World Organisation for Animal Health

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WOAH Reference Laboratory Reports Activities 2025

This report has been submitted: 24 janvier 2026 11:00

LABORATORY INFORMATION

***Name of disease (or topic) for which you are a designated WOAH Reference Laboratory:**	Swine streptococcosis
***Address of laboratory:**	College of Veterinary Medicine, Nanjing Agricultural University, No. 1 Weigang, Nanjing 210014, China
***Tel:**	+86-18651836283
***E-mail address:**	wuzongfu@njau.edu.cn
Website:	
***Name (including Title) of Head of Laboratory (Responsible Official):**	Prof. Huochuan Yao
***Name (including Title and Position) of WOAH Reference Expert:**	Prof. Zongfu Wu, WOAH-Designated Expert
***Which of the following defines your laboratory? Check all that apply:**	Academic institution

TOR1: DIAGNOSTIC METHODS

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 WOAH Manual (Yes/No)	Total number of test performed last year	
Indirect diagnostic tests		Nationally	Internationally
Direct diagnostic tests		Nationally	Internationally
PCR and qPCR assays for Streptococcus suis	No	1900	100
PCR and qPCR assays for Streptococcus pasteurianus	No	300	0

TOR2: REFERENCE MATERIAL

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

No

3. Did your laboratory supply standard reference reagents (nonWOAH-approved) and/or other diagnostic reagents to WOAH Members?

Yes

Type of reagent available	Related diagnostic test	Produced/ provide	Amount supplied nationally (ml, mg)	Amount supplied internationally (ml, mg)	No. of recipient WOAH Member Countries	Country of recipients
Streptococcus suis reference strains	PCR and qPCR	provide	5 mL	0	1	CHINA (PEOPLE'S REP. OF),
DNA of Streptococcus suis reference strains	PCR and qPCR	provide	2 mL	0	1	CHINA (PEOPLE'S REP. OF),

4. Did your laboratory produce vaccines?

Yes

5. Did your laboratory supply vaccines to WOAH Members?

No

TOR3: NEW PROCEDURES

6. Did your laboratory develop new diagnostic methods for the designated pathogen or disease?

Yes

Name of the new test or diagnostic method developed	Description and References (Publication, website, etc.)
Quantitative PCR assay for Streptococcus suis; Multiplex PCR assay for Streptococcus suis different pathogenic serotypes; Quantitative PCR assay for Streptococcus equi subsp. zooepidemicus	These methods have been described in "Diagnostic techniques for swine streptococcosis" applied for National Standard of the People's Republic of China.
Multiplex PCR assay for Streptococcus suis and Streptococcus pasteurianus	Shuoyue Wang, Xinchun Li, Chenxu Zheng, Juan J Quereda, Jie Sun, Huochun Yao, Zongfu Wu*. Genomic characteristics and antimicrobial resistance of the underreported zoonotic pathogen Streptococcus pasteurianus and its co-colonization with Streptococcus suis. Veterinary Microbiology, 2025, 303: 110428
Multiplex PCR method for identification of virulent strains of Streptococcus suis serotype 4	Jinlu Zhu, Zeren Peng, Hongkun Zhuang, Jie Sun, Zongfu Wu*. A multiplex PCR method for identification of virulent strains of Streptococcus suis serotype 4[J]. Acta Microbiologica Sinica, 2025, 65(8): 3782-3793.

7. Did your laboratory validate diagnostic methods according to WOAH Standards for the designated pathogen or disease?

No

8. Did your laboratory develop new vaccines for the designated pathogen or disease?

Yes

Name of the new vaccine developed	Description and References (Publication, website, etc)
Streptococcus suis Ghosts Vaccine	Jianan Liu, Xinming Pan, Wanxia Pu, Pei Li, Caiying Li, Zhen Zhang, Huochun Yao, Yinchu Zhu, Jiale Ma. Engineered Streptococcus suis Bacterial Ghosts via Lytic Plasmid and Cell-Penetrating Peptides for Enhanced Protective Immunity. Advanced Healthcare Materials. 2025: e03790.

9. Did your laboratory validate vaccines according to WOAH Standards for the designated pathogen or disease?

No

TOR4: DIAGNOSTIC TESTING FACILITIES

10. Did your laboratory carry out diagnostic testing for other WOAH Members?

No

11. Did your laboratory provide expert advice in technical consultancies on the request of an WOAH Member?

Yes

Name of the WOAH Member Country receiving a technical consultancy	Purpose	How the advice was provided
CHINA (PEOPLE'S REP. OF)	Expert technical consultancy on the diagnosis and serotyping of Streptococcus suis, including a scientific lecture and the sharing of practical laboratory methods for detection, identification, and serotyping	on-site lecture and technical guidance

TOR5: COLLABORATIVE SCIENTIFIC AND TECHNICAL STUDIES

12. Did your laboratory participate in international scientific studies in collaboration with WOAH Members other than the own?

Yes

Title of the study	Duration	Purpose of the study	Partners (Institutions)	WOAH Member Countries involved other than your country
		we reported the second known		

Genomic characterization and virulence of Streptococcus suis serotype 7 sequence type 373 of clonal complex 94	2023-2025	human infection caused by Streptococcus suis serotype 7-ST373. We described a comparative genomic analysis of S. suis ST373 strains isolated from humans and pigs, providing insights into their genomic characteristics, putative virulence genes, and genetic relationships.	Faculty of Public Health, Kasetsart University	THAILAND
Genomic characterization and virulence of Streptococcus suis serotype 7 sequence type 373 of clonal complex 94	2023-2025	we reported the second known human infection caused by Streptococcus suis serotype 7-ST373. We described a comparative genomic analysis of S. suis ST373 strains isolated from humans and pigs, providing insights into their genomic characteristics, putative virulence genes, and genetic relationships.	Faculty of Veterinary Medicine, University of Montreal	CANADA
Genomic characteristics and antimicrobial resistance of the underreported zoonotic pathogen Streptococcus pasteurianus and its co-colonization with Streptococcus suis	2023-2025	Streptococcus pasteurianus is an opportunistic pathogen affecting various animals and is an underreported zoonotic threat. It is also a causative agent of swine streptococcosis and can be co-detected with Streptococcus suis, another significant pig and zoonotic pathogen. However, the dynamics of co-colonization between these pathogens, along with the genomic features and antibiotic resistance profiles of S. pasteurianus, remain poorly understood. In this study, we developed a multiplex PCR (mPCR) assay to detect S. pasteurianus and S. suis in 827 tonsil samples from healthy pigs, with 81 samples positive for both pathogens.	Facultad de Veterinaria, Universidad Cardenal Herrera-CEU, CEU Universities	SPAIN

13. In exercising your activities, have you identified any regulatory research needs* relevant for WOAH?

Yes

Research need : 1

Please type the Research need: The identification of swine streptococcosis pathogens including Streptococcus suis, Streptococcus equi subsp. zooepidemicus, and Streptococcus pasteurianus is not in the Terrestrial and Aquatic Codes and Manuals. This should be included in Terrestrial and Aquatic Codes and Manuals.

Relevance for WOAH Disease Control, Capacity Building, Standard Setting,

Relevance for the Code or Manual Manual,

Field Epidemiology and Surveillance, Diagnostics,

Animal Category Terrestrial,

Disease:

Swine streptococcosis

Kind of disease (Zoonosis, Transboundary diseases) Zoonosis, Transboundary diseases,

If any, please specify relevance for Codes or Manual, chapter and title

(e.g. Terrestrial Manual Chapter 2.3.5 - Minimum requirements for aseptic production in vaccine manufacture)

Answer:

Notes:

Answer:

TOR6: EPIZOOLOGICAL DATA

14. Did your Laboratory collect epidemiological data relevant to international disease control?

Yes

If the answer is yes, please provide details of the data collected:

We collected epizootiological data of Streptococcus suis and Streptococcus pasteurianus isolated from healthy and diseased pigs.

15. Did your laboratory disseminate epidemiological data that had been processed and analysed?

Yes

If the answer is yes, please provide details of the data collected:

We provided the details of epidemiological data of Streptococcus suis and Streptococcus pasteurianus in the following paper:

1. Shuoyue Wang, Xinchun Li, Chenxu Zheng, Juan J Quereda, Jie Sun, Huochun Yao, Zongfu Wu*. Genomic characteristics and antimicrobial resistance of the underreported zoonotic pathogen Streptococcus pasteurianus and its co-colonization with Streptococcus suis. Veterinary Microbiology, 2025, 303: 110428
2. Rujirat Hatrongjit, Parichart Boueroy, Peechanika Chopjitt, Thidathip Wongsurawat, Piroon Jenjaroenpun, Natnicha Wankaew, Zeren Peng, Han Zheng, Marcelo Gottschalk, Zongfu Wu*, Anusak Kerdsin*. Genomic characterization and virulence of Streptococcus suis serotype 7 sequence type 373 of clonal complex 94. Veterinary Research, 2025, 56(1): 125
3. Xiyan Zhang, Jinlu Zhu, Anusak Kerdsin, Jianping Wang, Mingliu Wang, Hui Yang, Weiming Kang, Xiaojing Lu, Yan Wang, Hui Sun, Marcelo Gottschalk, Han Zheng*, Jianguo Xu, Zongfu Wu*. Streptococcus suis serotype 5: Emerging zoonotic threat with distinct genomic heterogeneity. Virulence, 2025, 16(1): 2523882
4. Jinlu Zhu, Zeren Peng, Hongkun Zhuang, Jie Sun, Zongfu Wu*. A multiplex PCR method for identification of virulent strains of Streptococcus suis serotype 4[J]. Acta Microbiologica Sinica, 2025, 65(8): 3782-3793.

16. What method of dissemination of information is most often used by your laboratory? (Indicate in the appropriate box the number by category and list the details in the box)

a) Articles published in peer-reviewed journals:

10

1. Zeren Peng, Jianping Wang, Shun Kang, Sixiang Xu, Hongkun Zhuang, Jinlu Zhu, Huochun Yao, Han Zheng, Zongfu Wu*. A Single Amino Acid in PBP1a Drives High-Level Penicillin and Amoxicillin Resistance in Streptococcus suis. International Journal of Antimicrobial Agents, 2025, 76: 107604*

2. Huizhen Wu, Yifan Wu, Qiankun Bai, Zijing Liang, Xinchi Zhu, Xinming Pan, Minghui Liu, Huochun Yao, Jiale Ma, Zongfu Wu*. A LXG toxin stabilized by DUF4176 contributes to Streptococcus suis competition and pathogenicity. BMC Biology, 2025, 23: 284*

3. Xinchi Zhu, Yifan Wu, Huochun Yao, Zongfu Wu. OseR, a bacterial redox sensor, regulates ergothioneine uptake via a Cys thiol switch, enhancing oxidative stress resistance and virulence. Redox Biology, 2025, 86:103790*

4. Rujirat Hatrongjit, Parichart Boueroy, Peechanika Chopjitt, Thidathip Wongsurawat, Piroon Jenjaroenpun, Natnicha Wankaew, Zeren Peng, Han Zheng, Marcelo Gottschalk, Zongfu Wu, Anusak Kerdsin*. Genomic characterization and virulence of Streptococcus suis serotype 7 sequence type 373 of clonal complex 94. Veterinary Research, 2025, 56(1): 125*

5. Xiyan Zhang, Jinlu Zhu, Anusak Kerdsin, Jianping Wang, Mingliu Wang, Hui Yang, Weiming Kang, Xiaojing Lu, Yan Wang, Hui Sun, Marcelo Gottschalk, Han Zheng, Jianguo Xu, Zongfu Wu*. Streptococcus suis serotype 5: Emerging zoonotic threat with distinct genomic heterogeneity. Virulence, 2025, 16(1): 2523882*

6. Zijing Liang, Shuoyue Wang, Xinchi Zhu, Jiale Ma, Huochun Yao, Zongfu Wu. A small RNA from Streptococcus suis epidemic ST7 strain promotes bacterial survival in host blood and brain by enhancing oxidative stress resistance. Virulence, 2025, 16(1): 2491635*

7. Shuoyue Wang, Xinchun Li, Chenxu Zheng, Juan J Quereda, Jie Sun, Huochun Yao, Zongfu Wu. Genomic characteristics and antimicrobial resistance of the underreported zoonotic pathogen Streptococcus pasteurianus and its co-colonization with Streptococcus suis. Veterinary Microbiology, 2025, 303: 110428*

8. Zijing Liang, Jiaxuan Lu, Yinli Bao, Xiang Chen, Huochun Yao, Zongfu Wu. Glycerol metabolic repressor GlpR contributes to Streptococcus suis oxidative stress resistance and virulence. Microbes and Infection. 2025, 27(1): 105307*

9. Jinlu Zhu, Zeren Peng, Hongkun Zhuang, Jie Sun, Zongfu Wu. A multiplex PCR method for identification of virulent strains of Streptococcus suis serotype 4[J]. Acta Microbiologica Sinica, 2025, 65(8): 3782-3793.*

10. Jianan Liu, Xinming Pan, Wanxia Pu, Pei Li, Caiying Li, Zhen Zhang, Huochun Yao, Yinchu Zhu, Jiale Ma. Engineered Streptococcus suis Bacterial Ghosts via Lytic

Plasmid and Cell-Penetrating Peptides for Enhanced Protective Immunity. Advanced Healthcare Materials. 2025: e03790.

b) International conferences:

1
Prof. Zongfu Wu was invited for an oral presentation: September 5 2025, University of Cambridge, United Kingdom, the 6th International Symposium on Streptococcus suis, Streptococcus suis OseR, a redox sensor, regulates ergothioneine uptake via a Cys thiol switch, enhancing oxidative stress resistance and virulence

c) National conferences:

2
Streptococcosis in Swine and Detection of Its Causative Agent – Sixth International Conference on Veterinary Testing and Diagnostics – Zongfu Wu – 15 June 2025

Prevention and Control of Swine Streptococcosis – Zongfu Wu – Shandong Provincial Animal Disease Prevention and Control Center – 5 June 2025

d) Other (Provide website address or link to appropriate information):

TOR7: SCIENTIFIC AND TECHNICAL TRAINING

17. Did your laboratory provide scientific and technical training to laboratory personnel from other WOAH Members?

Yes

a) Technical visit : 0

b) Seminars : 1

c) Hands-on training courses: 0

d) Internships (>1 month) 0

Type of technical training provided (a, b, c or d)	Country of origin of the expert(s) provided with training	No. participants from the corresponding country
B	CHINA (PEOPLE'S REP. OF)	13

TOR8: QUALITY ASSURANCE

18. Does your laboratory have a Quality Management System?

Yes

Quality management system adopted	Certificate scan (PDF, JPG, PNG format)	
ISO/ICE 17025	Accreditation certificate 2025	Accreditation certificate 2025.pdf

19. Is your quality management system accredited?

Yes

Test for which your laboratory is accredited	Accreditation body
PCR detection for Streptococcus suis serotype 2	China National Accreditation Service for Conformity Assessment (CNAS)
qPCR detection for Streptococcus suis serotype 2	China National Accreditation Service for Conformity Assessment (CNAS)

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

Yes

The laboratory activities are carries out according to Biosecurity Law of the People's Republic of China.

TOR9: SCIENTIFIC MEETINGS

21. Did your laboratory organise scientific meetings related to the pathogen in question on behalf of WOAH?

No

22. Did your laboratory participate in scientific meetings related to the pathogen in question on behalf of WOAH?

No

TOR10: NETWORK WITH WOAH REFERENCE LABORATORIES

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

Not applicable (only WOAH Reference Laboratory designated for the disease

24. Are you a member of a network of WOAH Reference Laboratories designated for the same pathogen?

Not applicable (only WOAH Reference Laboratory designated for the disease

25. Did you organise or participate in inter-laboratory proficiency tests with WOAH Reference Laboratories designated for the same pathogen during the past 2 years?

Not applicable (Only WOAH Reference Laboratory designated for the disease)

Not applicable

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

Not applicable (only WOAH Reference Laboratory designated for the disease

TOR11: OTHER INTERLABORATORY PROFICIENCY TESTING

27. Did your laboratory organise or participate in inter-laboratory proficiency tests with laboratories other than WOAH Reference Laboratories for the same pathogen during the past 2 years?

Yes

Purpose for inter-laboratory test comparisons1	Role of your reference laboratory (organizer/participant)	No. participating laboratories	Name of the test	WOAH Member Countries
Checking the laboratory capability to conduct diagnostic tests	participant	2	qPCR detection for Streptococcus suis serotype 2	CHINA (PEOPLE'S REP. OF),

TOR12: EXPERT CONSULTANTS

28. Did your laboratory place expert consultants at the disposal of WOAH?

No

29. Additional comments regarding your report:

No