

PORTFOLIO OF TECHNOLOGICAL OFFER AND SERVICES

IRTA Animal Health Program
IRTA-CReSA Animal Health Research Center

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Consultancy and advisory services in animal health and zoonosis

Scientific advice and counseling on epidemiology, pathogenesis, immunology, prevention and control of livestock and poultry diseases, including zoonosis are provided to producers, private companies, public administration, and researchers from public and private organizations.

DESCRIPTION

Counseling and advice on:

- Development of innovative and effective vaccines.
- Optimization and development of new diagnostic techniques.
- Epidemiological studies and risk assessment for animal diseases.
- Standardized experimental infection models for the most relevant livestock and poultry diseases, as well as animal models for human diseases.
- Vector competence studies.
- Expertise in biosafety and management of biocontainment facilities.

INNOVATIVE AND COMPETITIVE ASPECTS

- Multidisciplinary research team. Scientific knowledge on endemic and transboundary diseases of livestock and poultry.
- BSL2 and BSL3 laboratory and animal facilities, including a BSL3 insectarium.

TECHNOLOGICAL APPLICATIONS

- Specific counseling on scientific-technical activities.
- Tailor-made training courses and educational programs for animal and public health professionals.
- Transfer of knowledge on different aspects of animal health.
- Partnering as a contract research organization (CRO) or for research projects.

CONTACT:

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Design and development of experimental vaccine prototypes

Technological offer upon request serving private businesses and public institutions interested in designing and developing new vaccine prototypes for animal and human purposes.

DESCRIPTION

- Scientific consulting leading to design the most appropriate immunization strategy, adapted to the etiology of the pathogen and to the protective immune mechanisms.
- In silico prediction of potential vaccine candidates, including epitope prediction (B and T).
- Design and preparation of vaccine prototypes: from inactivated and attenuated vaccines to recombinant subunit vaccines.
- Design and performance of *in vivo* studies: from safety and immunogenicity assays to efficacy studies in small and large animals.

INNOVATIVE AND COMPETITIVE ASPECTS

- Multidisciplinary team of researchers: from the basics to the field.
- BSL3 infrastructures: controlled containment facilities.

TECHNOLOGICAL APPLICATIONS

- New vaccine prototypes for large animals (commercial purposes).
- Proof of concept and validation of candidates for new human vaccines.
- Know how transfer.
- Partnering as a Contract Research Organization (CRO) or for research projects.

Examples of previous achievements

- Patent 200502296(9). Experimental vaccine against Haemophilus parasuis obtained by reverse vaccinology.
- Patent P26002ES00. Characterization of specific CD8 T-cell epitopes from African swine fever virus with protective potential.
- Experimental vaccine prototypes against: Porcine Respiratory and Reproductive Syndrome Virus, porcine circovirus type 2, classical swine fever virus, African swine fever virus, porcine and avian influenza Viruses, foot-and-mouth disease virus, *Haemophilus parasuis, Mycobacterium spp*, Gumboro, Rift Valley fever virus and many others.

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Design and development of pathogen-vector competence assays in mosquito vectors and transmission studies

Technological offer upon request serving private businesses and public institutions interested in designing and developing vector competence assays for mosquito-borne pathogens.

DESCRIPTION

- Scientific consulting leading to design the most appropriate vector competence assays in mosquitoes.
- Performance of vector competence studies.
- Performance of vector transmission studies *in vitro* and *in vivo* (small and large animals).
- Design and performance of *in vivo* studies in small and large animals to study how arthropod saliva affects virus infection.
- Design and performance of molecular techniques to identify vectors and mosquito-borne viruses.
- Rearing and maintenance of arthropods in BSL2 and BLS3 infrastructures.

INNOVATIVE AND COMPETITIVE ASPECTS

- Multidisciplinary team of researchers: from the basics to the fields.
- BSL2 and BSL3 infrastructures: controlled containment facilities.

TECHNOLOGICAL APPLICATIONS

- Establishing or adapting models of vector competence by autochthonous or exotic mosquito vectors.
- Developing *in vitro* and *in vivo* transmission assays for mosquito-borne pathogens
- Proof of concepts and Know how transfer.
- Partnering as a Contract Research Organization (CRO) or for research projects.

Examples of previous achievements

- Quantitative transcriptomic and translatomics to identify key determinants for emerging viruses infection and adaptation to vertebrate and insect hosts (Mosquivir; APCIN (INFECT-ERA), 2016-2021)
- Research Infrastructures for the control of vector borne diseases (Infravec2; INFRAIA, 2016-2021).
- A Global Alliance for Zika Virus Control and Prevention (Zikalliance: H2020, 2016-2021).
- Emergencia de la Fiebre del Valle del Rift en Europa: evaluación del rol de mosquitos autóctonos en la potencial diseminación de la enfermedad (ENRIFTMOSQ; MINECO, 2013-2016).

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Design, development & optimization of diagnostic tools for rapid diagnosis and etiological characterization

Technological offer serving private businesses and public institutions interested in designing, developing and optimization of existing and novel diagnostic tools.

DESCRIPTION

- Scientific consulting leading to design the most appropriate diagnostic strategy, adapted to the etiology of the disease.
- In silico prediction of potential diagnostic tools candidates and development of new DIVA diagnostic techniques. From standard techniques to new molecular assays, which will be used for the rapid diagnosis and characterization of new etiological agents.
- Diagnostic tools for the characterization of humoral or cellular immune response against the etiological agents in their infected host.
- Design, optimization, standardization, and validation of diagnostic techniques.
- Design and performance of in vivo studies to obtain immunoreactives for the different assays as well as to validate their sensitivity and specificity.

INNOVATIVE AND COMPETITIVE ASPECTS

- Multidisciplinary team of researchers: from the basics to the field.
- BSL3 infrastructures: controlled containment facilities.

TECHNOLOGICAL APPLICATIONS

- New diagnostic techniques, optimization, and validation of existing diagnostic tools.
- Proof of concept and validation of candidates for novel diagnostic techniques.
- Know how transfer.
- Partnering as a Contract Research Organization (CRO) or for research projects.

Examples of previous achievements

- A duplex SYBR Green I real-time RT-PCR assay for the simultaneous differentiation of serotypes of Infectious Bronchitis Virus.
- A multiple SYBR Green I- real-time PCR system for the simultaneous detection of porcine circovirus type 2, porcine parvovirus, pseudorabies virus and Torque Teno Sus virus 1 and 2 in pigs
- Identification of a porcine pestivirus as a Border Disease virus.
- Decrypting the origin and Pathogenesis in Pregnant Ewes of a New Ovine Pestivirus closely related to Classical Swine Fever Virus.
- Isolation and complete genomic characterization of pandemic H1N1/2009 influenza viruses.
- Development and validation of a novel SYBR Green real-time RT-PCR assay for the detection of classical swine fever virus.
- Phylogenetic analysis and molecular characterization of Infectious Bursal Disease viruses.
- Molecular epidemiology of classical swine fever virus and porcine reproductive and respiratory syndrome virus.
- Revisiting the genetic diversity of classical swine fever virus: A proposal for new genotyping and subgenotyping schemes of classification.

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Development and validation of diagnosis and control tools for bacterial diseases

Technological offer for private companies and public institutions with interest in developing new tools for the diagnosis and control of bacterial diseases

DESCRIPTION

- Development of improved diagnosis tools for the detection of one or more specific pathogens simultaneously.
- Characterization of bacterial strains by genotypic and phenotypic methods, including virulence factors and antimicrobial resistances.
- Development of animal models for bacterial diseases and vaccine trials.
- Studies of microbiota from different mucosal surfaces, by classical methods and metagenomics, and identification of possible probiotics.
- Effect of feed, feed additives or other treatments (including antimicrobial treatments) in animal health and food safety.
- Development and validation of diagnosis and control tools for bacterial diseases.

INNOVATIVE AND COMPETITIVE ASPECTS

- Possibility of working with the target animal model, under controlled experimental conditions and under field conditions.
- Experience working under Good Laboratory and Good Clinical Practices (GLP and GCP).

TECHNOLOGICAL APPLICATIONS

- Animal models for testing methods for the control of bacterial diseases, including vaccine and antimicrobial efficacy trials.
- New probiotics for animal health.
- Validation of new diagnostic tools.
- Partnering as a Contract Research Organization (CRO) or for research projects.

Examples of previous achievements

- Patent 200502296(9). Development and validation of a PCR for the simultaneous detection of *Haemophilus parasuis* and the identification of virulent strains.
- Identification of two surface proteins of *H. parasuis* with role in virulence (phagocytosis resistance).
- Identification of bacterial strains with probiotic effect.

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Immunological characterization of adjuvants, probiotics and immunomodulators

Technological offer upon request serving private businesses and public institutions interested in testing the immunological responses induced by adjuvant, probiotics or any other compound with immunomodulator properties.

DESCRIPTION

- Scientific consulting leading the most appropriate experimental design, adapted to the biological nature of the compound to be tested and to the intended applications.
- In vitro and in vivo characterization of the innate and adaptive immune response, induced; using as targets small and large animal models
- In vivo characterization of the adaptive immune response induced (antibody and T-cell responses) by the given product alone or in combination with experimental or commercial vaccines.
- Efficacy studies in experimental animals and in the field.
- Design and development of new immunological tools such as specie-specific polyclonal or monoclonal antibodies.

INNOVATIVE AND COMPETITIVE ASPECTS

- Studies can be performed using many different animal species.
- Multidisciplinary team of researchers: from the basics to the field.
- BSL3 infrastructures: controlled containment facilities.

TECHNOLOGICAL APPLICATIONS

- Proof of concept and validation of candidates for novel immunomodulatory.
- Development of new immunological tools.
- Know how transfer.
- Collaborating as a Contract Research Organization (CRO) or for research projects.

Examples of previous achievements

- Characterization of the immunomodulatory properties of diverse adjuvant and probiotic molecules in different animal species.
- Characterization of dendritic cell populations in pigs.
- Interaction of porcine dendritic cells with different bacteria and viruses.
- Effects of immunomodulatory molecules in vaccination and infection.

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Molecular biology and bioinformatics research of viral pathogens

Technological offers upon request serving private businesses and public institutions interested in designing and performing research on viral molecular biology and bioinformatics.

DESCRIPTION

- Scientific consulting leading to the most appropriate experimental design.
- *In vitro* and *in vivo* experimental settings for characterization of viruses.
- From full genome analysis to studies on genomic diversity.
- Detailed bioinformatics analysis of next generation sequencing data.

INNOVATIVE AND COMPETITIVE ASPECTS

- Combination of molecular biology research in vivo and in vitro with bioinformatics.
- BSL3 infrastructures: controlled containment facilities.
- Multidisciplinary team of researchers.
- Studies can be performed using many different animal species: from the basics to the field.

TECHNOLOGICAL APPLICATIONS

- Viral genomics and diversity.
- Molecular characterization of viruses.
- Phylogenetics.
- Next generation sequencing applied to virology
- Collaborating as a Contract Research Organization (CRO) or for research projects.

Examples of previous achievements

- Patent EP2530170A1. Diagnostic tools for Torque teno sus viruses by genomic analysis.
- Contracts with companies and research projects on molecular characterization and bioinformatics analysis of viruses.

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Small and large animal models for research and product testing

A broad portfolio of well-characterized disease models in pigs, poultry, ruminants and other species are available to support studies on human and veterinary biological and pharmaceutical products.

DESCRIPTION

- IRTA-CReSA offers the possibility of using already established and characterized animal models on swine, poultry, and ruminants,
- Development of new models using these, and other animal species, is also offered.

INNOVATIVE AND COMPETITIVE ASPECTS

- More than 20 animal models already available.
- Biosafetyy level 2 and 3 facilities.
- Multidisciplinary group of researchers: from the basics to the field.
- Well-trained and experienced animal caretakers and technicians.

TECHNOLOGICAL APPLICATIONS

- Testing commercial vaccines and pharmacological products or new prototypes in the target species.
- Testing vaccines and pharmacological products for human using both in small and large animals: preclinical trial models.
- Proof of concept and validation of safety and efficacy studies under controlled conditions.
- Developing new animal models.
- Partnering as a contract research organization (CRO) or for research projects.

Examples of previous achievements

- Available swine models: porcine reproductive and respiratory syndrome virus, porcine circovirus type 2, classical swine fever virus, African swine fever virus, *Mycoplasma hyopneumoniae, Haemophilus parasuis, Actinobacillus pleuropneumonie, Escherichia coli, Mycobaterium spp*, and others.
- Available poultry models: Gumboro disease virus, Newcastle disease virus, avian influenza virus (low and high pathogenicity), *Salmonella spp., Clostridium spp., Escherichia coli* and others
- Available ruminant models: bluetongue virus, Schmallenberg virus, border disease virus, *Mycobaterium spp* and others.
- Available experimental models in other species: prions and lymphocytic choriomeningitis virus in mice, border disease virus in Pyrenean chamois, bluetongue virus in cervids and others.

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Arthropod colony maintenance and evaluation of insecticides and repellents

Arthropod colony maintenance and evaluation of insecticides and repellents performed to the IRTA-CReSA expertise at the request of the customer.

DESCRIPTION

Establishment and maintenance of arthropod colonies

- Biosafety level 2 insectarium facilities for autochthonous species to perform insecticide and repellent tests
- Biosafety level 3 insectarium facilities for both exotic and autochthonous species for vector competence studies, pathogens transmission blocking strategies studies and others.

Laboratory evaluation of insecticides

- Susceptibility and resistance laboratory test conducted with the World Health Organization (WHO) or Environmental Protection Agency (EPA) conditions.

Laboratory evaluation of repellents

- Skin laboratory test with both technical grade material and commercial formulations, using WHO or EPA conditions.

Examples of previous achievements

- De novo establishment of mosquito colonies (genus *Culex*, *Aedes* and *Anopheles*) and *Culicoides*, for both exotic and autochthonous species.
- Breeding of arthropods and secure manipulation under biosafety level 2 (BSL2) laboratories and BSL3 for exotic species.
- Available colonies for *Ae. albopictus*, *Ae. aegypti*, *Cx. pipiens* and *Culicoides nubeculosus*.
- Insecticide susceptibility tests (WHO) for mosquitoes and *Culicoides*.
- Skin repellent tests (WHO) on human volunteers for mosquitoes.

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Laboratory and animal studies in a BLS3 biocontainment unit

The BSL3 facilities allow working human and animal pathogenic agents or any other biological material under optimal confinement conditions. Alternatively, to the present service IRTA-CReSA offer to their clients the possibility of renting spaces (laboratory space and animal facilities).

DESCRIPTION

- Technologically advanced facilities to carry out studies with pathogenic agents that require Biosafety Level 3 (BSL3) measures for their handling.
- Secure management of high-risk infectious agents including hermetic isolation systems, negative pressure gradients, absolute air filtration and treatment of liquid and solid wastes.
- The BSL3 facility comprises working spaces dedicated to laboratories and animal facilities to work with small and large animals
- Experiments are performed following strict ethical and biosafety regulations, providing as much care and welfare as possible.

Animal facilities

- Experimental infections with human and animal pathogens (except those requiring BSL4 facilities) using multiple animal species such as mice, guinea pigs, ferrets, rabbits, farm animals (sheep, goat, cattle, and pigs) and wild animal species. The facility counts on 12 experimental boxes for housing large animals.
- Vector competence studies with different mosquito species can be also carried out in a BSL3 climatic chamber.

Laboratory spaces

- Six fully equipped rooms are available when properly scheduled. They are devoted to: cell culture, virology, bacteriology, prions and molecular biology work.
- A BD FACSAria cell sorter is available and can provide independent services if required.
- Training, advice, and equipment can be also provided upon request.

Examples of previous achievements

- Research and services for public and private companies working in BSL3 pathogens such as: Classical swine fever virus, African swine fever virus, Rift Valley virus, prions, highly pathogenic influenza viruses, Mycobacterium spp and many other endemic pathogens requiring high containment facilities for their handling such as: Haemophilus parasuis, Mycoplasma hyopneumoniae, Salmonella spp, porcine circovirus, etc.
- Surveillance programs for the Catalan Government of relevant animal health problems (some of them shared with humans), such as: prions, West Nile virus, tuberculosis, avian Influenza, entomological surveys for West Nile…

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Validation of microbial inactivation studies

Evaluation of the inactivation or elimination of viruses or bacteria attending to the demand of public and private customers. Expert reports on microbial inactivation or biosafety issues, biocontainment facility management, or inactivation capabilities are also available upon request.

DESCRIPTION

- Designing the validation study attending to the specific nature of the product to be tested.
- Evaluation of the inactivation or elimination of viruses and bacteria by disinfectants, antiseptics, or decontamination processes or in any other step of a defined manufacturing process.
- Performing and validating the microbial inactivation procedures.
- IRTA-CReSA collects a broad range of viral (SARSCoV, SARSCoV2, Chikungunya virus, African Swine Fever Virus, Classical Swine Fever Virus, among others) and bacterial pathogens both belonging to culture collections but also field isolates.
- All the equipment used in inactivation studies is fully maintained following GLP regulations.
- GLP quality regulations also affects the rest of the activities regarding the study: protocol, amendment issues, raw data handling and final report.
- Studies subjected to confidentiality and following the specific European guidelines regarding the design, contribution and interpretation of studies validating the inactivation and removal of viruses.
- IRTA-CReSA can provide with expert reports on inactivation procedures, viral risks assessment for starting material and final products, etc.
- Expert reports on biosafety issues, management of facilities, inactivation capabilities are also available upon request.

Examples of previous achievements

- Validation studies on viral inactivation for several blood derivative companies and other pharmaceutical enterprises.
- Redaction of expert reports regarding viral safety of raw materials or starting materials.
- Preparation of validation reports confirming the viral inactivation capabilities of a specific manufacturing step.

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Pre-clinical and clinical studies with veterinary products

Expertise and resources to conduct pre-clinical and clinical trials with livestock species aimed to register veterinary products for animal health at national and European level or for any other specific purposes required by our clients.

DESCRIPTION

- Specific pre-clinical and clinical studies that guarantee the safety and efficacy of a given product following the official regulations required to approve their commercialisation.
- More than 10 years' experience conducting tolerance, safety and efficacy studies for private companies aimed to register veterinary products at national and European level.
- Possibility of working with biosafety level 2 and 3 laboratories and animal facilities under high quality standards following Good Laboratory Practices and Good Clinical Practices.
- Complementary studies aimed to support the registration process and post-registration studies are also performed.
- Conduction of concept and epidemiological studies motivated by marketing strategies.

Examples of previous achievements

Porcine
- Field efficacy and safety of vaccines against porcine circovirus type 2, Mycoplasma hyopneumoniae and atrophic rhinitis
- Efficacy and immune response of porcine reproductive and respiratory syndrome virus vaccines
- Epidemiological study of lung lesions in Spanish slaughterhouses.
- Efficacy studies of pre- and probiotics on gut health (also performed for avian species)

Avian
- Environmental safety of a modified live vaccine of Escherichia coli in turkeys and broilers
- Efficacy of antimicrobials against avian colibacillosis
- Efficacy of vaccines against avian salmonellosis

Ruminants
- Safety and efficacy of Schmallenberg and bluetongue virus vaccines in bovines and the latter also in ovines
- Safety and efficacy of vaccines in bovines

Others
- Efficacy of antimicrobials against digestive disorders of rabbits
- VIH-1 Prophylactic vaccine development in mice
- Immunotoxicity evaluation of different pharmaceutical compounds in mice
- Efficacy of different pharmaceutical formulations in front of *Candida albicans* in rats

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Slaughterhouse support network (SESC)

Online service intended to enable a final diagnosis of the lesions found in slaughterhouses.

SESC
Suport a escorxadors

DESCRIPTION

- Online service aimed to facilitate the task of meat inspectors.
- Submission forms are available at the website: www.cresa.cat/blogs/sesc
- The service allows uploading images of lesions observed in the carcasses inspected at the slaughterhouse.
- Samples can also be submitted to IRTA-CReSA for laboratorial diagnosis.
- Undiagnosed slaughterhouse cases will be collegially discussed and studied by a panel of pathologists and animal health experts from IRTA-CReSA, counting also with the opinion of external advisors (network already established).
- SESC will provide a conclusion to the requesting inspectors.

Main benefits:

- Meat inspector continuing education.
- Public health: zoonosis surveillance.
- Animal health: epidemiological sentinel.

Examples of previous achievements

- The most relevant cases are published in a public blog for continuing education: www.cresa.cat/blogs/sesc
- SESC has been created by and offers support to the official meat inspectors of the Catalan Government department of public health (Agència de Salut Pública de Catalunya, Generalitat de Catalunya) since 2008.
- From 2008 to 2013: 975 enquiries have been managed, of which 116 were solely telematic and 859 included samples for laboratorial analysis.

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Applied bacteriology in farm animals: antibiotic resistance, inmunology, metagenomics

This service guarantees a complete bacteriological characterization of samples received from veterinarians or companies for their analysis using classical identification methods (selective culture plates, biochemical tests, etc.) and advanced molecular techniques. Additionally, antibiotics resistance studies are performed.

DESCRIPTION

- Classical microbiological cultures serve as first step for isolation of bacteria which will be further identified using a Vitek 2 compact system (BioMerieux).
- A fine PCR and sequencing analysis can also be performed if a more precise identification of the isolated bacteria is required.
- Quantitative studies performed by real time-PCR can be also requested.
- Additional antibiotic resistance analysis can be done using different systems, such as Neosensitabs discs, e-test strips or dilution system.
- Analysis of intestinal microbiota by next generation sequence
- Studies with new pro and prebiotics in farm animals.
- Large experience in experimental infections in animal models
- Development of new vaccines. Efficacy and safety studies.
- Studies under GLP and GCP.
- Inmunological studies: inmunoglobulines, citokines.

Examples of previous achievements

- Our laboratory has many years of experience in bacterial identification and characterization, serving both the industry and the governmental agencies.
- Development and registration of avian vaccine of salmonella.
- Studies about efficacy of different products used instead of antibiotics.
- Studies about efficacy of different products used as a probiotics

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Veterinary epidemiology and risk assessment

This offer deals with epidemiological studies (both descriptive and analytical), modeling and risk assessment, as well as scientific advice in the design, implementation and evaluation of surveillance and control programs for several diseases.

DESCRIPTION

- Epidemiological studies: design of the study, statistical analyses and epidemiological interpretation.
- Determination of disease transmission between and within farms: investigation of the spatial pattern of animal diseases, modeling disease spread within and between farms and evaluation of control measures, outbreak investigations, determination of the most probable causes of disease introduction into a farm.
- Risk analysis of disease introduction in an animal population according to the World Organization for Animal Health (OIE) recommendations.
- Design, implementation and evaluation of surveillance and control programs: design of a surveillance network, design of a control program and analysis of the sensitivity of surveillance systems using scenario-tree models.

Examples of previous achievements

- Courses in veterinary epidemiology at national and International level for international organizations such as the Food and Agriculture Organization of the United Nations (FAO) or the European Commission.
- Development of an application for the management of surveillance and control in case of an epidemic of African Swine Fever, in collaboration with the Department of Agriculture of Catalonia.
- Epidemiological studies:
    - Evaluation of the economic impact and risk factors of *Streptococcus suis* within PIGSs (H2020) project.
    - Evaluation of the effectiveness of the surveillance system for tuberculosis in cattle in Spain within Epi-Tuber (MICINN) and Epi-Risk (Era-Net ANIHWA) projects.
    - Development of generic approaches for Risk Assessment of infectious animal disease introduction within G-RAID (EFSA - Partnering Grant) project.

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