Fleming Fellowships
Bhutan

The Fleming Fund Management Agent proposes to fund SEVEN Fleming Fellowships in Bhutan.

The Fleming Fellowships address the priority areas of antimicrobial resistance (AMR), antimicrobial consumption (AMC) and antimicrobial use (AMU) surveillance and laboratory quality management, and contribute to building a One Health approach by having both human health and an animal health Fellows working together in the Fellowship programme.

Terms of Reference (ToR) for the proposed Fleming Fellowships are given in the following sections and comprise two parts: A. General ToR that apply to all Fellowships, and B. Specific ToR for each individual Fellowship.

A. General ToR for All Fellowships
One Health & Collaborative Activities

B. Specific ToR for Individual Fellowships
AMR Surveillance Fellowship – Human Health (RCDC)
AMR Laboratory Fellowship – Human Health (JDWNRH)
AMC Surveillance Fellowship – Human Health (JDWNRH)
AMU Surveillance Fellowship – Human Health (JDWNRH)
AMR Surveillance Fellowship – Animal Health (NCAH)
AMR Laboratory Fellowship – Animal Health (NVL/NCAH)
AMC/U Surveillance Fellowship – Animal Health (NCAH)

A. General ToR for All Fellowships

One Health & Collaborative Activities

Proposed Activities	Expected Outcomes
One Health collaboration ▪ Identify opportunities for collaboration and sharing of approaches, resources and trainings related to AMR, AMC and AMU surveillance in the human and animal health sectors. ▪ Identify areas for integrated surveillance and joint programming between sectors.	▪ More efficient use of resources. ▪ Stronger relationships and information sharing between human and animal health professionals contributing to AMR, AMC and AMU surveillance ▪ Strengthened One Health approach to managing AMR, AMC and AMU across all sectors. ▪ Improved hypothesis driven surveillance.
Collaborative Project conducted involving Fleming Fellowship counterparts Topic to be chosen in collaboration with counterparts during development of Fellowship workplans, incorporating a One Health approach.	▪ Stronger relationships and understanding of AMR between human & animal health sectors. ▪ A collaborative project report with clear recommendations for policy and practice. ▪ One or more scientific manuscripts submitted to a peer-reviewed scientific journal.
Expert meeting & contribution to the multi-sectoral National AMR Technical Committee (NATC) After approximately 12 months of AMR, AMC and AMU data collection and analysis, hold an expert meeting to include all the Fleming Fellows in Bhutan, and their mentors, under the relevant technical working groups to: ▪ Share the information on AMR, AMC and AMU in humans and animals that has been generated through the Fleming Fund Country Grant (FFCG) and the Fleming Fellowship Scheme (FFS). ▪ Combine this with other information on AMR, AMC and AMU generated through other programmes in Bhutan (if any). ▪ Interpret the AMR findings in humans and animals in the context of AMC and AMU information from humans and animals. ▪ Summarise the current state of knowledge on AMR, AMC and AMU in Bhutan. ▪ Prepare a set of recommendations regarding priorities for future surveillance. ▪ Present results in a way that is accessible to policy makers and include recommendations for policy and practice that would improve the appropriate use of antibiotics.	▪ A cross-sectoral understanding of the knowledge on AMR, AMC and AMU in Bhutan. ▪ A combined multi-disciplinary report presenting and discussing the results of AMR, AMC and AMU surveillance in humans and animals during the previous year. ▪ Recommendations regarding priorities for future AMR, AMC and AMU surveillance in humans. ▪ An improved evidence base for recommendations regarding policies and actions to facilitate responsible antibiotic use and reduction in AMR.
Train-the-trainer for all Fellows	▪ Fellows are trained in delivering training using participatory adult learning approaches. ▪ Strengthened AMR surveillance is sustained.
Networking, collaboration and resource sharing Actively foster and contribute to communities of practice across the Fleming Fellowship Scheme to share experience, practices and resources.	▪ An active and engaged community of practice across the Fleming Fellowship Scheme that shares approaches and resources within and between countries.

Eligibility criteria that apply to all Fleming Fellowships

Candidates must meet the following criteria which apply to all Fleming Fellowships:

- Be a citizen or resident of Bhutan.
- Be available and commit to participating fully in the Fellowship programme for the full duration.
- Be proficient in communication and the use of computers, basic word processing and spreadsheet software, and the internet.
- Meet the English language proficiency requirements described below.
- Submit a full application form including the section acknowledging the support of the relevant Beneficiary Institution and attaching all required documentation.

Successful candidates are expected to continue working for the Beneficiary Institution for the duration of the Fellowship, and may also:

- Undertake travel for short periods within their home country and/or internationally;
- Enter into an agreement with the designated Host Institution regarding code of conduct.

Fleming Fellowships provide customised professional development and do not fund the award of a formal degree or a diploma from the Host Institution.

Specific language proficiency requirements

The applicant must provide evidence of proficiency in written and spoken English by either:

1. Having completed an internationally recognised language proficiency test in the last 24 months (e.g. IELTS - International English Language Testing System, TOEFL - Test of English as a Foreign Language, or other internationally recognised proficiency test); or
2. Having completed a tertiary academic qualification in the last 24 months that was taught and assessed in English; or
3. Providing alternative evidence of current proficiency in the specified language that is acceptable to the Fleming Fund Management Agent.

Applicants who cannot provide sufficient recent evidence of the required language proficiency will be required to undergo testing to establish their eligibility under this criterion.

Intended Start Date and duration

The Fellowships are intended to start November 2018 and be 18 months in duration, ending in May 2020.

Schedule

Application, candidate selection and confirmation of Fleming Fellows are proposed to proceed according to the following schedule:

Stage	Date:
NATC agree to Fellowships	June 2018
Selection of Host Institutions	August – September 2018
Selection of Fellows	September 2018
Fellowship begins	October 2018
Finalisation of Fellowship Work Plan & Agreement	November 2018
Fellowship ends	May 2020

B.   Specific ToR for Individual Fellowships

AMR Surveillance Fellowship – Human Health (RCDC)

Beneficiary Institution

Royal Centre for Disease Control (RCDC)
Department of Public Health, Ministry of Health (MoH)

Purpose and objectives

The AMR Surveillance Fellowship – Human Health will focus on strengthening epidemiological skills to manage, analyse and utilise AMR surveillance data collected from humans, and help develop the Fellow to become a leader in AMR surveillance in the human health sector.

The purpose of this Fellowship is:

To strengthen One Health AMR surveillance in Bhutan by strengthening the epidemiology-related capabilities and competencies of an AMR surveillance leader in the RCDC to:

- Produce scientifically robust evidence of AMR patterns in human bacterial infections from AMR surveillance data.
- Interpret this together with evidence from other sectors to inform future surveillance priorities within the human, animal and environmental health sectors.
- Inform policies or actions to reduce the incidence of AMR in Bhutan.

The objectives of this Fellowship are to:

1. Support an AMR surveillance leader in the RCDC to strengthen the AMR surveillance system in humans through the design of AMR surveillance programmes, enhancing data flows, managing and analysing data to support evidence-based decision making regarding future priorities for AMR surveillance, and identifying policies and actions to reduce AMR.
2. Strengthen the One Health approach to AMR surveillance in Bhutan by sharing of information generated through AMR surveillance between the human and animal health sectors.
3. Expertly interpret results of AMR surveillance in the context of AMC and AMU in related settings.
4. Contribute to the sustainability of the AMR surveillance programme in Bhutan by developing training expertise and implementing training programmes.

Proposed Activities	Expected Outcomes
Mentoring to analyse the AMR data that has been generated through past surveillance, including outbreak investigations. - Contribute AMR analyses from human health to a multi-sectoral report that includes existing AMR information from humans, animals and the environment (if available).	- A multi-sectoral report on AMR patterns in humans, animals and the environment generated from past AMR surveillance and/or research conducted in the country. - Identification of weaknesses in the system & recommendation of priorities for improvement.
Mentoring in surveillance system design Mentoring on key aspects of surveillance system design will be incorporated in the above work programme, i.e. in the context of understanding the data that has been generated and the inferences that can be made from the results of analyses. Likewise, during the discussion of recommendations for future surveillance priorities.	A Surveillance expert with the epidemiological understanding of how to: - Evaluate & refine surveillance programmes. - Design new surveillance programmes. - Correctly interpret surveillance results based on an understanding of biases in the data. - Utilise surveillance results to support decision making regarding AMR policies.

Proposed Activities	Expected Outcomes

On-the-job mentoring and training to strengthen the design, collection and flow of AMR data from surveillance sites and the reference laboratory, and to work with the national dataset, including:
■ Maintaining a backed-up national database.
■ Trouble-shooting and validating data.
■ Understanding the source of the samples from contributing hospitals and identifying biases in samples submitted to the laboratories.
■ Analysing the data.
■ Interpreting the results in the context of antibiotic use patterns and potential biases in the AMR data.
■ Preparing an AMR surveillance report which includes:
  o Description of the AMR surveillance data and comparison with data from previous years, including analytical methodologies.
  o Results including figures and tables where appropriate.
  o Discussion of the results and consideration of possible biases and limitations (comparison of resistance patterns between: bacteria and antibiotics, hospitals, time periods, etc).
  o Recommendations for future surveillance arising from the results.
■ Sharing AMR surveillance results with those from other sectors in the NATC.
■ Presenting results in a way that is accessible to policy makers and including recommendations for policy and practice that would improve the appropriate use of antibiotics.
	■ A secure and up-to-date national WHONET database containing validated human AMR surveillance data generated from AMR surveillance sites.
	■ Evidence and understanding of AMR patterns, related to AMC and AMU, in populations of clinical cases from surveillance sites.
	■ Appropriate interpretation of and inference drawn from AMR data analyses.
	■ A report on AMR surveillance in humans, which will contribute to the combined multi-sectoral AMR and AMC/AMU report.

Eligibility criteria for the AMR Surveillance Fellowship in RCDC

Candidates for the AMR Surveillance Fellowship at RCDC must meet the following criteria which are specific to this Fellowship:

■ Be endorsed by and accountable to the RCDC through employment, contract, or similar such as formal secondment.
■ Hold at least an undergraduate qualification in public health or epidemiology, and/or relevant professional experience.
■ Be working in a position that enables access to information on AMR, AMC and AMU surveillance activities in Bhutan and analysis of the AMR data generated by the Jigme Dorji Wangchuck National Referral Hospital (JDWNRH) and associated surveillance sites.
■ Show evidence of experience and leadership potential in the field of surveillance, data management, data analysis and interpretation, as applied to AMR.

B: Specific ToR for Individual Fellowships

AMR Laboratory Fellowship – Human Health (JDWNRH)

Beneficiary Institution

Jigme Dorji Wangchuck National Referral Hospital (JDWNRH)
Ministry of Health (MoH)

Purpose and objectives

The AMR Laboratory Fellowship – Human Health will focus on establishing and maintaining quality systems in human surveillance site laboratories to assure high quality diagnostic data. The Fellowship will help develop the fellow to be a leader in human health laboratory quality management.

The purpose of this Fellowship is:

To strengthen One Health AMR surveillance in Bhutan by strengthening the accuracy of pathogen identification and Antibiotic Susceptibility Testing (AST) results produced by the JDWNRH and associated human health laboratories.

The objectives of this Fellowship are to:

1. Support a Quality Assurance leader at JDWNRH to strengthen the AMR surveillance system in humans by improving the quality of pathogen identification and AST results produced by JDWNRH and associated human health laboratories.
2. Strengthen the role of JDWNRH as the national AMR reference laboratory by maintaining a national biorepository of isolates sent from surveillance sites and ensuring these are appropriately used.
3. Strengthen the One Health approach to AMR surveillance in Bhutan by facilitating the sharing between human and veterinary laboratories of materials and activities that are relevant to both sectors.
4. Contribute to the sustainability of the AMR surveillance programme in Bhutan by developing training expertise and implementing training programmes.

Proposed Activities	Expected Outcomes
Placement in a well-functioning lab and mentoring to learn key components of laboratory quality management systems (LQMS) and understand effective implementation in relation to pathogen identification and AST in a clinical environment, including: ▪ Good Laboratory Practice (GLP). ▪ Documentation (SOPs). ▪ Pre-analytical, analytical and post analytical processes and procedures. ▪ On-site Quality Control (QC) programme (media performance, testing methods including quality control material and strains, and competencies). ▪ External Quality Assessment (EQA) programme.	▪ Fellow has knowledge and experience regarding LQMS that can be applied within Bhutan.
On-the-job training and mentoring in strengthening LQMS associated with pathogen identification, AST and associated diagnostic data recording at both JDWNRH and associated surveillance sites, including: ▪ Strengthening GLP and QA programmes.	Reliable quality diagnostic results ▪ Improved quality of AMR diagnostic results. ▪ Improved diagnostic data recording. ▪ Improved laboratory efficiency. ▪ Improved trust between laboratories and clinicians who submit samples.

Proposed Activities	Expected Outcomes
▪ Preparing practical documentation (benchtop guidelines, flow charts). ▪ Leading the EQA programme and analysing trends in quality over time and across surveillance sites. ▪ Providing corrective actions and recommendations following EQA results.	Strengthened laboratory system ▪ Strengthened network of AMR surveillance labs. ▪ Strengthened role of JDWNRH as the National Reference Laboratory for AMR in humans.
On-the-job training and mentoring in advanced diagnostic methods for specific AMR types ▪ ESBL, acquired AmpC (pAmpC) and/or carbapenem resistance	▪ More specific data on important types of AMR
Mentoring in maintaining a secure and inventoried biorepository of isolates ▪ Good storage practices (including Biorepository-specific SOPs). ▪ Temperature monitoring systems. ▪ Bio-specimen database management. ▪ Barcoding and automated specimen identification.	▪ Inventoried and secure biorepository of isolates generated through the AMR surveillance system for genotypic surveillance.

Eligibility criteria for the AMR Laboratory Fellowship at JDWNRH

Candidates for the AMR Laboratory Fellowship at JDWNRH must meet the following criteria which are specific to this Fellowship:

▪ Be endorsed by and accountable to JDWNRH through employment, contract, or similar such as formal secondment.
▪ Hold at least a microbiology or laboratory-related undergraduate qualification, and/or relevant professional experience.
▪ Be working in a position that enables you to strengthen laboratory quality management systems at JDWNRH and associated surveillance site laboratories.
▪ Be working in a position that enables you to manage a national biorepository of bacterial isolates collected through AMR surveillance.
▪ Show evidence of experience and leadership potential in the field of quality management systems especially pertaining to bacterial culture and antibiotic susceptibility testing.

B: Specific ToR for Individual Fellowships

AMC Surveillance Fellowship – Human Health (JDWNRH)

Beneficiary Institution

Jigme Dorji Wangchuck National Referral Hospital (JDWNRH)
Ministry of Health (MoH)

Purpose and objectives

The AMC Surveillance Fellowship – Human Health will focus on strengthening epidemiological skills to collect, manage, analyse and interpret data on antimicrobial consumption (AMC) in the human health sector in Bhutan, and help develop the Fellow to become a leader in AMC surveillance.

The purpose of this Fellowship is:

To strengthen AMC surveillance in Bhutan by strengthening the capabilities and competencies of an AMC surveillance leader in the human health sector to:

- Compile and keep up to date with information on antibiotic distribution and consumption in hospitals and public healthcare facilities in Bhutan.
- Produce scientifically robust evidence of AMC practices in hospitals & other healthcare settings.
- Interpret AMC and AMU surveillance data together with evidence from AMR surveillance to inform future AMC, AMU and AMR surveillance priorities within the human, animal & environmental health sectors.
- Provide data and results to inform policies or actions regarding responsible AMC to reduce the threat of AMR in Bhutan.

The objectives of this Fellowship are to:

1. Strengthen the use of AMC surveillance information to inform programmes that improve antibiotic prescribing practices.
2. Strengthen the One Health approach to AMC and AMU surveillance in Bhutan by facilitating the sharing of information between human & animal health sectors.
3. Facilitate the interpretation of the results of AMR surveillance in the context of evidence of AMC.
4. Contribute to the sustainability of the AMC surveillance programme in Bhutan by developing training expertise and implementing training programmes.

Proposed Activities	Expected Outcomes
Training and mentoring: ■ Designing and establishing an effective AMC surveillance programme in hospitals and public healthcare facilities using appropriate AMC data collection tools. ■ Assessing patterns and appropriateness of AMC in Bhutan. ■ Improving understanding by healthcare administrators and clinicians about surveillance results and appropriate AMC and AMU.	■ Fellow has knowledge and experience in designing an AMC surveillance plan and working with AMC data collection tools, and an understanding of how these may be applied in Bhutan hospital and healthcare settings. ■ Fellow can assess appropriateness of antibiotic consumption and how this may be applied in Bhutanese hospital and healthcare settings.
Mentoring to analyse the AMC data that has been generated through past surveillance if any data has been collected.	■ A combined report on AMC patterns in humans from past AMC surveillance data generated in the Fellow's healthcare setting.

Proposed Activities	Expected Outcomes
On-the-job training and mentoring of the Fellow to implement AMC surveillance in Bhutan, including: ▪ Developing a data collection survey based on the Anatomical Therapeutic Chemical (ATC) Classification System and defined daily dose (DDD) methodologies. ▪ Collating and analysing existing ATC/DDD data from a selection of surveillance sites. ▪ Analysing, interpreting and reporting AMC surveillance data. ▪ Developing recommendations for the design of an electronic database for recording AMC data at hospital pharmacies. ▪ Presenting stratified AMC data from selected surveillance site pharmacies to the NATC.	▪ An AMC surveillance leader able to facilitate and support the collection of AMC data in hospitals and use this to inform antibiotic consumption practices. ▪ Standardisation of AMC data collection amongst hospitals and healthcare settings, facilitating comparison of practices between locations. ▪ Recommendations on the design of an electronic database for recording antibiotic consumption data at hospital pharmacies. ▪ AMC data is available to enhance interpretation of AMU and AMR surveillance results, resulting in more appropriate recommendations to improve antibiotic prescribing practices.

Eligibility criteria for the AMC Surveillance Fellowship at JDWNRH

Candidates for the AMC Surveillance Fellowship at JDWNRH must meet the following criteria which are specific to this Fellowship:

▪ Be endorsed by and accountable to JDWNRH through employment, contract, or similar such as formal secondment.
▪ Hold at least an undergraduate qualification in a medical or a pharmacy degree, and/or relevant professional experience.
▪ Be working in a position that enables you to collect data on antibiotic consumption in hospitals and other public healthcare facilities.
▪ Show evidence of experience and leadership potential in the field of AMC in human medicine and pharmacy.

B: Specific ToR for Individual Fellowships

AMU Surveillance Fellowship – Human Health (JDWNRH)

Beneficiary Institution

Jigme Dorji Wangchuck National Referral Hospital (JDWNRH)
Ministry of Health (MoH)

Purpose and objectives

The AMU Surveillance Fellowship – Human Health will focus on strengthening epidemiological skills to collect, manage, analyse and interpret data on AMU in humans, and help develop the Fellow to become a leader in AMU surveillance in the human health sector.

The purpose of this Fellowship is:

To strengthen One Health AMU surveillance in Bhutan by strengthening the capabilities and competencies of an AMU surveillance leader in the human health sector to:

- Produce scientifically robust evidence of AMU practices in hospitals & other healthcare settings.
- Work with clinicians to improve antibiotic prescribing practices.
- Interpret AMU surveillance data together with evidence from AMR and AMC surveillance to inform future AMR, AMC and AMU surveillance priorities within the human, animal & environmental health sectors.
- Provide data and results to inform policies or actions regarding responsible AMU to reduce the threat of AMR in Bhutan.

The objectives of this Fellowship are to:

1. Support an AMU surveillance leader to strengthen the human AMU surveillance system by collecting representative AMU data in hospital and other healthcare settings.
2. Strengthen the use of AMU surveillance information to inform programmes that improve antibiotic prescribing practices.
3. Strengthen the One Health approach to AMU surveillance in Bhutan by facilitating the sharing of information generated through AMU surveillance between human & animal health sectors.
4. Facilitate the interpretation of the results of AMR and AMC surveillance in the context of evidence of AMU.
5. Contribute to the sustainability of the AMU surveillance programme in Bhutan by developing training expertise and implementing training programmes.

Proposed Activities	Expected Outcomes
Training and mentoring: - Designing and establishing an effective AMU surveillance programme in hospital and other healthcare settings using appropriate AMU data collection tools. - Assessing appropriateness of prescriptions to treat a selection of human cases with infectious disease. - Working with clinicians to understand AMU surveillance results.	- Fellow has knowledge and experience in designing an AMU surveillance plan and working with AMU data collection tools, and an understanding of how these may be applied in Bhutan hospital and healthcare settings. - Fellow can assess appropriateness of antibiotic prescriptions and how this may be applied in Bhutan hospital and healthcare settings.

Proposed Activities	Expected Outcomes
Mentoring to analyse the AMU data that has been generated through past surveillance if any data has been collected.	▪ A combined report on AMU patterns in humans from past AMU surveillance data generated in the Fellow's healthcare setting.
On-the-job training and mentoring of the Fellow to implement AMU surveillance in Bhutan, including: ▪ Designing an appropriate survey approach for one or more selected institutions. ▪ Collecting and analysing AMU data & assistance with reporting. ▪ Support for assessing appropriateness of antibiotic prescriptions. ▪ Support for working with clinicians to understand the AMU surveillance results and modifying prescribing practices where appropriate.	▪ An AMU surveillance leader able to facilitate and support the collection of AMU data in hospitals and use this to inform prescribing practices. ▪ Standardisation of AMU data collection amongst hospitals and healthcare settings, facilitating comparison of practices between locations. ▪ AMU data is available to enhance interpretation of AMR and AMC surveillance results, resulting in more appropriate recommendations to improve antibiotic prescribing practices.

Eligibility criteria for the AMU Surveillance Fellowship at JDWNRH

Candidates for the AMU Surveillance Fellowship at JDWNRH must meet the following criteria which are specific to this Fellowship:

▪ Be endorsed by and accountable to JDWNRH through employment, contract, or similar such as formal secondment.
▪ Hold at least an undergraduate qualification in a medical or a pharmacy degree, and/or relevant professional experience.
▪ Be working in a position that enables you to collect data on antibiotic prescriptions in hospitals and public healthcare facilities.
▪ Show evidence of experience and leadership potential in the field of AMU in human medicine and pharmacy.

B: Specific ToR for Individual Fellowships

AMR Surveillance Fellowship – Animal Health (NCAH)

Beneficiary Institution

National Centre for Animal Health (NCAH)
Department of Livestock, Ministry of Agriculture and Forestry (MoAF)

Purpose and objectives

The AMR Surveillance Fellowship – Animal Health will focus on strengthening epidemiological skills to manage, analyse and utilise AMR surveillance data collected from animals, and help develop the Fellow to become a leader in AMR surveillance in the animal health sector.

The purpose of this Fellowship is:

To strengthen One Health AMR surveillance in Bhutan by strengthening the epidemiology-related capabilities and competencies of an AMR surveillance leader at NCAH to:

- Produce scientifically robust evidence of AMR patterns in animals from AMR surveillance data.
- Interpret this together with evidence from other sectors to inform future surveillance priorities within the human, animal and environmental health sectors.
- Inform policies or actions to reduce the incidence of AMR in Bhutan.

The objectives of this Fellowship are to:

1. Support an AMR surveillance leader at NCAH to strengthen the AMR surveillance system for animals through the design and implementation of active AMR surveillance, enhancing data flows, managing and analysing data to support evidence-based decision making regarding future priorities for AMR surveillance, and identifying policies and actions to reduce AMR in Bhutan.
2. Strengthen the One Health approach to AMR surveillance in Bhutan by sharing of information generated through AMR surveillance between the human and animal health sectors.
3. Facilitate the interpretation of the results of AMR surveillance in the context of an understanding of AMU in animals.
4. Contribute to the sustainability of the AMR surveillance programme in Bhutan by developing training expertise and implementing training programmes.

Proposed Activities	Expected Outcomes
Mentoring to analyse the AMR data that has been generated through past surveillance. ▪ Contribute AMR analyses from animal health to a multi-sectoral report that includes existing AMR information from humans, animals and the environment (if available).	▪ A multi-sectoral report on AMR patterns in humans, animals and the environment generated from past AMR surveillance and/or research conducted in the country. ▪ Identification of weaknesses in the system & recommendation of priorities for improvement.
Mentoring in surveillance system design Mentoring on key aspects of surveillance system design will be incorporated in the above work programme, i.e., in the context of understanding the data that has been generated and the inferences that can be made from the results of analyses. Likewise, during the discussion of recommendations for future surveillance priorities.	A Surveillance expert with the epidemiological understanding of how to: ▪ Evaluate & refine surveillance programmes. ▪ Design new surveillance programmes. ▪ Correctly interpret surveillance results based on an understanding of biases in the data. ▪ Utilise surveillance results to support decision making regarding AMR policies.

Proposed Activities	Expected Outcomes

On-the-job mentoring and training to ensure an active surveillance programme for AMR is being implemented according to protocol and to work with the national dataset, including:
■ Contribute to the design of the active surveillance programme for AMR in animals, especially sample collection.
■ Liaise with the laboratory network to collate national AMR surveillance data into a national database.
■ Maintain a backed-up national database.
■ Trouble-shooting and validating data.
■ Analysing AMR surveillance data from animals.
■ Interpreting the results in the context of AMC/U patterns and potential biases in the AMR data.
■ Preparing an AMR surveillance report which includes:
   o Description of the AMR surveillance data and comparison with data from previous years, including analytical methodologies.
   o Results including figures and tables where appropriate.
   o Discussion of the results and consideration of possible biases and limitations (comparison of resistance patterns between: bacteria and antibiotics, animal and production system types, location, time periods, etc).
   o Recommendations for future surveillance arising from the results.
■ Sharing AMR surveillance results with those from other sectors in the NATC.
■ Presenting results in a way that is accessible to policy makers and including recommendations for policy and practice that would improve the appropriate use of antibiotics.
	■ AMR surveillance programme implemented according to the agreed protocol.
	■ A secure and up-to-date national database containing validated animal AMR surveillance data.
	■ An understanding of AMR patterns, related to AMC and AMU, in the animal populations under surveillance.
	■ Appropriate interpretation of and inference drawn from AMR data analyses.
	■ A report on AMR surveillance in animals, which will contribute to the combined multi-sectoral AMR, AMC and AMU report described as an outcome of the next activity.

Eligibility criteria for the AMR Surveillance Fellowship in NCAH

Candidates for the AMR Surveillance Fellowship at NCAH must meet the following criteria which are specific to this Fellowship:

■ Be endorsed by and accountable to NCAH through employment, contract, or similar such as formal secondment.
■ Hold at least an undergraduate qualification in veterinary medicine or epidemiology, and/or relevant professional experience.
■ Be working in a position that enables access to and analysis of the AMR data generated by both national and regional veterinary laboratories and the National Food Testing Laboratory (NFTL).
■ Show evidence of experience and leadership potential in the field of surveillance, data management, data analysis and interpretation, as applied to AMR.

B: Specific ToR for Individual Fellowships

AMR Laboratory Fellowship – Animal Health (NVL, NCAH)

Beneficiary Institution

National Veterinary Laboratory (NVL), National Centre for Animal Health (NCAH)
Department of Livestock, Ministry of Agriculture and Forestry (MoAF)

Purpose and objectives

The AMR Laboratory Fellowship – Animal Health will focus on establishing and maintaining quality systems in veterinary laboratories to assure high quality diagnostic data. The Fellowship will help develop the Fellow to be a leader in veterinary laboratory quality management.

The purpose of this Fellowship is:

To strengthen One Health AMR surveillance in Bhutan by strengthening the accuracy of pathogen identification and Antibiotic Susceptibility Testing (AST) results produced by NVL (NCAH), the National Food Testing Laboratory (NFTL) and selected regional laboratories.

The objectives of this Fellowship are to:

1. Support a Quality Assurance leader at NVL (NCAH) to strengthen the AMR surveillance system in animals by improving the quality of pathogen identification and AST results produced by NVL (NCAH), NFTL and regional laboratories participating in AMR surveillance.
2. Strengthen the role of NVL (NCAH) as an AMR Reference Laboratory by maintaining a national bio-repository of isolates from veterinary laboratories and the NFTL ensuring these are appropriately used.
3. Strengthen the One Health approach to AMR surveillance in Bhutan by facilitating the sharing between human, veterinary and food testing laboratories of materials and activities that are relevant to both sectors.
4. Contribute to the sustainability of the AMR surveillance programme in Bhutan by developing training expertise and implementing training programmes.

Proposed Activities	Expected Outcomes
Placement in a well-functioning lab and mentoring to learn key components of laboratory quality management systems (LQMS) and understand effective implementation in relation to pathogen identification and AST for AMR surveillance in animals, including: ▪ Good Laboratory Practice (GLP). ▪ Documentation (SOPs). ▪ Pre-analytical, analytical and post analytical processes and procedures. ▪ On-site Quality Control (QC) programme (media performance, testing methods including quality control material and strains, and competencies). ▪ External Quality Assessment (EQA) programme.	▪ Fellow has knowledge and experience regarding LQMS that can be applied within Bhutan.
On-the-job training and mentoring in strengthening LQMS associated with pathogen identification, AST, and associated diagnostic data recording at	Reliable quality diagnostic results ▪ Improved quality of diagnostic results. ▪ Improved diagnostic data recording. ▪ Improved laboratory efficiency.

Proposed Activities	Expected Outcomes
both NVL (NCAH) and associated laboratories, including: ▪ Strengthening GLP and QA programmes. ▪ Preparing practical documentation (benchtop guidelines, flow charts). ▪ Leading the EQA programme and analysing trends in quality over time and across surveillance sites. ▪ Providing corrective actions and recommendations following EQA results.	▪ Improved trust between surveillance units and laboratories. Strengthened laboratory system ▪ Strengthened network of AMR surveillance labs. ▪ Strengthened role of NVL (NCAH) as a National Reference Laboratory for AMR in animals.
On-the-job training and mentoring in advanced diagnostic methods for specific AMR types ▪ ESBL, acquired AmpC (pAmpC) and/or carbapenem resistance ▪ Minimum Inhibitory Concentration (MIC) testing for antibiotic resistance	▪ More specific data on important types of AMR
Mentoring in maintaining a secure and inventoried biorepository of isolates including ATCC strains, including: ▪ Good storage practices (including Biorepository-specific SOPs). ▪ Temperature monitoring systems. ▪ Bio-specimen database management. ▪ Barcoding and automated specimen identification.	▪ Inventoried and secure biorepository of isolates generated through the AMR surveillance system and ATCC strains for genotypic surveillance.

Eligibility criteria for the AMR Laboratory Fellowship in NVL (NCAH)

Candidates for the AMR Laboratory Fellowship in NVL (NCAH) must meet the following criteria which are specific to this Fellowship:

▪ Be endorsed by and accountable to the NVL (NCAH) through employment, contract, or similar such as formal secondment.
▪ Hold at least a microbiology or laboratory-related qualification, and/or relevant professional experience.
▪ Be working in a position that enables you to strengthen laboratory quality management systems in NVL (NCAH)'s bacteriology laboratory.
▪ Be working in a position that enables you to manage a national biorepository of bacterial isolates collected through AMR surveillance.
▪ Show evidence of experience and leadership potential in the field of quality management systems especially pertaining to bacterial culture and antibiotic susceptibility testing.

B: Specific ToR for Individual Fellowships

AMC/U Surveillance Fellowship – Animal Health (NCAH)

Beneficiary Institution

National Centre for Animal Health (NCAH)
Department of Livestock, Ministry of Agriculture and Forestry (MoAF)

Purpose and objectives

The AMC/U Surveillance Fellowship – Animal Health will focus on strengthening epidemiological skills to collect, manage, analyse and interpret data on antimicrobial consumption and use (AMC/U) in poultry and livestock in Bhutan, and help develop the Fellow to become a leader in AMC/U surveillance in the animal health sector.

The purpose of this Fellowship is:

To strengthen One Health AMC/U surveillance in Bhutan by strengthening the capabilities and competencies of an AMC/U surveillance leader in the animal health sector to:

- Produce scientifically robust evidence of AMC/U practices in poultry and livestock production.
- Interpret AMC/U and AMR surveillance data together to inform future surveillance priorities within the human, animal & environmental health sectors.
- Provide data and results to inform policies or actions regarding responsible AMC/U to reduce the threat of AMR in Bhutan.
- Strengthen the accuracy and completeness of AMC/U data reported by Bhutan to the World Organisation for Animal Health (OIE).

The objectives of this Fellowship are to:

1. Support an AMC/U surveillance leader to strengthen AMC/U surveillance system in poultry and livestock.
2. Strengthen the One Health approach to AMC/U surveillance in Bhutan by facilitating the sharing of information generated through AMC/U surveillance between human & animal health sectors.
3. Facilitate the interpretation of the results of AMR surveillance in the context of evidence of AMC/U.
4. Contribute to the sustainability of the AMC/U surveillance programme in Bhutan by developing training expertise and implementing training programmes.

Proposed Activities	Expected Outcomes
Training and mentoring: ■ Designing and establishing an effective AMC/U surveillance programme for poultry and livestock production systems in Bhutan using appropriate AMC/U data collection tools. ■ Interpreting AMC/U surveillance results.	■ Fellow has knowledge and experience in designing an AMC/U surveillance plan and working with AMC/U data collection tools, and an understanding of how these may be applied in Bhutanese poultry and livestock production systems.
Mentoring to analyse the AMC/U data that has been generated through past surveillance if any data has been collected.	■ A report on AMC/U patterns in poultry and livestock production systems from past AMC/U surveillance data, if available.
On-the-job training and mentoring of the Fellow to implement AMC/U surveillance in selected livestock production systems in Bhutan, including: ■ Analysing national veterinary AMC/U records, and reporting data to OIE.	■ An AMC/U leader able to facilitate and support collection of AMC/U data from the poultry and livestock production sectors in Bhutan. ■ Report on AMC/U in the targeted poultry and livestock production sector(s).

Proposed Activities	Expected Outcomes
▪ Analysing AMC/U data currently stored in paper records, in either one or both of the Chukha and Trashigang Regional Livestock Development Centres (RLDCs), including antibiotics used by private pharmacies. ▪ Designing an electronic database for recording AMC/U data, and transferring AMC/U data from paper records to an electronic database for data analysis. ▪ Designing and implementing a survey to collect AMC/U data from selected poultry or livestock production sectors using appropriate data collection tools. ▪ Interpreting and reporting AMC/U data to stakeholders. ▪ Collecting population data for the target poultry and livestock production sectors and relevant geographic areas.	▪ Recommendations on the design of an electronic database for recording antibiotic prescription data. ▪ AMC/U data is available to enhance interpretation of AMR surveillance results, resulting in more appropriate recommendations regarding antimicrobial prescribing practices.

Eligibility criteria for the AMC/U Surveillance Fellowship at NCAH

Candidates for the AMC/U Surveillance Fellowship at NCAH must meet the following criteria which are specific to this Fellowship:

▪ Be endorsed by and accountable to NCAH and/or the Department of Livestock through employment, contract, or similar such as formal secondment.

▪ Hold at least an undergraduate qualification in veterinary medicine or epidemiology, and/or relevant professional experience.

▪ Be working in a position that enables you to conduct a field-based survey of AMC/U by poultry and/or livestock farmers in Bhutan.

▪ Show evidence of experience and leadership potential in the field of AMC/U in poultry and livestock production.