Improved understanding of how coronaviruses enter host cells (e.g. identification of receptors), and how they replicate and persist in various animal species - Development of species-specific immunological reagents, particularly for livestock and wildlife species - Encourage better One Health collaborations between human and veterinary coronavirus vaccine researchers - Economic and easier production/manufacturing systems via collaborative, multi-disciplinary efforts between academia, industry and regulatory bodies to accelerate the development, scalability and accessibility of vaccines

STAR-IDAZ IRC and coronaviruses

STAR-IDAZ International Research Consortium (IRC) is a global initiative to address the coordination of research programmes at an international level in the area of animal health and in particular infectious animal diseases including zoonoses (STAR-IDAZ – Global Strategic Alliances for the Coordination of Research on the Major Infectious Diseases of Animals and Zoonoses) – for details see http://www.star-idaz.net/.

Coronaviruses cause a number of important diseases in livestock, companion animals and humans, including infectious bronchitis (poultry), transmissible gastroenteritis virus (pigs), calf diarrhoea, enteritis (turkeys) and porcine epidemic diarrhoea (PED). The emergence of zoonotic coronaviruses causing MERS, SARS and COVID-19 has increased interest in this group of viruses, as has their ability to jump species. Research on coronaviruses is a high priority topic for the STAR IDAZ IRC, where we wish to speed up the delivery of improved control methods for animal coronavirus outbreaks for the benefit of One Health.

Research on coronavirus

In October 2024, a series of three workshops were held to finalize research roadmaps for animal coronaviruses. These workshops addressed three critical areas: 1. Control strategies development, 2. Vaccine development, and 3. Diagnostic tools development. Conducted online, each session facilitated in-depth discussions among small groups of 10–15 international experts, building on insights from a gap analysis workshop held in collaboration with the UK International Coronavirus Network (UK-ICN) in May 2023, alongside the 'International Conference on Livestock, Companion Animals, and Wildlife'. Ther report of this meeting can be found here. Prior to the workshops, a global survey, circulated among 56 respondents from 21 countries, gathered valuable input on the current state of research, existing challenges, and potential solutions for coronavirus management.

The resulting research roadmaps, which integrate findings from the workshops, survey responses, and gap analysis, outline essential steps for directing research efforts effectively, supporting more efficient responses to future outbreaks. The complete roadmap details are available here. During each workshop, experts identified research priorities for each main topic using an online voting tool, summarized above in Table 1.

Conclusion

STAR IDAZ IRC, as suggested by the coronavirus working group, recommend research funding targeted at the research priorities listed above, and detailed in the research roadmaps, to speed up the delivery of improved control strategies, from understanding the socio-environmental factors driving pandemics to advancing surveillance systems, diagnostics and vaccine development.

STAR-IDAZ

Global **S**trategic **A**lliances for the Coordination of **R**esearch
on the Major **I**nfectious **D**iseases of **A**nimals and **Z**oonoses
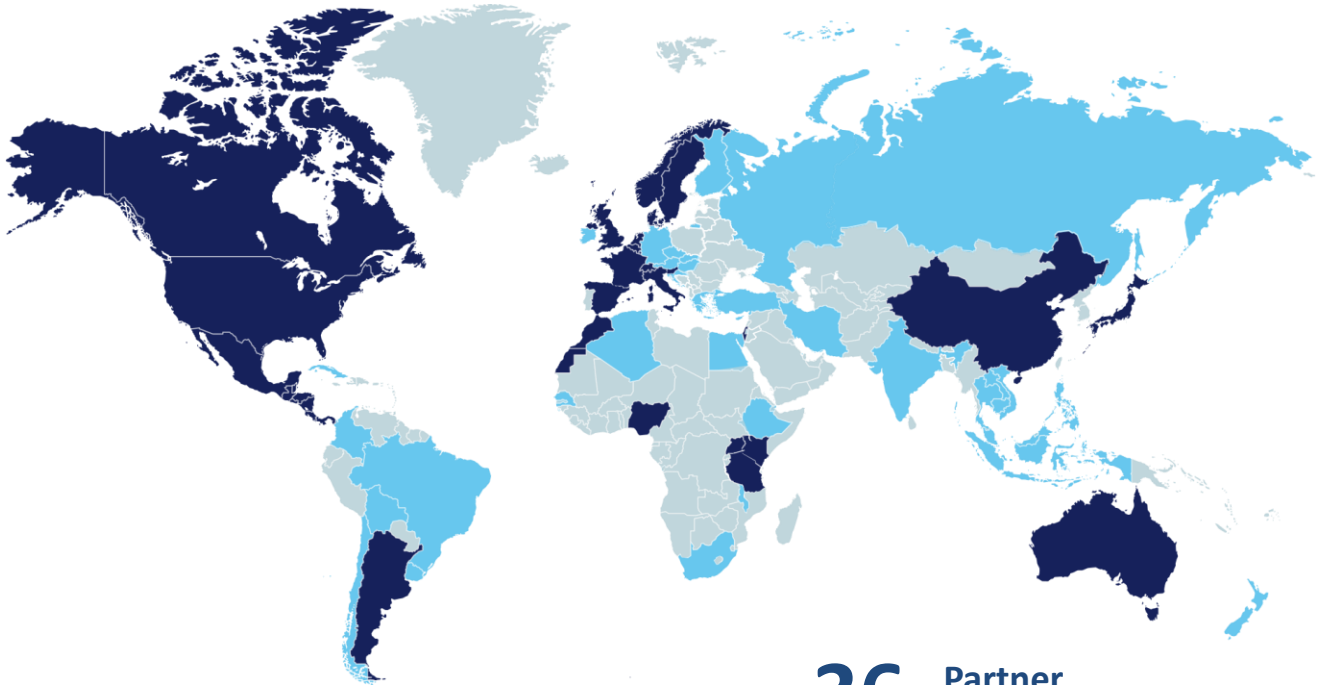
4 Regional Networks

55+ Countries

36 Partner organisations

23 Countries

+$2.5B Research investment

www.star-idaz.net