BIOSURVEILLANCE RESEARCH PROGRAMME
GRANT CALL 1

1. Definitions

1.1 In this Call for Proposal, unless the contrary intention appears: -

(a) "Host Institution" means the body or institution or administering organisation named in the Letter of Award as the "Host Institution" as the body responsible for undertaking and managing the Research;

(b) "Partner Institutions" means the bodies or institutions named in the Letter of Award as the "Partner Institutions" as the bodies responsible for working together with the Host Institution to undertake the Research;

(c) "Institutions" means collectively the Host Institution and the Partner Institutions and "Institution" shall mean any one of them;

(d) "Investigators" means collectively, the Lead Principal Investigator, Team Principal Investigators and Co-Investigators;

(e) "Collaborator" means any company, institution, incorporated body or other industry or academic collaborator, which is not an Institution or an Investigator but is to be engaged in the Research in collaboration with the Institutions or any of them;

(f) "Lead Agency" means the government agency leading and driving the Research;

(g) "Other Agencies" means the government agency/agencies participating in the Research other than the Lead Agency; and

(h) "Research" means the research project selected and awarded a grant under the Biosurveillance Research Programme.

2. Introduction

2.1 Zoonotic diseases most often emerge at the human-animal interface where there is an increased likelihood of human exposure to infectious animal hosts and vectors, for example, when there are heightened interactions between animal and human populations in our urban landscapes. Singapore is also a hub for international travel and trade and the migration of wild birds, thus serving as an entry point for zoonotic reservoirs. Other anthropogenic activities and environmental risk drivers (e.g., land use change, climate change) are also expected to further heighten the risks of zoonotic diseases. There is an urgent need to increase our understanding of how urban and natural landscapes influence zoonotic disease spread through changes in animal host and vector populations, and as further mediated by human activities and socio-behavioural factors.

2.2 Led by the National Parks Board (NParks), the Biosurveillance Research Programme seeks to advance the scientific understanding of zoonoses and their key drivers at the animal-human-environment interface in Singapore and to develop and examine evidence-based upstream mitigation strategies. Research efforts will be augmented by fostering transdisciplinary research collaboration. This will involve the capture and use of diverse and complex datasets (e.g., genomic and epidemiological data), leveraging synergies across different subject expertise, and harnessing a spectrum of tools and

technologies across different fields. The programme will create and build up a fundamental knowledge and outcomes to enhance zoonoses detection, prevention, and mitigation capabilities across two Research Themes:

- Genomics and Genetics
- Epidemiological and Ecological Connectivity

[Please see Annex A for further details on the programme and the themes]

3. Call Topic

3.1 Please refer to Annex B for the details of the Call Topic.

4. Eligibility

4.1 Principal Investigators (PIs) from all Singapore-based public research institutes (RIs) (e.g., Institutions of Higher Learning (IHLs) and A*STAR RIs), companies, company-affiliated research laboratories or institutions and not-for-profit entities are eligible to apply.

4.2 The Lead PI who leads the Research must be based in Singapore[1]. Collaboration with Singapore-based organisations and experts, in the capacity of Co-Investigator (Co-I) or as Collaborator, is strongly encouraged in line with the Biosurveillance Research Programme's emphasis on multi-disciplinary and translational research. Collaboration with foreign organisations and experts in the capacity of Co-I or as Collaborator is allowed, and strongly encouraged for areas with potential for introduction of new research capabilities and transfer of technical expertise into Singapore. Research work should be done in Singapore, and should not be carried out overseas unless expressly approved by the grantor.

4.3 Grant applicants are strongly encouraged to collaborate with industry partners to develop innovative solutions that can address the call objectives and demonstrate strong potential for real-world application within and beyond Singapore.

4.4 Where applicable, we encourage the integration of relevant real-world conditions or social and behavioural research to complement the R&D work under these grant calls, to ensure the practicality, user-centricity and acceptability of the solutions proposed.

4.5 PIs should submit proposals in accordance with the Call Topic(s) launched under the Grant Call. Please clearly indicate the Call Topic that the proposal will address in the Proposal Template.

[1] Lead PIs must maintain a minimum of 1 year employment with the Host Institution, starting from the closing date of the Grant Call.

4.6 R&D proposals already funded by other government agencies will not be considered under the Biosurveillance Research Programme. PIs will need to declare their other funding sources as well as participation in other funding initiatives during application. Proposals with similar scope, which are currently under evaluation by other funding initiatives, will not be considered until the results from the other funding initiatives are finalised.

4.7 Funding for private sector entities for (i) research projects with a total project budget more than S$500,000 or (ii) test-bedding/demonstration/scale-up projects with a total project budget more than S$2 mil, would be conditional on collaboration with a public research performer. Nonetheless, below these quanta, private sector Lead PIs are also strongly encouraged to collaborate with public research performers as far as possible.

5. Funding Support

5.1 When budgeting for funding under the Biosurveillance Research Programme, the total cost of the project should include all approved direct costs[2] and indirect costs[3]. All expenditure should be budgeted inclusive of any applicable Goods and Services Taxes (GST) at the prevailing rates. The Lead PI should exercise due diligence and ensure that the proposed budget is correct and free from error.

5.2 Direct costs are incremental cost required to execute the programme. Supportable direct costs can be classified into the following cost categories:-

(a) Expenditure on manpower (EOM);
(b) Equipment;
(c) Other Operating Expenses (OOE); and
(d) Overseas Travel.

5.3 For all direct cost items proposed for the project, please note that:

(a) Host Institutions must strictly comply with their own procurement practices;
(b) Host Institutions must ensure that all cost items are reasonable and are incurred under formally established, consistently applied policies and prevailing practices of the Host Institution; and
(c) All items/ services/ manpower purchased/ engaged must be necessary for the R&D work.

[2] More information on the non-fundable direct costs of research can be found in Annex C.
[3] Indirect costs are costs that are incurred for common or joint objectives and therefore cannot be identified readily and specifically with a particular sponsored research project, but contribute to the ability of the Institutions to support such research projects (e.g., providing research space, research administration, utilities), and not through the actual performance of activities under the sponsored projects.

5.4 For proposed Equipment to be purchased, please ensure that they are currently unavailable in the Host Institution. In the event where the Lead PI is aware that a similar Equipment is available in the Host Institution, but has still proposed to purchase such Equipment, the Lead PI has to provide the necessary justifications for the Biosurveillance Research Programme Office's approval. Please also note that there is a requirement to share Equipment purchased using NRF funds with other researchers in Singapore.

5.5 At the end of the Research, the Biosurveillance Research Programme Office may enter a negotiation with the Host Institution to transfer ownership of any of the Assets to the Biosurveillance Research Programme Office or any other person or body at no cost.

5.6 Biosurveillance Research will support 100% of the approved qualifying direct costs of a project for Singapore-based IHLs/public RIs. Private sector entities[4] will qualify for up to 50%[5,6,7] of the approved qualifying direct costs of a project, depending on the entities involved:

(a) 30% for all non-Singapore entities based in Singapore (including non-Singapore not-for-profits) and Singapore Large Local Enterprises; and

(b) 50% for Singapore Small Medium Enterprises and start-ups.

5.7 Support for indirect costs, in the form of overheads, will only be provided for Singapore-based IHLs/public RIs. Funding support of 30% of the total qualifying approved direct costs will be allowed. Host Institutions will be responsible for administering and managing the support provided by the Biosurveillance Research Programme for the indirect costs of research. Indirect costs must be specifically provided for in the grant, and approved by the Grantor based on the nature of the research.

5.8 Please refer to the document "Guidelines for the Management of Research Grants" for information on Disbursement of funds, Variation requests, Audit and Progress reports and List of Non-Fundable Direct Costs for Research Projects.

5.9 Collaborators are not permitted to receive, directly or indirectly, any part of the funding, whether in cash or in the form of assets acquired using the funding or otherwise unless expressly approved by the grantor. All assets acquired using the funding must be located in Singapore and maintained within the control of the grantees.

[4] Definitions of the different private sector entity types can be found in Annex D.

[5] Singapore not-for-profits will be treated based on their size (i.e., will qualify for up to 50% of the approved qualifying direct costs of a project, if they meet the Small Medium Enterprise definition).

[6] Exemption: Temasek Life Sciences Laboratory will qualify for up to 100% of the approved qualifying direct costs and up to 100% of the indirect costs of a project.

[7] All funding support levels are accurate as of grant call launch, and may potentially be subject to future review and revision.

6. Intellectual Property Rights

6.1 Government agencies who are Institutions or Collaborators may co-own any Intellectual Property (IP) arising from the Research. If Government agencies choose not to co-own IP, they shall make this position known prior to award.

6.2 The Institutions shall keep and maintain a full, comprehensive and updated list of all Research IP, which shall be made available to the Biosurveillance Research Programme Office for inspection at any time.

6.3 The parties shall use best efforts to ensure that Research IP is properly managed and wherever feasible, fully exploited and commercialized. When required to do so by Biosurveillance Research Programme Office, the Institutions shall attend such meetings as Biosurveillance Research Programme Office may direct to discuss the potential for exploitation and commercialization of Research IP.

6.4 The Government and public sector agencies shall reserve a non-exclusive, non-transferable, perpetual, irrevocable, worldwide, royalty-free right and license to use, modify, reproduce and distribute the Research IP for non-commercial, R&D and/or educational purposes.

6.5 For projects funding non-Singaporean entities[8], a Singapore Technology Licensing Office (STLO) must be appointed regardless of the involvement of the public research performer. The STLO will assist to manage RIE-sponsored foreground IP for maximum utility in Singapore, and provide fair access to Singapore entities in the public and private sector.

7. Data Management

7.1 USS domain agencies are compiling a metadata catalogue to improve data discoverability for researchers. It seeks to encourage early (i.e. pre-award) data-related discussions between Lead agencies and Investigators and will serve as a central reference for datasets available within agencies for request, to be used exclusively for the Research. However, Investigators should note that to lower data/cybersecurity risks of the project, data from the catalogue may not be shared in the publicised form (see para 7.4).

7.2 Interested Investigators may write in to request for the metadata catalogue. Please note that access to the metadata catalogue, as well as any data subsequently requested from the Government and/or public agencies require the signing of Catalogue Undertaking by the requestor's institution/company as a pre-requisite.

[8] Non-Singaporean entities are defined as companies with less than 30% local shareholding, determined by the ultimate individual ownership.

7.3 To safeguard against data leaks/breaches, depending on the nature of the Research, the Host Institution, Partner Institutions and/or Collaborators may be required by the Biosurveillance Research Programme Office to attain one of the data and/or cybersecurity standards certification listed below (hyperlinked) as a pre-requisite to receive data requested or execute the data collection (e.g. survey) for the Research. Exact requirements will be determined after evaluation and Biosurveillance Research Programme Office will officially inform the applicants selected for award in writing[9]. Failure to obtain the required certifications may affect project progress leading to delays in payment milestones, and potentially termination of the award.

Cyber Security Agency (CSA) Cybersecurity Standards[10]	**Inforcomm Media Development Authority (IMDA) Data Security Standards**
Cyber Trust Essentials (CTE)	Data Protection Essentials (DPE)
Cyber Trust Mark Tier 2 - Practitioner	
Cyber Trust Mark Tier 3 - Promoter	Data Protection Trust Mark (DPTM)
Cyber Trust Mark Tier 4 - Performer	
Cyber Trust Mark Tier 5 - Advocate	

7.4 Any datasets shared by Lead agencies may be aggregated, anonymised and desensitised, where feasible, to lower the data classification/sensitivity. In the same vein, where feasible, any proposed data collection from human subjects (e.g. survey) by the Investigators should be anonymised as well. These efforts would help to reduce the inherent data/cybersecurity risks of the Research and minimise the need for data/cybersecurity standards certifications.

7.5 To facilitate data sharing, Host institutions are required to submit cleaned data that is collected or generated in the Research as identified by the Biosurveillance Research Programme Office. Please note that data may be shared with other publicly funded projects in the future through the metadata catalogue, unless they are commercial data or bounded by NDAs, to maximise synergies across projects and minimise duplicative works.

[9] Should there be new data request or new data collection works identified later over the course of the project, the Biosurveillance Research Programme Office reserves the right to require additional certifications to be attained during the project's progress (i.e. after project is awarded).
[10] Cyber Trust Mark controls are also mapped to (and is a subset of) ISO/IEC 27001:2022. Applicants may use ISO/IEC 27001:2022 certification to meet all tiers of Cyber Trust Mark certifications.

8. Publications

8.1 All public disclosure of project information (e.g., publications, abstracts, presentations, documentaries, media interviews, etc.) shall be subject to prior review and approval by the Biosurveillance Research Programme Office. The Biosurveillance Research Programme Office reserves the right to object to or require revisions to any such disclosure to ensure the protection of sensitive information and accuracy of represented information or reference made to government agencies.

9. Post-Research Support

9.1 Based on agencies' experience, there is a need for a handover period as often, there are practical issues such as debugging or additional tests for compatibility with government systems required, depending on the nature of the research project. In this regard, to better reap project outcomes, the Host Institution shall ensure that the Lead PI, Co-I and Collaborators shall provide all necessary support for continued product development and technology translation of the Research, for a period of up to 9 months ("**Handover Period**"), as may be required by the Biosurveillance Research Programme Office, depending on the nature of the project. The support required shall include but not be limited to the carrying out of training sessions and conducting of debugging, user acceptance tests and compatibility tests with existing government systems. The detailed terms of the Handover Period for each Research would be set out in the written agreement referred to at para 12.8 below. For the avoidance of doubt, the duration of the Research shall include the Handover Period.

10. Research Integrity Policy

10.1 The Host Institution shall ensure that all necessary approvals for the research, including all ethics approvals, have been granted prior to the commencement of any research activities.

10.2 The Host Institution is responsible for establishing a research ethics and integrity policy and enforcing its compliance. In carrying out any Research, the Host Institution shall agree to:-

(a) Comply with the provisions of any relevant laws of the Republic of Singapore, statutes, regulations, by-laws, rules, guidelines and requirements applicable to it, as well as all applicable policies and procedures adopted by Biosurveillance Research as the same may be amended or varied from time to time;

(b) Have in place a research integrity policy which sets out the principles for the responsible conduct of research and procedures for investigating and responding to accusations of misconduct;

(c) Provide training in responsible conduct of researchers, for all researchers;

(d) Be held responsible for the conduct of research and researchers; and

(e) Ensure compliance with best practice, as well as the ethical, legal and professional standards relevant to the research.

10.3 All PIs, research personnel and all other persons involved in the Research must comply with the research ethics and integrity policy, and other approval requirements needed to carry out the research programme. The PIs should undertake the following declaration:

(a) In carrying out Research, agree to comply with the provisions of any relevant laws of the Republic of Singapore, statutes, regulations, by-laws, rules, guidelines and requirements applicable to it, as well as all applicable policies and procedures adopted by the Biosurveillance Research Programme as the same may be amended or varied from time to time;

(b) Agree to hold primary responsibility for the responsible conduct of research, and shall abide and comply with the ethical, legal and professional standards relevant to research, in accordance to the research integrity policy of the Host Institution; and

(c) Declare any potential conflict of interest that may arise from the purchase of equipment/ physical items or engagement of manpower/ services in the course of carrying out Research.

11. Evaluation Process

11.1 Proposals will be evaluated based on the following criteria:

(a) Potential Contribution to Biosurveillance Research Objectives

- Relevance of proposed research in contributing to objectives/targets stated for the Biosurveillance Research Call Topic.

(b) Potential for Breakthrough and Innovation

- Quality and significance of proposed research, including value for money, potential for breakthrough/innovation to advance knowledge and understanding within its own field or across different fields, and proposed application of research outcomes (pathway to impact).

(c) Execution Strength and Technical Competency of Research Team

- Quality of plans for execution and delivery of the research programme and goals, including the appropriateness of the proposed milestones and deliverables (specific to evaluation of full proposal applications).
- Quality, significance, and relevance of the recent research record of the Lead PI and Co-Is and the strength of the applicant group, including likely synergy in delivering research and potential for international leadership.

12. Letter of Award & Acceptance

12.1 The Biosurveillance Research Programme Office is under no obligation to award research grant in whole or in part to any proposal. The Biosurveillance Research Programme Office may require proposals to be revised as it sees fit to enhance research outcomes, facilitate integration of research concepts and technologies, and optimise funding resources. Specific data/cybersecurity standards certifications required (if applicable) will also be communicated to the applicant in writing for the selected proposal for award. **The Biosurveillance Research Programme Office's decision on project and funding support will be final** and shall be abided by the applicants.

12.2 Successful applicants will be informed by the Biosurveillance Research Programme Office of the award of the grant. Notification in the form of a Letter of Award will be sent to the Director of Research (DOR) for the respective Lead PI's Host Institution, and copied to the Lead PI.

12.3 The Letter of Award will include the following:

- **(a)** Statement of Acceptance;
- **(b)** Terms and Conditions of the Grant;
- **(c)** Guidelines on Grant Management;
- **(d)** Performance Indicators and Milestones;
- **(e)** Schedule and Budget Details; and
- **(f)** Data/Cybersecurity Standards Certification Requirements.

12.4 The Acceptance Form must be acknowledged by all of the following:

- **(a)** The Director of Research (or equivalent);
- **(b)** The PI; and
- **(c)** The Co-Investigators (Co-Is).

12.5 Upon acceptance of the Biosurveillance Research grant, the PI, Co-Is and Host Institution are bound by these clauses and all other terms as specified in the Letter of Award.

12.6 The PI or Co-Is cannot also be the authorised officer representing the Institution (i.e. DOR). In such cases, another officer duly authorised by the management of the Institution shall approve on its behalf.

12.7 The Acceptance Form and Annexes (if applicable) should be returned to Biosurveillance Research Programme Office within a pre-determined time frame from the date of the Letter of Award. The date on which the Statement of Acceptance is signed shall be taken as the date of acceptance of the Award.

12.8 After the acceptance of the Award, as may be required by Agencies, the Lead Agency, Host Institution, Partner Institutions, Collaborators and/or Other Agencies shall enter into a written agreement that is consistent with the obligations assumed under this Research and that includes conditions about: -

(a) the role of each party in the Research;
(b) the provision of cash or in-kind contributions to the Research by each party;
(c) the work to be undertaken by each party and its technical/scientific contributions;
(d) terms relating to Intellectual Property ownership and commercialization;
(e) the detailed terms of and each party's obligations during the Handover Period; and
(f) any other obligations to be fulfilled as laid out in this set of guidelines.

12.9 The Investigators are responsible for putting in place research collaboration agreements where and when applicable.

13. Submission Instructions

13.1 Please download the Integrated Grant Management System (IGMS) User Guide from the IGMS system at https://www.researchgrant.gov.sg/Pages/TrainingGuides.aspx for all instructions and guidelines on the submission process and information relating to the Grant Call.

13.2 Lead PI and Co-Is from organisations that are not registered in the IGMS are advised to contact biosurveillance_research@nparks.gov.sg as soon as possible. Applicants are advised to allow sufficient time (at least 2 weeks) for their respective organisation to be registered, including registering their respective researcher profiles in the IGMS prior to submitting proposals. Refer to Annex E and the Grant Call FAQs for further information.

13.3 All applications and supporting documents for the Biosurveillance Research Grant Call must be submitted through IGMS at https://www.researchgrant.gov.sg/. Once PIs have submitted their documents online, their applications will be routed to the Director of Research (or equivalent) of their respective Host Institution for online endorsement. Separate submissions outside of IGMS will not be considered.

13.4 Please note that it is mandatory for applications to be lodged in the IGMS system and endorsed by **28 March 2025, 2:00pm, Singapore time (UTC +08:00). Late submissions or submissions from individual applicants without endorsement from the Host Institution will not be entertained.**

13.5 For enquiries on the Grant Call, please email to biosurveillance_research@nparks.gov.sg. For other enquiries pertaining to IGMS system, please email IGMS helpdesk at Helpdesk@researchgrant.gov.sg.

13.6 Applications are considered to be successful only if all relevant documents are submitted in IGMS. The Research Administrative Office from IHLs or equivalent outfits in companies are required to ensure information submitted by their researchers for the grant call are compiled according to the requirements set out. Incomplete submissions may be rejected. A soft copy of the application documents should also be sent by email to the Biosurveillance Research Programme Office at biosurveillance_research@nparks.gov.sg. The application documents required for the submission can be downloaded from the 'Research Proposal' section under "Research Details" after the applicant login to IGMS and navigate to "Proposals", view "Proposal information". The documents required to be submitted are:

(a) Full Proposal Template (Form A); and

(b) Budget Template (Form B)

It is advised to restrict each attachment to be less than 4MB.

13.7 Please follow the naming convention and format for labelling of softcopy attachments:

Attachment	Naming Convention	Format of attachment
Full Proposal Template	*[Topic Code]* FP_ *Project title*	MS Word
Budget Template	*[Topic Code]* Budget_ *Project title*	MS Excel
CVs	*[Topic Code]* CV_ *Project title*	MS Word
References (optional)	*[Topic Code]* References_ *Project title*	MS Word

Important: Where relevant privileged or confidential information is needed to help convey a better understanding of the project, such information should be disclosed and must be clearly marked in the proposal.

13.8 In case of discrepancy between the information in the IGMS application form and the attachments uploaded, the information in the attachments shall be taken as final.

13.9 As part of the Biosurveillance Research Programme evaluation process, project submissions will be subjected to a round of peer review by domain experts, followed by evaluation by a Project Evaluation Panel. Research teams applying for the grant call are invited to recommend peer reviewers for the Biosurveillance Research Programme Office's consideration under the "Reviewers" section of the application form in IGMS.

13.10 The final decision on the peer reviewers will be decided by the Biosurveillance Research Programme Office. Please refer to the following guidelines when recommending peer reviewers:

(a) Potential reviewers should not have a real or perceived conflict of interest to any members of the research team (e.g., from the same institution as the research team; recently published work with members of the research team; have personal connections with the members of the research team etc.)

(b) Potential reviewers should be experts in the related field. Researchers cited in the reference list may be recommended as potential peer reviewers.

Annex A: Overview of the Biosurveillance Research Programme, and its Research Themes

Biosurveillance is the systematic and continuous gathering, integration, interpretation, and communication of information on emerging diseases, animal hosts and vectors for early warning and detection. Early response policies and measures reduce the magnitude, and cost of emergency response measures subsequently. The One Health agencies (MOH, NEA, NParks, PUB and SFA) have identified four strategic thrusts under the Whole-of-Government (WOG) Biosurveillance Framework (Figure 1) to build up capabilities to proactively monitor disease threats upstream in natural and urban environments.

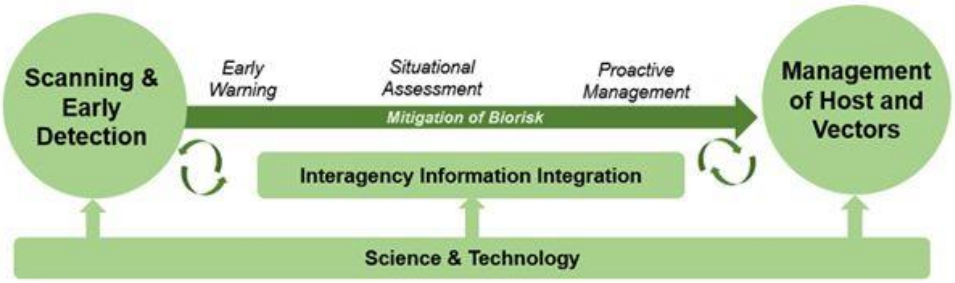

Figure 1. Whole-of Government Biosurveillance Framework

The Biosurveillance Research Programme, developed under NRF's Urban Solutions and Sustainability (USS) domain of RIE2025, builds on existing national biosurveillance efforts and interagency One Health collaboration to address public health disease challenges brought about by climate change and the transboundary movement of people, animals and vectors. The programme will advance the scientific understanding of zoonoses and their key drivers at the animal-human-environment interface in Singapore, with a focus on zoonoses in animal hosts and vectors in the urban and wider tropical environment, and to develop and examine evidence-based upstream mitigation strategies. Led by NParks, this $15M research programme is part of overall efforts to building a safe, healthy, and resilient City in Nature.

Research efforts under the programme aim to foster transdisciplinary research collaboration and data sharing, and harness and consolidate expertise across public agencies, research institutes, and industry partners, across key disciplines such as genomics, disease modelling, ecology, and vector biology. Through these efforts, the programme aims to:

- Build scientific knowledge to establish a more effective system to monitor and detect zoonotic diseases within the urban environment
- Provide insights on how urban development and animal movement may affect zoonotic disease transmission and ecology
- Inform upstream strategies for effective zoonotic disease mitigation, such as through land-use planning, habitat restoration, and targeted animal management measures
- Empower relevant industry and community stakeholders with the required scientific knowledge and safe practices for zoonotic diseases prevention

Research efforts under the Biosurveillance Research Programme will be centred around two key themes:

1. **Genomics and Genetics** – to study novel molecular approaches that can be used to gain insights on zoonotic pathogens and their animal hosts and vectors, as well as enable high-resolution detection and characterisation of these pathogens. Key examples include enhanced invertebrate (iDNA) and environmental sampling (eDNA), and the use of field-deployable sensors, diagnostic platforms, and automated analytics. Findings from this theme can inform efforts in disease source tracking in animal hosts and their environments through, for instance, documenting the diversity of animal host reservoirs, mapping animal host population connectivity, and studying the evolution and transmission dynamics of novel pathogens.

2. **Epidemiological and Ecological Connectivity** – to better understand the interactions between zoonotic pathogens and their animal hosts and vectors, as well as with people and the environment, by using a range of modelling, observational, and risk analysis approaches. This includes examining the socioeconomic and behavioural drivers of animal movement, such as the illegal trade of pets and wildlife, as well as the effects of land use and habitat connectivity on animal host and vector distribution. Efforts under this theme will deepen scientific insights and create new knowledge products to guide the implementation of evidence-based interventions and countermeasures for mitigating zoonotic disease risk in Singapore's urban context.

Annex B: Grant Call Topic

Grant Call ID/ Topic Code: BioRP_GC2025_06

Call Topic: Risk and drivers of zoonotic disease transmission from mammalian wildlife in Singapore

Research Theme: Genomics and Genetics, Epidemiological & Ecological Connectivity

1. Background

1.1 Wildlife has been recognised as a significant source of emerging infectious zoonotic diseases, particularly through heightened interactions between wildlife, humans and domestic animals. Despite documented cases of zoonotic disease transmissions[1-3] in Singapore, the drivers of such transmission and outbreaks from wildlife population remains relatively under-documented. This project aims to focus on the epidemiology (e.g., prevalence, transmission risk) of zoonotic pathogens that corresponds to the ecology of native synanthropic mammals (e.g., otters, squirrels, bats, macaques and civets), which are the more commonly encountered mammals in Singapore.

Long-tailed macaques and mosquito-borne zoonotic pathogens

1.2 In Singapore, there are efforts to characterise the ecology of native long-tailed macaques[4,5] (*Macaca fascicularis*; henceforth referred to as macaques), and there is a growing body of literature that suggests an increase in the monkey-human interface, particularly in the face of increasing urbanisation efforts[6]. Despite reports of wild macaques serving as potential reservoirs for various mosquito-borne zoonotic pathogens (MBP), such as Yellow Fever[7], Dengue[8], Zika[9] and Malaria[10], their capacity to do so in Singapore remains poorly understood, even when the epidemiology and disease ecology of MBP (and their associated vectors) have been extensively examined within the region.

1.3 In light of the implications to both animal and human health, the epidemiology of MBP from the perspectives of macaques is a critical area of study not only due to their capacity to facilitate pathogen transmission as reservoirs and/or direct contact (e.g., bites[11]), but also through their adaptive associations with humans and anthropogenic landscapes. More importantly, Singapore is host to a range of climate, environmental and animal-host factors that are synonymous with regions within the immediate vicinity that reports MBP outbreaks and infections. As a result, it is imperative to understand the prevalence and transmission dynamics of MBP from native macaque populations in order to reduce the burden of MBP and mitigate potential spillover into human populations through effective surveillance and control strategies and improved public health responses.

Bat-borne zoonoses

1.4 Bats are the second largest order of mammals and shows great physiological and ecological diversity. Aside from their significant ecological functions such as the facilitation of seed dispersal and pollination, these animals also play host to a range of viral, bacterial, fungal and parasitic zoonotic pathogens due to their ubiquitous biology

(e.g., greater metabolic rate and innate immunity). As a result of their enhanced adaptive immunology, many pathogens survive in bats without showing pathogenicity and in favourable ecological conditions, zoonotic and reverse zoonotic transmission can occur between other terrestrial animals, including humans. More importantly, bats can adapt to live closely with humans, which inevitably increases the risk of disease transmission and the emergence of zoonoses. However, the transmission route is often not well understood, which can be particularly concerning for certain zoonotic pathogens that have high transmissibility and infectivity, such as henipaviruses (comprising of Hendra virus and Nipah virus; HeV and NiV, respectively) and coronaviruses.

1.5 Despite a Nipah outbreak among abattoir workers in Singapore in 1999, the epidemiology of henipaviruses (i.e., HeV and NiV) in animal and human populations in Singapore has remained largely under-studied. However, the detection of HeV and NiV in flying fox populations, which are the primary reservoir of the henipaviruses, within the surrounding regions (i.e., Malaysia[12], Bangladesh[13]; and Thailand[14]) as well as incidences of human infections and zoonotic transmission[15-17] underscores the risk of this emerging public health threat in Singapore. This risk is further exacerbated not only by the relative proximity of these affected countries but also by the range of environmental, landscape and animal-host similarities shared with Singapore.

1.6 In the past two decades, three coronaviruses (CoV) with ancestral origins in bats have emerged and caused widespread outbreaks in humans, including the most recent severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) pandemic. Given that bats have been directly and indirectly involved in the three previous CoV pandemics and are the likely evolutionary source, their role in historic and future pandemics will require careful and ongoing investigations. However, the study of CoV epidemiology in native bat populations are scarce, with studies leaning more heavily towards the development and evaluation of detection methods[18-19]. As a result, less is known about the epidemiology and spillover risk factors of CoV from native bat populations in Singapore.

Zoonoses in other small mammals (e.g., civets, otters and squirrels)

1.7 Civet cats (henceforth referred to as civets) are another wildlife species that have been increasingly identified as emerging cause for concern in the transmission of CoV into human populations, potentially either as missing links between humans and bats or disease reservoirs[20-22]. These sentiments are largely backed by the belief that the SARS epidemic from 2002 to 2003 stems from a zoonotic spillover event between palm civets and humans[23], although the infection has also been reported in other domestic and wild animals. Nevertheless, the ecology of native civets has been relatively understudied despite their ability to persist across peri-urban habitat gradients and adapt to anthropogenic landscape[24]. This lack of comprehensive ecological data impedes our understanding of their role in disease transmission dynamics and risk factors, particularly across the human-civet interface in Singapore.

1.8 In addition, there are other small mammals like otters and squirrels with increased direct interaction with humans. For example, otters can be urban generalists[25] (i.e., able to use a wide range of habitats within an urban-rural gradient) with the potential to move into more urban environments[26]. NParks has also reported a steady increase in otters from 2020[27, 28], which not only reinforces the idea of a growing otter population but also

suggests a potential rise in human-wildlife interactions. There is limited literature reporting the oral or claw bacteria flora of common local small mammals such as otters and squirrels that may inflict bite injuries on humans. A greater understanding is also needed on the risk factors that may predispose to these incidents, especially given that wildlife attacks on humans are primarily determined by behaviour related to human encroachment[29, 30]. Therefore, increased research efforts are crucial to elucidate the behaviour, population dynamics, and potential health risks posed by these small mammals, which in turn, informs effective surveillance and mitigation strategies to prevent future spillovers events.

1.9 The research under this topic aims to assess the risk and drivers of zoonotic disease transmission and outbreaks from certain mammal wildlife (e.g., otters, squirrels, bats, civet cats, macaques) in Singapore through advanced sampling and analysis of genomes and other molecules (e.g., proteins) in pathogens and hosts. In addition, through the examination of the human-wildlife interface, this project aims to identify the drivers in the transmission dynamics and spill-over events of associated zoonotic pathogens through a multifaceted approach to inform and guide mitigative and surveillance measures that can safeguard both human and animal health.

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2. Objectives and Scope of Call for Proposals

2.1 Objectives

(a) To establish the prevalence of emerging and re-emerging zoonotic diseases (e.g., malaria, henipavirus) from native synanthropic mammalian wildlife species (e.g., squirrels, otters, bats, macaques and civets) through advanced sampling and omics-based techniques. *The use of non-invasive and environmental sampling (e.g., faecal, wastewater, air and other environmental matrices) shall be explored for this objective, in addition to conventional animal-based sampling methods.*

(b) To identify the disease reservoir potential, transmission dynamics and risks considering the ecological factors of the studied native synanthropic mammalian wildlife.

(c) To examine the impacts of environmental and anthropogenic factors on disease transmission dynamics in Singapore.

(d) To identify the socio-demographic factors that influence disease transmission dynamics within the human-wildlife interface.

Projects are also encouraged to further build upon the above-mentioned objectives, and/or propose additional research objectives.

2.2 Technical Deliverables

To guide preventative and mitigative strategies against zoonotic pathogen outbreaks in mammalian wildlife by:

(a) Assessing the prevalence of zoonotic diseases originating from native synanthropic mammalian wildlife (e.g., squirrels, otters, bats, civets and macaques) reservoirs and evaluating the associated disease transmission risks to human populations/communities.

(b) Examining the transmission and outbreak risks of certain zoonotic diseases across various gradients of the human-wildlife interface (e.g., compassionate feeding, illegal wildlife trade) and identifying the socio-behavioural and population demographic profiles that are associated with such interactions.

(c) Developing practical and non-invasive environmental sampling and adaptable omics-based techniques to identify, detect and monitor zoonotic diseases and pathogens.

(d) Constructing risk models* to inform targeted and multi-faceted intervention strategies aimed at mitigating the transmission of zoonotic diseases from native synanthropic mammalian wildlife in Singapore.

** The use of artificial intelligence could be explored.*

Projects are encouraged to further build upon the above-mentioned deliverables, and/or propose additional deliverables.

2.3 Impact Outcomes

In relation to the overall aims and key research themes of the Biosurveillance Research Programme, this project should look towards contributing to the following impact outcomes:

(a) In establishing the baseline prevalence and epidemiology of zoonotic disease transmission risk, we collect crucial data that enhances ongoing (and future) public health readiness and response strategies.

(b) By having a deeper understanding of the drivers of human-wildlife interactions, we will be able to facilitate the development of targeted interventions that reduces the risk of disease transmission inherent across such interfaces.

(c) The development of informative environmental sampling and/or omics-based techniques not only strengthens our disease surveillance capabilities, but also provides greater opportunities to streamline and/or optimise current (and future) biosurveillance efforts.

(d) Outputs from this project can contribute to policy-making decisions, communication strategies, professional education and intervention responses for effective zoonotic disease management in both human and wildlife populations.

(e) Facilitating contributions towards to capacity building and knowledge transfer while fostering collaborative research amongst One Health agencies in Singapore to tackle the threats of emerging zoonotic diseases.

3. Funding Support

3.1 The Call for Proposals offers funding support up to S$2.4 million (including all direct and indirect costs) (i.e., for meeting all objectives/ deliverables). Proposals more than S$2.4 million will require strong justifications.

3.2 This Call for Proposals offers funding support for a period up to 3 years. Proposals spanning more than 3 years will require strong justifications.

4. Agencies Involved

4.1 The following agencies will be involved in the project to provide technical direction to ensure that the project meets the objectives and scope of the Call Topic.

(a) National Parks Board (Lead Agency)

4.2 Further clarifications before the project award should surround the stated Call Topic requirements. All clarifications and queries should be submitted directly to the Biosurveillance Research Programme Office at Biosurveillance_Research@nparks.gov.sg during the open grant call process, i.e., research teams should not contact agencies directly. Biosurveillance Research Programme Office will respond to the clarifications and queries, by periodically updating the Grant Call FAQs document with the relevant answers, on the Biosurveillance Research 1st Grant Call website and IGMS website to ensure equal accessibility to all additional information. Please refer to these websites for the latest version of the FAQs. Agencies involved will work with research teams to provide further technical advice and discuss potential study sites during the proposal scrubbing stage.

Annex C: Non-Fundable Direct Costs for NRF-Funded Projects

This list may be subject to revision.

Type of Expenses	Description
Salaries of Lead PIs / Investigators / Project Leads	Not allowable, to ensure no double-funding of salaries and related costs, as the salaries are already supported from other sources (e.g. faculty salaries are supported separately by the IHL as it is in support of the IHLs' core mission).
Salaries of teaching staff / teaching substitutes	Not allowable, as this is already being supported from capitation grants.
Undergraduate tuition support	Not allowable, as this should be supported under the respective scholarship grants and bursary schemes.
Salaries of general administrative support staff	Not allowable, as this is an indirect cost*.
Costs related to general administration and management	Not allowable, as this is an indirect cost*. This includes common office equipment, such as furniture and fittings, office software, photocopiers, scanners and office supplies.
Costs of office or laboratory space	Not allowable, as this is an indirect cost*. This includes renovation/outfitting costs, rent, depreciation of buildings and equipment, and related expenditures such as water, electricity, general waste disposal and building/facilities maintenance charges.
Personal productivity tools & communication expenses	Not allowable, unless the use of mobile phones and other form of smart devices were indicated in the methodology for the Research/I&E Project. All other costs under this expense type is an indirect cost*.
Entertainment	Not allowable, as this is an indirect cost*.
Refreshment	Not allowable, unless this is related to a hosted conference or workshop for the Research/I&E Project. All other costs under this expense type is an indirect cost*.
Audit fees (Internal and external audit) and Legal fees	Not allowable, as this is an indirect cost*.
Fines and Penalties	
Professional Membership Fees	
Staff retreat and team-building activities	
Patent Application	Not allowable, as this should be supported from overheads given to I&E Office (IEO)*. This includes patent application filing, maintenance and other related costs.

* Note: Indirect cost items should be supported from overheads or other funding sources.

Annex D: Definitions of Different Private Sector Entity Types

S/N	Type	Criteria
1	Non-Singapore entities based in Singapore	• <30% local shareholding , determined by the ultimate individual ownership
2	Large Local Enterprises (LLEs)	• ≥30% local shareholding; and • More than $100M in annual turnover
3	Small Medium Enterprises (SMEs)	• Have Group Annual Sales Turnover of not more than $100M, or maximum employment of 200 employees • To qualify as an SG entity, the entity must also have at least 30% local shareholding, i.e. local equity held directly or indirectly by Singaporean(s) and/or Singapore PR(s)
4	Start-ups	• Registered for less than 5 years at time of grant application • Has individual ownership of more than 50% at reference year; and • Employs at least 1 worker • To qualify as an SG entity, the entity must also have at least 30% local shareholding
5	Not-for-profits	• Registered as a public Company Limited by guarantee, society or charity trust • Main purpose is to support or engage in activities of public or private interest without any commercial or monetary profit, and are prohibited from distributing monetary residual to their own members • To qualify as an SG not for profit, the entity must meet all 3 of the following criteria: (1) Registered and physically present in Singapore; (2) Core funding (i.e. excl. competitive grant funding) is derived entirely/mostly from SG entities; (3) Managed by a Board, which is at least half appointed by SG entities

Annex E: SOP for Creation of New Companies/Institutions in IGMS

1. Before you begin, please familiarise yourself with the various training guides on navigating the IGMS system. The various guides and manuals will help you understand the roles of various users in the IGMS and the application process. These documents can be downloaded from: https://www.researchgrant.gov.sg/Pages/TrainingGuides.aspx

2. Please be informed that companies or institutions who wish to apply for grants in IGMS will need to be registered in IGMS for first time application. The registration of the company or institution within IGMS is mandatory as part of the proposal submission workflow.

3. Please refer to the SOP below for the **creation of a new company/institution within IGMS**.

Steps	Details

1	**[For all]**
	To register a new entry in IGMS, companies/institutions will need to send an e-mail to biosurveillance_research@nparks.gov.sg with the following details:
	Subject: Creation of new Company/Institution in IGMS for Biosurveillance Research Grant Call 1, Project 6
	
	Details of the New Company/Institution to be Created in IGMS
	• Full Name of Company:
	• Indicate Local Company or Foreign Company:
	• Indicate Public Company or Private Company:
	• UEN (for local company) or CorpPass issued UEN or Unique Identifier (for foreign Company):
	  • For Foreign Company, please provide the screenshot from CorpPass email/profile page indicating the Foreign Entity's CorpPass issued UEN, for verification purpose.
	  • More details on how to register CorpPass for Foreign Company, please refer to the following link: https://www.corppass.gov.sg/help/CP_User_Guide_03B_Admin_Corppass_Admin_Registration_Foreign_Entities.pdf

2	**[For all]** After the respective company/institution has been registered on IGMS, please proceed to register an account on IGMS using CorpPass. To set up a CorpPass account, please visit www.CorpPass.gov.sg. For foreign company users who have an existing IGMS account registered via "For overseas users without SingPass" route, please refer to **step 2a**. An Open Researcher and Contributor ID (ORCID) is also necessary to complete the application. Please register for a ORCID at: https://orcid.org and update the user profile on the IGMS system with the ORCID.

	Thereafter, the Lead PI will be able to add the Co-Is' name in the IGMS when he/she fills up the application form.
2A	**[For foreign company user with existing IGMS account registered via "For overseas users without SingPass" route"]** When registering an account on IGMS using CorpPass, please ensure to use the same email address that was used for the existing IGMS account. In order to continue accessing past transactions in IGMS, it is important that the following steps are done to (i) update the Foreign Entity's CorpPass issued UEN in IGMS (i.e., **step 1**), and (ii) register using CorpPass with the same email address.
3	**[For Lead PI]** Lead PI who will be submitting the application under their company/institution will need to check with his/her company/institution, whether there is already a HI Admin assigned. If not, please refer to **step 3a for the creation of new HI Admin**. To complete a proposal submission, **3 distinct roles** are required from any company or institution to endorse the proposal, namely: • Lead Principal Investigator (PI); • Office of Research (ORE); and • Director of Research (DOR) Grant application is only considered to be submitted after the PI had submitted the proposal on IGMS for ORE's verification and DOR's endorsement.
	[For HI Admin] HI Admin will manage the roles of the users in their company or institution. He/She needs to assign the relevant roles such as "ORE", "DOR", "HI Finance", "HI HR", and "Data Admin", etc to other IGMS users in the company/institution. A HI Admin can concurrently hold the role of Lead PI. He/She will be able to select different profiles upon login to IGMS: • Login as HI Admin – to maintain company / institution & user profiles • Login as PI – to apply for grant call.
3A	**[Creation of new HI Admin]** In the case of creation of new HI Admin, after the company/institution has been created in IGMS, Biosurveillance Research Programme Office will inform them to nominate an HI Admin. The following steps will apply:

	(1) The company/institution will need to nominate a HI Admin. The HI Admin (including all other intended IGMS users) will need to ensure that his/her CorpPass account and ORCID account has been setup (refer to step 2 for more details). (2) The HI Admin will need to login to IGMS using his/her CorpPass account to register/update his/her profile inside IGMS. Please note that the IGMS would grant him/her the Principal Investigator (PI) role by default. (3) After the HI Admin has been successfully registered in IGMS, the HI Admin will notify Biosurveillance Research Programme Office with the information below: • Full Name of HI Admin: • E-mail Address of HI Admin: • Designation of HI Admin in his/her company: Biosurveillance Research Programme Office will arrange with Research Grant Officer (RGO) to change the role of the person from a Principal Investigator (PI) to a HI Admin. (1) After the role has been updated from Principal Investigator (PI) to HI Admin in IGMS, Biosurveillance Research Programme Office will inform the company/institution. (2) Once granted the role as a HI Admin, he/she can proceed to assign the relevant roles (e.g. “DOR”, “ORE”, etc.) to the various users within his/her organisation.