

OIE Reference Laboratory Reports Activities

Activities in 2019

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Name of disease (or topic) for which you are a designated OIE Reference Laboratory:	Foot and mouth disease
Address of laboratory:	177, Hyeoksin 8-ro Gimcheon-si Gyeongsangbuk-do, 39660 KOREA (REP. OF)
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Name (including Title) of Head of Laboratory (Responsible Official):	Park, BongKyun Commissioner of Animal and Plant Quarantine Agency(APQA)
Name (including Title and Position) of OIE Reference Expert:	Jong-Hyeon Park
Which of the following defines your laboratory? Check all that apply:	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
FMD Ab tests (SP)	Yes	1939	0
FMD Ab tests (NSP)	Yes	2128	0
Direct diagnostic tests		Nationally	Internationally
Realtime RT-PCR	Yes	1461	0
Antigen ELISA	Yes	3	0
VP1 gene sequencing(genotype)	Yes	5	0
Virus isolation	Yes	5	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
VDRD FMDV 3Diff/PAN Rapid kit	FMDV Rapid kits for Pan, serotype O, A or Asia1	MedianDiagnositcs/APQA	550tests	50tests	LBVD, Myanmar	<input type="checkbox"/> Africa <input type="checkbox"/> Americ as <input checked="" type="checkbox"/> Asia and Pacific <input type="checkbox"/> Europe <input type="checkbox"/> Middle East
VDpro FMDV SP-O ELISA	FMD Ab tests(SP)	MedianDiagnositcs/APQA	0	400tests	LBVD, Myanmar	<input type="checkbox"/> Africa <input type="checkbox"/> Americ as <input checked="" type="checkbox"/> Asia and Pacific <input type="checkbox"/> Europe <input type="checkbox"/> Middle East
VDpro FMDV NSP-3AB ELISA	FMD Ab tests(NSP)	MedianDiagnositcs/APQA	0	400tests	LBVD, Myanmar	<input type="checkbox"/> Africa <input type="checkbox"/> Americ as <input checked="" type="checkbox"/> Asia and Pacific <input type="checkbox"/> Europe <input type="checkbox"/> Middle East
BIONOTE FMDV NSP-3ABC ELISA	FMD Ab tests(NSP)	Bionote/APQA	0	400tests	LBVD, Myanmar	<input type="checkbox"/> Africa <input type="checkbox"/> Americ as <input checked="" 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?

Yes

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

No

Name of the new test or diagnostic method or vaccine developed	Description and References (Publication, website, etc.)
Bionote FMD type O Ab ELISA	Antibody ELISA for the detection of antibodies against serotype O FMDV and in Preparation for publication
VDPro FMDV type O Ab b-ELISA	Antibody ELISA for the detection of antibodies against serotype O FMDV and in Preparation for publication
VDRD FMDV 3Diff/PAN ELISA kit	FMDV ELISA kits for serotype differentiation(O, A and Asia1) and in Preparation for publication

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?

Yes

Name of the OIE Member Country receiving a technical consultancy	Purpose	How the advice was provided
MONGOLIA	Training on FMD Diagnosis	The 7th workshop on Diagnosis of Animal Disease supported by OIE Reference laboratories
PHILIPPINES	Training on FMD Diagnosis	The 7th workshop on Diagnosis of Animal Disease supported by OIE Reference laboratories
MALAYSIA	Training on FMD Diagnosis	The 7th workshop on Diagnosis of Animal Disease supported by OIE Reference laboratories
KAZAKHSTAN	Training on FMD Diagnosis	The 7th workshop on Diagnosis of Animal Disease supported by OIE Reference laboratories
MYANMAR	Training and consultant on FMD Diagnosis and	KOICA global training project(Apr, 2019)

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
Comparative studies for avian influenza virus and FMD virus between Korea and Vietnam	10years(2015-2024)	To carry out the joint research project(Title : Comparative studies of Avian influenza virus and FMDV between Korea and Vietnam)	NCVD (National Center for Veterinary Diagnosis, Department of Animal Health, Hanoi, Vietnam)	VIETNAM
Comparative studies for avian influenza virus and FMD virus between Korea and Cambodia	5 years(2018-2022)	To carry out the joint research project(Title : comparative studies of Avian influenza virus and FMDV between Korea and Cambodia)	NAHPRI (National Animal Health and Production Research Institute, Phnom Penh, Cambodia)	CAMBODIA
Comparative studies for avian influenza virus and FMD virus between Korea and LAO PDR	5 years(2018-2022)	To carry out the joint research project(Title : comparative studies of Avian influenza virus and FMDV between Korea and LAO PDR)	AHL (National Animal Health Laboratory, Vientiane, LAO PDR)	LAOS
Surveillance and Diagnosis Development of Foot-and-Mouth Disease in Myanmar	3 years(2018-2020)	To transfer FMD control and diagnostic technique in Myanmar(KOICA Global training project)	FMD BL2 Lab, LBVD, Nay Pai Taw Myanmar	MYANMAR
Collaborative validation studies of solid phase competitive enzyme-linked immunosorbent assay and rapid detection kits for antibodies to NSPs for FMDV	2years(2019-2020)	To carry out the joint research project(Title : Collaborative validation studies of solid phase competitive enzyme-linked immunosorbent assay and rapid detection kits for antibodies to NSPs for FMDV)	NCFAD, Canada (FAO FMD Lab.)	CANADA

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:
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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:
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**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: 16

1. Lee MJ, Jo H, Shin SH, Kim SM, Kim B, Shim HS, Park JH. Mincle and STING-Stimulating Aduvants Elicit Robust Cellular Immunity and Drive Long-Lasting Memory Responses in a foot-and-mouth disease vaccine. *Front Immunol.* 2019. 10:2509.
2. Taeseong Kim, Jan-Kwan Hong, Jae-Ku Oem, Kwang-Nyeong Lee, Hyang-Sim Lee, Yong Joo Kim, Soyeon Ryoo, Young-Joon Ko, Jong-Hyeon Park, Jida Choi, Seung Heon Lee, Hye Jun Jo, Myoung-Heon Lee, Byoungan Kim, Jaejo Kim. Cross-protective efficacy of the O1 Manisa + O 3039 bivalent vaccine and the O 3039 monovalent vaccine against heterologous challenge with FMDV O/Jincheon/SKR/2014 in pig. *Vaccine*, 2019, 37(12);1702-9.
3. Jaejo Kim, Taeseong Kim, Jan-Kwan Hong, Hyang-Sim Lee, Kwang-Nyeong Lee, Hye Jun Jo, Jieun Choi, Jida Choi, Seung Heon Lee, , Byoungan Kim, Jong-Hyeon Park. The interference effect of maternally-derived antibodies on the serological performance of pigs immunized with a foot-and-mouth oil emulsion vaccine. *Vaccine* 2019(published online 28 Dec 2019).
4. Hyunji Lee, JinJu Nah, SoyeonRyoo, Taeseong Kim, Sumee Lee, Semin Jung,Jinwoo Lee, Hye-jin Park, Byeong-suk Ha, Jung-won Lee, Tho Dang Nguyen,LongThanh TO, SungHwanWee, BokkyungKu. Complete genome sequence of O/VN1/2014, a foot-and-mouth disease virus of serotype O isolated in Vietnam in 2014. *Microbiology Resource Annoucement.* 8(6) e01343-18
5. Jin-Woo Lee, Sumee Lee, Jin-Ju Nah, Soyeon Ryoo, Moon-Kyun Shin, Taeseong Kim, Byeong-Suk Ha, Hyun-Ji Lee, Hye-Jin Park, Jeong-Won Lee, Semin Jung,Sung-Hwan Wee, Bok-Kyung Ku* Developing Peptide Nucleic Acid based Multiplex real time RT-PCR to detect Foot-and-Mouth-Disease Virus Serotype A. *Korean J Vet Serv*, 2019, 42(1), 31-37
6. Byeong-Suk Ha, Taeseong Kim, Jin-Woo Lee, Hyun-Ji Lee, Sumee Lee, Hye-Jin Park, Jin-Ju Nah, Soyeon Ryoo, Moon-Kyun Shin, Jae-Won Byun, Mi-Young Park,Hyun-Mi Pyo, Sung-Hwan Wee, Yi-Hyun Nam, Seung-Yoon Lee, Bok-Kyung Ku, Application of cotton rope to detect foot-and-mouth disease virus in the pigs of farms in which nonstructural protein (NSP) antibody were detected in 2016.*Korean J Vet Serv*, 2019, 42(1), 25-29
7. Kim H, Kim AY, Kim JS, Lee JM, Lee HY, Cheong KM, Kim B, Park CK, Ko YJ. A simple and rapid assay to evaluate purity of foot-and-mouth disease vaccine before animal experimentation. *Vaccine*, 2019, 37(29):3825-3831.
8. Kim H, Kim AY, Kim JS, Lee JM, Kwon M, Bae S, Kim B, Park JW, Park CK, Ko YJ. Determination of the optimal method for the concentration and purification of 146S particles for foot-and-mouth disease vaccine production. *Journal of Virological Methods*, 2019, 269:26-29.
9. Hwang JH, Lee KN, Kim SM, Lee G, Moon Y, Kim B, Lee JS, Park JH. Needless intradermal vaccination for foot-and-mouth disease induced granuloma-free effective protection in pigs. *J Vet Sci.* 2019. 20(3):e29.
10. Ko MK, Jo HE, Choi JH, You SH, Shin SH, Jo H, Lee MJ, Kim SM, Kim B, Park JH. Chimeric vaccine strain of type O foot-and-mouth disease elicits a strong immune response in pigs against ME-SA and SEA topo types. *Vet Microbiol.* 2019. 229:124-129.
11. KW Lee, KN Lee, HS Lillehoj, JH Park. Serum concentration of acute phase proteins and cytokines in vaccinated pigs challenged with foot-and-mouth disease virus serotype O. *R. Bras. Zootec.* 2019. 48:e20180190.
12. You SH, Jo HE, Choi JH, Ko MK, Shin SH, Lee MJ, Kim SM, Kim B, Park JH. Evaluation of novel inactivated vaccine for type C foot-and-mouth disease in cattle and pigs. *Vet Microbiol.* 2019. 234:44-50.

13. Choi JH, Ko MK, Shin SH, You SH, Jo HE, Jo H, Lee MJ, Kim SM, Lee JS, Kim B, Park JH. Improved foot-and-mouth disease vaccine, O TWN-R, protects pigs against SEA topotype virus occurred in South Korea. *Vet Microbiol.* 2019. 236:108374.
14. Jo HE, Ko MK, Choi JH, Shin SH, Jo H, You SH, Lee MJ, Kim SM, Kim B, Park JH. New foot-and-mouth disease vaccine, O JC-R, induce complete protection to pigs against SEA topotype viruses occurred in South Korea, 2014-2015. *J Vet Sci.* 2019. 20(4):e42.
15. Ko MK, Jo HE, Choi JH, You SH, Shin SH, Jo H, Lee MJ, Kim SM, Kim B, Park JH. Improved foot-and-mouth disease vaccine with O PanAsia-2 strain protect pigs against O/Jincheon/SKR/2014 originated from South Korea. *Vaccine.* 2019. Pii: S0264-410X(19)31554-3.
16. Jo HE, You SH, Choi JH, Ko MK, Shin SH, Song J, Jo H, Lee MJ, Kim SM, Kim B, Park JH. Evaluation of novel inactivated vaccines for the SAT 1, SAT 2 and SAT 3 serotypes of foot-and-mouth disease in pigs. *Virologia.* 2019. 16(1):156.
- b) International conferences: 48
1. Ku Bok Kyung, Lee Jeongwon, Ryoo Soyoon, Nah Jin Ju, Lee Hyun-ji, Lee Dong Sook, Kim Taeseong, Park Hye-jin, Lee Sumee, Jeong Semin, Kil Keun Young, Choi Kang Seuk ENZYME-LINKED IMMUNOSORBENT ASSAY (ELISA) for the detection of antigen against Foot-and-mouth disease virus, GFRA, 2019
 2. Bok-kyung Ku, Jin-ju Nah, Soyoon Ryoo, Jung-won Lee, Hyun-ji Lee, Teaseong Kim, Hey-jin Park, Dong-sook Lee, Sung-hwan Wee, Kang-seuk Choi., Field application of developed 3Diff- Rapid kit for the detection of FMDV, APVS, 2019
 3. Soyoon Ryoo, Jin-ju Nah, Hyun-ji Lee, Dong-sook Lee, Nguyen Dang Tho, Thanh Long To, Bounlom Douangngeun, Watthana Theppangna, Teaseong Kim, Hye-jin Park, Jeong-won Lee, Sumee Lee, Sung-hwan Wee, Kang-seuk Choi, Bok-kyung Ku., Phylogenetic analysis of the foot-and-mouth disease virus O/ME-SA/Ind2001 in Laos, Vietnam, Myanmar and South Korea, APVS, 2019
 4. Dong-sook Lee, Jin-ju Nah, Hyun-ji Lee, Soyoon Ryoo, Nguyen Dang Tho, Thanh Long To, Bounlom Douangngeun, Watthana Theppangna, Teaseong Kim, Hye-jin Park, Jeong-won Lee, Sung-hwan Wee, Kang-seuk Choi, Bok-kyung Ku., Comparative genetic analysis of the recent foot-and-mouth disease virus O/SEA/Mya98 in Vietnam, LAO, and South Korea, APVS, 2019
 5. Ryoo Soyoon, Lee Dong Sook, Nah Jin Ju, Park Hye-jin, Lee Hyun-ji, Kim Taeseong, Lee Sumee, Lee Jeongwon, Jeong Semin, Kil Keun Young, Choi Kang Seuk, Ku Bok Kyung., Molecular epidemiology of Foot-and-mouth disease virus type O isolated in South Korea between 2010 and 2014 epizootic, GFRA, 2019
 6. Hyun-ji Lee, Jin-Ju Nah, So-Yoon Ryoo, Tae-Seong Kim, Hye-Jin Park, Jeong-Won Lee, Su-Mee Lee, Se-Min Jung, Sung-Hwan Wee, Kang-Seok Choi, Bok-Kyung Ku, Monitoring of the mutation in 3D and IRES genomes for foot-and-mouth disease diagnosis, APVS, 2019
 7. Jae-Won Byun, Mi-Young Park, Hyun Mi Pyo, Youjin Han, Hyeonjun Lyuk, Gang Seuk Choi., Experimental infection of Foot and Mouth Disease Asia 1 Sindh-08 in conventional pigs 2019APVS
 8. Heeyeon Kim, Youjin Han, Mi-Young Park, Hyun Mi Pyo, Hyeonjun Lyuk, Gang Seuk Choi, Jae-Won Byun., Antibody positive rates following national emergency vaccination in pig farm in 2019 2019APVS
 9. Youjin Han, Hyun Mi Pyo, Kang-seok Choi, Jae-Won Byun, Rokeya Pervin, Heeyeon Kim, Hyeonjun Lyuk, Chang-Yeop Lee and Mi-Young Park., Comparative evaluation of Current Serological test of Foot and Mouth Disease Vaccine Immunity in Pigs. APVS 2019 Busan
 10. Rokeya Pervin, Hyun Mi Pyo, Jae-Won Byun, Chang-Yeop Lee and Mi-Young Park., Improvement of serological diagnosis for the detection of antibody to the Non-Structural Proteins of Foot and Mouth Disease Virus In cattle, APVS 2019 Busan
 11. Mi-Young Park, Hyun Mi Pyo, Kang-seok Choi, Rokeya Pervin, Heeyeon Kim, hyeonwoo Hwang, Junseong Lim, Hyoyun Nam, Hyeonjun Lyuk, Chang-Yeop Lee and Jae-Won Byun., Investigation of vaccine-induced effects in pigs vaccinated and subsequently challenged with foot and mouth disease virus. APVS 2019 Busan
 12. Changyeop Lee, Hyun Mi Pyo, Jae-Won Byun and Mi-Young Park., Sero-surveillance of foot and mouth disease in

wild boars in korea. GFRA 2019 Bangkok

13. Mi-Young Park, Hyun Mi Pyo, Jae-Won Byun, Chang yeop Lee, Gang Seuk Choi, Youjin Han, Rokeya Pervin, Heeyeon Kim, Hyeonjun Lyuk and JinWook Jang., Comparative analytical sensitivity of seven commercial nsp-elisas with six reference sera for the detection of antibodies to foot and mouth disease virus nonstructural proteins. GFRA 2019 Bangkok

14. Jae-Won Byun, JinWook Jang, Hyun Mi Pyo, Chang yeop Lee, Rokeya Pervin, Gang Suk Choi and Mi-Young Park., Comparative evaluation of commercial NSP-ELISAS and immuno-blotting assay for foot and mouth disease surveillance to support the control program in korea. GFRA 2019 Bangkok

15. Hyun Mi Pyo, Mi-Young Park, Jae-Won Byun, Hee-Yeon Kim, Youjin Han, Jung-Eun Park, Hyeonjun Lyuk, Rokeya Pervin, Chang yeop Lee, Kang Seuk Choi., Foot-and-mouth disease virus infection in goats. GFRA 2019 Bangkok

16. Mi-Young Park, Rokeya Pervin, Hyeonjun Lyuk, Chang-Yeop Lee, Hyun Mi Pyo, Jae-Won Byun, Kang Seuk Choi and Jinwook Jang., Simultaneous profiling of serological immune response against five non-structural proteins of foot-and-mouth disease virus (FMDV) in experimentally infected pigs by a multiplexed immunoblotting assay American Society for Viology

17. Serological Responses in Repeatedly Vaccinated Animals against Foot and Mouth Disease Virus with Four Commercial Non Structural Protein Assays Jinwook Jang, Rokeya Pervin, Hyeonjun Lyuk, Chang-Yeop Lee, Hyun Mi Pyo, Jae-Won Byun, Kang Seuk Choi and Mi-Young Park American Society for Viology

18. Ah-Young Kim, Hyejin Kim, Sun Young Park, Sang Hyun Park, Jung-Min Lee, Jae-Seok Kim, Byoungan Kim, Young-Joon Ko., Production and preservation of intact vaccine antigen from a local strain of foot-and-mouth disease virus, Positive Strand RNA Virus Conference, 2019.

19. Ah-Young Kim, Hyejin Kim, Sun Young Park, Sang Hyun Park, Jae-Seok Kim, Jung-Min Lee, Byoungan Kim, and Young-Joon Ko., Strategies to prevent antigen loss during FMD vaccine production and storage, APVS, 2019

20. Sun Young Park, Jung-Min Lee, Hyejin Kim, Jae-Seok Kim, Ah-Young Kim, Sang Hyun Park, Byoungan Kim, Choi-Kyu Park, Young-Joon Ko., Concentration of foot-and-mouth disease virus (FMDV) by tangential-flow ultrafiltration to produce FMD vaccine antigen, APVS, 2019

21. Jung-Min Lee, Sun Young Park, Hyejin Kim, Jae-Seok Kim, Ah-Young Kim, Sang Hyun Park, Byoungan Kim, Choi-Kyu Park, Young-Joon Ko., Separation of foot-and-mouth disease virus and non-structural protein using a hydrophobic interaction chromatography, APVS, 2019

22. Hyejin Kim, Ah-Young Kim, Jae-Seok Kim, Jung-Min Lee, Hye-Young Lee, Kwang-Myun Cheong, Byoungan Kim, Choi-Kyu Park and Young-Joon Ko., A Lateral Flow Assay for testing Nonstructural Protein Content in Foot-and-mouth disease Vaccine, APVS, 2019

23. Hyejin Kim, Ah-Young Kim, Jae-Seok Kim, Jung-Min Lee, Minhee Kwon, Soohyun Bae , Byoungan Kim, Jung-Won Park, Choi-Kyu Park and Young-Joon Ko., Methodological comparison for concentration and purification of foot-and-mouth disease vaccine antigen, APVS, 2019

24. Jae-Seok Kim, Sang Hyun Park, Hyejin Kim, Jung-Min Lee, Ah-Young Kim, Sun Young Park, Byoungan Kim, and Young-Joon Ko., Optimal conditions for foot-and-mouth disease virus production in pilot-scale, APVS, 2019

25. Sun Young Park, Jung-min Lee, Hyejin Kim, Jae-Seok Kim, Ah-Young Kim, Sang Hyun Park, Jong-Hyeon Park and Young-Joon Ko., Efficient chromatographic method for NSP removal in the process of foot-and-mouth disease vaccine production, Vaccine Congress, 2019

26. Sang Hyun Park, Jae-Seok Kim, Ah-Young Kim, Sun young Park, Hyejin Kim, Jung-Min Lee, Sung-Han Park, Jida Choi, Jaejo Kim, Jong-Hyeon Park, Young-Joon Ko., Comparison of the optimal culture conditions of serotype O foot-and-mouth disease virus for vaccine production in a pilot-scale, GFRA, 2019

27. YuRan Han, Jong-Hyeon Park, Sung-han Park., Evolutionary phylodynamics of foot-and-mouth disease virus serotypes O circulating in 2006-2017, APVS, 2019

28. YuRan Han, HoYoung Kwak, Jong-Hyeon Park, Sung-han Park., Intradermal immunization by inactivated Foot-and-Mouth disease virus antigen using mice., APVS, 2019

29. YuRan Han, Jaejo Kim, Jida Choi, SangHyun Park, Jong-Hyeon Park, Sung-han Park., Comparison Between Intramuscularly and Intradermal Immunization using Inactivated Foot-and-Mouth Disease Virus Antigen in Guinea Pig., GFRA, 2019
30. Jaejo Kim, Jida Choi, Jieun Choi, Seung Heon Lee, Sung-Han Park, Sang Hyun Park, Jong-Hyeon Park. Correlative analysis between serological titration and protection against challenge with serotype O foot-and-mouth disease virus in pigs vaccinated with serotype O vaccine. GFRA2019.
31. Jida Choi, Jaejo Kim, Jieun Choi, Seung Heon Lee, Sung-Han Park, Sang Hyun Park, Jong-Hyeon Park. Establishment and validation of a liquid-phase blocking ELISA based on foot-and-mouth disease virus O/Jincheon/SKR/2014 for sero-monitoring. GFRA2019.
32. Jieun Choi, Hye jun Jo, Seung Heon Lee, Jida Choi, Byoungan Kim, and Jaejo Kim. In vivo heterologous efficacy of the O1 Manisa + O 3039 bivalent vaccine and the O 3039 monovalent vaccine pigs. ASM microbe 2019.
33. Hye jun Jo, Jieun Choi, Seung Heon Lee, Jida Choi, Byoungan Kim, and Jaejo Kim. Stabilizing Effect of Candidate Buffer Formulations on Dissociation of Intact Foot-and-Mouth Disease Particle (146S) during Storage. ASM microbe 2019.
34. Yoojin Jeon, Jieun Choi, Hye jun Jo, Seung Heon Lee, Jida Choi, Byoungan Kim, and Jaejo Kim. Development of a liquid-phase blocking ELISA based on FMD virus O/Jincheon/SKR/2014 for the use of post-vaccination sero-surveillance. 2019 APVS
35. Jaejo Kim, Hye jun Jo, Jieun Choi, Seung Heon Lee, Jida Choi, and Byoungan Kim. Evaluation of protective immunity against serotype O FMD virus in pigs vaccinated with double oil based emulsion FMD serotype O vaccine. 2019 APVS
36. Jong-Hyeon Park. FMD-related Activities in 2019 of Animal and Plant Quarantine Agency (APQA), Republic of Korea. OIE/FAO FMD Reference Laboratory Network (2019.12.4.) *Oral presentation
37. Jong-Hyeon Park. Improved vaccine for foot-and-mouth disease eradication. 2019 GFRA. (2019.10.29.) *Oral presentation
38. SM Kim, JH Park, GM Lee, JH Hwang, M Lee, B Kim. Foot-and-mouth disease vaccine development using O/SKR/Boeun/2017 classified to O/ME-SA/Ind-2001 lineage. 13rd Vaccine Congress. (2019.9.15.-18.)
39. SM Kim, JH Park, GM Lee, JH Hwang, M Lee, B Kim. Sucrose(3%) acts as a thermo-stabilizer for cell-adapted foot-and-mouth disease virus without negatively affecting virus growth. 13rd Vaccine Congress. (2019.9.15.-18.)
40. Hye-Eun Jo, Mi-Kyeong Ko, Joo-Hyung Choi, Sung Ho Shin, Hyundong Jo, Su-Hwa You, Min Ja Lee, Su-Mi Kim, Byoungan Kim, Jong-Hyeon Park. Type O foot-and-mouth disease vaccine, O JC-R, induce complete protection against SEA topotype viruses occurred in South Korea. APVS 2019. (2019.08.25-28)
41. Joo-Hyung Choi, Min-Ja Lee, Su-Hwa You, Mi-Kyeong Ko, Hye Eun Jo, Sung Ho Shin, Hyundong Jo, Su-Mi Kim, Byoungan Kim, Jong-Hyeon Park. Enhanced immunity and safety of foot and mouth disease vaccine with supplementary components. APVS 2019. (2019.08.25-28)
42. Mi-Kyeong Ko, Hye-Eun Jo, Joo-Hyung Choi, Su-Hwa You, Sung-Ho Shin, Ji-Soo Song, Hyun-Dong Jo, Min Ja Lee, Su-Mi Kim, Byoungan Kim, Jong-Hyeon Park. Improved foot-and-mouth disease vaccine with O PanAsia-2 strain protect pigs
43. against O/Jincheon/SKR/2014 originated from South Korea. APVS 2019. (2019.08.25-28)
44. Min Ja Lee, Hyundong Jo, Mi-Kyeong Ko, Su-Hwa You, Joo-Hyung Choi, Kwang-Nyeong Lee, Su-Mi Kim, Byoungan Kim, Jong-Hyeon Park. Interleukin (IL)-23 Signaling in Dendritic cells and Macrophages is a Key Immune Modulator of Foot-and-Mouth Disease Infection. APVS 2019. (2019.08.25-28)
45. Hyundong Jo, Sung Ho Shin, Su-Mi Kim, Byoungan Kim, Hang Sub Shim, Jong-Hyeon Park, Min Ja Lee. Mincle and STING-Stimulating Adjuvants Elicit Robust Cellular Immunity and Drive Long-Lasting Memory Responses in a Foot-and-Mouth Disease Vaccine. APVS 2019. (2019.08.25-28)
46. Su-Mi Kim, Ji-Hyeon Hwang, Gyeong-Min Lee, Jong-Hyeon Park, Min Ja Lee, and Byoungan Kim. Foot-and-mouth disease vaccine development using A/SKR/YC/2017 classified to A/ASIA/Sea-97 topotype. APVS 2019.

(2019.08.25-28)

47. Jong-Hyeon Park. Current Research for Eradication of Foot and Mouth Disease in Korea. KMB (The Korean Society for Microbiology and Biothchnology) 2019, 46th Annual Meeting & International Symposium. (2019.0.6.24.) *Oral presentation.

48. Min Ja Lee, Hyundong Jo, Mi-Kyeong Ko, Joo-Hyung Choi, Su-Mi Kim, Byoungan Kim, Hang-Sub Shim and Jong-Hyeon Park. Fundamental Differences in Foot-and-Mouth Disease Virus (FMDV) Antigen-Mediated Cellular Immune Response between Porcine and Bovine Immune Cells. Keystone Symphosia, '19 Positive-Strand RNA. (2019.06.11.)

c) National conferences: 7

1. Jieun Choi, Hye jun Jo, Seung Heon Lee, Jida Choi, Jaejo Kim, and Byoungan Kim. Development of a liquid-phase blocking ELISA based on foot-and-mouth disease virus O/Jincheon/SKR/2014 for sero-monitoring vaccinated and infected animals. Conference for the Korean Society of Veterinary Science, 2019.

2. Hye jun Jo, Jieun Choi, Seung Heon Lee, Jida Choi, Jaejo Kim, and Byoungan Kim. Establishment of indirect assessment model for potency testing of serotype O foot-and mouth disease vaccine as an alternative to in vivo challenge test. Conference for the Korean Society of Veterinary Science, 2019.

3. Jong-Hyeon Park. Ideal vaccine for FMD eradication. KMB (The Korean Society for Microbiology and Biothchnology). (2019.12.20.)

4. Joo-Hyung Choi, Mi-Kyeong Ko, Sung Ho Shin, Su-Hwa You, Hye-Eun Jo, Hyundong Jo, Min Ja Lee, Su-Mi Kim, Jong-Soo Lee, Byoungan Kim, Jong-Hyeon Park. Improved foot-and mouth disease vaccine, O TWN-R, protects pigs against SEA topotype virus occurred in South Korea. (2019.05.17.)

5. Hye-Eun Jo, Su-Hwa You, Joo-Hyung Choi, Mi-Kyeong Ko, Sung Ho Shin, Hyundong Jo, Min Ja Lee, Su-Mi Kim, Byoungan Kim, Jong-Hyeon Park. Evaluation of vaccines for the SAT 1, SAT 2, and SAT 3 serotypes of Foot-and-Mouth Disease in pigs. (2019.05.17.)

6. Su-Hwa You, Hye-Eun Jo, Joo-Hyung Choi, Mi-Kyeong Ko, Sung Ho Shin, Min Ja Lee, Su-Mi Kim, Byoungan Kim, Jong-Hyeon Park. Evaluation of improved vaccine for type C Foot-and-Mouth Disease in cattle and pigs. (2019.05.17.)

7. Jong-Hyeon Park. Current FMD outbreaks and FMD vaccine. SVC. (2019.04.23.)

d) Other:

(Provide website address or link to appropriate information) 1

Monthly National sero-surveillance results for overall population immunity and prevalence of infection surveillance(in Korean, www.data.go.kr)

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?

Yes

a) Technical visits: 0

b) Seminars: 14

c) Hands-on training courses: 14

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	Myanmar(Management level at LBVD)	3
bc	Myanmar(Working level at LBVD)	3
bc	MONGOLIA	2
bc	PHILIPPINES	2
bc	MALAYSIA	2
bc	KAZAKHSTAN	2

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)
ISO/IEC 17025	20191111_KT372.pdf

16. Is your quality management system accredited?

Yes

Test for which your laboratory is accredited	Accreditation body
Antigen detection(Realtime RT-PCR, RT-PCR, Antigen ELISA)	KOLAS(Korean Laboratory Accrediation Scheme)
Antibody detection(SP ELISA, NSP ELISA)	KOLAS(Korean Laboratory Accrediation Scheme)

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?

Yes

National/ International	Title of event	Co-organiser	Date (mm/yy)	Location	No. Participants
International	OIE/FAO Reference Laboratory Network Annual Meeting	Pirbright	12/2019	Busan, Korea	50

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

Yes

Title of event	Date (mm/yy)	Location	Role (speaker, presenting poster, short communications)	Title of the work presented
Regional Expert Group Meeting on Foot and Mouth disease	05/2019	Bangkok, Thailand	Speaker	FMD Molecular 1. FMD clinical sample collection protocol 2. Diagnostic protocol in APQA, Korea
OIE/FAO Reference Laboratory Network Annual Meeting	12/2019	Busan, Korea	Speaker	FMD-related activities in 2019 of Animal and plant Quarantine Agency, Republic of Korea

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?

Yes

Purpose of the proficiency tests: ¹	Role of your Reference Laboratory (organiser/ participant)	No. participants	Participating OIE Ref. Labs/ organising OIE Ref. Lab.
FMD and SVD Proficiency Testing Scheme	Participant	1	The Pirbright Insitutue, UK

¹ validation of a diagnostic protocol: specify the test; quality control of vaccines: specify the vaccine type, etc.

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?

Not applicable (Only OIE Reference Lab. designated for disease)

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 ¹	No. participating laboratories	Region(s) of participating OIE Member Countries
National Proficiency test for Diagnosis of FMD	Twice a year(1st and 2nd : 46 Regional Animal Health Laboratories)	<input type="checkbox"/> Africa <input type="checkbox"/> Americas <input checked="" type="checkbox"/> Asia and Pacific <input 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?

No

25. Additional comments regarding your report:

