

科研成果

一、科研项目（见表1）

2016 至今，本团队承担竞争性项目（国家级&省市部级）共 49 项，留所经费达 2000 多万。

编号	项目名称	项目类别	主持人	项目周期
1	口蹄疫口服活载体疫苗制剂的研发	国家外专局引进国外技术、管理人才项目	郭慧琛	2016
2	Atg5-Atg12 自噬复合体对口蹄疫病毒复制影响的研究	中国博士后科学基金面上项目	郜原	2016-2017
3	猪 O/A 型口蹄疫广谱多表位双价疫苗和乳酸菌介导口蹄疫黏膜免疫疫苗的研制	甘肃省科技支撑计划项目	潘丽&邵军军	2016-2017
4	重大动物疫病快速筛查和防治技术的研发	兰州市科技发展计划项目	邵军军	2016-2018
5	口蹄疫疫苗免疫效果评估方法研究	“十三五”国家重点研发计划课题	潘丽	2016-2020
6	种畜场口蹄疫综合防控与净化技术集成	“十三五”国家重点研发计划课题	王永录	2016-2020
7	种畜场口蹄疫净化技术集成与示范	“十三五”国家重点研发计划项目	张永光	2016-2020
8	强制性免疫病防控	国家生猪产业体系项目	张永光	2016-2020
9	口蹄疫疫苗纳米佐剂的研发	国家外专局引进国外技术、管理人才项目	张韵	2017
10	口蹄疫病毒 3B 蛋白通过 VISA 蛋白调控宿主天然免疫反应的分子机制研究	国家自然科学基金青年基金项目	赵付荣	2017
11	口蹄疫病毒调控 CD59 表达时响应蛋白的筛选与功能分析	国家自然科学基金青年基金	魏衍全	2017-2019
12	基于稀土发光微球的免疫层析技术用于口蹄疫病毒抗体检测的研究	甘肃省科技计划（创新基地和人才计划）青年科技基金	茹嘉喜	2017-2019
13	miR-361 和 miR-34a 在口蹄疫病毒感染 PK15 细胞中的免疫调控作用研究	国家自然科学基金青年基金	郜原	2017-2019
14	猪流行性腹泻病毒变异株对仔猪致病性减弱的分子机制	国家自然科学基金青年基金项目	刘新生	2017-2019
15	口蹄疫病毒化学发光免疫与重要细菌病 POCT 诊断试剂盒的创制开发	甘肃省重点研发项目	赵付荣	2017-2019
16	仿生矿化优化口蹄疫病毒样颗粒耐热抗逆性研究	国家自然科学基金面上项目	郭慧琛	2017-2020
17	牛羊疫苗新型佐剂及工艺研究	“十三五”国家重点研发	郭慧琛	2017-2020

		计划课题		
18	重大跨境动物疫病防控新产品的合作创制与应用研究	“十三五”国家重点研发计划战略性国际科技创新合作重点专项子课题	李彦敏&孙世琪	2017-2020
19	区分免疫与感染的畜禽重大疫病标记疫苗创制	“十三五”国家重点研发计划子课题	刘在新&孙世琪	2017-2020
20	动物重大疫病新概念防控产品研发项目	“十三五”国家重点研发计划子课题	刘在新&潘丽	2017-2020
21	牛羊重大动物疫病基因工程疫苗及防控研究	“十三五”国家重点研发计划课题	常惠芸	2017-2020
22	战略性国际科技创新合作重点专项, 重大跨境动物疫病防控新产品的合作创制与应用研究	“十三五”国家重点研发计划子课题	李彦敏&常惠芸	2017-2020
23	ID1 (Inhibitor of DNA binding1)在口蹄疫病毒感染中作用机制的研究	国家自然科学基金面上项目	孙跃峰	2017-2020
24	猪繁殖与呼吸综合症分子诊断试剂盒研制	甘肃省特派员项目	张杰	2017-2020
25	边境地区家养动物外来口蹄疫监测溯源技术研究	“十三五”国家重点研发计划子课题	张杰	2017-2021
26	在中波农业科技中心框架下开展的重要动物疫病诊断技术交流与合作	农业农村部对外经济合作中心项目	张杰	2018
27	表达 Var2 株 S 基因的重组传染性支气管炎病毒的构建及其特性分析	中国-波兰科技合作委员会第 37 届例会交流项目	魏衍全	2018-2020
28	口蹄疫病毒样颗粒靶向树突状细胞的免疫优化及机制研究	国际科学自然基金国际(地区)合作与交流项目	郭慧琛	2018-2020
29	双重靶向 APCs 的载壳聚糖 PLGA 纳米微球增强黏膜免疫的分子机制	国家自然科学基金面上项目	潘丽	2018-2021
30	万人计划特殊支持	万人计划特殊支持	郭慧琛	2018-2022
31	“科技助力经济 2020”重点专项口蹄疫防控与净化技术的推广应用	国家科技专项	潘丽	2020-2021
32	寨卡病毒 VP1 蛋白 B 细胞表位和 T 细胞表位图谱的绘制	甘肃省自然基金	张中旺	2020-2022
33	热休克蛋白 HSP60 参与口蹄疫病毒形态发生的作用及其机制	国家自然科学基金面上项目	孙世琪	2021-2024
34	DEXD/H-box RNA 解旋酶介导 FMDV-IRES 依赖性翻译和复制及其在抗病毒免疫中的作用机制	国家自然科学基金青年基金项目	吴金恩	2020-2023
35	CD44 蛋白参与口蹄疫病毒巨胞饮方式入侵细胞的机制	国家自然科学基金面上项目	郭慧琛	2021-2024
36	口蹄疫仿生纳米颗粒诱导免疫应答的分子机制	甘肃省自然基金	刘伟	2021-2023
37	动物疫病综合防控关键技术研发与应	“十四五”国家重点研	孙世琪	2023-2026

	用	发计划课题		
38	猪口蹄疫 O 型多表位基因工程疫苗工艺创新及产业化	兰州市重大专项	邵军军	2021
39	口蹄疫病毒样颗粒疫苗的成果转化与应用	甘肃省科技重大专项	郭慧琛	2022-2023
40	新型生物制品质量控制技术及标准物质研究	“十四五”国家重点研发计划子课题	董虎	2022-2025
41	衣康酸抑制 NLRP3 炎性小体调控 O 型口蹄疫病毒复制的分子机制	甘肃省自然科学基金	丁耀忠	2022-2024
42	口蹄疫病毒拮抗 RALY 蛋白抑制 IRES 依赖性翻译的作用机制	甘肃省青年科技基金	吴金恩	2023-2025
43	含铝金属有机框架矿化提升病毒样颗粒疫苗热稳定性与免疫效果的机制	甘肃省在站博士后专项	滕志东	2023-2025
44	二氧化硅矿化提升口蹄疫病毒样颗粒疫苗热稳定性与免疫效果的机制	中国博士后科学基金面上项目	滕志东	2023-2025
45	提高 FMD VLPs 稳定性的 LFcIn 类多肽水凝胶佐剂的构建及作用机制研究	国家自然科学基金青年基金项目	周静静	2024-2026
46	基于 VLP 的非洲猪瘟多表位疫苗设计及其免疫机理研究	国家自然科学基金面上项目	邵军军	2023-2026
47	稳定优势动物病毒样颗粒疫苗的分子设计及产品创制	兰州市重大专项	郭慧琛	2023-2025
48	中国农业科学院兰州兽医研究所-埃塞俄比亚梅克尔大学兽医科学学院建立重大动物疫病预防与控制国际联合领域伙伴研究所交流项目	科技部国际合作司中国-非洲伙伴研究生交流项目	丁耀忠	2024-2025
49	草食家畜重大疫病疫苗研究	十四五国家重点研发计划课题	潘丽	2023-2027

表 1. 科研项目信息

二、获奖情况（见表 2）

序号	获奖名称	奖励类别	获奖时间
1	口蹄疫 A 型灭活疫苗	甘肃省专利二等奖	2016
2	牛羊等反刍动物口蹄疫 O、A 型双价灭活疫苗	甘肃省专利一等奖	2017
3	牛羊等反刍动物口蹄疫 O、A 型双价灭活疫苗	第二届中国专利银奖	2018
4	口蹄疫病毒样颗粒及制备方法和用途	甘肃省专利一等奖	2019
5	口蹄疫病毒样颗粒及制备方法和用途	甘肃省专利发明人奖	2020
6	口蹄疫病毒样颗粒及制备方法和用途	中国农业科学院成果转化奖	2020
7	口蹄疫病毒样颗粒及制备方法和用途	中国专利优秀奖	2022
8	病毒样颗粒关键技术平台及疫苗创制	中国农业科学院科技成果奖	2023

		(杰出科技创新奖)	
9	口蹄疫病毒样颗粒疫苗	中国农业农村重大科技新成果奖	2023

表 2. 获奖信息





三、新兽药情况（见表3）

类别	名称	证书号码	授权或批准部门
一类新兽药	猪口蹄疫O型病毒样颗粒疫苗	中华人民共和国农业农村部第471号公告新兽药证字57号	农业农村部 (2021.9.9)
一类新兽药	牛口蹄疫O型病毒样颗粒疫苗	中华人民共和国农业农村部第471号公告新兽药证字58号	农业农村部 (2021.9.9)
二类新兽药	口蹄疫O、A、Asia1型三价灭活疫苗工艺变更注册	中华人民共和国农业部第2550号公告	农业农村部 (2017.7.17)
二类新兽药	口蹄疫O、A、Asia1型三价灭活疫苗组分变更注册	中华人民共和国农业农村部第5号公告	农业农村部 (2018.4.4)



表3.新兽药情况

四、论文

2023年

序号	论文名称	期刊名称,年,卷(期):页	全部作者	影响因子
1	Poly(I:C) and CpG improve the assembly of foot-and-mouth disease virus-like particles and	Virology.2023,Feb;579:94-100	Liu H, Teng Z, Dong H, Li J, Waheed Abdullah S, Zhang Y, Wu J,	3.513

	immune response in mice		Guo H, Sun S.	
2	Local and systemic immune responses induced by intranasal immunization with biomineralized foot-and-mouth disease virus-like particles	Frontiers in Microbiology. 2023 ;14:1112641	Li S, Zhao R , Song H, Pan S, Zhang Y, Dong H, Bai M, Sun S, Guo H, Yin S	6.064
3	Advances and Breakthroughs in IRES-Directed Translation and Replication of Picornaviruses	mBio. 2023 Mar 20:e0035823	Abdullah SW, Wu J, Wang X, Guo H, Sun S	7.786
4	Identification of p72 epitopes of African swine fever virus and preliminary application	Front Microbiol.2023, 14:1126794.	Chun Miao, Sicheng Yang, Junjun Shao, Guangqing Zhou,Yunyun Ma, Shenghui Wen, Zhuo Hou, Decai Peng,HuiChen Guo,Wei Liu,and Huiyun Chang	6.064
5	Structure and function of African swine fever virus proteins: Current understanding	Front Microbiol. 2023,14: 1043129	Sicheng Yang,Chun Miao,Wei Liu,Guanglei Zhang, Junjun Shao,and Huiyun Chang	6.064
6	Difference of the pathogenicity and humoral immune status in Chinese virulent genotype GIIa and GIIb porcine epidemic diarrhea virus strain infected conventional one-and two-month-old weaned pigs.	Archives of Virology;2023,Feb 27;168(3):97.	Liping Zhang, Ruiming Yu, Zhongwang Zhang, Peng Zhou, Jianliang Lv, Yonglu Wang, Li Pan, Xinsheng Liu	2.685 /Q3
7	Recombinant human adenovirus type 5 based vaccine candidates against GIIa- and GIIb-genotype porcine epidemic diarrhea virus induces robust humoral and cellular response in mice	Virology;584 (2023) 9 – 23	Xin Miao, Liping Zhang, Peng Zhou, Zhongwang Zhang, Ruiming Yu, Jianliang Lv, Yonglu Wang, Huichen Guo, Li Pan, and Xinsheng Liu	3.513
8	Mucosal immune responses induced by oral administration of recombinant Lactococcus lactis expressing the S1 protein of PDCoV	Virology 578 (2023) 180 – 189	Kaige Zhai, Zhongwang Zhang, Xinsheng Liu, Jianliang Lv, Liping Zhang, Jiahao Li, Zhongyuan Ma, Yonglu Wang, Huichen Guo, Yongguang Zhang, Li Pan	3.513
9	Identification of B-cell epitopes on structural proteins VP1 and VP2 of Senecavirus A and development of a multi-epitope recombinant protein vaccine	Virology 582 (2023) 48 – 56	Zhongwang Zhang, Fei Yao, Jianliang Lv, Yaozhong Ding, Xinsheng Liu, Liping Zhang, Zhongyuan Ma, Peng Zhou, Yonglu Wang, Huichen Guo, Li Pan	3.513
10	Foot-and-mouth disease virus downregulates vacuolar protein sorting 28 to promote viral replication	J Virol.2023 June 11;JVI.00181-23	Xuefei Wang, Sahibzada Waheed Abdullah, Jin'en Wu, Jianli Tang, Yun Zhang, Hu Dong, Manyuan Bai, Sumin Wei, Shiqi Sun, Huichen Guo	6.549
11	Nicotinamide Efficiently Suppresses Porcine Epidemic Diarrhea Virus and Porcine	Viruses . 2023 Jul 21;15(7):1591.	Mingxia Li, Liping Zhang, Li Pan , Peng Zhou , Ruiming Yu ,	5.05

	Deltacoronavirus Replication		Zhongwang Zhang, Jianliang Lv , Huichen Guo, Yonglu Wang, Sa Xiao, and Xinsheng Liu	
12	Adenovirus-vectored PDCoV vaccines induce potent humoral and cellular immune responses in mice	Vaccine . 2023 Oct 26;41(45):6661-6671	Xin Miao , Liping Zhang , Peng Zhou , Ruiming Yu , Zhongwang Zhang , Cancan Wang , Huichen Guo, Yonglu Wang, Li Pan, Xinsheng Liu	5.5
13	Development and application of classical swine fever virus monoclonal antibodies derived from single B cells	Vet Res . 2023 Oct 16;54(1):90	Zhongyuan Ma, Yongcong Zhao, Jianliang Lv, Li Pan	5.6

2022 年

序号	论文名称	期刊名称,年,卷(期):页	全部作者	影响因子
1	The biomineralization of virus-like particles by metal-organic framework nanoparticles enhances the thermostability and immune responses of the vaccine	Journal of Materials Chemistry B. 2022 Apr 13;10(15):2853-2864	Zhidong Teng, Fengping Hou, Manyuan Bai, Jiajun Li, Jun Wang, Jinen Wu, Jiayi Ru, Mei Ren, Shiqi Sun, Huichen Guo	6.331
2	Flower-like mesoporous silica nanoparticles as an antigen delivery platform to promote systemic immune response	Nanomedicine. 2022 Feb 16;42:102541.	Hou F, Teng Z, Ru J, Liu H, Li J, Zhang Y, Sun S, Guo H.	5.307
3	Development of a competitive ELISA method based on VLPs detecting the antibodies of serotype A FMDV	J Virol Methods. 2022 Feb;300:114406.	Yun Zhang, Rui Wang, Manyuan Bai, Xuefei Wang, Hu Dong, Jiajun Li, Suyu Mu, Haisheng Miao, Jianling Song, Shiqi Sun, Huichen Guo	2.014
4	Establishment and application of a solid-phase blocking ELISA method for the detection of antibodies against classical swine fever virus	J Vet Sci . 2022 Sep;23(5):e32	Yuying Cao, Li Yuan, Shunli Yang, Youjun Shang, Bin Yang, Zhizhong Jing, Huichen Guo, shuanghui Yin	1.672
5	Antigenic and immunogenic properties of recombinant proteins consisting of two immunodominant African swine fever virus proteins fused with bacterial lipoprotein OprI	Viol J. 2022, 19(1):16.	Guanglei Zhang, Wei Liu, Zhan Gao, Yanyan Chang, Sicheng Yang, Qian Peng, Sudan Ge, Bijing Kang, Junjun Shao, Huiyun Chang	4.099
6	Global phosphoproteomics analysis of IBRS-2 cells infected with senecavirus A	Frontiers in Microbiology. 2022 Jan 26;13:832275.	Jieyi Li; Zhongwang Zhang; Jianliang Lv; Zhongyuan Ma; Li Pan; Yongguang Zhang.	5.64
7	Preparation of a polysaccharide adjuvant and its application in the production of a foot-and-mouth disease virus-like particles vaccine.	Biochemical Engineering Journal, 2022, 184:108479.	Yang K, Song H, Shi X, Ru J, Tan S, Teng Z, Dong H, Guo H, Wei F, Sun S.	4.446
8	Heat Shock Protein 60 Is Involved in Viral Replication Complex Formation and Facilitates	mBio. 2022 Oct 26;13(5):e0143422.	Tang J, Abdullah SW, Li P, Wu J, Pei C, Mu S, Wang Y, Sun S, Guo	7.786

	Foot and Mouth Viral Nonstructural Proteins 3A and 2C.		H.	
9	Development of an indirect ELISA using a novel linear epitope at the C-terminal region of the VP2 protein to specifically detect antibodies against Senecavirus A	Virology Journal (2022) 19:204	Zhongyuan Ma, Jianliang Lv, Zhongwang Zhang and Li Pan	5.913
10	Mucosal immune responses induced by oral administration of recombinant Lactococcus lactis expressing the S1 protein of PDCoV	Virology . 2023 Jan:578:180-189	Kaige zhai, Zhongwang zhang, Xinsheng liu, Jianliang lv, Liping zhang, Jiaohao li, Zhongyuan ma, Yonglu wang, Huichen guo, Yongguang zhang, Li pan	3.513

2021 年

序号	论文名称	期刊名称,年,卷(期):页	全部作者	影响因子
1	Structural and molecular basis for foot-and-mouth disease virus neutralization by two potent protective antibodies.	Protein Cell.2021(Pt 3)	Dong H, Liu P, Bai M, Wang K, Feng R, Zhu D, Sun Y, Mu S, Li H, Harmsen M, Sun S, Wang X, Guo H.	14.87
2	A heat-induced Mutation on VP1 of FMDV Serotype O Enhanced Capsid Stability and the Immunogenicity.	J Virol.2021 May 19;JVI.00177-21.	Dong H, Lu Y, Zhang Y, Mu S, Wang N, Du P, Zhi X, Wen X, Wang X, Sun S, Zhang Y, Guo H.	5.107
3	Bi-functional gold nanocages enhance specific immunological responses of foot-and-mouth disease virus-like particles vaccine as a carrier and adjuvant.	Nanomedicine-Nanotechno logy Biology and Medicine.2021 Apr;33:102358	Teng Z, Sun S, Luo X, Zhang Z, Seo H, Xu X, Huang J, Dong H, Mu S, Du P, Zhang Z, Guo H.	6.458
4	Nucleolin promotes IRES-driven translation of foot-and-mouth disease virus by supporting the assembly of translation initiation complexes	J Virol.2021 Jun 10;95(13):e0023821.	Han S, Wang X, Guan J, Wu J, Zhang Y, Li P, Liu Z, Abdullah SW, Zhang Z, Jin Y, Sun S, Guo H.	5.107
5	Ribosomal Protein L13 Participates in Innate Immune Response Induced by Foot-and-Mouth Disease Virus	Frontiers in Immunology. 2021 May 20;12:616402.	Junyong Guan, Shichong Han1, Jin'en Wu, Yun Zhang, Manyuan Bai,Sahibzada Waheed Abdullah, Shiqi Sun , Huichen Guo	7.561
6	Identification of a new cell-penetrating peptide derived from the african swine fever virus CD2v protein	Drug Deliv.2021 Dec;28(1):957-962.	Yang S, Zhang X, Cao Y, Li S, Shao J, Sun S, Guo H, Yin S.	6.419
7	Development and validation of a competitive ELISA based on virus-like particles of serotype Senecavirus A to detect serum antibodies.	AMB Express.2021 Jan 6;11(1):7.	Bai M, Wang R, Sun S, Zhang Y, Dong H, Guo H.	3.298
8	Four kinds of biomaterials improve thermostability and immunogenicity of foot-and-mouth disease virus-like particles vaccine Authors	Vaccines.2021, 9, 891	Mengnan Guo, Jiajun Li, Zhidong Teng, Mei Ren, Hu Dong, Yun Zhang, Jiayi Ru, Ping Du, Shiqi Sun, Huichen Guo	4.422

9	Sec62 regulates endoplasmic reticulum stress and autophagy balance to affect foot-and-mouth disease virus replication	Front. Cell. Infect. Microbiol. 2021,11:707107.	Jin'en Wu,Zhihui Zhan,Zhidong Teng,Sahibzada Waheed Abdullah1, Shiqi Sun,Huichen Guo,	5.293
10	DDX21, a host restriction factor of FMDV-IRES dependent translation and replication	Viruses 2021, 13, 1765.	Sahibzada Waheed Abdullah, Jin'en Wu, Yun Zhang, Manyuan Bai, Junyong Guan, Xiangtao Liu, Shiqi Sun , Huichen Guo	5.048
11	Evaluation of four commercial vaccines for the protection of piglets against the highly pathogenic Porcine Reproductive and Respiratory Syndrome Virus (hp-PRRSV) QH-08 strain	Vaccines.2021 .9.1020	Yaozhong Ding , Ashenafi Kiros Wubshet , Xiaolong Ding , Zhongwang Zhang, Qian Li, Junfei Dai, Qian Hou, Yonghao Hu , Jie Zhang	4.422
12	Immune Responses to Orally Administered Recombinant Lactococcus lactis Expressing Multi-Epitope Proteins Targeting M Cells of Foot-and-Mouth Disease Virus	Viruses 2021,13, 2036.	Fudong Zhang, Zhongwang Zhang, Xian Li, Jiahao Li, Jianliang Lv, Zhongyuan Ma, Li Pan	5.048
13	Development of an Indirect Chemiluminescence Immunoassay Using a Multi-epitope Recombinant Protein To Specifically Detect Antibodies against Foot-and-Mouth Disease Virus Serotype O in Swine	J Clin Microbiol. 2021 Feb 18;59(3):e02464-20.	Liu W, Shao J, Zhang G, Chang Y, Ge S, Sun Y, Gao Z, Chang H.	5.944
14	Development of an indirect ELISA to specifically detect antibodies against African swine fever virus: bioinformatics approaches	Virol J. 2021 May 5;18(1):97.	Gao Z, Shao JJ, Zhang GL, Ge SD, Chang YY, Xiao L, Chang HY.	4.091
15	Development of a competitive chemiluminescence immunoassay using a monoclonal antibody recognizing 3B of foot-and-mouth disease virus for the rapid detection of antibodies induced by FMDV infection.	Virol J.2021 Sep 26;18(1):193.	Wei Liu, Guanglei Zhang, Sicheng Yang, Junhui Li, Zhan Gao, Sudan Ge, Huihui Yang, Junjun Shao, Huiyun Chang	4.094

2020 年

序号	论文名称	期刊名称,年,卷(期):页	全部作者	影响因子
1	NLRP3 inflammasome activation by Foot-and-mouth disease virus infection mainly induced by viral RNA and non-structural protein 2B	RNA Biol.2020, 17(3): 335-349	Zhi, XY; Zhang, Y; Sun, SQ; Zhang, ZH; Dong, H.; Luo, X.; Wei, YQ; Lu, ZJ; Dou, YX; Wu, R; Jiang, ZF; Weng, CJ; Seo, HS; Guo, HC	5.477
2	Ribosomal Protein L13 Promotes IRES-Driven Translation of Foot-and-Mouth Disease Virus in a Helicase DDX3-Dependent Manner	J Virol. 2020, 94(2): e01679-19.	Han S, Sun S, Li P, Liu Q, Zhang Z, Dong H, Sun M, Wu W, Wang X, Guo H	4.324
3	The immune response to a recombinant Lactococcus lactis oral vaccine against foot-and-mouth disease virus in mice	Biotechnol Lett. 2020;1 - 11.	Xinsheng Liu, Linlin Qi, Jianliang Lv, Zhongwang Zhang, Peng Zhou, Zhongyuan Ma, Yonglu Wang,	2.154

			Yongguang Zhang , Li Pan	
4	Comparison of immune responses in guinea pigs by intranasal delivery with different nanoparticles-loaded FMDV DNA vaccine	Microbial pathogenesis. 2020,142:104061	Huabing Zheng, Li Pan, Jianliang Lv, Zhongwang Zhang, Yuanyuan Wang, Wenfa Hu, Xinsheng Liu, Peng Zhou, Yonglu Wang, Yongguang Zhang	2.581
5	A chemiluminescence immunoassay for rapid detection of classical swine fever virus E2 antibodies in pig serum samples	Transboundary and Emerging Diseases. 2020,00:1-7	Zhongyuan Ma, Jianliang Lv, Zhongwang Zhang, Ye zhao, Li Pan, Yongguang Zhang	3.554
6	Evaluation of the immune response in conventionally weaned pigs infected with porcine deltacoronavirus	Arch Virol. 2020;165(7):1653 - 1658.	Donghong Zhao, Xiang Gao, Peng Zhou, Liping Zhang, Yongguang Zhang, Yonglu Wang, Xinsheng Liu	2.261
7	Rapid and visual detection of porcine deltacoronavirus by recombinase polymerase amplification combined with a lateral flow dipstick	BMC Vet Res. 2020;16(1):130	Gao X, Liu X, Zhang Y, Wei Y, Wang Y.	1.792
8	Characterization, pathogenicity and protective efficacy of a cell culture-derived porcine deltacoronavirus	Virus Res. 2020;282:197955	Xiang Gao, Donghong Zhao, Peng Zhou, Liping Zhang, Mingxia Li, Weiyan Li, Yongguang Zhang, Yonglu Wang, Xinsheng Liu	2.736

2019 年

序号	论文名称	期刊名称,年,卷(期):页	全部作者	影响因子
1	Host microRNA miR-1307 suppresses foot-and-mouth disease virus replication by promoting VP3 degradation and enhancing innate immune response	Virology, 2019, 535, 162-170	Linlin Qi, Kailing Wang, Haotai Chen, Xinsheng Liu, Jianliang Lv, Shitong Hou, Yongguang Zhang, Yuefeng Sun	2.657
2	Basal level p53 suppresses antiviral immunity against foot-and-mouth disease virus	Viruses, 2019, 11, E727	Tianliang Zhang, Haotai Chen, Xinsheng Liu, Linlin Qi, Xin Gao, Kailing Wang, Kaishen Yao, Jie Zhang, Yuefeng Sun, Yongguang Zhang and Run Wu	3.811
3	Antiviral activity of brequinar against foot-and-mouth disease virus infection in vitro and in vivo.	Biomedicine & Pharmacotherapy. 2019, 116: 108928.	Shi-fang Li, Mei-jiao Gong, Yue-feng Sun, Jun-jun Shao, Yong-guang Zhang, Hui-yun Chang.	3.743
4	Antiviral effects of IMPDH and DHODH Inhibitors against foot and mouth disease virus.	Biomedicine & Pharmacotherapy . 2019,118: 109305.	Mei-jiao Gong ,Shi-fang Li, Yan-yan Chang,Jun-jun Shao, Yue-Feng Sun, Ting-ting Ren,Yong-guang Zhang, Hui-yun Chang.	3.743
5	Immunogenicity and protective efficacy of recombinant proteins consisting of multiple	Applied Microbiology and Biotechnology, April 2019,	Baofeng Cui,Xinsheng Liu,Peng Zhou,Yuzhen Fang,Donghong	3.67

	epitopes of foot-and-mouth disease virus fused with flagellin	Volume 103, Issue 8, pp 3367–3379	Zhao,Yongguang Zhang,Yonglu Wang,	
6	Identification of three linear B cell epitopes against non-structural protein 3ABC of FMDV using monoclonal antibodies.	Appl. Microbiol. Biotechnol. 2019.,103(19): 8075-8086.	Wei Liu, Junjun Shao, Danian Chen, Yanyan Chang, Huiyun Chang, Yongguang Zhang	3.67
7	Antiviral activity of merimepodib against foot and mouth disease virus in vitro and in vivo.	Molecular Immunology, 2019,114:226-232	Shi-fang Li, Mei-jiao Gong, Jun-jun Shao,Yue-feng Sun, Yong-guang Zhang, Hui-yun Chang.	3.064
8	In Vitro and In Vivo Antiviral Activity of Mizoribine Against Foot-And-Mouth Disease Virus.	Molecules 2019, 24:1723.	Shi-Fang Li, Mei-Jiao Gong, Yue-Feng Sun, Jun-Jun Shao, Yong-Guang Zhang*, Hui-Yun Chang*.	3.060
9	Evaluation and comparison of immunogenicity and cross-protective efficacy of two inactivated cell culture-derived GIIa-and GIIb-genotype porcine epidemic diarrhea virus vaccines in suckling piglets.	Veterinary Microbiology, Volume 230, March 2019, Pages 278-282	Xinsheng Liu, Liping Zhang, Qiaoling Zhang, Peng Zhou, Yuzhen Fang, Donghong Zhao, Jiaxin Feng,Weiyan Li, Yongguang Zhang, Yonglu Wang.	2.791
10	A newly isolated Chinese virulent genotype GIIb porcine epidemic diarrhea virus strain: biological characteristics, pathogenicity and immune protective effects as an inactivated vaccine candidate	Virus Res. 2019 Jan 2;259:18-27.	Liu X, Zhang Q, Zhang L, Zhou P, Yang J, Fang Y, Dong Z, Zhao D, Li W, Feng J, Cui B, Zhang Y, Wang Y	2.736
11	A novel type I interferon,interferon alphaomega, shows antiviral activity against foot-and-mouth disease virus in vitro.	Microbial Pathogenesis, 2019,127:79-84.	Shi-fang Li, Mei-jiao Gong , Yin-li Xie, Jun-jun Shao, Fu-rong Zhao, Yong-guang Zhang, Hui-yun Chang.	2.581
12	A novel type I interferon,interferon alphaomega, shows antiviral activity against foot-and-mouth disease virus in vitro.	Microbial Pathogenesis, 2019,127:79-84.	Shi-fang Li, Mei-jiao Gong , Yin-li Xie, Jun-jun Shao, Fu-rong Zhao, Yong-guang Zhang, Hui-yun Chang.	2.581
13	Application of built-in adjuvants for epitope-based vaccines.	PeerJ. 2019,6:e6185 DOI10.7717.	Yao Lei , Furong Zhao, Junjun Shao, Yangfan Li , ,Shifang Li, Huiyun Chang, Yongguang Zhang.	2.353
14	Biological characterization and pathogenicity of a newly isolated Chinese highly virulent genotype GIIa porcine epidemic diarrhea virus strain.	Archives of Virology, May 2019, Volume 164, Issue 5, pp 1287–1295	Liping Zhang, Xinsheng Liu,Qiaoling Zhang , Peng Zhou, Yuzhen Fang,Zhaoliang Dong, Donghong Zhao, Weiyan Li, Jiaxin Feng,Yongguang Zhang,Yonglu Wang.	2.261
15	Evaluation of the Efficacy of a Recombinant Adenovirus Expressing the Spike Protein of Porcine Epidemic Diarrhea Virus in Pigs.	Biomed Res Int, Volume 2019, Article ID 8530273, 8 pages	Xinsheng Liu , Donghong Zhao, Peng Zhou,Yongguang Zhang,Yonglu Wang.	2.197
16	Artificially designed hepatitis B virus core particles composed of multiple epitopes of type A and O foot-and-mouth disease virus as a bivalent vaccine	J Med Virol. 2019,91:2142-2152	Yao Lei, Junjun Shao, Furong Zhao,Yangfan Li,Chenglin Lei,Feifei Ma, Huiyun	2.049

	candidate.		Chang,Yongguang Zhang	
17	Review on Outbreak Dynamics, the Endemic Serotypes, and Diversified Topotypic Profiles of Foot and Mouth Disease Virus Isolates in Ethiopia from 2008 to 2018	Viruses 2019, 11, 1076	Ashenafi Kiros Wubshet, Junfei Dai, Qian Li, Jie Zhang	3.811
18	MicroRNA-34/449 family and viral infections	Virus Research, 2019, 260,1-6	Jianliang Lv,Zhongwang Zhang, Li Pan,Yongguang Zhang	2.745
19	Development and validation of a competitive ELISA based on bacterium-original virus-like particles of serotype O foot-and-mouth disease virus for detecting serum antibodies	Appl Microbiol Biotechnol, 2019, 103(7):3015-3024	Ran XH#, Yang ZY#, Bai MY, Zhang Y, Wen XB, Guo HC, Sun SQ*	3.67
20	Sec62 Suppresses Foot-and-Mouth Disease Virus Proliferation by Promotion of IRE1 α -RIG-I Antiviral Signaling	J Immunol, 2019, 203(2):429-440	Han S, Mao L, Liao Y, Sun S, Zhang Z, Mo Y, Liu H, Zhi X, Lin S, Seo HS, Guo H	4.718
21	Hollow mesoporous silica nanoparticles as delivery vehicle of foot - and - mouth disease virus - like particles induce persistent immune responses in guinea pigs	J Med Virol, 2019, 91: 941-948	Bai M, Dong H, Su X, Jin Y, Sun S, Zhang Y, Yang Y, Guo H	2.049
22	Biom mineralization improves the thermostability of foot-and-mouth disease virus-like particles and the protective immune response induced.	Nanoscale. 2019,11(47):22748-22761	Du P, Liu R, Sun S, Dong H, Zhao R, Tang R, Dai J, Yin H, Luo J, Liu Z, Guo H	6.97, 封面 文章
23	A naphthalimide-based lysosome-targeting fluorescent probe for the selective detection and imaging of endogenous peroxynitrite in living cells.	Analytical and Bioanalytical Chemistry, 2019, 411: 3929-3939.	Qian J, Gong D, Ru J, Guo Y, Cao T, Liu W, Iqbal A, Iqbal K, Qin W, Guo H	3.286
24	A ratiometric fluorescent probe for detection of endogenous and exogenous hydrogen sulfide in living cells.	Talanta2019, 198: 185-192	Cao T, Teng Z, Gong D, Qian J, Liu W, Iqbal K, Qin W, Guo H.	4.916
25	Ratiometric fluorescent probe based on ESIPT for the highly selective detection of cysteine in living cells	Talanta, 2019, 194: 717-722	Li X, Ma H, Qian J, Cao T, Teng Z, Iqbal K, Qin W, Guo H	4.916
26	Uniform dendrimer-like mesoporous silica nanoparticles as a nano-adjuvant for foot-and-mouth disease virus-like particle vaccine	J. Mater. Chem. B, 2019, 7, 3446-3454	Zhijun Liu,Jiaxi Ru,Shiqi Sun,Zhidong Teng,Hu Dong, Pin Song,Yunshang Yang and Huichen Guo	5.047
27	Synthesis of nitrogen-doped graphene quantum dots (N-GQDs) from marigold for detection of Fe ³⁺ ion and bioimaging.	Spectrochimica Acta Part A: Molecular and Biomolecular Spectroscopy, 2019, 217: 60-67	Zhang YP, Ma JM, Yang YS, Ru JX, Liu XY, Ma Y, Guo HC	2.931

28	Self-Assembling Ratiometric Fluorescent Micelle Nanoprobe for Tyrosinase Detection in Living Cells	ACS Appl. Nano Mater, 2019, 2: 3819–3827	Jiemin Wang , Jing Qian , Zhidong Teng , Ting Cao , Deyan Gong , Wei Liu , Yuping Cao , Wenwu Qin , Huichen Guo , Anam Iqbal
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2018 年

序号	论文名称	期刊名称,年,卷(期):页	全部作者	影响因子
1	Development of a chemiluminescence immunoassay using recombinant non-structural epitope-based proteins to accurately differentiate foot-and-mouth disease virus-infected and vaccinated bovines.	Transbound Emerg Dis. 2018, 65: 338–344.	Liu ZZ, Zhao FR, Gao SD, Shao JJ, Zhang YG, Chang HY.	3.504
2	Antiviral activity of porcine interferon delta 8 against foot-and-mouth disease virus in vitro.	International Immunopharmacology 59 (2018) 47–52.	Li SF, Shao JJ, Zhao FR, Gong MJ, Xie YL, Chang HY, Zhang YG	3.118
3	Antiviral activity of porcine interferon omega 7 against foot-and-mouth disease virus in vitro.	J Med Virol. doi: 10.1002/jmv.25272.	Li SF, Zhao FR, Gong MJ, Shao JJ, Xie YL, Chang HY, Zhang YG.	1.988
4	Transcript Profiling Identifies Early Response Genes against FMDV Infection in PK-15 Cells	Viruses 2018, 10(7), 364.	Zhang Tianliang, Chen Haotai, Qi Linlin, Zhang Jie, Wu Run, Zhang Yongguang, Sun Yuefeng	3.761
5	Roles and applications of probiotic Lactobacillus strains.	Applied Microbiology and Biotechnology. 2018, 102: 8135-8143	Zhang Z, Lv J, Pan L, Zhang Y	3.34
6	A newly isolated Chinese virulent genotype G1b porcine epidemic diarrhea virus strain: biological characteristics, pathogenicity and immune protective effects as an inactivated vaccine candidate.	Virus Research, 2019, 259:18-27	Xinsheng Liu, Qiaoling Zhang, Liping Zhang, Peng Zhou, Jun Yang, Yuzhen Fang, Zhaoliang Dong, Donghong Zhao, Weiyan Li, Jiaxin Feng, Baofeng Cui, Yongguang Zhang ¹ , Yonglu Wang.	2.484
7	Flagellin as a vaccine adjuvant..	Expert Rev Vaccines. 2018 ,17(4):335-349	Cui B, Liu X(co-first), Fang Y, Zhou P, Zhang Y, Wang Y.	4.271
8	Adaptation and Constraint in the Atypical Chemokine Receptor Family in Mammals.	BioMed Research International. Volume 2018, Article ID 9065181,9 pages.	Li Pan, Jianliang Lv, Zhongwang Zhang, Yongguang Zhang.	2.583
9	The program of antiviral agents inhibits virus infection	Archives of Microbiology (2018) 200:841–846	Ding YZ, Lv JL, Zhang ZW, Ma XY, Zhang J, Zhang YG	1.607
10	Development of a new RT-PCR with multiple primers for detecting Southern African Territories foot-and-mouth disease viruses	J Vet Res 62, 000-000, 2018	Ya-Li Liu, Yao-Zhong Ding, Jun-Fei Dai , Bing Ma, Ji-Jun He, Wei-Min Ma, Jian-Liang Lv, Xiao-Yuan Ma, Yun-Wen Ou, Jun Wang, Yong-Sheng Liu, Hui-Yun	0.811

			Chang, Yong-Lu Wan, Qiang Zhang, Xiang-Tao Liu, Yong-Guang Zhang, Jie Zhang	
11	Type I Interferons: Distinct Biological Activities and Current Applications for Viral Infection	Cellular Physiology and Biochemistry, 2018,51:2377-2396	Shi-fang Li, Mei-jiao Gonga, Fu-rong Zhao, Jun-jun Shao, Yin-li Xie, Yong-guang Zhang, Hui-yun Chang	5.5
12	Golden-star nanoparticles as adjuvant effectively promotes immune response to foot-and-mouth disease virus-like particles vaccine	Vaccine, 2018, 36: 6752-6760	Teng Z, Sun S, Chen H, Huang J, Du P, Dong H, Xu X, Mu S, Zhang Z, Guo H	3.285
13	BODIPY-based fluorescent sensor for imaging of endogenous formaldehyde in living cells	Talanta, 2018, 189: 274-280	Cao T, Gong D, Han SC, Iqbal A, Qian J, Liu W, Qin W, Guo H	4.244
14	Two-stage ratiometric fluorescent responsive probe for rapid glutathione detection based on BODIPY thiol-halogen nucleophilic mono-or disubstitution	Sensors and Actuators, B: Chemical, 2018, 258: 72-79	Gong D, Ru J, Cao T, Qian J, Liu W, Iqbal A, Liu W, Qin W, Guo H	5.667
15	Heterogeneous synthesis of nitrogen-doped carbon dots prepared via anhydrous citric acid and melamine for selective and sensitive turn on-off-on detection of Hg (II), glutathione and its cellular imaging	Sensors and Actuators, B: Chemical, 2018, 255: 1130-1138	Iqbal A, Iqbal K, Xu L, Li B, Gong D, Liu X, Guo Y, Liu W, Qin W, Guo H	5.667
16	Foot-and-mouth disease virus infection stimulates innate immune signaling in the mouse macrophage RAW 264.7 cells	Can J Microbiol. 2018, 64(2):155-166	Zhi XY, Lv JL, Wei YQ, Gao Y, Du P, Chang YY, Zhang Y, Wu R, Guo HC	1.243
17	A novel biphenyl-derived salicylhydrazone Schiff base fluorescent probes for identification of Cu ²⁺ and application in living cells	Spectrochim Acta A Mol Biomol Spectrosc. 2018, 199:202-208.	Yang YS, Ma SS, Zhang YP, Ru JX, Liu XY, Guo HC	2.880
18	A chromene pyrazoline derivatives fluorescent probe for Zn ²⁺ detection in aqueous solution and living cells	Inorganica Chimica Acta, 2018, 479, 128-134	Zhang YP, Xue QH, Yang YS, Liu XY, Ma CM, Ru JX, Guo HC	2.264
19	A highly selective "turn-on" fluorescent sensor for zinc ion based on a cinnamyl pyrazoline derivative and its imaging in live cells	Anal. Methods, 2018, 10, 1833-1841	Yang YS, Ma CM, Zhang YP, Xue QH, Ru JX, Liu XY, Guo HC	2.073

2017 年

序号	论文名称	期刊名称,年,卷(期):页	全部作者	影响因子
1	Chimeric virus-like particles elicit protective immunity against serotype O foot-and-mouth disease virus in guinea pigs	Appl Microbiol Biotechnol, 2017, 101(12):4905-4914	Liu, X.; Fang, Y.; Zhou, P.; Lu, Y.; Zhang, Q.; Xiao, S.; Dong, Z.; Pan, L.; Lv, J.; Zhang, Z	3.42
2	Expression and Immunogenicity of Two Recombinant Fusion Proteins Comprising Foot-and-Mouth Disease Virus Structural Protein VP1 and DC-SIGN-binding glycoproteins	BioMed Research International, 2017, 2017: 7658970	Xinsheng Liu,.; Jianliang Lv,.; Yuzhen Fang,.; Peng Zhou,.; YongLu, Wang	2.476

3	Detection and Phylogenetic Analyses of Spike Genes in Porcine Epidemic Diarrhea Virus Strains Circulating in China in 2016-2017	virology journal., 2017, 14:194	Zhang Q, Liu X, Fang Y, Zhou P, Wang Y, Zhang Y	2.119
4	Interferon-omega: Current status in clinical applications	Int Immunopharmacol. 2017 Sep 25;52:253-260	Li SF, Zhao FR, Shao JJ, Xie YL, Chang HY, Zhang YG.	2.956
5	Chemiluminescence immunoassay for the detection of antibodies against the 2C and 3ABC nonstructural proteins induced by infecting pigs with the foot-and-mouth disease virus	Clin Vaccine Immunol. 2017 Aug 4;24(8). pii: e00153-17	Liu Z, Shao J, Zhao F, Zhou G, Gao S, Liu W, Lv J, Li X, Li Y, Chang H, Zhang Y	2.425
6	Transcriptomic analysis of porcine PBMCs in response to FMDV infection	Acta Trop. 2017 Sep;173:69-75	Zhao FR, Xie YL, Liu ZZ, Shao JJ, Li SF, Zhang YG, Chang HY	2.218
7	Lithium Chloride inhibits early stages of foot-and-mouth disease virus (FMDV) replication in vitro	J Med Virol. 2017 Nov;89(11):2041-2046	Zhao FR, Xie YL, Liu ZZ, Shao JJ, Li SF, Zhang YG, Chang HY	1.935
8	eEF1G interaction with foot-and-mouth disease virus nonstructural protein 2B: identification by yeast two-hybrid system	Microbial Pathogenesis, 2017, 112, 111-116	Zhongwang Zhang, Li Pan, Yaozhong Ding, Jianliang Lv, Peng Zhou, Yuzhen Fang, Xincheng Liu, Yongguang Zhang, Yonglu Wang	2.009
9	Interferon-omega: Current status in clinical applications	IntImmunopharmacol. 2017, 52: 253-260	Li SF, Zhao FR, Shao JJ, Xie YL, Chang HY, Zhang YG	
10	Complete Genome Sequence of Variant Porcine Epidemic Diarrhea Virus Strain CH/HNZZ47/2016 Isolated from Suckling Piglets in China	Genome Announcements,2017,5(9): e01744-16	Xincheng Liu, Qiaoling Zhang, Yuzhen Fang, Peng Zhou, Yanzhen Lu, Shuai Xiao, Zhaoliang Dong, Yongguang Zhang, Yonglu Wang	
11	Foot-and-mouth disease virus infection suppresses autophagy and NF-κB antiviral responses via degradation of ATG5-ATG12 by 3Cpro	Cell Death and Disease. 2017, 8: e2561	Xuxu Fan, Shichong Han, Dan Yan, Yuan Gao, Yanquan Wei, Xiangtao Liu, Ying Liao, Huichen Guo, and Shiqi Sun	5.965
12	Foot-and-mouth Disease Virus-like Particles as Integrin-Based Drug Delivery System Achieve Targeting Anti-tumor Efficacy	Nanomedicine: NBM, 2017, 13: 1061-10706	Dan Yan, Zhidong Teng, Shiqi Sun, Shan Jiang, Hu Dong, Yuan Gao, Yanquan Wei, Wenwu Qin, Xiangtao Liu, Hong Yin, Huichen Guo.	5.720
13	Phenylselenium-Substituted BODIPY Fluorescent Turn-off Probe for Fluorescence Imaging of Hydrogen Sulfide in Living Cells	Anal. Chem. 2017, 89: 1801-1807	Deyan Gong, Xiangtao Zhu, Yuejun Tian, Shi-Chong Han, Min Deng, Anam Iqbal, Weisheng Liu, Wenwu Qin, and Huichen Guo	6.320
14	The Important Role of Lipid Raft-Mediated Attachment in the Infection of Cultured Cells by Coronavirus Infectious Bronchitis Virus Beaudette Strain	PLoS One. 2017, 12(1):e0170123	Huichen Guo, Mei Huang, Quan Yuan, Yanquan Wei, Yuan Gao, Lejiao Mao, Lingjun Gu, Yong Wah Tan, Yanxin Zhong, Dingxiang Liu, Shiqi Sun	2.806
15	Purification of foot-and-mouth disease virus by	J Chromatogr B, 2017,	Du P, Sun S, Dong J, Zhi X, Chang	2.603

	heparin as ligand for certain strains	1049-1050: 16-23	Y, Teng Z, Guo H, Liu Z	
16	BODIPY based phenylthiourea derivatives as highly selective MeHg ⁺ and Hg ²⁺ ions fluorescent chemodosimeter and its application to bioimaging	Sensors and Actuators B 243 (2017) 195–202	Deng M, Gong D, Han S, Zhu X, Iqbal A, Liu W, Qin W, Guo H	5.401
17	A new pyrazoline-based probe of quenched fluorescent reversible recognition for Cu ²⁺ and its application in cells	Spectrochim Acta A Mol Biomol Spectrosc, 2017, 177: 147-152	Zhang YP, Dong YY, Yang YS, Guo HC, Cao BX, Sun SQ	2.536
18	CD59 association with infectious bronchitis virus particles protects against antibody-dependent complement-mediated lysis	J Gen Virol. 2017, 98 (11) :2725-2730	Wei Y, Ji Y, Guo H, Zhi X, Han S, Zhang Y, Gao Y, Chang Y, Yan D, Li K, Liu DX, Sun S	2.514
19	Fast and Selective Two-Stage Ratiometric Fluorescent Probes for Imaging of Glutathione in Living Cells	Anal. Chem. 2017, 89, 13112-13119	Deyan Gong, ShiChong Han, Anam Iqbal, Jing Qian, Ting Cao, Wei Liu, Weisheng Liu, Wenwu Qin, and Huichen Guo	6.320

2016 年

序号	论文名称	期刊名称,年,卷(期):页	全部作者	影响因子
1	Features of human-infecting avian influenza viruses and mammalian adaptations	J Infect.2016 Jul;73(1):95-97	Zhao F, Tian J, Lin T, Shao J, Zhang Y, Chen Y, Chang H	4.382
2	Lactic acid bacteria as mucosal delivery vehicles: a realistic therapeutic option	Appl Microbiol Biotechnol. 2016 Jul;100(13):5691-701	Wang M, Gao Z,Zhang Y, Pan L	3.376
3	The Applications of Gold Nanoparticle- Initialed Chemiluminescence in Biomedical Detection	Nanoscale Res Lett. 2016, 11(1):460	Liu Z, Zhao F, Gao S, Shao J, Chang H	2.584
4	Relationship of long noncoding RNA and viruses	Genomics 107 (2016) 150–154	Yao-zhong Ding, Zhong-wang Zhang, Ya-li Liu, Chong-xu Shi, Jie Zhang, Yong-guang Zhang	2.386
5	Dendritic cell targeted vaccines: Recent progresses and challenges	Human Vaccines & Immunotherapeutics. 2016, 12(3):612-622	Chen P, Liu X, Sun Y, Zhou P, Wang Y, Zhang Y	2.146
6	Features of human-infecting avian influenza viruses and mammalian adaptations	J Infect.2016 Jul; 73(1): 95-97	Zhao F, Tian J, Lin T, Shao J, Zhang Y, Chen Y, Chang H	4.603
7	The Influence of Porcine Reproductive and Respiratory Syndrome Virus Infection on the Expression of Cellular Prion Protein in Marc-145 Cells	Virol Antivir Res,2016,4:4	Chongxu Shi, Yaozhong Ding, Xiaoyuan Ma, Yali Liu, Yunwen Ou, Bing Ma, Alexei D Zaberezhny, Zygmunt Pejsak, Anna Szczotka-Bochniarz, Laszlo Stipkovits, Susan Szathmary, Yongguang Zhang and Jie Zhang	
8	Development of an Indirect-Elisa to Detect Antibodies against Porcine Reproductive and Respiratory Syndrome Virus Nucleocapsid Protein in Gansu China	Journal of Virology and Antiviral Research. 2016,5:2	Xiaoyuan Ma, Ying Qin, Yaozhong Ding, Yongsheng Liu, Zygmunt Pejsak, Anna Szczotka-Bochniarz, Yunwen Ou, Laszlo Stipkovits,	

			Susan Szathmary, Bing Ma, Huaijie Jia, Jun Wang, Yongguang Zhang and Jie Zhang
9	Genome Sequence of a Subgenotype 1a Bovine Viral Diarrhea Virus in China	Genome Announc. 2016, 14(6)	Gao S, Du J, Tian Z, Xing S, Luo J, Liu G, Chang H, Yin H
10	Magnetic Resonance Imaging Revealed Splenic Targeting of Canine Parvovirus Capsid Protein VP2	Scientific Reports, 2016, 6: 23392	Ma Y, Wang H, Yan D, Wei Y, Cao Y, Yi P, Zhang H, Deng Z, Dai J, Liu X, Luo J, Zhang Z, Sun S, and Guo H
11	Productive Entry of Foot-and-Mouth Disease Virus via Macropinocytosis Independent of Phosphatidylinositol 3-Kinase	Scientific Reports, 2016, 6: 19294	Han S, Guo H, Sun S, Jin Y, Wei Y, Feng X, Yao X, Cao S, Liu D, and Liu X
12	Fluorescent glutathione probe based on MnO ₂ -phenol formaldehyde resin nanocomposite	Biosensors & Bioelectronics, 2016, 77: 299-305.	Wang X, Wang D, Guo Y, Yang C, Liu X, Iqbal A, Liu W, Qin W, Yan D, and Guo H
13	Biological function of Foot-and-mouth disease virus non-structural proteins and non-coding elements	Virology, 2016, 13: 107	Gao Y, Sun S, Guo H
14	Transcriptome profiling indicating canine parvovirus type 2a as a potential immune activator	Virus Genes. 2016, 52(6) :768-779	Fan X, Gao Y, Shu L, Wei Y, Yao X, Cao S, Peng G, Liu X, Sun S

五、专利：

2023 年

序号	专利名称	类别	授权/批准时间	专利号	全部发明人
1	一种空心介孔硅纳米微球及其制备方法和用途	国家发明专利	20230312	ZL202111367359.9	郭慧琛;茹嘉喜;董虎;孙世琪;吴金恩;尹双辉;张韵;白满元
2	一种介孔硅纳米材料及其制备方法和应用	国家发明专利	20230228	ZL202111367802.2	郭慧琛;茹嘉喜;孙世琪;尹双辉;张韵;白满元;吴金恩;董虎
3	含分子内佐剂的非洲猪瘟病毒重组蛋白、表达载体及应用	国家发明专利	20230516	ZL202110446849.1	常惠芸;张光磊;邵军军;刘伟;常艳燕
4	基于树突状细胞的口蹄疫仿生纳米疫苗及其制备方法和应用	国家发明专利	20230526	ZL202110446811.4	常惠芸;高瞻;邵军军;常艳燕
5	一种 A 型塞内卡病毒基因工程复合表位蛋白、疫苗及其应用	国家发明专利	20230331	ZL202110801177.1	张中旺;潘丽
6	CEPPO DI VIRUS DELLA DIARREA EPIDEMICA	欧盟发明专利	20210824	N.102019000015644	LIUxinsheng,FANG

	SUINA DEL GENOTIPO GIla E SUA APPLICAZIONE NELLA PREPARAZIONE DI UN VACCINO PER LA DIARREA EPIZOOTICA SUINA				yuzhen, ZHOUpeng,ZHANG yongguang,Wangyo nglu
7	一种口蹄疫病毒 VP1 嵌合纳 米颗粒及其制备方法和应用	国家技术发 明专利授权	20230509	ZL202210771918.0	郭慧琛;孙世琪;白 满元;裴辰辰;董虎; 张韵;吴金恩;尹双 辉;丁耀忠;何继军; 靳野;刘在新
8	Virus-Like Particle(VLP), and Preparation Method and Use Thereof	国际专利	20221130	2022/09860	郭慧琛;孙世琪;董 虎;白满元;穆素雨; 何融泽;张韵;吴金 恩;丁耀忠;冯霞;尹 双辉
9	非洲猪瘟病毒 p49 蛋白抗原表 位及其应用	国家技术发 明专利	20230721	ZL202111610740.3	邵军军;李俊慧;刘 伟;常惠芸
10	重组非洲猪瘟病毒抗原“鸡尾 酒”疫苗及应用	国家技术发 明专利	20230912	ZL202210024618.6	邵军军;张光磊;刘 伟;梁霞霞;常惠芸
11	非洲猪瘟病毒 p54 蛋白抗原表 位及其应用	国家技术发 明专利	20230912	ZL202111610755.X	邵军军;李俊慧;刘 伟;常惠芸

2022 年

序号	专利名称	类别	授权/批准时 间	专利号	全部发明人
1	一种耐热型口蹄疫重组病毒 株、由该病毒株制成的灭活疫 苗及其应用	国家技术发 明专利	2022.04.07	ZL202010725839.7	郭慧琛;孙世琪;董 虎;卢源录;张韵;白 满元;吴金恩;茹嘉 喜;尹双辉;冯霞;马 军武
2	一种检测 A 型塞内卡病毒的 荧光定量 PCR 引物及试剂盒	国家技术发 明专利	2022.03.22	ZL201910013717.2	郭慧琛;穆素雨;孙 世琪;张韵;茹嘉喜; 郭笑然;罗建勋;殷 宏
3	猪口蹄疫病毒 A 型 Fc 多肽疫 苗及其制备方法和应用	国家技术发 明专利	2022.01.30	ZL201810074694.1	常惠芸, 李扬帆, 邵军军, 张永光
4	用中国仓鼠卵巢细胞表达外 源蛋白时信号肽的选择方法 及应用	国家技术发 明专利	2022.01.10	ZL201911052154.4	常惠芸, 孙振文, 邵军军, 张永光
5	一种基于抗猪流行性腹泻病 毒变异毒株重组 S2 蛋白的 IgA 抗体 ELISA 检测试剂盒	国家技术发 明专利	2022.04.12	ZL202011163418.6	刘新生;张莉萍;周 鹏;于瑞明;潘 丽;吕建亮;张中 旺;王永录;张永

					光; 郭慧琛
6	一种用于检测口蹄疫病毒抗体的抑制 ELISA 方法及应用	国家技术发明专利	20220422	ZL202110154139.1	周广青; 马军武; 邵军军; 常惠芸; 龚真莉; 郭建宏; 祁淑云; 李苗苗; 何继军
7	一种具有多级孔结构的二氧化硅材料制备方法	国家技术发明专利	20220923	ZL201911078617.4	郭慧琛; 茹嘉喜; 孙世琪; 张韵; 白满元; 尹双辉; 吴金恩; 殷宏
8	一种耐热型口蹄疫重组病毒株及其在制备口蹄疫灭活疫苗中的应用	国家技术发明专利	20221025	ZL202010724770.6	郭慧琛; 孙世琪; 董虎; 卢源录; 张韵; 白满元; 吴金恩; 茹嘉喜; 尹双辉; 冯霞; 马军武
9	一种开口型空心硅纳米胶囊及其制备方法和用途	国家技术发明专利	20221102	ZL202111367318.X	郭慧琛; 茹嘉喜; 张韵; 孙世琪; 尹双辉; 白满元; 吴金恩; 董虎
10	组成型分泌表达 O 型 FMDV 重组抗原表位基因工程 CHO 细胞系的构建方法	国家技术发明专利	20220902	ZL202010451052.6	常惠芸; 孙振文; 邵军军; 常艳燕

2021 年

序号	专利名称	类别	授权/批准时间	专利号	全部发明人
1	用于 O 型口蹄疫病毒抗体定量检测的上转换发光免疫层析试纸条及其制备方法	国家技术发明专利	2021.06.01	ZL202010061291.0	郭慧琛; 孙世琪; 侯风萍; 张韵; 白满元; 柳海云; 高震东; 殷宏
2	一种口蹄疫病毒样颗粒体外组装的方法及应用	国家技术发明专利	2021.07.06	ZL202010116531.2	郭慧琛; 孙世琪; 柳海云; 董虎; 张韵; 白满元; 吴金恩; 茹嘉喜
3	一种基于病毒样颗粒的 C 型口蹄疫病毒抗体竞争 ELISA 检测试剂盒	国家技术发明专利	2021.08.03	ZL201811492145.2	孙世琪, 白满元, 郭慧琛, 张韵, 茹嘉喜, 杨志元
4	猪塞内加谷病毒、猪塞内加谷病毒灭活疫苗的制备方法、猪塞内加谷病毒灭活疫苗和应用	国家技术发明专利	2021.04.09	ZL201910137696.5	吕建亮, 方鹏飞, 潘丽, 李妍, 马中元, 吴学婧, 张中旺, 李捷, 刘新生, 严欢, 周鹏, 王永录, 张永光
5	一种尼莫地平在制备预防口蹄疫病毒感染的药物中的应用	国家技术发明专利	2021.02.19	ZL201910202396.0	李世芳, 常惠芸, 龚美娇, 邵军军,

	用				常艳燕, 张永光
6	一种咪唑立宾在制备预防口蹄疫病毒感染的药物中的应用	国家技术发明专利	2021.02.19	ZL201910175969.5	常惠芸, 李世芳, 龚美娇, 邵军军, 赵付荣, 常艳燕, 张永光
7	一种 AVN-944 在制备预防口蹄疫病毒感染的药物中的应用	国家技术发明专利	2021.02.19	ZL201910180670.9	龚美娇, 常惠芸, 李世芳, 邵军军, 常艳燕, 张永光
8	Inauhzin 在制备预防口蹄疫病毒感染的药物中的应用	国家技术发明专利	2021.02.26	ZL201910178107.8	李世芳, 常惠芸, 龚美娇, 邵军军, 常艳燕, 张永光
9	一种常山酮在制备预防口蹄疫病毒感染的药物中的应用	国家技术发明专利	2021.02.26	ZL201910202391.8	常惠芸, 李世芳, 龚美娇, 邵军军, 常艳燕, 张永光
10	一种吡唑呋喃菌素在制备预防口蹄疫病毒感染的药物中的应用	国家技术发明专利	2021.03.16	ZL201910175549.7	常惠芸, 李世芳, 龚美娇, 邵军军, 常艳燕, 张永光
11	一种 Merimepodib 在制备预防口蹄疫病毒感染的药物中的应用	国家技术发明专利	2021.04.16	ZL201910175967.6	常惠芸, 李世芳, 龚美娇, 邵军军, 赵付荣, 常艳燕, 张永光
12	一种 SB203580 在制备预防口蹄疫病毒感染的药物中的应用	国家技术发明专利	2021.04.20	ZL201910175576.4	常惠芸, 李世芳, 龚美娇, 邵军军, 常艳燕, 张永光
13	一种 PF-4708671 在制备预防口蹄疫病毒感染的药物中的应用	国家技术发明专利	2021.04.30	ZL201910178189.6	常惠芸, 龚美娇, 李世芳, 邵军军, 常艳燕, 张永光
14	一种特立氟胺在制备预防口蹄疫病毒感染的药物中的应用	国家技术发明专利	2021.06.08	ZL201910180665.8	李世芳, 常惠芸, 龚美娇, 邵军军, 常艳燕, 张永光
15	一种阿米洛利在制备预防口蹄疫病毒感染的药物中的应用	国家技术发明专利	2021.06.22	ZL201910175934.1	龚美娇, 常惠芸, 李世芳, 邵军军, 常艳燕, 张永光
16	一种表达 eGFP 的同源重组载体、重组细胞及其制备方法和应用	国家技术发明专利授权	2021.06.01	ZL201910886881.4	常艳燕, 常惠芸, 邵军军, 李扬帆, 张永光
17	利用多表位串联蛋白检测猪口蹄疫 O 型抗体的化学发光检测试剂盒	国家技术发明专利	2021.04.13	ZL202010037597.2	常惠芸, 刘伟, 邵军军, 常艳燕
18	检测口蹄疫非结构蛋白抗体的单抗原竞争化学发光试剂盒	国家技术发明专利	2021.06.15	ZL202010149812.8	常惠芸, 刘伟, 邵军军
19	一种非洲猪瘟病毒重组抗原及其应用	国家技术发明专利	2021.07.16	ZL 202010255206.4	常惠芸, 高瞻, 邵军军, 常艳燕

20	一种布喹那在制备预防口蹄疫病毒感染药物中的应用	国家技术发明专利	2021.07.23	ZL 201910175972.7	常惠芸, 李世芳, 龚美娇, 邵军军, 赵付荣, 常艳燕, 张永光
21	猪口蹄疫病毒 O 型 Fc 多肽疫苗及其制备方法和应用	国家技术发明专利	2021.07.27	ZL 201810074696.7	邵军军, 常惠芸, 李扬帆, 张永光
22	核糖体蛋白 RPL13 抑制剂在制备抑制 IRES-依赖性翻译的病毒复制的药物中的应用	国家技术发明专利	2021.08.18	ZL201910610793.1	郭慧琛;王晓佳;孙萌萌;韩世充;孙世琪;张韵;茹嘉喜
23	Kit for detecting antibody against Foot-and-mouth Disease Virus 2C	国际专利	2021.8.19	2021106008	陈豪泰;尹双辉;冯霞;张韵;丁耀忠
24	Visualized Rapid detection Kit for type A Foot-and-mouth Disease Virus and preparation method thereof	国际专利	2021.8.18	2021105751	陈豪泰;尹双辉;冯霞;张韵;丁耀忠
25	Visualized Rapid detection Kit for type O Foot-and-mouth Disease Virus and preparation method thereof	国际专利	2021.8.18	2021105824	陈豪泰;尹双辉;冯霞;张韵;丁耀忠
26	Visualized Rapid detection Kit for swine fever Virus antibody and application thereof	国际专利	2021.8.18	2021105785	陈豪泰;尹双辉;冯霞;张韵;丁耀忠

2020 年

序号	专利名称	类别	授权/批准时间	专利号	全部发明人
1	口蹄疫病毒样颗粒在作为重组质粒运载载体中的作用	国家技术发明专利	2020.7.3	ZL201610929291.1	郭慧琛, 孙世琪, 郜原, 靳野, 魏衍全, 张韵, 刘湘涛, 李杰林, 马军武, 冯霞
2	金纳米颗粒作为佐剂在制备病毒样颗粒疫苗中的应用	国家技术发明专利	2020.11.10	ZL201710553111.9	郭慧琛, 孙世琪, 张智军, 滕志东, 黄洁, 陈浩, 徐小雨, 茹嘉喜, 常艳燕, 冯霞, 刘湘涛, 殷宏
3	矿化口蹄疫病毒样颗粒及其制备方法和应用	国家技术发明专利	2020.10.16.	ZL201710539048.3	郭慧琛, 孙世琪, 杜平, 滕志东, 唐睿康, 赵瑞波, 茹嘉喜, 魏衍全, 张韵, 郜原, 马军武,

					刘湘涛, 殷宏
4	MINERALIZED FOOT-AND-MOUTH DISEASE VIRUS LIKE PARTICLES, AND PREPARATION METHOD AND USE THEREOF	国际专利	2020.1.14	US 10532092B2	郭慧琛, 孙世琪, 杜平, 靳野, 滕志东, 茹嘉喜, 魏衍全, 张韵, 郜原, 马军武, 刘湘涛, 殷宏
5	VIRUS-LIKE PARTICLE OF SENECAVIRUS A	国际专利	2020.1.14	US 10532077B2	郭慧琛, 孙世琪, 韩世充, 董虎, 郭笑然, 殷宏, 罗建勋;
6	METHOD FOR PREPARING FOOT-AND-MOUTH DISEASE VIRUS-LIKE PARTICLES, AND TEST STRIP FOR DETECTING FOOT-AND-MOUTH DISEASE	国际专利	2020.11	US10829741B2	孙世琪, 郭慧琛, 张韵, 常艳燕; 魏衍全; 茹嘉喜; 智晓莹; 杜平; 刘湘涛; 殷宏; 罗建勋
7	Kit for detecting anti-foot-and-mouth disease virus 3ABC antibody and detection method thereby	国际专利	2020.7.22	2020101144	陈豪泰, 张永光, 孙跃峰, 祁林林, 张杰, 潘丽
8	Kit for detecting foot-and-mouth disease virus type Asia1 antibody and detection method	国际专利	2020.7.29	2020101172	陈豪泰, 张永光, 孙跃峰, 祁林林, 张杰, 潘丽
9	一种虫草素在制备预防口蹄疫病毒感染药物中的应用	国家技术发明专利	2020.11.3	ZL201910181159.0	常惠芸, 龚美娇, 李世芳, 邵军军, 常艳燕, 张永光
10	猪口蹄疫病毒 O 型、A 型 Fc 多肽双价疫苗及其制备方法和应用	国家技术发明专利	2020.11.17	ZL201810074700.3	常惠芸, 邵军军, 李扬帆, 张永光
11	一种吉西他滨在制备预防口蹄疫病毒感染的药物中的应用	国家技术发明专利	2020.12.25	ZL201910175580.0	常惠芸, 宫美娇, 李世芳, 邵军军, 赵付荣, 常艳燕, 张永光
12	一株猪德尔塔冠状病毒毒株及其应用	国家技术发明专利	2020.8.28	ZL201910394213.X	刘新生, 王永录, 方玉珍, 周鹏, 张永光

2019 年

序号	专利名称	类别	授权/批准时间	专利号	全部发明人
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1	CHIMERIC FOOT-AND-MOUTH DISEASE VIRUS-LIKE PARTICLE AND PREPARATION METHOD THEREOF.	国际专利	2019.10.2	2019101002	XINSHENG LIU
2	PRIMER SET, KIT, AND METHOD FOR DETECTING PORCINE ELTACORONAVIRUS.	国际专利	2019.9.18	2019100972	XINSHENG LIU
3	PRIMER SET, KIT, AND METHOD FOR DETECTING PORCINE EPIDEMIC DIARRHEA VIRUS.	国际专利	2019.9.25	2019100992	XINSHENG LIU
4	RECOMBINANT SHUTTLE PLASMID CONTAINING PORCINE EPIDEMIC DIARRHEA VIRUS S GENE, RECOMBINANT ADENOVIRUS, AND APPLICATION THEREOF.	国际专利	2019.9.25	2019100990	XINSHENG LIU
5	一种猪口蹄疫 3ABC 和 2C 抗体化学发光检测试剂盒	国家发明专利	2019.01.25	ZL 201611051539.5	常惠芸, 刘泽众, 邵军军, 赵付荣, 李秀梅, 张永光
6	一种牛口蹄疫 3ABC 抗体化学发光检测试剂盒。	国家发明专利	2019.03.19	ZL 201611052512.8	常惠芸, 刘泽众, 邵军军, 赵付荣, 李秀梅, 张永光
7	氯化锂抑制口蹄疫病毒的用途。	国家发明专利	2019.	ZL 201710146292.3	赵付荣, 常惠芸
8	一种快速显色一步法检测美洲型高致病性猪繁殖与呼吸综合征的 RT-LAMP 试剂盒	国家发明专利	2019.7.26	ZL201610760227.5	张杰,刘永生,丁耀忠,马炳,陈豪泰,贾怀杰,邵军军,潘丽,常惠芸,张永光
9	一种快速显色一步法检测猪细小病毒的 LAMP 试剂盒	国家发明专利	2019.7.26	ZL201610760067.4	张杰,张永光,刘永生,丁耀忠,陈豪泰,常惠芸,吕建亮,林彤,潘丽,刘新生,王永录
10	一种快速显色一步法检测猪圆环病毒 2 型的 LAMP 试剂盒	国家发明专利	2019.7.26	ZL201610760228.X	张杰,刘永生,丁耀忠,陈豪泰,张永光,马丽娜,潘丽,王永录,常惠芸,邵军军,张中旺,吕建亮,林

					彤,刘新生
11	用于快速检测南非型口蹄疫病毒的特异性引物组及包含有该引物组的试剂盒	国家发明专利	2019.3.29	ZL201610398763.0	张杰,张永光,刘亚丽,王永录,方玉珍,丁耀忠,潘丽,常惠芸,吕建亮,周鹏
12	PRRSVN 蛋白的原核可溶性表达方法	国家发明专利	2019.10.18	ZL201810149238.9	张杰,张永光,丁耀忠,刘永生,代君飞,王俊,马炳,欧云文,孙跃峰,吕建亮,邵军军,周鹏
13	一种 A 型赛内卡病毒病毒样颗粒及其制备方法和用途	国家发明专利	2019.12.24	ZL-201810483236.3	郭慧琛,孙世琪,韩世充,董虎,郭笑然,殷宏,罗建勋
14	一种 O 型口蹄疫病毒样颗粒及其制备方法和用途	国家发明专利	2019.07.02	ZL-201610929279.0	孙世琪,郭慧琛,杜平,靳野,张韵,魏衍全,朱向涛,刘湘涛,殷宏

2018 年

序号	专利名称	类别	授权时间	专利号	全部发明人
1	RT-RPA 与侧向流动层析技术相结合的猪喘病毒快速检测方法及其检测试剂盒	国家发明专利	2018.09.28	201710984183.9	刘新生、方玉珍、王永录、张永光、潘丽、吕建亮、周鹏、张中旺、邵军军、赵付荣、陈豪泰、孙跃峰、常惠芸
2	同时鉴定三种猪流行性腹泻病毒毒株的引物组合和通用型半套式 RT-PCR 方法	国家发明专利	2018.09.07	201510901924.3	刘新生、张永光、王永录、方玉珍、周鹏、刘占旭
3	一种高效表达口蹄疫病毒抗原基因的重组乳酸杆菌及其制备方法和应用	国家发明专利	2018.06.08	ZL201510256221.X	潘丽,张永光,王淼,张中旺,王永录,方玉珍,吕建亮,周鹏,刘新生
4	一种共表达口蹄疫病毒 VP1 基因与免疫佐剂 IL-6 基因的重组乳酸杆菌及其制备方法和应用	国家发明专利	2018.08.10	ZL201510258195.4	潘丽,张永光,张中旺,吕建亮,王永录,方玉珍,周鹏,刘新生
5	一种肿瘤药物靶向载体及制备方法与应用	国家发明专利	2018.07.06	ZL-201510128809.7	孙世琪,郭慧琛,闫丹,董虎,魏衍全,刘湘涛

2017 年

序号	专利名称	类别	授权时间	专利号	全部发明人
1	免疫兔血清中猪圆环病毒 PCV2 抗体水平间接 ELISA 检测试剂盒及其检测方法和应用	国家技术发明专利	2017.08.29	ZL201510141663.X	张杰, 陈豪泰, 丁耀忠, 张永光, 王永录, 常惠芸, 潘丽, 邵军军, 吕建亮, 周鹏
2	牛 A 型口蹄疫广谱多表位疫苗及其制备方法和应用	国家技术发明专利	2017.04.12	ZL201310144390.5	常惠芸, 邵军军, 林彤, 丛国正, 独军政, 高闪电
3	牛 A 型口蹄疫国外流行毒株广谱多表位疫苗及其制备方法和应用	国家技术发明专利	2017.04.24	ZL201310146236.1	邵军军, 常惠芸, 陈建文
4	一种用病毒样颗粒包被量子点的方法	国家技术发明专利	2017.08.23	ZL-201510037803.9	孙世琪, 郭慧琛, 王斌, 王海明, 徐进, 魏衍全, 孙德惠, 刘湘涛
5	猪圆环病毒 2 型抗体快速检测层析试纸条及其制备方法	国家技术发明专利	2017.08.18	ZL-201610190933.0	孙世琪, 张韵, 郭慧琛, 智晓莹, 魏衍全, 常艳燕, 郜原

2016 年

序号	专利名称	类别	授权时间	专利号	全部发明人
1	牛 Asia1/O 型口蹄疫双价多表位疫苗及其制备方法和应用	国家技术发明专利	2016.08.24	ZL201410093058.5	邵军军, 常惠芸
2	牛 A 型口蹄疫广谱多表位疫苗及其制备方法和应用	国家技术发明专利	2016.09.17	ZL201310144390.5	邵军军, 常惠芸
3	嵌合 IBV 4/91 株纤突蛋白膜外区基因片段的重组传染性支气管炎病毒及其构建方法和应用	国家技术发明专利	2016.01.27	ZL-201310573277.9	郭慧琛, 孙世琪, 魏衍全, 董虎, 王海民, 孙德惠, 刘定祥, 方守国, 才学鹏, 殷宏