

 GIG CYMRU NHS WALES Iechyd Cyhoeddus Cymru Public Health Wales	Name of Meeting Knowledge, Research and Information Committee Date of Meeting 16 June 2022 Agenda item: 6.1
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Research in Specialist & Reference Units, Infection Services Division

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Approval/Scrutiny route:	Meng Khaw, National Director Health Protection and Screening Services Executive Medical Director

Purpose

The report provides the Knowledge, Research and Information Committee with an update on the Research, Development and Evaluation (RDE) within in the Reference and Specialist Laboratories within the Infection Services Division for discussion .

Recommendation:

APPROVE ☐	CONSIDER ☒	RECOMMEND ☐	ADOPT ☐	ASSURANCE ☐
The Committee is asked to: • Consider the update provided on the Research, Development and Evaluation (RDE) within in the Reference and Specialist Laboratories within the Infection Services Division for discussion				

Link to Public Health Wales [Strategic Plan](#)

Public Health Wales has an agreed strategic plan, which has identified seven strategic priorities and well-being objectives.

This report contributes to seven of the strategic priorities and well-being objectives.

Summary impact analysis

Equality and Health Impact Assessment	An Equality and Health Impact Assessment is not required in support of this report
Risk and Assurance	Not applicable
Health and Care Standards	This report supports and/or takes into account the Health and Care Standards for NHS Wales Quality Themes Governance, Leadership and Accountability
Financial implications	Not applicable
People implications	Not applicable

1. Purpose / situation

Research, Development and Evaluation (RDE) are embedded within Clinical and Diagnostic Infection Services. This paper summarises RDE in the Reference and Specialist Laboratories within the Infection Services Division and notes some of the issues that can impede outputs.

It should be noted that this does not represent the totality of RDE within the Infection Services Division, and there is significant work with significant outputs in many other areas. For examples a paper in Science from a Virology colleague ¹ and a paper in New England Journal of Medicine from a Clinical colleague. ²

2. Reference and Specialist Laboratories

The Infection Services Division includes a number of Specialist and Reference Services. They are listed in Table 1 with their commonly-used acronyms that will be used within this paper.

Table 1: Specialist & Reference Units

Acronym	Title	Coverage
ARU	Anaerobe Reference Unit	UK
CRU	Cryptosporidium Reference Unit	Wales & England
MRL	Mycology Reference Laboratory	Wales
SACU	Specialist Antimicrobial Chemotherapy Unit	Wales
TRU	Toxoplasma Reference Unit	UK
WCM	Welsh Centre for Mycobacteria	Wales & SW England

The staffing establishment for each unit varies depending on service workload and external income, including RDE income.

Key functions for Specialist and Reference Laboratories are:

- Scientific & Clinical Research in their subject areas
- Development of novel diagnostics and clinical pathways
- Evaluation of new Diagnostics and clinical pathways

We are fortunate in Public Health Wales in having Scientific and/or Clinical Leads for our Specialist & Reference Units who are internationally recognised experts in their fields and who drive RDE in their areas.

¹ Kevin W Ng, Catherine Moore, et al. Pre-existing and de novo humoral immunity to SARS-CoV-2 in humans. Science. 2020 Dec 11; 370(6522): 1339-1343.

² H.-K. Li, H Hughes, et al. Oral versus Intravenous Antibiotics for Bone and Joint Infection. N Engl J Med 2019; 380: 425-436.

2.1 Recent, Current, and Future Research

The Specialist and Reference Units are all actively involved in RDE in their areas with 69 current on-going projects (Appendix A). There have been 29 recently completed projects (Appendix B) and plans for initiation of a further 35 projects (Appendix C).

There are a range of different types of RDE projects:

- Clinical trials led by external partners or from within PHW
- Diagnostic or Clinical developments within PHW
- Evaluation of novel Clinical pathways or Diagnostics led by PHW or external partners

2.2 Research Outputs

The main quantifiable RDE outputs are publications in peer-reviewed journals. Over the 4 ½ years from 2018 – present, there have been 145 papers published from the 6 Units – an average of 5.4 papers/unit/year. Table 2 shows the number of peer-reviewed publications /unit.

Table 2: Publications by Unit (2018 – present)

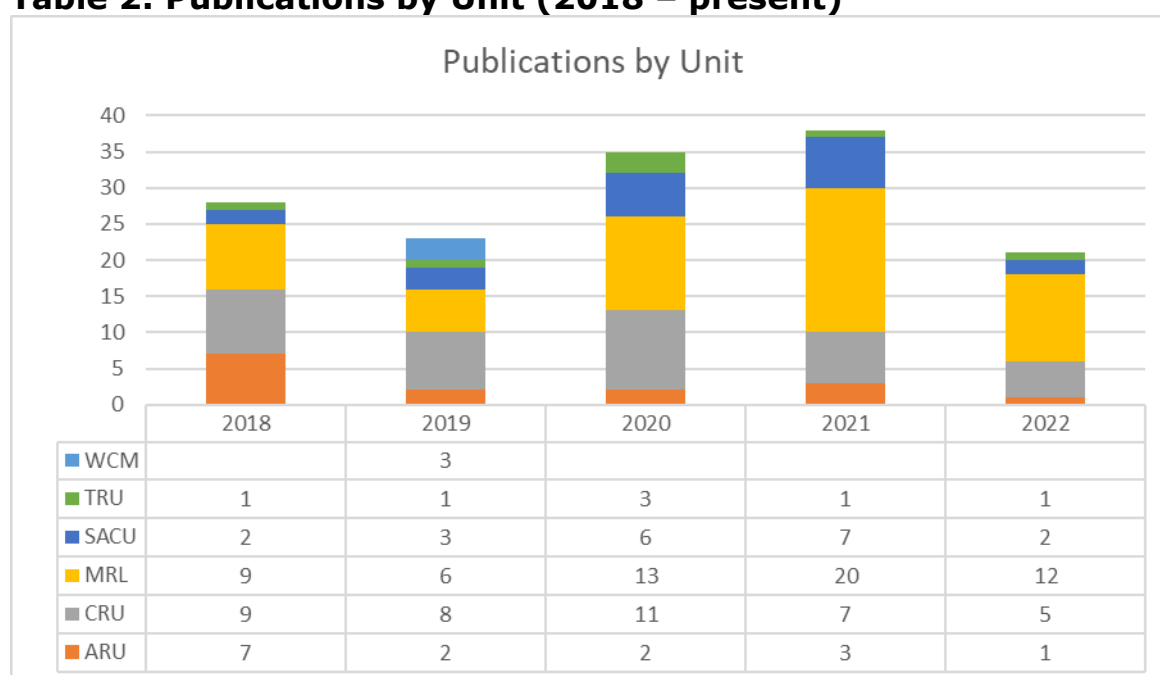


Table 3 shows the journals in which Specialist & Reference units have published recently. The list is limited to publications with >1 paper plus a few prominent journals with only a single paper. Although imperfect, the Journal Impact Factors (IF) confirm that our units are publishing in significant journals. Of note are a number of publications in premier journals; 14 in journals with IF>10.

Table 3: Journal coverage by publications of Specialist & Reference units (2018- present)

Journal	ARU	CRU	MRL	SACU	TRU	WCM	Total	Impact Factor
Journal of Antimicrobial Chemotherapy	2		4	5			11	5.217
Anaerobe	8						8	2.64
Journal of Clinical Microbiology	1		6	1		1	9	4.362
Journal of Fungi			8				8	5.816
Clinical Infectious Diseases			6				6	9.069
Lancet Infectious Diseases		1	3	1			5	25.071
Medical Mycology			5				5	2.851
Food and Waterborne Parasitology		4					4	4.073
Clinical Microbiology & Infection	1		1		1		3	7.117
Current Fungal Infection Reports			3				3	0.413
Journal of Infectious Diseases		2	1				3	5.226
Methods in Molecular Biology		3					3	1.37
Parasites and Vectors		3					3	3.035
BMJ Open		2					2	2.692
Clinical Microbiology & Infectious Diseases	1			1			2	2.837
Emerging Infectious Diseases			1		1		2	6.883
European Journal of Clinical Microbiology and Infectious Diseases		1		1			2	2.837
Frontiers of Immunology			1	1			2	6.429
Journal of Clinical Pathology		1	1				2	2.894
Lancet Microbe			2				2	\$\$
Nature Microbiology		1	1				2	17.74
Scientific Reports			2				2	4.38
Water		2					2	3.103
New England Journal of Medicine				1			1	91.24

Journal	ARU	CRU	MRL	SACU	TRU	WCM	Total	Impact Factor
Nature Reviews Microbiology			1				1	60.63
JAMA				1			1	56.27
British Medical Journal				1			1	39.89
Intensive Care Medicine			1				1	17.44
European Respiratory Journal			1				1	16.67
Nature Communications					1		1	14.92
Cochrane Database of Systematic Reviews			1				1	9.289

\$\$ - to be determined

Full details of all publications are given in Appendix D

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2.3 Challenges to the delivery of RDE

- Staffing.
 - This is a particular challenge for smaller units with respect to the ability to flex the workforce.
 - The requirement to employ staff under A4C can be a disadvantage in a competitive market.
- Equipment
 - Some key equipment may open additional opportunities
- Space
 - The estate within the Microbiology laboratories has been previously recognised as inadequate. Specialist and Reference laboratories are included in this and both laboratory and office space are inadequate.
- Bioinformatics support
 - Genomics is a significant area for research for all of the Specialist and Reference units. Limited bioinformatics resource has meant that many units have involved external collaborations to advance their genomic research. The Public Health Wales Pathogen Genomics Unit (PenGU) is relatively new but has expanded significantly through the COVID pandemic. It is hoped that it will be able to give more support to the Specialist & Reference Units in the future.
- BREXIT.
 - Challenges in terms of 'BREXIT red-tape' delaying involvement in ECDC and other International collaborations
 - Customs paperwork delaying shipment of samples
 - European funding eligibility
- Research Governance
 - Navigating the complexities of Research Governance, particularly when Public Health Wales is leading a multi-centre project as PI.
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- Research administrative support
- Access to relevant journals
 - Athens coverage through Public Health Wales is limited compared to that provided by the universities
- Journal publication fees

2.4 Positives for the delivery of RDE noted by Specialist and Reference Units

- Recognition and support by Public Health Wales of the importance of health care research underpinning service development, which is greatly appreciated when required.
- Support from individuals within the Research and Evaluation, Knowledge Directorate has been extremely helpful

2.5 Conclusions

The primary focus of the Specialist and Reference Units is on service delivery. However, Research Development and Evaluation is critical for the development and maintenance of excellent cutting-edge services, and scientific and clinical leadership in their specialist fields.

There is a significant amount of RDE performed within the 6 Specialist and Reference Units with the Infection Services. The research impact, as measured by publication outputs is impressive. Wider impact is more difficult to quantify, but can be seen in the diagnostic and clinical innovations within the units and the national and international standing of many of the Clinical and Scientific Leads.

3. Recommendation

The Committee is asked to:

- **Consider** the update provided on the Research, Development and Evaluation (RDE) within in the Reference and Specialist Laboratories within the Infection Services Division for discussion

APPENDIX A: Current Research & Evaluation Projects by Unit

UNIT	SUBJECT
SACU	The epidemiology and impact of bacterial secondary infections and antimicrobial resistance on Intensive Care during the SARS-CoV-2 pandemic.
SACU	Understanding the impact of COVID-19 on bacterial sepsis, antibiotic consumption and stewardship, and antimicrobial resistance
MRL	An evaluation of the performance of PCP PCR when testing throat swabs
MRL	A systematic review/Meta-analysis of PCP PCR
MRL	Evaluation of novel diagnostics/incidence of IA in non-COVID-19 ICU patients
MRL	Understanding the burden of fungal disease in Wales
MRL	Evaluation of Candida biomarker performance in patients post abdominal surgery as part of the INTENSE study
MRL	Development of ECMM Candida guidelines
MRL	Evaluation of OLM and Bruker Candida PCR performance – Lewis
MRL	Update on the European Conference of Infections in leukaemia guidelines for the diagnosis of IFD
MRL	Review of chest radiology in COVID-19 patients with aspergillosis
MRL	Determining the optimal strategy for diagnosing PCP (ESCMID study)
MRL	A multicentre evaluation of the incidence, diagnosis of aspergillosis in COVID-19 and influenza patient (ASPILFU)
MRL	F2G Phase II trial evaluating the efficacy of olorofim for the management of refractory IFD
MRL	An evaluation of susceptibility testing using Gliad derived amphotericin (FUNGOMICS)
MRL	Diagnosing Aspergillosis in Penguins (Royal Zoological Society of Scotland)
MRL	Understanding the optimal diagnostic approach for Candidaemia (A-STOP clinical trial)
MRL	CERBA – Pulmocide Clinical trial.
MRL	An evaluation of the OLM Aspergillus ELISA
MRL	An evaluation of the Dynamiker Aspergillus ELISA
MRL	An evaluation of the ACC STAT assay for the diagnosis of IFD
MRL	An evaluation of SNP's in ICU patients to predisposing risk to candida colonization and infection
MRL	Standardization of Mucorales PCR (FPRCI study)
MRL	An evaluation of air-quality in the houses of CF patients
MRL	International Standardization of Mucorales PCR
MRL	International Standardization of PCP PCR
MRL	International Standardization of Candida PCR

UNIT	SUBJECT
MRL	Ambiguard Phase III trial – Biomarker Evaluation
MRL	EORTC Pre-emptive vs Empirical AFT Phase III trial – Biomarker Evaluation
MRL	Development of an international standard for <i>Aspergillus</i> PCR
ARU	UKARU first to offer WGS of <i>C. difficile</i> as an accredited service. All Wales <i>C.difficile</i> Focus Group formed to bring together cross disciplinary teams focussing on key areas (RCAs, Diagnostics and Typing, Treatment and Management, Epidemiology). R&D opportunities from within these sub groups.
ARU	Assessment of impact of introducing <i>C. difficile</i> PCR in wales
ARU	MSc project (EH) looking at <i>C.diff</i> within South Wales laundry
ARU	Recovery of <i>C.difficile</i> from waste water
ARU	Evaluaiton of commercial assay kits
ARU	WGS examination of Clade 2/ST1 strains - cross country transimssion
ARU	Work with ECDC as reference centre for development of cgMLST
ARU	Kate Baldwin (Clinical Liaison) - in silico analysis of <i>C. difficile</i> binary toxin
ARU	Anaerobe MIC database - for the surveillance of antimicrobial resistance and development of breakpoints for individual species. Tableau view. To be enhanced to include organism meta-data as part of Lead Scientist Doctorate work
ARU	Utilise WGS to replace 16S sequencing for the gold standard identification and characterisation of anaerobes referred to UKARU. ARU 16S sequencer is at end of life and WGS is reference level expectation. Part of Lead Scientist Doctorate work
ARU	AST of Bifido/Lacto probiotic strains x7 to ascertain whether certain strains have resistance to antimicrobials that may be used to treat them should patients develop bacteremia/sepsis
ARU	Development of FAA as reference AST media for agar dilution of anaerobes
ARU	Providing MIC data to support development of disk diffusion testing
ARU	Development of AD methodology within Anaerobic Workstation
ARU	Pip/Tazo GS for Anaerobes validation (EUCAST warning)
ARU	Co-amoxiclav gradient strip development
ARU	<i>Fusobacterium necrophorum</i> is an important oral pathogen, as prominent in acute/persistent/recurrent sore throats as Group A streptococcus - we aim to ascertain by WGS whether strains are related. If we can prove transmission of cases then the pathogen could become notifiable and we can influence cases of Lemmieres disease

UNIT	SUBJECT
ARU	Review of beta-lactamase testing methods for anaerobic bacteria as part of development of EUCAST recommendations for testing of Anaerobic Bacteria
ARU	Ed Kuiiper group have identified a mobile plasmid conferring MZ resistance in <i>C.difficile</i> . UKARU to screen all isolates in its collection for the presence of this plasmid
ARU	To ascertain whether <i>C.difficile</i> is developing resistance to frontline antimicrobials Fidaxo/Vanc/Mtz
ARU	Resistance Gene detection by traditional Vs WGS methods
TRU	Investigation of anti- <i>T. gondii</i> antibody levels in intravenous immunoglobulin preparations and their potential confounding effects on serological testing.
TRU	Investigation of monoclonal antibodies for use in anti-toxoplasma IgM enzyme immunoassay.
TRU	Investigation of significance of high levels of serum IgM detected by enzyme immunoassay in serum giving Toxoplasma dye test results.
TRU	Audit of neonatal serology
CRU	Capturing the genomic variation present in <i>Cryptosporidium</i> and cryptosporidiosis
CRU	Project partner in the 4-year Food Standards Agency-funded IID3 study
CRU	Diversity within <i>Cryptosporidium parvum</i> for improved epidemiological understanding
CRU	Collaborating with Cardiff University (Tom Connor and Arthur Morris) to develop a pipeline for <i>Cryptosporidium</i> genomics that will be incorporated into the <i>Cryptosporidium</i> genomics workstream.
CRU	Collaborating with CDSC, we are undertaking an interrupted time-series analysis to explore the changing epidemiology of <i>Cryptosporidium</i> linked to COVID-19 interventions.
CRU	The EU "PARADISE" project, by advising on <i>Cryptosporidium</i> subtyping methods, providing <i>Giardia</i> and <i>Cryptosporidium</i> DNA for method development, direct comparison of subtyping methods, technology transfer and participation in future ring trial.
WCM	MSc project looking at NGS on primary specimens
WCM	Service evaluation of patients with CF/bronchiectasis sending sputum samples from home
WCM	Service evaluation of induced sputum for patients with possible TB
WCM	PhD project looking at developing novel diagnostics for LTBI and epidemiological work looking at the utilisation of IGRA testing in Wales
WCM	Epidemiology of NTM infection in Wales

UNIT	SUBJECT
WCM	Study looking at follow up of patients with drug resistant LTBI
WCM	Testing/screening underserved population for TB/LTBI
WCM	Joining the WHO programme for the analysis of WGS-pDST data for the update of the WHO Catalogue of mutations

APPENDIX B: Recent Research or Evaluation Projects by Unit

UNIT	SUBJECT
SACU	Genomic surveillance of carbapenem-resistant <i>Klebsiella</i> in Wales reveals persistent spread of <i>K. pneumoniae</i> ST307 and adaptive evolution of pOXA-48-like plasmids
SACU	Comparative genomics and rapid molecular characterisation of <i>Klebsiella pneumoniae</i> ST1788, an otherwise uncommon strain spreading in Wales.
SACU	Use of whole genome sequencing to predict antimicrobial susceptibility of carbapenemase and non-carbapenemase producing <i>Escherichia coli</i> and <i>Klebsiella pneumoniae</i> isolates
SACU	510K study to evaluation sulbactam/durlobactam Etest for BioMerieux
SACU	Antibacterial compounds
SACU	Advancing and evaluating a breakthrough Diagnostic interVention for Acute uriNary traCt infEction.
MRL	The impact of Exophiala on the lung function of CF patients
MRL	Development of ECMM/ISHAM CAPA guidelines
MRL	Development of US/CDC care pathways for IFD in COVID
MRL	Evolutionary/Genetic studies of Azole resistance in <i>A. fumigatus</i>
MRL	Review of Antifungal resistance
MRL	Understanding the impact of Mucorales infection in COVID-19 patients
MRL	An evaluation of the IMMY Aspergillus LFA for the diagnosis of CAPA
MRL	An evaluation of the IMMY Aspergillus ELISA
MRL	An evaluation of the ACC STAT assay for the diagnosis of CAPA
MRL	An evaluation of Aspergillus ELISpot assay for the diagnosis of chronic aspergillosis
MRL	An evaluation of host biomarkers (cytokines/chemokines) to identify risk of, or diagnosis aspergillosis.
MRL	Using β -D-glucan as prognostic marker post abdominal surgery
MRL	An evaluation of the Burker Mucorales PCR
TRU	Genomic and computational analysis of <i>Toxoplasma gondii</i> direct from clinical samples using selective genome enrichment
TRU	European Standardisation of management of Toxoplasma in the Immunosuppressed
TRU	Investigation of IgG antibody levels in HIV-positive patients with <i>Toxoplasma gondii</i> .
CRU	A Thames Water-funded project to characterize water catchments for <i>Cryptosporidium</i> species and genotypes was completed under a SLA in March 2022.
CRU	Use of the Polymerase Chain Reaction (PCR) for the Analysis and Enumeration of <i>Cryptosporidium</i> Oocysts in Drinking Water
CRU	Standardising molecular detection methods to Improve risk assessment capacity for foodborne protozoan parasites, using <i>Cryptosporidium</i> in ready-to-eat salad as a model

UNIT	SUBJECT
CRU	A small project funded by the Liverpool School of Tropical Medicine for PCR screening of stool-extracted DNA from recruits to the Gurkha regiment for <i>Cyclospora</i> provided visiting Clinical BMS's the opportunity to undertake in-house PCR tests.
CRU	Subtyping by sequencing gp60 gene amplicons from real-time PCR, with automated analysis of DNA sequencing files using the CryptoGenoTyper programme, improving typability, reducing turn-around time and adding to the quality assurance of the analysis.
CRU	Verification of in-house fragment sizing on SeqStudio, reducing turnaround times for MLVA.
CRU	Investigation of the effect of pool water chlorination on inactivating Sars-Cov-2 – provision of advice on experimental design and translation of outcome to revision of the Pool Water Treatment Advisory Group's Code of Practice with respect to chlorination and pH values.

APPENDIX C: Future Research & Evaluation Projects planned

UNIT	SUBJECT
SACU	Advancing and evaluating breakthrough Diagnostic interVentions for Acute uriNary traCt infEction
SACU	Impact of duration of antibiotic therapy on effectiveness, safety and selection of antibiotic resistance in adult women with urinary tract infections (UTI): a randomised controlled trial.
SACU	Feasibility cohort study on predictors of diagnosis and prognosis of urine infection in care home residents: DIagnoSing Care hOme UTI Study
SACU	Investigate the role of antibiotics in skin surgery for skin cancers.
SACU	Specific Diagnostics rapid AST instruments
MRL	Application of pneumonia scores in ICU patients with and without CAPA.
MRL	Audit of 10 years fungal biomarker screening in haematology/the impact of changes in treating haematological malignancy on GM performance.
MRL	Audit of biomarkers/antibody testing for chronic aspergillosis
MRL	Impact of BDG positivity on the prognosis of COVID-19 ICU patients
MRL	Impact of BDG positivity on the prognosis of non-COVID-19 ICU patients
MRL	A systematic review/Meta-analysis of <i>Candida</i> PCR
MRL	Evaluation of the Fungal audit tool.
MRL	F2G Phase III trial evaluating the efficacy of olorofim for the management of refractory IA
MRL	Relationship of antifungal exposure to emergence of <i>Candida</i> resistance in Intensive Care patients: a multi-site cohort study (CandiRes)
MRL	Scynexis Phase II Clinical trial
MRL	Scynexis Phase III Clinical trial
MRL	Amplix Phase III Clinical trial
MRL	Understanding the performance of microbiological testing of induced sputum compared to BAL fluid in Haematology patients (SPITFIRE)
MRL	CERBA – Sputum trial
MRL	BioDrive Clinical trial – Assessing diagnostic driven versus empirical antifungal approaches in UK Haematology patients.
TRU	Investigation of relationship between clinical presentation and <i>T. gondii</i> genotype in cases of ocular toxoplasmosis.
TRU	Application of selective whole genome amplification procedure developed for PhD for genotyping and whole genome sequencing of <i>T. gondii</i> from human clinical samples, meat and wildlife.
CRU	Participate in the FSA-funded IID3 project by genotyping <i>Cryptosporidium</i> , <i>Giardia</i> and <i>Cyclospora</i> specimens from the community and GP cohorts. The <i>Cyclospora</i> genotyping work will strengthen collaboration with the CDC in the US. The <i>Cryptosporidium</i> work will provide further information about the distribution and

UNIT	SUBJECT
	frequency MLVA subtypes, supplementing the NIHR HPRU project data.
CRU	Complete the NIHR HPRU-funded project on <i>C. parvum</i> diversity and make decisions about future molecular surveillance using MLVA. Set up and manage a curated organism database for <i>Cryptosporidium</i> in www.PubMLST.org to facilitate sharing of MLVA profiles.
CRU	Contribute to the NIH-funded project "Capturing the genomic variation present in <i>Cryptosporidium</i> and cryptosporidiosis" by providing DNA samples, meta data and as technology transfer recipient. Additionally, the hybridization baits capture is a gateway technology for routine application of genomics to <i>Cryptosporidium</i> and other low abundance, non-culturable organisms. The technology transfer from UGA and development will be part of the <i>Cryptosporidium</i> genomics workstream.
CRU	Establish a workstream for <i>Cryptosporidium</i> genomics, which will be supported by our ongoing pipeline developments with Cardiff University and collaborations with UGA and NIH.
CRU	Complete an interrupted time-series analysis with CDSC to explore the changing epidemiology of <i>Cryptosporidium</i> spp. linked to COVID-19 interventions; investigate staff resources to apply to <i>Giardia duodenalis</i> assemblages as this may help inform the as yet not so clear cut epidemiology.
CRU	Validate the SeqStudio for in-house Sanger sequencing, reducing turnaround time for this service.
CRU	Sequence <i>C. hominis</i> and <i>C. parvum</i> DNA to understand the genetic shifts during the COVID-19 pandemic, and monitor for routine target escapees.
CRU	Investigate the potential impact of Genetic Signatures diagnostic PCRs on our confirmatory processes, verify with marginal specimens and dilution series samples, and adjust our testing algorithms and reporting processes and narratives accordingly.
CRU	Improve and evaluate narrative reporting.
CRU	Develop a QMRA for <i>Cryptosporidium</i> in swimming pools, using data generated from a previous survey and predicting risks under different scenarios. Possible collaboration with Prof. James Amburgey, University of North Carolina.
CRU	Establish a closer working relationship with Norwich Medical School and University of East Anglia to contribute to and participate in pre-clinical studies of <i>Cryptosporidium</i> and enable sharing of materials.

UNIT	SUBJECT
CRU	To work towards, and seek funding for, developing methods for the detection of <i>Cryptosporidium</i> and other gastrointestinal protozoan parasites in food with a view to ultimately providing this as a core service. Initially, build on the recently completed EFSA-funded IMPACT project to develop methods for other food types which have been implicated in outbreaks of cryptosporidiosis (e.g. milk).
CRU	Seek funding to develop and evaluate methods to improve detection of <i>Cryptosporidium</i> in water, building on the findings of the recently completed Drinking Water Inspectorate-funded project "Use of the Polymerase Chain Reaction (PCR) for the Analysis and Enumeration of <i>Cryptosporidium</i> Oocysts in Drinking Water".

APPENDIX D: Publications (2018 – 2022) by Unit

UNIT	REFERENCE
ARU	Veloo ACM, Jean-Pierre H, Justesen US, Morris T, Urban E, Wybo I, Kostrzewa M, Friedrich AWAn overview of the data obtained during the validation of an optimized MALDI-TOF MS Biotyper database for the identification of anaerobic bacteria. On Behalf Of The Enria Workgroup. Data Brief. 2018 Apr 23; 18: 1484-1496.
ARU	Ulger Toprak N, Alida C M V, Urban E, Wybo I, Justesen US, Jean-Pierre H, Morris T, Akgul O, Kulekci G, Soyletir G, Nagy EPerformance of mass spectrometric identification of clinical Prevotella species using the VITEK MS system: A prospective multi-center studyESCMID Study Group for Anaerobic Infections (ESGAI). . Anaerobe. 2018 Dec;54: 205-209.
ARU	Morris T, Copsey-Mawer S, Hughes HThe International Anaerobe Quality Assurance Scheme (IAQAS) Anaerobe. 2018. 49(pp 132):February
ARU	Ulger Toprak N, Veloo ACM, Urban E, Wybo I, Justesen US, Jean-Pierre H, Morris T, Akgul O, Kulekci G, Soyletir G, Nagy EA multicenter survey of antimicrobial susceptibility of Prevotella species as determined by Etest methodologyESCMID Study Group for Anaerobic Infections (ESGAI). . Anaerobe. 2018 Aug;52:9-15. doi: 10.1016/j.anaerobe.2018.05.005. Epub 2018 May 17. PMID: 29860038.
ARU	Veloo ACM, Jean-Pierre H, Justesen US, Morris T, Urban E, Wybo I, Kostrzewa M, Friedrich AWValidation of MALDI-TOF MS Biotyper database optimized for anaerobic bacteria: The ENRIA projectENRIA workgroup. . Anaerobe. 2018 Dec;54:224-230. doi: 10.1016/j.anaerobe.2018.03.007. Epub 2018 Mar 12. PMID: 29545163.
ARU	Krutova M, Kinross P, Barbut F, Hajdu A, Wilcox MH, Kuijper EJ; Morris TE; survey contributors.How to: Surveillance of Clostridium difficile infectionsClin Microbiol Infect. 2018 May;24(5):469-475. doi: 10.1016/j.cmi.2017.12.008.
ARU	Knetsch CW, Kumar N, Forster SC, Connor TR, Browne HP, Harmanus C, Sanders IM, Harris SR, Turner L, Morris T, Perry M, Miyajima F, Roberts P, Pirmohamed M, Songer JG, Weese JS, Indra A, Corver J, Rupnik M, Wren BW, Riley TV, Kuijper EJ, Lawley TDZoonotic Transfer of Clostridium difficile Harboring Antimicrobial Resistance between Farm Animals and HumansJ Clin Microbiol. 2018 Feb 22;56(3):e01384-17. doi: 10.1128/JCM.01384-17. PMID: 29237792; PMCID: PMC5824051.
ARU	Toprak NU, Veloo ACM, Urban E, Wybo I, Jean-Pierre H, Morris T, Justesen US, Tripkovic V, Jeverica S, Soyletir G, Nagy EComparing identification of clinically relevant Prevotella species by VITEK MS and MALDI biotyper.ESCMID Study Group for Anaerobic Infections

UNIT	REFERENCE
	(ESGAI)**. Acta Microbiol Immunol Hung. 2019 Dec 9;67(1):6-13. doi: 10.1556/030.66.2019.022. PMID: 31813262.
ARU	Eyre DW, Shaw R, Adams H, Cooper T, Crook DW, Griffin RM, Mannion P, Morgan M, Morris T, Perry M, Jones S, Peto TEA, Sutton J, Walker AS, Williams D, Craine NWGS to determine the extent of Clostridioides difficile transmission in a high incidence setting in North Wales in 2015J Antimicrob Chemother. 2019 Apr 1;74(4):1092-1100. doi: 10.1093/jac/dky523. PMID: 30561656.
ARU	Perry MD, White PL, Morris TE.Impact of the introduction of nucleic acid amplification testing on Clostridioides difficile detection and ribotype distribution in Wales.Anaerobe. 2020 Dec 9;67:102313. doi: 10.1016/j.anaerobe.2020.102313. Epub ahead of print. PMID: 33309680.
ARU	Tiltres TS, Kehrer M, Hughes H, Morris TE, Justesen US.Ceftriaxone treatment of spondylodiscitis and other serious infections with Cutibacterium acnesJ Antimicrob Chemother. 2020 Oct 1;75(10):3046-3048. doi: 10.1093/jac/dkaa259. PMID: 32591800.
ARU	Kahlmeter G, Morris TE.EUCAST invite comments on new methods for antimicrobial susceptibility testing of anaerobic bacteria.Anaerobe. 2021 Aug;70:102417. doi: 10.1016/j.anaerobe.2021.102417
ARU	Copsey-Mawer S, Hughes H, Scotford S, Anderson B, Davis C, Perry MD, Morris TEUK Bacteroides species surveillance survey: Change in antimicrobial resistance over 16 years (2000-2016).Anaerobe. 2021 Dec;72:102447. doi: 10.1016/j.anaerobe.2021.102447. Epub 2021 Sep 21
ARU	Bavelaar H, Justesen US, Morris TE, Anderson B, Copsey-Mawer S, Stubhaug TT, Kahlmeter G, Matuschek E. Development of a EUCAST disk diffusion method for the susceptibility testing of rapidly growing anaerobic bacteria using Fastidious Anaerobe Agar (FAA): a development study using Bacteroides species.Clin Microbiol Infect. 2021 Apr 2:S1198-743X(21)00163-4. doi: 10.1016/j.cmi.2021.03.028. Online ahead of print.PMID: 33813129
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