

# OIE Reference Laboratory Reports Activities

## *Activities in 2020*

**This report has been submitted : 2021-02-03 12:11:18**

<b>Name of disease (or topic) for which you are a designated OIE Reference Laboratory:</b>	Bovine tuberculosis
<b>Address of laboratory:</b>	New Haw, Addlestone Surrey KT15 3NB Weybridge UNITED KINGDOM
<b>Tel.:</b>	+44-1932 34.11.11
<b>Fax:</b>	+44-1932 34.70.46
<b>E-mail address:</b>	glh14@aber.ac.uk
<b>Website:</b>	<a href="https://www.gov.uk/government/organisations/animal-and-plant-health-agency">https://www.gov.uk/government/organisations/animal-and-plant-health-agency</a>
<b>Name (including Title) of Head of Laboratory (Responsible Official):</b>	Mr Chris Hadkiss, CEO
<b>Name (including Title and Position) of OIE Reference Expert:</b>	Professor Glyn Hewinson
<b>Which of the following defines your laboratory? Check all that apply:</b>	Governmental

**ToR 1: To use, promote and disseminate diagnostic methods validated according to OIE Standards**

1. Did your laboratory perform diagnostic tests for the specified disease/topic for purposes such as disease diagnosis, screening of animals for export, surveillance, etc.? (Not for quality control, proficiency testing or staff training)

Yes

Diagnostic Test	Indicated in OIE Manual (Yes/No)	Total number of test performed last year	
		Nationally	Internationally
Indirect diagnostic tests		Nationally	Internationally
Gamma interferon micro (2 antigen) assay	Yes	280507	0
Gamma interferon extended micro (3 antigen) assay	Yes	4922	0
Lateral flow serology test - camelid	No	418	0
Lateral flow serology test - badger	No	97	0
Lateral flow serology test - other	No	379	0
IDEXX ELISA serology test - bovine	Yes	8846	0
IDEXX ELISA serology test - camelid	No	1291	0
EnferPlex serology ELISA - camelid	No	1196	0
Direct diagnostic tests		Nationally	Internationally
Culture (bovine)	Yes	8798	0
Culture (non bovine)	Yes	566	0
Spoligotyping (bovine)	Yes	2938	0
VNTR (bovine)	Yes	2938	0
Spoligotyping (non bovine)	Yes	371	0
VNTR (non bovine)	Yes	371	0
DNA testing of cattle to confirm identity	No	54	0
Culture (badgers)	No	863	0

**ToR 2: To develop reference material in accordance with OIE requirements, and implement and promote the application of OIE Standards.  
To store and distribute to national laboratories biological reference products and any other reagents used in the diagnosis and control of the designated pathogens or disease.**

2. Did your laboratory produce or supply imported standard reference reagents officially recognised by the OIE?

No

3. Did your laboratory supply standard reference reagents (non OIE-approved) and/or other diagnostic reagents to OIE Member Countries?

Yes

Type of reagent available	Related diagnostic test	Produced/ provide	Amount supplied nationally (ml, mg)	Amount supplied internationally (ml, mg)	No. of recipient OIE Member Countries	Region of recipients
Badger TB IGRA test antibodies	Badger TB IGRA ELISA	Provide	2 mg	0	1	<input type="checkbox"/> Africa <input type="checkbox"/> Americas <input type="checkbox"/> Asia and Pacific <input checked="" type="checkbox"/> Europe <input type="checkbox"/> Middle East
Cattle IGRA controls	Bovigam	Provide		700 mL	13	<input type="checkbox"/> Africa <input type="checkbox"/> Americas <input type="checkbox"/> Asia and Pacific <input checked="" type="checkbox"/> Europe <input type="checkbox"/> Middle East
Cattle DIVA skin test antigens	Cattle TB testing & research	Provide		75 mL		<input checked="" type="checkbox"/> Africa <input checked="" type="checkbox"/> Americas <input type="checkbox"/> Asia and Pacific <input type="checkbox"/> Europe <input type="checkbox"/> Middle East

4. Did your laboratory produce vaccines?

No

5. Did your laboratory supply vaccines to OIE Member Countries?

No

***ToR 3: To develop, standardise and validate, according to OIE Standards, new procedures for diagnosis and control of the designated pathogens or diseases***

6. Did your laboratory develop new diagnostic methods validated according to OIE Standards for the designated pathogen or disease?

No

7. Did your laboratory develop new vaccines according to OIE Standards for the designated pathogen or disease?

No

***ToR 4: To provide diagnostic testing facilities, and, where appropriate, scientific and technical advice on disease control measures to OIE Member Countries***

8. Did your laboratory carry out diagnostic testing for other OIE Member Countries?

No

9. Did your laboratory provide expert advice in technical consultancies on the request of an OIE Member Country?

No

***ToR 5: To carry out and/or coordinate scientific and technical studies in collaboration with other laboratories, centres or organisations***

10. Did your laboratory participate in international scientific studies in collaboration with OIE Member Countries other than the own?

Yes

Title of the study	Duration	Purpose of the study	Partners (Institutions)	OIE Member Countries involved other than your country
Field evaluation of BCG vaccination in cattle	on-going	To evaluate the efficacy of BCG in cattle in field situations in Ethiopia	Armauer Hansen Research Institute and Addis Ababa University	ETHIOPIA
Evaluation of inactivated vaccine efficacy in badgers	on-going	Assess efficacy of inactivated TB vaccine in badgers	Neiker Institute & SERIDA	SPAIN
Badger bait deployment studies	on-going	Investigate uptake of baits in badger population	ANSES & ONCFS	FRANCE
Accelerating Bovine tuberculosis Control in Developing Countries - India	on-going	TB control in India	Penn State University, Multiple Indian partners, Cambridge University, Universidad Complutense de Madrid, Douwe Bakker	INDIA SPAIN UNITED KINGDOM UNITED STATES OF AMERICA
Improvements in blood based TB test for cattle	on-going	Improvements in blood based TB test for cattle	University College Dublin	IRELAND
Replacement of the International Standard Bovine Tuberculin	on-going	To produce a replacement International Standard Bovine Tuberculin	This is an International Study led by the OIE	
Cattle vaccine and DIVA development	on-going	Cattle vaccine and DIVA development	AgResearch	NEW ZEALAND
Improved TB skin test delivery systems	on-going	Improved TB skin test delivery systems	MIT	UNITED STATES OF AMERICA
Discovery of novel antigens for TB serology	on-going	Discovery of novel antigens for TB serology	Antigen Discovery Inc	UNITED STATES OF AMERICA
Investigation of M.bovis levels in cattle faeces	on-going	Investigation of M.bovis levels in cattle faeces	Irish State Veterinary Laboratory	IRELAND

***ToR 6: To collect, process, analyse, publish and disseminate epizootiological data relevant to the designated pathogens or diseases***

11. Did your Laboratory collect epizootiological data relevant to international disease control?

Yes

If the answer is yes, please provide details of the data collected:
APHA is involved in the collection of data relevant to the bovine TB disease situation in Great Britain.

12. Did your laboratory disseminate epizootiological data that had been processed and analysed?

Yes

If the answer is yes, please provide details of the data collected:
Statistics and analysis of bovine TB disease situation in Great Britain are available at the following website: <a href="https://www.gov.uk/government/collections/bovine-tb">https://www.gov.uk/government/collections/bovine-tb</a>

**13. What method of dissemination of information is most often used by your laboratory?  
(Indicate in the appropriate box the number by category)**

a) Articles published in peer-reviewed journals: 39

BIFFAR L; BLUNT L; ATKINS W; ANDERSON P; HOLDER T; Xing Z; VORDERMEIER M; McShane H; VILLARREAL-RAMOS B (2020) Evaluating the sensitivity of bovine BCG challenge model using a prime boost Ad85A vaccine regimen. *Vaccine* 38 (5) 1241-1248.

Crispell J; BENTON CH; Belaz D; De Maio N; Ahkmetova A; Allen A; Biek R; Presho EL; DALE J; Hewinson G; Lycett SJ; Nunez-Garcia J; Skuce RA; Trewby H; Wilson DJ; Zadoks RN; DELAHAY RJ; Kao RR (2019) Combining genomics and epidemiology to analyse bi-directional transmission of *Mycobacterium bovis* in a multi-host system. *eLife* 8 e45833.

Enticott G; Maye D; Naylor R; Brunton L; DOWNS SH; Donnelly CA (2020) An assessment of risk compensation and spillover behavioural adaptations associated with the use of vaccines in animal disease management. *Vaccine* 38 (5) 1065-1075.

May E; PROSSER A; DOWNS SH; Brunton LA (2019) Exploring the risk posed by animals with an inconclusive reaction to the bovine tuberculosis skin test in England and Wales. *Veterinary Sciences* 6 (4) 97.

Palmer MV; Thacker TC; Rabideau MM; JONES GJ; Kanipe C; VORDERMEIER HM; Waters WR (2020) Biomarkers of cell-mediated immunity to bovine tuberculosis. *Veterinary Immunology and Immunopathology* 220 109988.

PERRIN LD; GIBBENS JC; DONNELLY CA; VIAL F; DELAHAY RJ; HEASMAN L; BRUNTON L; ROBERTSON A; ENTICOTT G; DOWNS SH (2019) How can good biosecurity reduce the incidence of bovine tuberculosis? In: McIntyre KM (ed); Nielsen LR (ed), *Society for Veterinary Epidemiology and Preventive Medicine: proceedings of a meeting held in Utrecht, the Netherlands, 27th - 29th March 2019*, 233-246.

ROMERO MP; Chang Y-M; Brunton LA; PARRY J; PROSSER A; UPTON P; REES E; TEARNE O; ARNOLD M; Stevens K; Drewe JA (2020) Decision tree machine learning applied to bovine tuberculosis risk factors to aid disease control decision making. *Preventive Veterinary Medicine* 175 104860.

Lyashchenko KP; VORDERMEIER HM; Waters WR (2020) Memory B cells and tuberculosis. *Veterinary Immunology and Immunopathology* 221 110016.

Balseiro A; Prieto JM; Alvarez V; Lesellier S; DAVE D; Salguero FJ; Sevilla IA; Infantes-Lorenzo JA; Garrido JM; Adriaensen H; Juste RA; Barral M (2020) Protective effect of oral BCG and inactivated *Mycobacterium bovis* vaccines in European badgers (*Meles meles*) experimentally infected With *M. bovis*. *Frontiers in Veterinary Science* 7 Article: 41.

BIANCO C; LESELLIER S; Barrat J; Richomme C; Boschirolì M-L; NUNEZ A (2020) Subclinical BCG-osis in a captive badger (*Meles meles*) with lymphoma. *Journal of Comparative Pathology* 176 76-80.

Courcier EA; Pascual-Linaza AV; ARNOLD ME; McCormick CM; Corbett DM; O'Hagan MJH; Collins SF; Trimble NA; McGeown CF; McHugh GE; McBride KR; McNair J; Thompson S; Patterson IAP; Menzies FD (2020) Evaluating the application of the dual path platform VetTB test for badgers (*Meles meles*) in the test and vaccinate or remove (TVR) wildlife research intervention project in Northern Ireland. *Research in Veterinary Science* 130 170-178.

DUNCAN D; BROUWER A; HARRIS KA; LAWES JR; AVIGAD R; DALE J; UPTON PA (2020) Bovine TB infection status in cattle in Great Britain in 2018. *Veterinary Record* 186 (12) 373-380.

BIANCO C; SANCHEZ-CORDON PJ; Verin R; GODINHO A; WEYER U; LESELLIER S; SPIROPOULOS J; FLOYD T; EVEREST D; NUNEZ A (2020) Investigation into the pathology of idiopathic systemic amyloidosis in four captive badgers (*Meles meles*). *Journal of Comparative Pathology* 176 128-132.

SOLDAN A (2020) Andrew Soldan, veterinary director of the APHA, responds (letter). *Veterinary Record* 186 (14) 456-457.

Allen A; Guerrero J; Byrne A; Lavery J; Presho E; Courcier E; O'Keeffe J; Fogarty U; DELAHAY R; Wilson G; Newman C; Buesching C; Silk M; O'Meara D; Skuce R; Biek R; McDonald RA (2020) Genetic evidence further elucidates the history and extent of badger introductions from Great Britain into Ireland. *Royal Society Open Science* 7 (4) Article number 200288.

Fielding HR; McKimley TJ; DELAHAY RJ; Silk MJ; McDonald RA (2020) Effects of trading networks on the risk of bovine tuberculosis incidents on cattle farms in Great Britain. *Royal Society Open Science* 7 (4) Article number 191806.

ASHFORD RT; ANDERSON P; WARING L; DAVE D; SMITH F; DELAHAY RJ; Gormley E; CHAMBERS MA; SAWYER J; LESELLIER S (2020) Evaluation of the Dual Path Platform (DPP) VetTB assay for the detection of *Mycobacterium bovis* infection in badgers. *Preventive Veterinary Medicine* 180, 105005.

Cadmus SI; Akinseye VO; Taiwo BO; Pinelli EO; van Soelingen D; RHODES SG (2020) Interactions between helminths and tuberculosis infections: Implications for tuberculosis diagnosis and vaccination in Africa. *PLOS Neglected Tropical Diseases* 14 (6) e0008069.

CIVELLO AN; SPIROPOULOS J; SANCHEZ-CORDON PJ; HICKS DJ; HOGARTH P J; BIRCH C; NUNEZ A (2020) The effect of BCG vaccination on macrophage phenotype in a mouse model of intranasal *Mycobacterium bovis* challenge. *Vaccine* 38 (30) 4755-4761.

Santos N; Richomme C; Nunes T; Vicente J; Alves PC; de la Fuente J; Correia-Neves M; Boschirolì M; DELAHAY R; Gortazar C (2020) Quantification of the animal tuberculosis multi-host community offers insights for control. *Pathogens* 9 (6) 421.

Vazquez CB; Prieto M; Barral M; Juste RA; Lesellier S; Salguero FJ; DAVE D; Martinez IZ; de Garnica Garcia MG; Casais R; Balseiro A (2020) Local lung immune response to *Mycobacterium bovis* challenge after BCG and *M. bovis* heat-inactivated vaccination in European badger (*Meles meles*). *Pathogens* 9 (6) article number: 456 Article number: 456.

Asai M; Li Y; SPIROPOULOS J; COOLEY W; EVEREST D; Robertson BD; Langford PR; Newton SM (2020) A novel biosafety level 2 compliant tuberculosis infection model using a  $\Delta$ leuD $\Delta$ panCD double auxotroph of *Mycobacterium tuberculosis* H37Rv and *Galleria mellonella*. *Virulence* 11 (1) 811-824 811-824.

Ballesteros C; FODDAI A; SMITH RP; Stevens K; Drewe JA (2020) Risk factor analysis for "diagnosis not reached" results from bovine samples submitted to British veterinary laboratories in 2013–2017. *Preventive Veterinary Medicine* 182 105099.

LESELLIER S; BIRCH CPD; DAVE D; DALLEY D; GOWTAGE S; PALMER S; MCKENNA C; WILLIAMS GA; ASHFORD R; WEYER U; BEATHAM S; COATS J; NUNEZ A; SANCHEZ-CORDON P; SPIROPOULOS J; POWELL S; SAWYER J; Pascoe J; Hendon-Dunn C; Bacon J; CHAMBERS MA

(2020) Bioreactor-grown bacillus of Calmette and Guérin (BCG) vaccine protects badgers against virulent *Mycobacterium bovis* when administered orally: Identifying limitations in baited vaccine delivery. *Pharmaceutics* 12 (8) 783.

Middlemiss C; SOLDAN A (2020) Rollout of approved tuberculin testers (letter). *Veterinary Record* 187 (4) 156.

Smith AA; VILLARREAL-RAMOS B; Mendum TA; Williams KJ; JONES GJ; Wu H; McFadden J; VORDERMEIER HM; Stewart GR (2020) Genetic screening for the protective antigenic targets of BCG vaccination. *Tuberculosis* 124, 101979.

Srinivasan S; Subramanian S; Balakrishnan SS; Selvaraju KR; Manomahan V; Selladurai S; Jothivelu M; Gopal DR; Kathaperumal K; Conlan AJK; Veerasami M; Bakker D; VORDERMEIER M; Kapur V (2020) A defined antigen skin test that enables implementation of BCG vaccination for control of bovine tuberculosis: Proof of concept. *Frontiers in Veterinary Science* 7, Article number 391.

BENTON CH; Phoenix J; SMITH FAP; ROBERTSON A; McDonald RA; WILSON G; DELAHAY RJ (2020) Badger vaccination in England: Progress, operational effectiveness and participant motivations. *People and Nature* 2 (3) 761-775.

Denholm SJ; Brand W; MITCHELL AP; Wells AT; Krzyzelewski T; Smith SL; Wall E; Coffey MP (2020) Predicting bovine tuberculosis status of dairy cows from mid-infrared spectral data of milk using deep learning. *Journal of Dairy Science* 103 (10) 9355-9367.

Pascoe J; Hendon-Dunn CL; BIRCH CPD; WILLIAMS GA; CHAMBERS MA; Bacon J (2020) Optimisation of *Mycobacterium bovis* BCG fermentation and storage survival. *Pharmaceutics* 12 (9) 900.

SCHROEDER P; Hopkins B; JONES J; GALLOWAY T; Pike R; Rolfe S; Hewinson G (2020) Temporal and spatial *Mycobacterium bovis* prevalence patterns as evidenced in the All Wales Badgers Found Dead (AWBFD) survey of infection 2014–2016. *Scientific Reports* 10, Article number: 15214.

KONOLD T; DALE J; SPIROPOULOS J; SIMMONS H; Godinho A (2020) Case of TB in a sheep caused by *Mycobacterium bovis* with transmission to another sheep and a steer in the same building. *Veterinary Record Case Reports* 8 (4) e001151.

Loiseau C; Menardo F; Aseffa A; Hailu E; Gumi B; Ameni G; BERG S; Rigouts L; Robbe-Austerman S; Zinsstag J; Gagneux S; Brites D (2020) An African origin for *Mycobacterium bovis*. *Evolution, Medicine and Public Health* 2020 (1) 49-59.

Mekonnen GA; Mihret A; Tamiru M; Hailu E; Olani A; Aily A; Sombo M; Lakew M; Gumi B; Ameni G; Wood JLN; BERG S (2020) Genotype diversity of *Mycobacterium bovis* and pathology of bovine tuberculosis in selected emerging dairy regions of Ethiopia. *Frontiers in Veterinary Science* 7: Article 553940.

SMITH F; ROBERTSON A; SMITH GC; Gill P; McDonald RA; Wilson G; DELAHAY RJ (2020) Estimating wildlife vaccination coverage using genetic methods. *Preventive Veterinary Medicine* 183, 105096.

KAVEH DA; GARCIA-PELAYO MC; BULL NC; SANCHEZ CORDON PJ; SPIROPOULOS J; HOGARTH PJ (2020) Airway delivery of both a BCG prime and adenoviral boost drives CD4 and CD8 T cells into the lung tissue parenchyma. *Scientific Reports* 10, Article number: 8703.

Rossi G; Crispell J; BROUGH T; Lycett SJ; White PCL; Allen A; ELLIS RJ; Gordon SV; Harwood R; PALKOPOULOU E; Presho EL; Skuce R; SMITH GC; Kao RR (2020) Phylodynamic analysis of an emergent *Mycobacterium bovis* outbreak in an area with no previously known wildlife infections. *BioRxiv preprint*.

Benedictus L; STEINBACH S; HOLDER T; Bakker D; Vrettou C; Morrison WI; VORDERMEIER M; Connelley T (2020) Hydrophobic mycobacterial antigens elicit polyfunctional T Cells in *Mycobacterium bovis* immunized cattle: Association with protection against challenge? *Frontiers in Immunology* 11, Article 588180.



Rossi G; Crispell J; Balz D; Lycett SJ; BENTON CH; DELAHAY RJ; Kao RR (2020) Identifying likely transmissions in Mycobacterium bovis infected populations of cattle and badgers using the Kolmogorov Forward Equations. Scientific Reports 10, Article number: 21980.

b) International conferences: 0

c) National conferences: 0

d) Other:

(Provide website address or link to appropriate information) 0

**ToR 7: To provide scientific and technical training for personnel from OIE Member Countries  
To recommend the prescribed and alternative tests or vaccines as OIE Standards**

14. Did your laboratory provide scientific and technical training to laboratory personnel from other OIE Member Countries?

No

**ToR 8: To maintain a system of quality assurance, biosafety and biosecurity relevant for the pathogen and the disease concerned**

15. Does your laboratory have a Quality Management System?

Yes

Quality management system adopted	Certificate scan (PDF, JPG, PNG format)
ISO17025	APHA ISO17025 certificate.pdf
ISO9001:2015	APHA ISO9001-2015_Certificate.pdf
ISO9001:2015	Animal and Plant Health Agency LRQ4001392 -Certificate Validity Letter.pdf

16. Is your quality management system accredited?

Yes

Test for which your laboratory is accredited	Accreditation body
Culture (bovine and non-bovine)	UKAS
Gamma interferon ELISA	UKAS

17. Does your laboratory maintain a “biorisk management system” for the pathogen and the disease concerned?

Yes

(See *Manual of Diagnostic Tests and Vaccines for Terrestrial Animals, Chapter 1.1.4*)

### **ToR 9: To organise and participate in scientific meetings on behalf of the OIE**

18. Did your laboratory organise scientific meetings on behalf of the OIE?

No

19. Did your laboratory participate in scientific meetings on behalf of the OIE?

No

### **ToR 10: To establish and maintain a network with other OIE Reference Laboratories designated for the same pathogen or disease and organise regular inter-laboratory proficiency testing to ensure comparability of results**

20. Did your laboratory exchange information with other OIE Reference Laboratories designated for the same pathogen or disease?

Yes

21. Was your laboratory involved in maintaining a network with OIE Reference Laboratories designated for the same pathogen or disease by organising or participating in proficiency tests?

No

22. Did your laboratory collaborate with other OIE Reference Laboratories for the same disease on scientific research projects for the diagnosis or control of the pathogen of interest?

No

**ToR 11: To organise inter-laboratory proficiency testing with laboratories other than OIE Reference Laboratories for the same pathogens and diseases to ensure equivalence of results**

23. Did your laboratory organise or participate in inter-laboratory proficiency tests with laboratories other than OIE Reference Laboratories for the same disease?

Yes

Note: See Interlaboratory test comparisons in: Laboratory Proficiency Testing at: <http://www.oie.int/en/our-scientific-expertise/reference-laboratories/proficiency-testing> see point 1.3

Purpose for inter-laboratory test comparisons <sup>1</sup>	No. participating laboratories	Region(s) of participating OIE Member Countries
TB EURL organised PT scheme: Histopathological and Immunohistochemical diagnosis of tuberculosis 2020	report not released	<input type="checkbox"/> Africa <input type="checkbox"/> Americas <input type="checkbox"/> Asia and Pacific <input checked="" type="checkbox"/> Europe <input type="checkbox"/> Middle East
TB EURL organised PT scheme: Direct extraction and bacteriological culture PT scheme	report not released	<input type="checkbox"/> Africa <input type="checkbox"/> Americas <input type="checkbox"/> Asia and Pacific <input checked="" type="checkbox"/> Europe <input type="checkbox"/> Middle East

**ToR 12: To place expert consultants at the disposal of the OIE**

24. Did your laboratory place expert consultants at the disposal of the OIE?

Yes

Kind of consultancy	Location	Subject (facultative)
OIE ad hoc Group meetings	Video conferences	OIE AD HOC GROUP ON REPLACEMENT OF THE INTERNATIONAL STANDARD BOVINE TUBERCULIN

25. Additional comments regarding your report: