Annual Progress Report

2018-19

CAAST-Advanced Centre for Livestock Health
NAHEP (ICAR-WB Project)
ICAR-Indian Veterinary Research Institute
(Deemed University)
Izatnagar-243122 (UP) India

Annual Progress Report
2018-19

CAAST-Advanced Centre for Livestock Health
NAHEP (ICAR) (ICAR-WB Project)

Head of Institution	**:**	**Dr R.K. Singh**, Director & Vice Chancellor
Nodal Officer	**:**	**Dr Triveni Dutt**, Joint Director (Academic) & Dean
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Front Cover page Photo:
IVRI, Deemed University Building

Back Cover Page Photo:
Experimental Dairy Farm at ICAR-IVRI, Izatnagar

Centre for Advanced Agricultural Science & Technology (CAAST)
Advanced Centre for Livestock Health (ACLH)
ICAR-World Bank Funded
National Agricultural Higher Education Project (NAHEP)
ICAR-Indian Veterinary Research Institute, Izatnagar-243 122 (U.P.)

Printed by:
Bytes & Bytes
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Objectives and Activities

A. OBJECTIVE 1:

To translate advanced knowledge in the field of livestock health for skill and entrepreneurship development among students and faculty, and empowering other stakeholders

Activities

1. Faculty up gradation through international training
2. PG students sandwich programme covering the identified areas
3. Adjunct / Visiting Professors in the thrust areas
4. Distinguished lecture series/ special lectures required
5. New PG courses development and existing PG courses revision
6. Development of e-content of PG courses
7. Development of certificate courses for skill development in advanced areas
8. Targeted research collaborations with national and international centres of excellence
9. Development of e-learning / ICT tools for effective education, Industry Collaboration and impact assessment

B. OBJECTIVE 2:

To develop a globally competitive state-of-the-art infrastructure in teaching and research in the proposed thrust areas

Activities

1. Procurement of high-end equipments to support advanced research, teaching and training in the identified areas
2. Renovation of existing infrastructural facilities like challenge animal shed, and select laboratories

C. OBJECTIVE 3:

To augment knowledge generation of students and faculty in the advanced areas of vaccinology, diagnostics, immune-nutrition and genomics for the improvement of livestock health

Activities: Knowledge Generation through Exposure to Advanced Areas (rDNA, reverse genetics, combination vaccines, biosensor-based diagnostics, herbal-, nanoparticle- and AMP-based-therapeutics, nutraceuticals, and genomics) in Livestock Health

a) Improved vaccines

i. Thermostable vaccines for FMD
ii. Thermostable vaccine for PPR
iii. Combined vaccines for PPR+Sheeppox, PPR+Goatpox

b) New vaccines

i. DIVA-compatible negative marker vaccine for FMD
ii. DIVA enabled Brucella vaccine for cattle/buffalo

c) New vaccine candidates

i. Marker vaccine for PPR
ii. Recombinant PCV-2 protein as vaccine candidate
iii. CSFV marker vaccine candidate using reverse genetics system
iv. Recombinant Sheeppox+PPR vaccine candidate

d) Diagnostics

i. Companion diagnostics for FMD
ii. DIVA compliant tests for PPR
iii. ELISA for PCV-2 antibodies
iv. Pen-side diagnostics for Brucella
v. Molecular/serological tests for haemo-parasitic infections in cattle/ buffalo

e) Generation of induced pluripotent stem cells and its depository

f) Therapeutic intervention for treatment of disease conditions (Mastitis, diarrhea) caused by AMR

g) Immuno-nutrition approaches

i. Development of pre-/probiotics-based nutraceuticals and test their efficacy using nutritional, metabolic, immunological and nutrigenomics approaches
ii. Feeding trials to validate potential of the proven nutraceuticals in improving the immune-competence of animals vaccinated against select bacterial and viral diseases

h) Genomic approaches

i. Generation of data on health and behavioural parameters in real time.
ii. Study of immune-competency of animals and response to vaccination by SNP chips/ genotyping-by-sequencing (GBS)-based genome-wide association study (GWAS)

Core Faculty

Sl. No.	Name and Designation	Discipline	Area of specialization	Contact address
1.	Dr Triveni Dutt, Joint Director (Academic) & Dean Nodal Officer	Livestock Production and Management	Animal Breeding, Livestock Production and Management and ICT	9412510980 trivenidutttivri@gmail.com
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3.	Dr B.P. Mishra, Joint Director (Research)	Animal Genetics & Breeding, Animal Biotechnology	Genomics, marker identification and association studies	9456947467 jdr@ivri.res.in bpmishra_1@hotmail.com
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Associate Faculty

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21.	Dr C.L. Patel Scientist	Veterinary Biotechnology	DIVA-capable vaccine, Reverse genetic system	9760821407 patelcl@gmail.com

22.	Dr Babloo Kumar Scientist	Veterinary Bacteriology	Brucella diagnostics	babbacteriol@gmail.com
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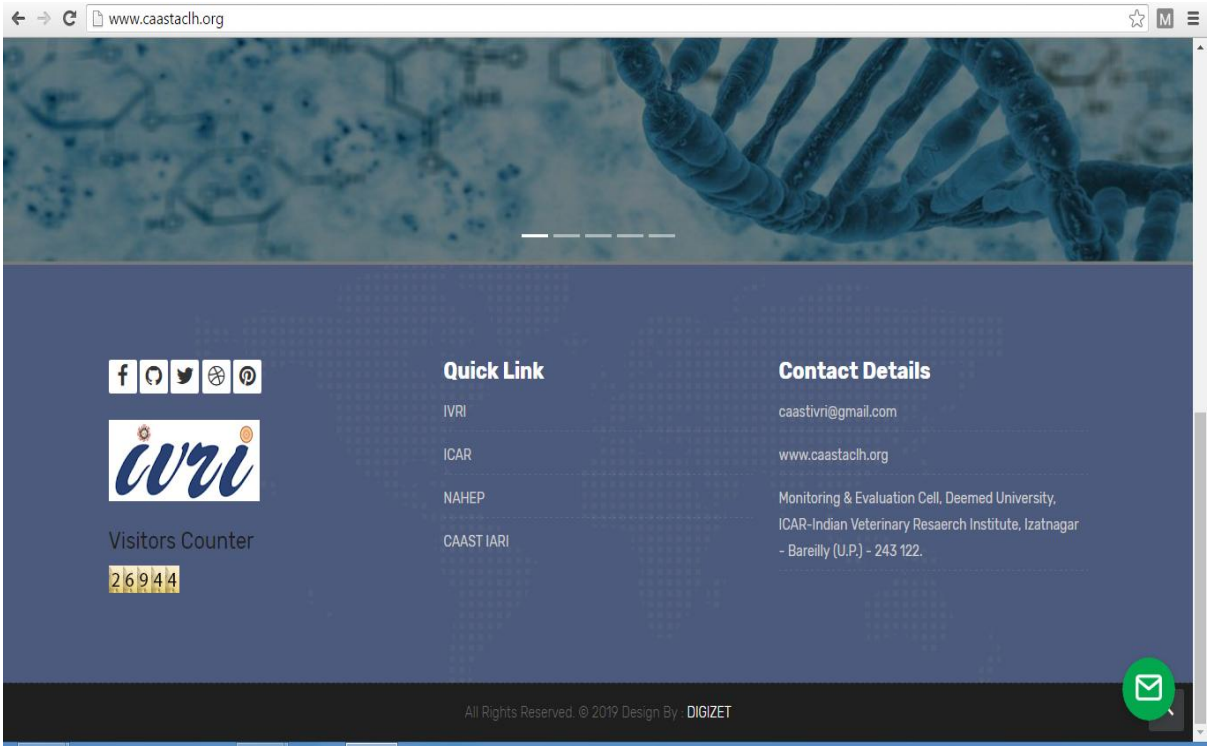

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Objective 1

To translate advanced knowledge in the field of livestock health for skill and entrepreneurship development among students and faculty, and empowering other stakeholders

Activities

1. Faculty up gradation through international training
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Activity-1

Faculty up gradation through International trainings

International Training for Faculty

Duration: One Month International level Training

Areas of Training:

- Protein modeling based vaccine design and development
- Reverse Genetics
- Nanotechnology & cell reprogramming
- Big data analysis and bioinformatics
- Advanced diagnostics
- Immuno-nutrition & Clinical nutrition
- QTL analysis and Statistical Modelling in GWAS, Animal Behaviour, Advanced animal health economics
- Promoter engineering / recombinant vectored vaccines
- e-learning, ICT, Expert system, Veterinary Higher Education

Total Faculty to be trained: Ten (Three in 2018-19)

Short Term Visit

Duration:

- One Week

Area of training:

- Veterinary higher education

Total Faculty to be deputed: Seven (Three in 2018-19)

Achievements

List of Faculty identified for training

Name, Designation& Adress of faculty	Institute visited / to be visited	Short visit/Training	Dates for visit
Dr Bina Mishra, PS, IVRI, Izatnagar	Pirbright Institute, UK	One month Training	23.06.2019 to 22.07.2019
Dr Madhu Hosamani, Scientist, IVRI Campus Bengaluru	Vesicular diseases laboratory, Wageningen Bioveterinary Research, Lelystad, Netherlands	One Month Training	25.07.2019 to 24.08.2019
Dr Shanmugam Chandra Sekar, Scientist (SS), Division of Virology, IVRI-Bengaluru Mukteswar	Pirbright Institute, Woking Surrey, UK	One Month Training	Likely to visit in January 2020
Dr Aniket Sanyal, PS & JD	Pirbright Institute, UK	Short Visit (One Week)	09.09.2019 to 16.09.2019
Dr Pallab Chaudhury, Head, Bacteriology and Mycology Division	Pirbright Institute and University of Reading UK	Short Visit (One Week)	09.09.2019 to 16.09.2019
Dr Samiran Bandopadhyay, Principal Scientist	Pirbright Institute, UK	Short Visit (One Week)	09.09.2019 to 16.09.2019

Activity-2

PG students sandwich programme

Duration:

- Three Month International level Training

Areas of Training:

- Protein modeling
- Vaccine delivery systems
- Marker/combined vaccine development
- Reverse genetics
- Advanced diagnostics
- Nano-technology, cell reprogramming
- CRISPR gene editing
- Bioinformatics/ big-data analyses
- Host-pathogen interaction
- Biosensor
- Molecular epidemiology of AMR
- Immuno-nutrition and clinical nutrition
- QTL analysis for GWAS
- E-learning and ICT tools

Total Students to be trained:

- Seventy Five (16 students in 2018-19)

Achievements

A total of 16 students were selected for were selected for 3 months overseas training. Out of them placements for a total of 10 students (9 Ph.D., 01 M.V.Sc) were fianlised. Details of these students are given in following table:

List of Students selected for the overseas training whose lab placements are finalized (1st batch)

Name of Student	Ph.D./ M.V.Sc.	Research area	International training undertaken or proposed	Host institute	Student photo
Akansha Singh, P-2051	Ph.D.	Genome wide association (GWAS)	Michigan State University, USA	ICAR-IVRI, Izatnagar	
Richa Arora, P- 2078	Ph.D.	Bioinformatics, big-data analyses, new-generaton sequencing and sequence data analysis	Michigan State University, USA	ICAR-IVRI, Izatnagar	
Waseem Akram Malla, P-2031	Ph.D.	Bioinformatics, big-data analyses, new-generaton sequencing and sequence data analysis	Michigan State University, USA	ICAR-IVRI, Izatnagar	
Anil Gattani, P- 2021	Ph.D.	Host-pathogen interaction	University of Missouri, Columbia, USA	ICAR-IVRI, Izatnagar	
Mageswary. R, P-1869	Ph.D.	Genetically engineered vaccine/reverse genetics	University of Maryland, USA	ICAR-IVRI, Izatnagar	
Arnav Mehrotra, P-2116	Ph.D.	Bioinformatics, big-data analyses, new-generaton sequencing and sequence data analysis	ETH, Zurich, Switzerland	ICAR-IVRI, Izatnagar	
Ranjitha H.B., P- 2082	Ph.D.	Genetically engineered vaccine/reverse genetics	CSIC, Madrid, Spain	ICAR-IVRI, Izatnagar	
Dharanesha N.K., P-2091	Ph.D.	Advanced diagnostics	Vetmed Uni Vienna, Switerzerland	ICAR-IVRI, Izatnagar	
Mahvash Hira Khan, M-5869	M.V.Sc.	Advanced diagnostics	Kyushu University, Fukuoka, Japan	ICAR-IVRI, Izatnagar	
Pragya Joshi	Ph.D.	ICT Application	Areadne, Lifelong learning Centre, Greece	ICAR-IVRI, Izatnagar	

Activity-3

Adjunct / Visiting Professorship

Duration:

- 12-14 hours; 20 -28 hours; 15 days, Less than a month, 1-4 months

Major Areas

- Nanoparticles in vaccine delivery
- Cellular reprogramming / nanotechnology
- Vaccine Differentiation
- Advance Diagnostics
- Advance Vaccinology
- Epidemiology of AMR
- Nutraceuticals, gut health and immunity
- QTL analysis in farm animals
- GWAS in farm animals

Total faculty to be invited:

- Ten (Three in 2018-19)

Activity-4

Distinguished Lecture Series/ Special Lectures

Duration:

- One hour

Major Areas:

- New generation sequencing and Bio-informatics
- Bio-statistics in vaccine research
- GMP-GLP
- Advance Vaccinology & Diagnostics
- GBS data analysis
- Translational Bioinformatics
- Genomics
- Genome analysis
- Vaccine Differentiation (DIVA strategy)
- Advance Vaccinology & Diagnostics
- Nutrition, gut health and immunity
- Nutrition and gut microbiome

Total lectures to be organized:

- Total seventeen (National; 12 and International ;5 & 05 lectures during 2018-19)

Achievements

Sl. No.	Name of the speaker	Topic	Date of lecture	Number of participants
1.	Dr Neerav Koharwal Biosafety Officer, IVRI, Izatnagar	Bio-waste Management in Research Institutes	17.01.2019	32
2.	Dr Rituraj Konwar Scientist-F, CDRI, Lucknow	Advances and Challenges in recent drug discovery approaches	23.03.2019	75
3.	Dr Sachin Kumar, Associate Prof, IIT-Guwahati	Avian paramyxo virus, friend or foe	23.03.2019	75
4.	Dr Narayan Chandra Mishra, IIT-Roorkie	Nanotechnology based biomimetic scaffolds for tissue engineering	26.03.2019	58
5.	Dr H.B.D. Rao, Scientist E, NIAB, Hyderabad	DNA Damage Response and Repair Pathway	27.03.2019	84
6.	Dr Amit Kumar Goyal, Scientist E, NIAB, Hyderabad	Targeted drug delivery and nanomedicine	27.03.2019	84

Glimpses of Distinguished lecture series

Dr Rituraj Konwar, Scientist-F, CDRI, Lucknow delivering lecture on 23rd March 2019 under distinguished lecture series

Lecture by Dr Sachin Kumar, Associate Prof, IIT-Guwahati on 23rd March 2019 under distinguished lecture series

Dr R.K. Singh, Director, ICAR-IVRI interacting with speakers during distinguished lecture series

Lecture by eminent speaker under distinguished lecture series

Participation of faculty and students in distinguished lecture series

Activity-5

New PG courses development and existing PG course revision

Total New Courses to be developed : 10
Existing PG Courses Revision : 2

Details of courses to be developed/ Revised

Sl. No.	Title of courses	Theory/ Practical	M.V.Sc./Ph.D.	Discipline
New courses				
1.	Advances in synthetic peptide Biology	T-1		logy
2.	Advances in synthetic peptide Biology	P-1	M.V.Sc./Ph.D.	Animal Biotechnology
3.	Basic techniques in development of Bioassays and Biosensors	T-1	M.V.Sc./Ph.D.	Animal Biotechnology
4.	Basic techniques in development of Bioassays and Biosensors	P-1	M.V.Sc./Ph.D.	Animal Biotechnology
5.	Electron Microscopy & bio-imaging	P-1	M.V.Sc./Ph.D.	Virology and Biotechnology
6.	GLP, GMP in R&D and product development	T-1	M.V.Sc./Ph.D.	Virology and Biotechnology
7.	Epidemiology of AMR and its mitigation strategies	T-1	M.V.Sc./Ph.D.	Vet. Public Health & Epidemiology
8.	Reproductive ultrasonography for farm animals	T1 +P1	M.V.Sc. & Ph.D.	Veterinary Gynaecology
9.	Principles of biosecurity and biosafety	T1	M.V.Sc. & Ph.D.	Biotechnology, Standardization/BP Division
10.	Advances in instrumentation techniques	P1	M.V.Sc. & Ph.D.	CIF
Existing PG courses revision				
1.	BCT 731/BCT 732 (Content addition SPR and Electrochemical sensing techniques, principal and applications)		Ph.D.	Animal Biochemistry
2.	Principles of Genetics		M.V.Sc.	Animal Genetics & Breeding

Achievements
Various new courses are under development, while two courses are under revision

Activity-6

Development of E-Content of PG courses

E-Content to be developed

- E-Books/ Atlas/Album
- Course PPts
- AV Aids
- Short Videos
- Interactive Case Studies
- E-tutorial
- Instructional module

Details of Courses for development of E-Content

Sl. No.	Title of courses	M.V.Sc./ Ph.D.	Discipline	Format (e-book, course PPts, i-lectures etc.)
1.	Veterinary Virology	M.V.Sc./Ph.D.	Veterinary Microbiology	e-book, e-course, PPts
2.	Advances in protein Engineering	M.V.Sc. & Ph.D.	Animal Biotechnology	e-book / course PPts
3.	Chemical synthesis of peptides and nucleotides	M.V.Sc. & Ph.D.	Animal Biotechnology	e-book / course PPts
4.	Basics of Bioassays and Biosensors	M.V.Sc. & Ph.D.	Animal Biotechnology	e-book / course PPts
5.	Parasitology Atlas	M.V.Sc./ Ph.D.	Veterinary Parasitology	e-Book and Hard Copy
6.	Epidemiology of AMR and its Mitigation Strategies	M.V.Sc./ Ph.D.	Vet. Public Health & Epidemiology	Course PPTs
7.	Developing MCQ (Multiple Choice Questions) based teaching modules on major reproductive events in farm animals	M.V.Sc. / Ph.D.	Veterinary Gynaecology	e-tutorial
8.	MCQ Based modules for surgical events	M.V.Sc. / Ph.D.	Veterinary Surgery and Radiology	e-tutorial
9.	MCQ Based modules for improving research methodology	M.V.Sc. / Ph.D.	Extension Education	e-tutorial
10.	MCQ Based e-modules in extension method and audio visual Aids	M.V.Sc. / Ph.D.	Extension Education	e-tutorial
11.	Lecture series on important reproductive facets of livestock	M.V.Sc. / Ph.D.	Veterinary Gynaecology	PPT series
12.	Developing AV aids on major obstetrical conditions in cows and buffalo	M.V.Sc. / Ph.D.	Veterinary Gynaecology	AV aids
13.	Instructional/ simulation model to imitate gynecological and obstetrical conditions of bovine	M.V.Sc. / Ph.D.	Veterinary Gynaecology	Instructional model
14.	Extension Teaching Methods and AV aids	M.V.Sc.	Extension Education	Course PPTs
15.	General and orthopedic surgery	M.V.Sc./ Ph.D.	Veterinary Surgery and Radiology	Short videos, interactive case studies, PPTs
16.	Anesthesiology	M.V.Sc./ Ph.D.	Veterinary Surgery and Radiology	Short videos, interactive case studies, PPTs
17.	Radiology	M.V.Sc./ Ph.D.	Veterinary Surgery and Radiology	Short videos, interactive case studies, PPTs, E-album

Target for 2018-19: Course content of three courses to be developed

Achievements

Sl. No.	Name of course	Discipline	M.V.Sc./Ph.D.	Course Content Developed
1.	Advances in Protein Engineering	Animal Biotechnology	M.V.Sc./Ph.D.	Lecture-wise PPTs of these course contents are being developed
2.	Epidemiology of AMR and its mitigation strategies	Veterinary Public Health & Epidemiology	M.V.Sc./Ph.D.	
3.	Important reproductive facets of livestock	Veterianry Gynaecology	M.V.Sc./Ph.D.	

Activity-7

Development of Certificate Courses

Total number of Certificate courses to be developed: **8**

Duration of various certificate courses: 1**0 Days to 1 Month**

Details of Certificate courses to be developed

Sl. No.	Title of courses	Minimum educational qualification of participant	Duration
1.	Hybridoma Technology	MSc	2 month
2.	Animal Cell culture & Viral Bio-assay	MSc	1 month
3.	Molecular Biology Techniques in Virus Research	MSc	1 month
4.	Advanced Techniques for Virus Disease Diagnosis	BVSc/MSc	1 month
5.	Veterinary Biologicals: Production and Quality control	BVSc/M.V.Sc.	1 month
6.	Basics of Biomedical Instrumentation	M.V.Sc.	10 days
7.	Nanotechnology and Bio-Molecules Loading	Post graduate	1 month
8.	Antimicrobial Sensitivity Monitoring in Veterinary Polyclinics	BVSc / BSc Lab. Tech.	1 month

Achievements

A total of three certificate courses viz., Animal Cell culture & Viral Bio-assay, Advanced Techniques for Virus Disease Diagnosis and Molecular Biology Techniques in Virus Research are under development

Activity-8

Targeted research collaborations with national and international centers of excellence

MOU signed with two Institutes & in process with 09 National Institute/Universities and FAO

List of Universities/Institutes with whom MoU Signed/ to be signed

Sl.No.	Name of the University
1.	MJP Rohilkhand University, Bareilly (Signed)
2.	Sri Venkateswara Veterinary University, Tirupati (AP) (Signed)
3.	Nanaji Deshmukh Veterinary Science University
4.	Banaras Hindu University
5.	Guru Angad Dev Veterinary and Animal Science University, Ludhiana, Punjab
6.	Karnataka Veterinary, Animal and Fisheries Sciences University, Nandinagar, Bidar
7.	Sher-e-KashmirUniversity of Agricultural Sciences and Technology, Jammu
8.	Indian Institute of Technology, Roorkee
9.	CCS NIAH, Bagpat
10.	FAO through, NAHEP
11.	Navsari Agricultural University, Gujarat

Activity-9

Development of e-learning/ICT Tools for effective education, Industry Collaboration and Impact Assessment

9.1 Development of e-learning/ICT Tools

1. Development of Educational Mobile Apps

Total Number of Mobile Apps to be developed:15

Sl.No.	Title of Mobile App
1	App on Animal Reproduction
2	App on Pig Farming
3	App on Dairy Farming
4	App on Pig Ration Formulation
5	App on Landlly Pig
6	App on Artificial Insemination
7	App on IVRI-Technologies
8	App on Prediction of Productivity parameter
9	App on Biosecurity & Biosafety in farms and labs
10	App on Vaccination Guide
11	App on Veterinary clinical care
12	App Parasite Management Guide
13	App on Livestock Disease Control
14	App on Bio-waste management and utilization
15	App on Zoonotic Diseases
16	App on AMR

2. Development of educational videos on scientific practices & intervention

Total Number of Educational Videos to be developed:15

Sl No.	Title of Video
1	Heat Detection
2	Use of Crystoscope for Heat detection
3	Artificial Insemination in dairy animals
4	Management of Uterine Torsion
5	Management of Dystocia
6	Management of Pre- and Post-partum Prolapse
7	Caesarean section
8	External Fixation for fracture in large animals
9	External Fixation for fracture in small ruminants
10	Tube Cystostomy in Bullock
11	Tube Cystostomy in Calves and Goats
12	Tendon Repair
13	Diagnostic Imaging
14	Neonatal Calf Management
15	Clean Milk Production

3. Development of information system/ expert system

Total information system/ expert system to be developed: 6

Sl.No.	Information System/Expert System
1	Fracture management in large animals
2	Fracture management in small ruminants
3	Urolithiasis management
4	Veterinary clinical care
5	Reproductive disorders and their management
6	Examination of reproductive tract

4. Development of E-Tutorials

Total number of E-Tutorials to be developed: 4

Sl. No.	E-Tutorials
1	MCQ based e-module for reproductive events
2	MCQ based e-module for surgical events
3	MCQ based e-module for improving research methodology
4	MCQ based e-module for improving knowledge and skills in extension methods and AV aids

Achievements

1. Mobile Applications Developed

Sl.No.	Name of the App	Link
1.	IVRI-Pashu Prajanan (Animal Reproduction) App	https://play.google.com/store/apps/details?id=com.mraaapsjd.akmu.pasujanapp&hl=en_IN
2.	IVRI-Shukar Palan (Pig Farming) App	https://play.google.com/store/apps/details?id=com.icar.ivri.pig_app&hl=en_IN
3.	IVRI –Artificial Insemination (Kritrim Garbhadhan) App	https://play.google.com/store/apps/details?id=com.ivri.iasri.aiapp
4.	IVRI-Vaccination Guide app	https://play.google.com/store/apps/details?id=com.icar.ivri.iasri.vcguideapp
5.	IVRI-Dairy Manager App	https://play.google.com/store/apps/details?id=com.ivri.iasri.dmapp
6.	IVRI-Pig Ration App	https://play.google.com/store/apps/details?id=icar.iasri.ivri.pigration
8.	IVRI-Landlly Pig App	https://play.google.com/store/apps/details?id=com.ivri.iasri.landlypig

Details of the Mobile Apps in terms of its ratings and downloads

Name of the App	Languages & other details	Date of Upload	Date of update	Usetr Rating	Downloads
IVRI-Shukar Palan (Pig Farming) App	Hindi, Punjabi language Version: 1.3 Size:6.1 MB	22nd January 2018	20th April, 2018	4.7/5.0	1k+
IVRI-Artificial Insemination App	English language Version: 1.6 Size:3.7MB	6th March 2018	3rd July, 2018	5.0/5.0	1k+
IVRI-Vaccination Guide app	English language Version: 1.2 Size:11MB	22nd November, 2018	26th Feb, 2019	4.5/5.0	5k+
IVRI Dairy Manager	English language Version: 1.3 Size:4.8MB	31st May, 2018	15th June, 2018	4.7/5.0	1k+
IVRI Pig ration	English language Version: 1.1 Size:8.1MB	27th September, 2018	5th November, 2018	4.7/5.0	500+
IVRI-Landlly pig	English language Version: 1.4 Size: 1.75 MB	10th April 2018	08th October, 2018	5.0/5.0	500+

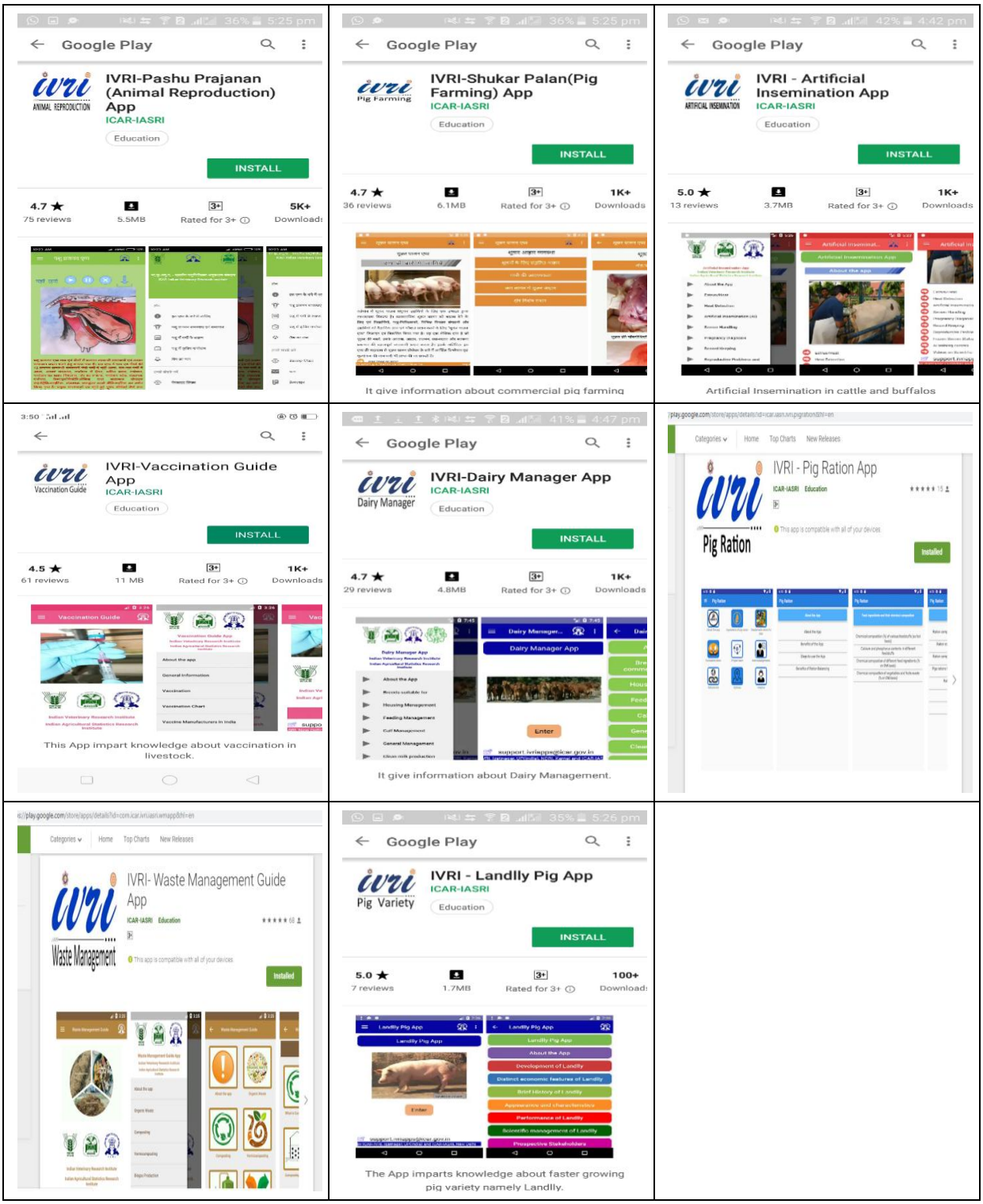
2. Educational Videos Developed

Sl No.	Educational Video	Link
1.	Heat Detection in Dairy Animals (English)	https://youtu.be/UDaT0i4JjpI
2.	Artificial Insemination in Dairy Animals (English)	https://youtu.be/f2YTB1UYvZ4
3.	Artificial Insemination in Dairy Animals (Hindi)	https://youtu.be/flCHtw1xMDg
4.	Heat Detection in animals Using Crystoscope (English)	https://youtu.be/iR6WIYEXvYg
5.	Heat Detection in animals Using Crystoscope (Hindi)	https://youtu.be/9bgsuPrWQ_Y
6.	Clean milk production (English)	https://youtu.be/dl9dag5VUcA
7.	Clean milk production (Hindi)	https://youtu.be/oKfymBSvUQ4
8.	Neonatal calf Management (English)	https://youtu.be/wXSHzzz9RpI
9.	Neonatal Calf Management (Hindi)	https://youtu.be/OmgnEGyZNg8

Details of the educational videos

Sl. No.	Educational Video	Duration	Date of Uploaded	Views
1.	Artificial Insemination in dairy animals (Hindi)	4.04 mins	21st March, 2018	101420
2.	Artificial Insemination in Dairy animals (English)	3.58 mins	21st March, 2018	2449
3.	Heat detection in dairy animals (English)	2.29 mins	1st November, 2018	699
4.	Heat Detection in animals Using Crystoscope (English)	2.36 mins	21st March, 2018	745
5.	Heat Detection in animals Using Crystoscope (Hindi)	2.33 mins	21st March, 2018	1793
6.	Clean milk production (English)	3.03 mins	1st June, 2018	1253
7.	Clean milk production (Hindi)	3.03 mins	1st June, 2018	1799
8.	Neonatal calf management (English)	1.56 mins	2nd July, 2018	172
9.	Neonatal calf management (Hindi)	1.56 mins	26th July, 2018	428

Screenshots of Mobile Apps developed



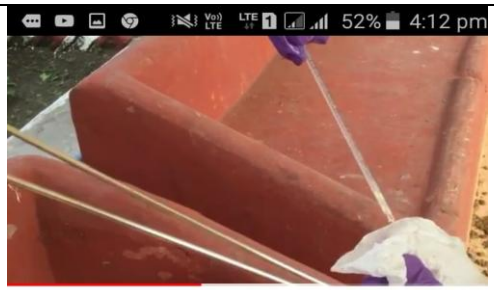
Screenshots of Educational Videos Developed and placed on You Tube in IVRI-Deemed University Educational Channel

Artificial insemination in Dairy Animals Hindi

189K views

985 94 Share Download Save

IVRI- Deemed... 2.65K subscribers SUBSCRIBED



Artificial Insemination in Dairy Animals English

4.2K views

68 2 Share Download Save

IVRI- Deemed... 2.65K subscribers SUBSCRIBED

Heat Detection Using Crystoscope English

924 views

20 0 Share Download Save

IVRI- Deemed... 2.65K subscribers SUBSCRIBED

Heat Detection in Animals using Crystoscope

2.2K views

55 0 Share Download Save

IVRI- Deemed... 2.65K subscribers SUBSCRIBED

Clean Milk Production in English

1.6K views

62 0 Share Download Save

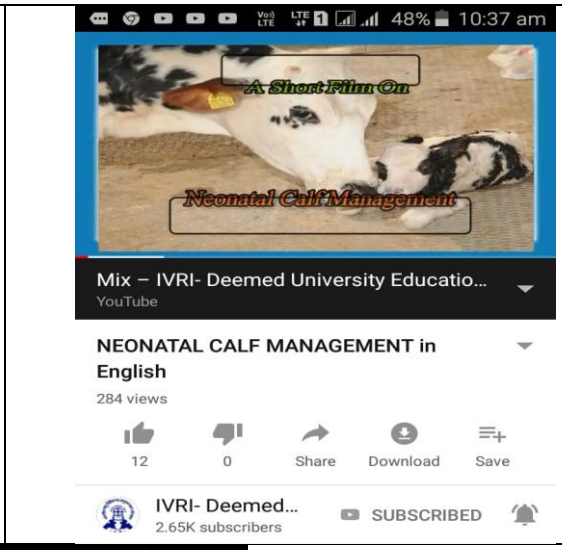
IVRI- Deemed... 2.65K subscribers SUBSCRIBED

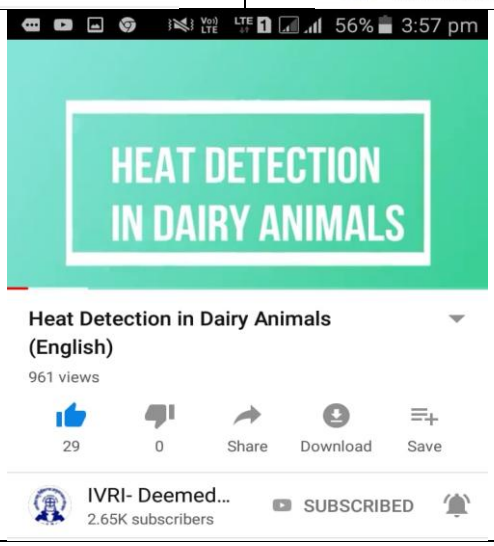
Clean Milk Production in Hindi

2.6K views

63 1 Share Download Save

IVRI- Deemed... 2.65K subscribers SUBSCRIBED





9.2 Industry Participation and Collaboration

Sl.No.	Interface Meets to be Organized	Numbers targeted
1	Interface meet / Business to Business (B2B) meet with Industry and Academia	06 (02 meets in 2018-19)
2	Meetings of Financial and Insurance Institutions with Potential Entrepreneurs	03 (01 meet in 2018-19)
3	Alumni meet for Sharing of Knowledge, Skill and Ideas and support to Veterinary Profession	03 (01 meet in 2018-19)

Achievements

Sl. No.	Interface Meets organised	Dates	Industries/Academia Participated	Number of participants
1.	Institute - Industry-Academia /Interface Meeting at IVRI-ERS, Kolkata	07.12.2018	1. West Bengal Poultry Federation, Keramitola, Bidhannagar East, Midnapore, WB, 2. M/s Cipla Mumbai, 3. M/s Globion India Pvt Ltd, Secunderabad,Telangana, 4. M/s Evonic, Mumbai, IAH&VB, Kolkata, 5. BAU, Ranchi IAH&VB, Kolkata	50

2.	Interface/B2B Meet with Industry, Academia, SAHD and Dairy Cooperatives organized at TEC-IVRI Pune	17.12.2018	1. MANAGE, Hyderabad 2. AB Vista South Asia 3. State Animal Husbandry Department, MS 4. Prado Pvt. Ltd., Pune 5. PDRC, Venkys, Pune, 6. Vetmays Healthcare Pvt Ltd., Pune 7. IVBP, Aundh, Pune 8. Maharashtra Animal and Fisheries Science University 9. Govind Milk Union, Phaltan, Satara 10. Poultry Breeders Welfare Association of Maharashtra	70

Glimpses of the Institute-Academia/ B2B Interface Meets

Group Photograph of the participants at the Institute-Academia meeting at IVRI-ERS, Kolkata on 7th December, 2018

Dr Triveni Dutt, Joint Director, IVRI, Izatnagar, Addressing the participants of the Institute-Academia meeting at IVRI-ERS, Kolkata on 7th December, 2018

Glimpses of the B2B Interface Meets at IVRI-TEC, Pune

Dr KN Bhilegaonkar welcoming the chief guest, Dr AS Ranade, for inaugural function during the B2B Interface Meets at IVRI-TEC, Pune

Dr (Ms) Chanda Nimbkar, Director NARI addressing the participants during the B2B Interface Meets at IVRI-TEC, Pune

Dr Puneet Kumar and Dr R.P. Singh delivering lecture during the B2B Interface Meet at IVRI-TEC, Pune

A view of participants during the B2B Interface Meet at IVRI-TEC, Pune

Group photo with the particiapnts of the B2B Interface Meet at IVRI-TEC, Pune

9.3 Impact assessment

Activities

1. To assess the ex-ante and ex-post impact of vaccines developed by Institute against important livestock diseases using economic surplus model
   - Assessment of impact of vaccine against HS
   - Assessment of impact of vaccine against FMD
   - Assessment of impact of combined vaccine, PPR+Goat pox
   - Assessment of impact of combined vaccine, PPR+Sheep pox
   - Potential impact of Thermostable PPR vaccine
2. To assess the impact of teaching and training conducted by IVRI
3. To assess the impact of extension activities conducted by IVRI using propensity score matching method

Targets: 2018-19

- Assessment of impact of vaccine against HS
- Impact of Teaching and Training
- Impact of extension activities of the institute

Achievements

1. **Cost-Benefit Analysis of vaccination against Haemorrhagic Septicaemia (HS) in India**

The impact was assessed through cost benefit analysis approach and it was found that the BCR calculated was well over unity (12.34, 24.09 and 13.86 for Indigenous cattle, Crossbred cattle and Buffaloes)for all the breeds/species of dairy animals, thus indicating that the benefits of vaccination far outweigh the associated costs. This point towards the economic feasibility of HS control programme through vaccination.

2. **Impact assessment of training imparted by ICAR-Indian Veterinary Research Institute**

On-campus training programmes organized by IVRI (JDEE and KVK) were selected purposively for assessing the impact. Secondary data from annual reports, the institute official website and official documents maintained by Joint Directorate, Extension Education and KVK were obtained regarding trainings focused towards livestock development, imparted during period 2014 to 2016. Farmers from different districts of U.P. had received trainings on different aspects of dairy farming. After complete profiling of trainees received trainings, probability proportional to size sampling was used to select proportionate amount of samples from each block to have an adequate sample size of 80 farmers for the study with the criteria of possessing at least one milch animal by the trainees. To generate the comparison group, non-trainee farmers were selected from the same block but from least intervened villages. As such, from eight villages, 30 dairy farmers who had never attended any training programme were selected randomly from the list of dairy farmer of that village. Thus, ultimate sample size for the study comprised of 80 trainees and 240 non-trainees. Analysis of secondary data revealed that training courses of JDEE is mostly focused towards training of field veterinarians, Livestock Extension Offices and pharmacists etc. As maximum trainings were focused towards training of field Veterinarians so they were selected for the study. A sampling frame of the trainees who had received training during the duration 2014-2016 was prepared. From the sampling frame, adequate number of trainees were selected randomly on the ultimate sampling units. A structured interview schedule was developed with suitable measuring devices including developed scales, existing scales, developed test, indices etc. The instrument for farmer was translated into Hindi for convenience in data collection. Impact of training programmes for farmers were assessed on five parameters like change in knowledge, change in adoption level of new technologies, attitude towards dairy farming, yield difference and profitability from dairy farming. To measure the knowledge of farmers on scientific dairy farming, one knowledge test was developed. For other parameters already developed scale and schedule were used. To reduce the selection bias between trainee and non-trainee farmers, propensity score matching (PSM) was used, so that the observed difference on the above mentioned parameters should be attributed to impact of training. For assessing the impact of training programmes of veterinary officers, a qualitative method i.e. Bennet's hierarchy was used. The training imparted had positive impact on Attitude, Knowledge, and Skills (practice) on Veterinary Officers and farmers. Limited manpower for training and timing of the training including duration were limiting factors adversely affecting the training outcome. The VOs expressed that they need trainings in clinical practices, followed by production aspects and extension services delivery.

Workshops/ Trainings for Technologies developed and Knowledge Sharing

Duration:

- One to Two Days

Major Areas:

- New generation sequencing and Bio-informatics
- Bio-statistics in vaccine research
- GMP-GLP
- Advance Vaccinology & Diagnostics
- GBS data analysis
- Translational Bioinformatics
- Genomics
- Vaccine Differentiation (DIVA strategy)
- Advance Vaccinology & Diagnostics
- Nutrition, gut health and immunity
- Nutrition and gut microbiome
- ICTs, Artificial Intelligence

Total Workshops to be organized:

- Six (Two in 2018-19)

Achievements

1. Workshop on "skill and entrepreneurship development in animal nutrition and allied sciences" planned on 18th June 2019
2. Training Cum Workshop on Next Generation Sequencing data analysis planned on 24th to 25th April, 2019

Objective 2

Procurement of high-end equipments to support advanced research, teaching and training in the identified areas

Activities

1. Procurement of high-end equipments to support advanced research, teaching and training in the identified areas
2. Renovation of existing infrastructural facilities like challenge animal shed, and select laboratories

Activity-1

Procurement of high end equipments and renovation of challenge shed

List of equipments to be procured

Sl.No.	Name of research and teaching equipment
i	Ultracentrifuge with rotors and other accessories (01 number)
ii	Ultracentrifuge rotors of different sizes (03 numbers)
iii	In-Vivo Imaging system (1 number)
iv	Automatic bacterial identification and growth measuring system (1 number)
v	Animal activity meters with accessories (1 number)
vi	Digital PCR Machine (1 number)
vii	Portable Colour Doppler ultrasonograph with probes and OPU unit (1 number)
viii	High-end data analytical system which includes servers/computers/softwares and other peripherals & accessories (1 number)
ix	RFID Tags (600 no.), applicator (3 no.), reader (5 no.), software with accessories (1 number)
x	CCTV camera with accessories and installation at the farm: 36
xi	Transmission Electron Microscope with accessories(1 number)

Achievements

Following equipment were approved for procurement under the CAAST:ACLH for the year 2018-19

1. Transmission Electron Microscope with accessories (ICB documents prepared and got vetted by RITES)
2. Ultracentrifuge with rotors and other accessories
3. Ultracentrifuge rotors of different sizes
4. High End data analysis system:

RFQ for above equipment were generated but purchase could not be materialized due to nonresponsive bids..

Activity-2

Renovation/ Repair of existing infrastructural facilities

- Renovation and repair of animal challenge shed and laboratories

Achievements

Technical specification for renovation of Animal as per ABSL-2 prepared and tender but tender was not floated due to non availability of sufficient funds

Objective-3

To augment knowledge generation of students and faculty in the advanced areas of vaccinology, diagnostics, immune-nutrition and genomics for the improvement of livestock health

Activities

Knowledge Generation through Exposure to Advanced Areas (rDNA, reverse genetics, combination vaccines, biosensor-based diagnostics, herbal-, nanoparticle- and AMP-based-therapeutics, nutraceuticals and genomics) in Livestock Health

Knowledge generation of students and faculty in the advanced areas of livestock health

Activities: Knowledge Generation through Exposure to Advanced Areas (rDNA, reverse genetics, combination vaccines, biosensor-based diagnostics, herbal-, nanoparticle- and AMP-based-therapeutics, nutraceuticals, and genomics) in Livestock Health

i. Improved vaccines

1. Thermostable vaccines for FMD

Thermostable FMD virus serotype Asia1 Virus Like particle (VLP) was produced in baculovirus expression system. For this infectious clone of FMDV type A 40-2000 vaccine strain was developed

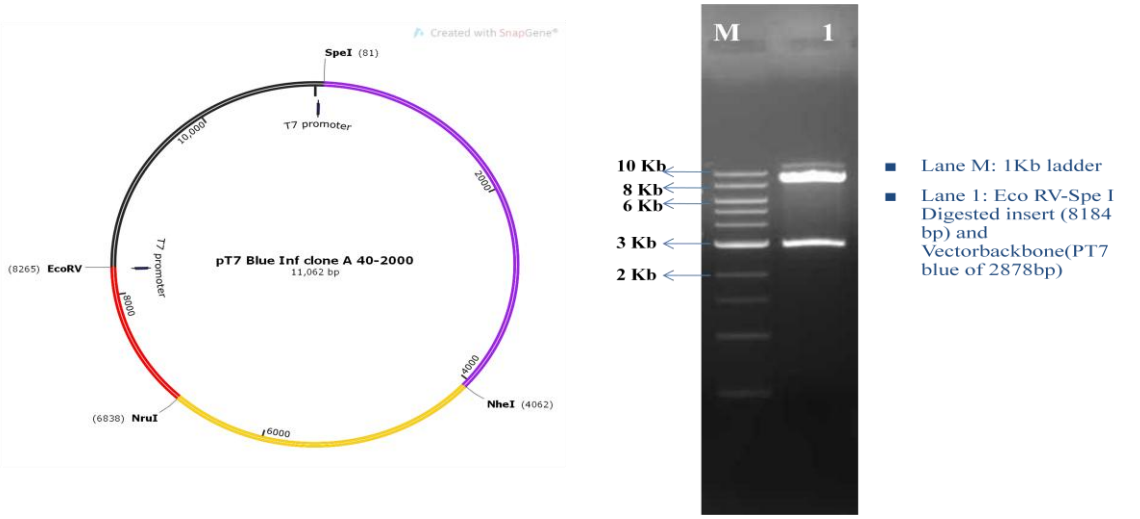


Fig. 1: *Schematic map of the infectious clone construct FMDV type A strain A40/2000*

2. Thermostable vaccine for PPR

The existing PPR vaccine is highly thermolabile. In order to increase utility of existing vaccine in field efforts are being made to develop a thermotolerant PPR vaccine using improved stabilizer formulations and freeze drying cycle 1.

A lyophilization cycle of 16 hours using 200µl of vaccine was developed with five selected formulations after screening ten stabilizer combinations based on the stability at 37°C and freeze-thaw cycles **(Figure 1 A & B).** The study revealed that inclusion of 5% trehalose and 0.5% gelatine to formulation containing Lactalbumin hydrolysate-sucrose (LS) has significantly improved the stability as compared to LS alone and maintained a shelf-life of at least 1305.3 against 437.7 days at 2-8°C, 23.68 against 14.91 days at25°C, 20.88 days against 11.95 days at 37°C, 5.01days against 2.76 days at40°C and 3.22 days against 1.8 days at 45°C. Reconstitution of vaccine with 200 µl of 0.85% NaCl maintained superior shelf-lives (10.13 days) at 25°C with 5% trehalose and 10% sorbitol in combination with Lactalbumin hydrolysate-sucrose (LS). A combination of LS, trehalose and gelatine provided a shelf-life of 1.77 days at 37°C, 22.41 h at 40°C and 10.05 h at 45°C in reconstituted vaccines. The study suggested that a combination of LS, 5% trehalose and 0.5% gelatine was stable at 40°C and can be used to develop thermotolerant PPR vaccine.

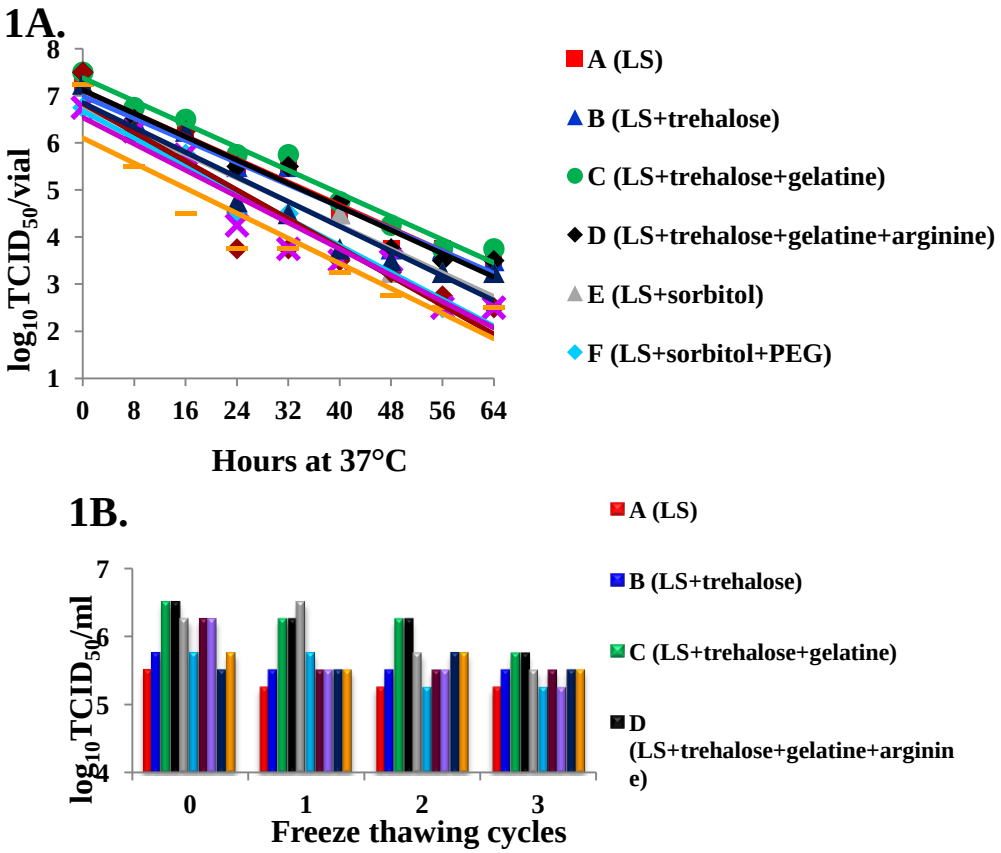


Fig. 2: *Screening of stabilizer formulation/combinations for liquid PPR virus stability by exposure at 37°C (1A) and three cycles of freeze-thaw (1B). Note that stabilizer combinations C and D are equally superior to all others both for exposure at 37°C and freeze-thaw cycles.*

3. Combined vaccines for PPR+Sheeppox, PPR+Goatpox:

Vaccine viruses of PPR, goatpox and sheeppox were propagated. Combined vaccines of PPR +goatpox, PPR + sheeppox were prepared. Both combined vaccines are being evaluated for their efficacy

ii. New vaccines

1. DIVA-compatible negative marker vaccine for FMD

FMDVA 40/2000: RT-PCR amplification was carried-out and amplicon was cloned to make complete genome length clone. The recombinant clone was characterized by sequence analysis and the sequence identity study with the parent virus was carriedout.. Infectious RNA from the linearized clone was generated through *in vitro* transcription.

FMDV Asia1 63/72: A deletion mutant of FMDV Asia1 63/72 vaccine strain infectious cDNA was generated by deleting C-terminal NSP3A gene using site directed mutagenesis PCR. The plasmid constructs were confirmed by sequencing. *In vitro* transcribed RNA of the partial 3A deleted constructs was transfected in T-7BSR cells.The study is under way to characterize mutant virus.

2. DIVA enabled Brucella vaccine for cattle/buffalo:

Brucella abortus Strain 19 was modified by deletion of perosamine synthetase gene and named as S19Δper strain. S19Δper was found to be attenuated in mice and conferred protection in immunized mice against challenge with virulent *B. abortus* 544. Further, the preclinical toxicity testing of S19Δper is under way in guinea pigs. The guinea pigshave been screened for reactivity to RBPT antigen. None of the animal sera showed agglutination reaction and were found negative for *Brucella* infection. Bacterial culture S19Δper has been revived and tested for Brucella specific primers. After confirmation of identity of the bacteria, S19Δper was grown in Brucella broth supplemented with antibiotics – CITA and kanamycin. Enumeration of bacterial culture was done by

10-fold serial dilution. Dose for preclinical toxicity analysis has been optimized. Further experiments are in progress.

iii. New vaccine candidates

1. Marker vaccine for PPR

Primers have been designed for the site directed mutagenesis of the PPRV infectious clone and mutated product is being generated.

2. Recombinant PCV-2 protein as vaccine candidate

The codon optimized capsid protein gene of Porcine Circovirus 2 was synthesized commercially for expression of gene inbaculovirus expression system. Appropriate restriction sites were added in the codon optimized gene for cloning in baculovirus expression vectors (pFAST bac-1 and pFAST HBSSS bac-1). Synthetic full length optimized capsid protein gene was cloned in pUC vector and confirmed by restriction enzyme digestion (Fig-1). Primers were designed to amplify 120 nucleotide n-terminal truncated caspid protein gene. Full length (702 nt) and truncated capsid protein gene (582 nt) was cloned in baculovirus expression vector and subsequently confirmed by restriction enzyme digestion (Fig-2). The Bacmids for both full length and truncated capsid protein were generated by transformation of recombinant baculovirus expression vector in MAX efficiency DH10Bac cells. Bacmids for both full and truncated capsid protein genes were confirmed by vector and gene specific primers (Fig. 3). Protein expression in insect cell line is under way.

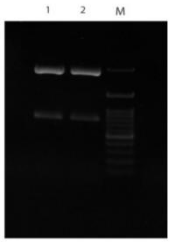


Fig.1
Confirmation of Full Length Capsid Protien gene In pUC vector by RE Digestion

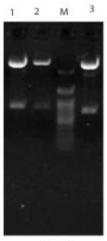


Fig. 2
Confirmation of Full (1,2-750 bp) & Truncated CapsidProtien gene (3-626 bp) In baculovirus expression vector by RE Digestion

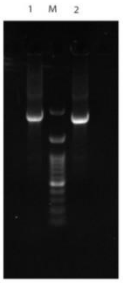
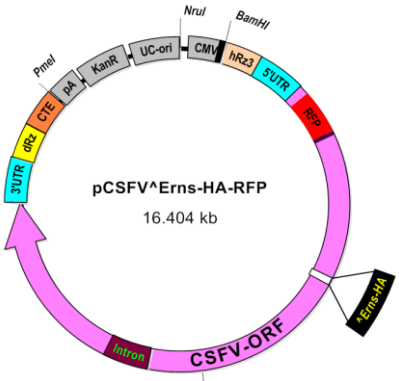
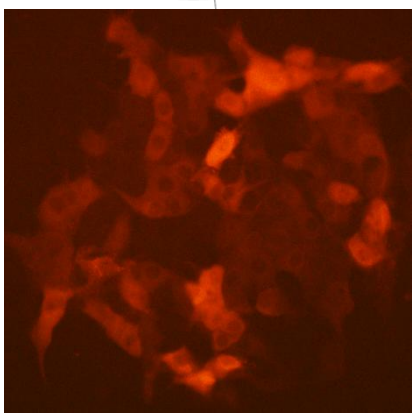


Fig.3
Colony PCR of white colonies of DH10Bac containing full (1-2950 bp) and truncated (2-2826 bp) genes of PCV-2 VP2 in respective Bacmids.

3. CSFV marker vaccine candidate using reverse genetics system

The different rescue plasmids (Fig. 1) having whole CSFV genome containing HA epitope tag, red fluorescence protein (RFP) gene, as well as partial deletion of E^{rns} gene encoding epitopes, are constructed through multiple cloning and sub-cloning steps, which is further characterized by sequencing.





The newly constructed rescue plasmid was transfected in PK15 cell line for its functional evaluation. The recovered CSFV progenies are non-cytopathic virus. Therefore, virus multiplication in the transfected cell line was observed in the fluorescence microscope as visible in figure-2.

Studies of other parameters like virus stability and growth kinetics are in progress.

Further, the exploration of classical swine fever virus as a recombinant viral vector for delivery of heterologous gene in mammalian cells for development of glycosylated proteins and multivalent vaccine. In this direction, various rescue plasmids containing reporter genes of different lengths are in progress to know the foreign gene accommodation capacity of CSFV.

4. Recombinant Sheeppox+PPR vaccine candidate

- Indigenous SPPV promoters were identified by *in-silico* analysis and their comparative evaluation in SPPV infected Vero cell line was done through reporter gene expression which indicated it to be 2.83 fold better in expression profile than Vaccinia viral p11 promoter, so it is taken further for the construction of donor vector.
- The bivalent pTKsppv-HPkzpprF-L4kzGFP donor vector (fig.1) containing both F and GFP gene was constructed to evaluate identified SPPV L4 promoter for its functional characteristcs. AlsoThe bivalent pTKsppv-HPkzpprF-L4kzpprH transfer vector (fig.1) containing both F and H immunogenic gene of PPR virus was constructed and characterized and transfer vectors were transfected in SPPV infected Vero cell line. The characterization of the recombinant virus is in progress.
- The recombinant SPPV-PPR (H+F) virus was selected using BrDU selection procedure as F and H gene of PPR virus was inserted in TK gene of SPPV.
- In BrDU selection methodology, we found that the wild type virus outnumber the recombinant SPPV-PPR (H+F) virus in normal Vero cell line. To resolve this issue, TK knocked out Vero cell line development by the CRISPR-CAS9 technique is under progress

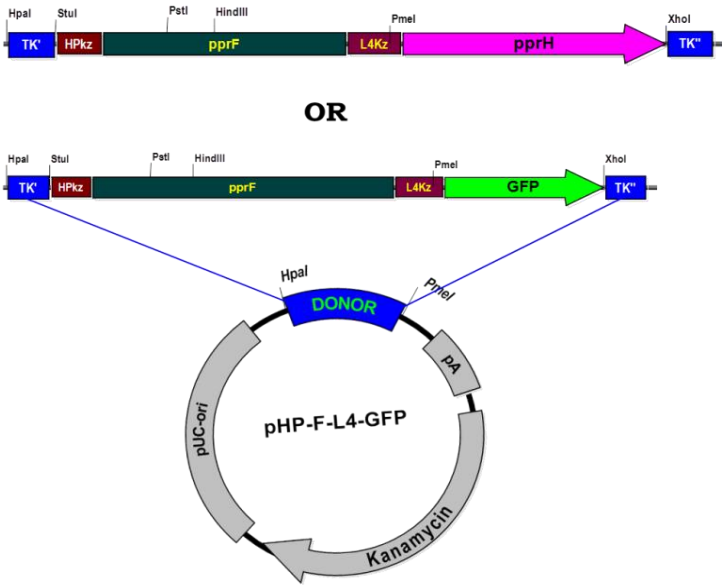


Fig. 1: *Typical Diagram depicting arrangements of DNA sequences in pTKsppv-HPkzpprF-L4kzppH and pTKsppv-HPkzpprF-L4kzGFP donor vector for homologous recombination with viral genome of SPPV in infected cell line*

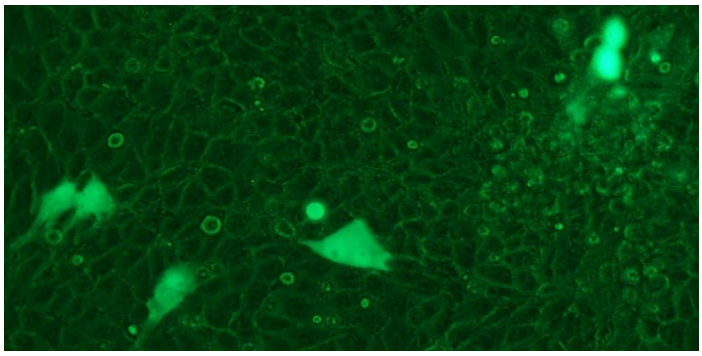


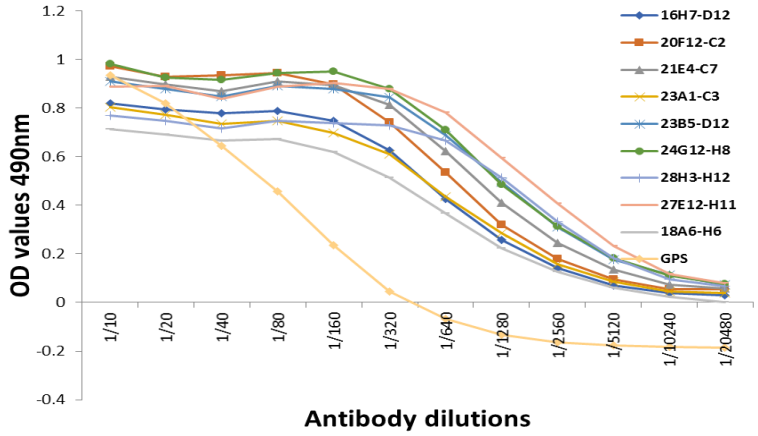
Fig. 2: *Fluorescence microscopy of pTKsppv-HPkzpprF-L4kzGFP donor plasmid transfected Vero cell line infected with SPPV virus. The green fluorescence indicate functional L4 promoter of SPPV. The plaques are also visible due to presence of SPPV growth (20X resolution under UV light).*

iv. Diagnostics

1. Companion diagnostics for FMD

Development of MAb based solid phase competitive ELISA for estimation of FMDV antibodies

Hybrodoma clones specific to structural proteins of FMDV were revived and MAb large quantity was produced



Reactivity of MAbs against FMDV type O

Development of MAb based assay for detection of NSP antigen in the vaccine antigen stocks

Hybrodoma clones specific to non-structural proteins of FMDV were revived and Mabs were produced in large quantity for developing ELISA

2. DIVA compliant tests for PPR

Two PPRV nonstructural proteins (NSPs) viz., C and V have been expressed in insect cells (Fig. 1A) and confirmed (Fig.1B).

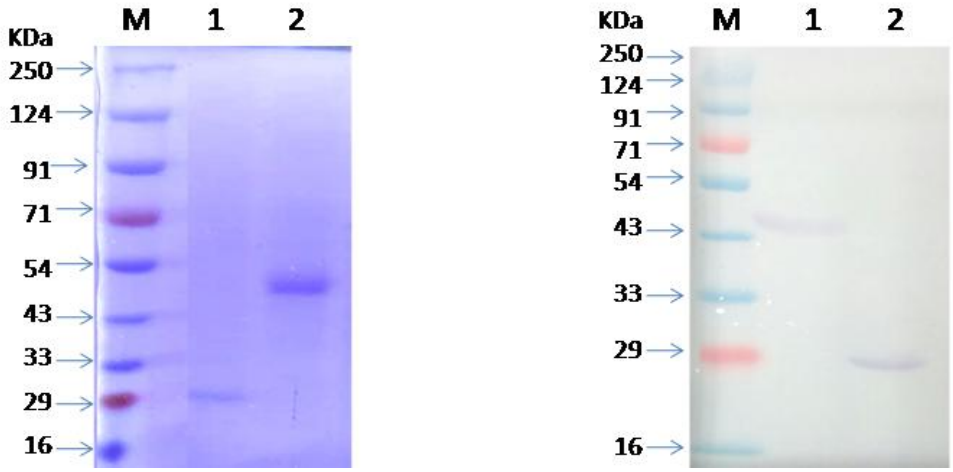
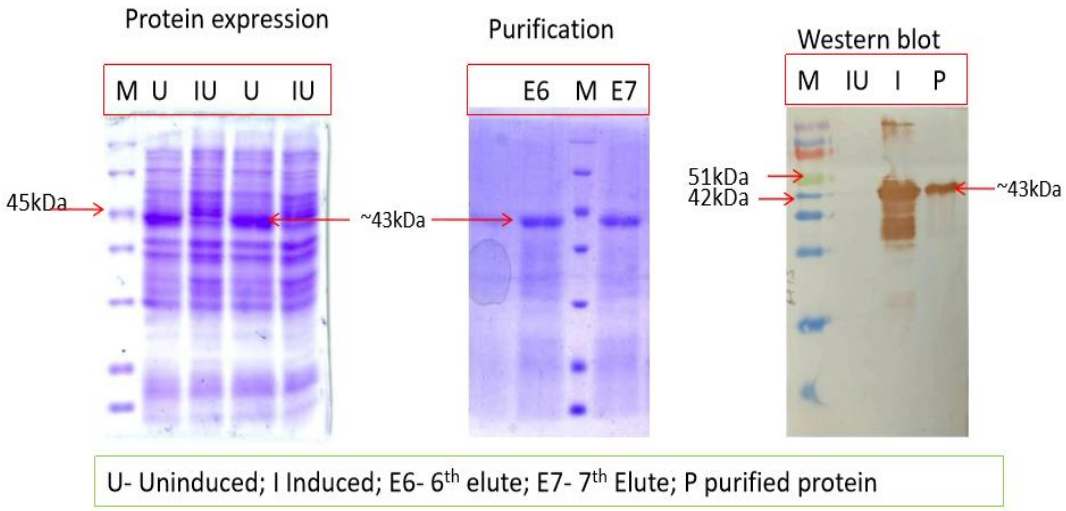


Fig. 1: *A) Insect cell expression and purification of PPRV NSPs Lane M: Protein ladder; Lane 1: Purified rNSP C – 23.6KDa; Lane 2: Purified rNSP V – 38.3KDa. B) Confirmation of recombinant NSPs by immunoblot. Lane M: Protein ladder; Lane 1: Purified rNSP V – 38.3 KDa; Lane 2: Purified rNSP C – 23.6KDa*

3. ELISA for PCV-2 antibodies

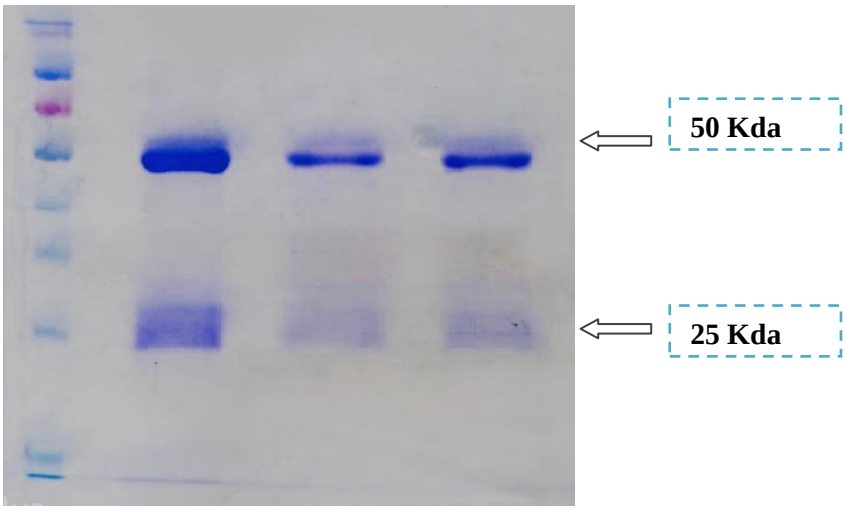
PCV-2 truncated capsid protein gene was amplified using specific primers and cloned into pET32b expression vector. Recombinant pET32b vector was transformed in expression host. Protein expression experiment performed using 1mM IPTG induction for 7 hour andprotein expression was analysed using SDS-PAGE and was purified using Ni-NTA chromatography. Recombinant protein was confirmed by Western Blot and ELISA using anti-his monoclonal anti-body and commercially available serum (VMRD). ELISA development for detecting antibody using recombinant capsid protein is under process.



4. Pen-side diagnostics for Brucella

Preparation of critical reagent for development of immunofiltration device/ immunochromatographic/ spot test for *Brucella*

- **Purification of LPS from *Brucella abortus*:** LPS were isolated from *Brucella abortus* antigen following hot phenol extraction method.
- **Raising Hyperimmunesera (HIS) against different antigen of Brucella abortus:** Hyperimmune sera using whole cell *Brucella abortus* S99 as well as LPS in guinea pig. FCA and FIA were used as adjuvant for immunization.
- **Testing reactivity of HIS:** Reactivity of HIS was tested using RBPT and quantified using SAT as well as i-ELISA. The SAT titer of anti Brucella whole cell HIS and LPS were 1280 IU/ml and 640 IU/ml, respectively**.** Mean OD of anti–Brucella whole cell HIS was 0.78 where as mean OD of anti LPS HIS was 0.40. The reactivity was also tested with Dot blot.
- **Purification and Quantification of IgG:** IgG was purified from pooled HIS raised against LPS and whole cell using Montage antibody purification kit and spin column with Prosep A media and quantified
- **Testing reactivity of IgG by Dot blot and Indirect ELISA:** Purified IgG was tested for reactivity by I-ELISA as well as Dot blot using LPS as antigen
- **Characterization of IgG by SDS PAGE:** Two distinct heavy and light chain was obtained in SDS PAGE.



- **Preparation of polyclonal IgG- gold nanoparticles (IgG-AuNP) conjugates**

- Purified IgG was conjugated with gold nano particle and the characterization of gold nano particle was checked by dot blot

Preparaion of Biologicals-Brucella antigen preparation

- OMP 28 recombinant protein

Recombinant *E coli* DH5α cell containing plasmid and DNA insert of OMP 28 glycerol stock was revived and protein was expressed. The protein purification was done by IMAC(immobilised metal anion chromatography) with Ni-NTA column by the method of batch protocol. Different fractions of elute were obtained and protein expression was checked on SDS PAGE and antigen was also tested with Indirect ELISA.

5. Molecular/serological tests for haemo-parasitic infections in cattle/ buffalo

5.1. **Molecular/ Serological test for *Babesia bigemina***: A total of 180 samples were collected out of which 15 (8.33%) were positive for *B. bigemina* infection by microscopy and 26 (14.44%) were positive for *B. bigemina* infection by PCR. Serum/ plasma were isolated from all the *B. bigemina* positive blood samples and all negative blood samples. The C-terminal of RAP-1 gene (RAP-1/CT) of *B. bigemina* was amplified (517 bp), cloned and expressed into pET32a(+) expression vector. The recombinant RAP-1/CT protein was purified under and characterized by western blotting using Ni-NTA HRP conjugate and *B. bigemina* positive bovine serum (Fig.1-2).

Similalarly, PCR amplicon (336 bp) of P200 gene of *B. bigemina* was amplified and cloned into pET32a(+) expression vector and the recombinant protein (rP200) was expressed in *Escherichia coli* BL21 (DE3, PLys) strain. The recombinant protein was purified under native conditions and characterized by western blotting using Ni-NTA HRP conjugate and *B. bigemina* positive bovine serum (Fig. 3).

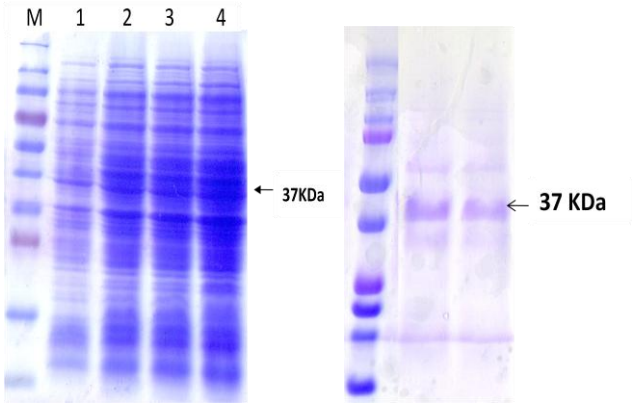


Fig. 1: *Babesia bigemina recombinant RAP-1/CT protein expressed in E. coli showing the expressed protein at ~37 kDa in SDS-PAGE (A) and purified under denaturing conditions (B)*

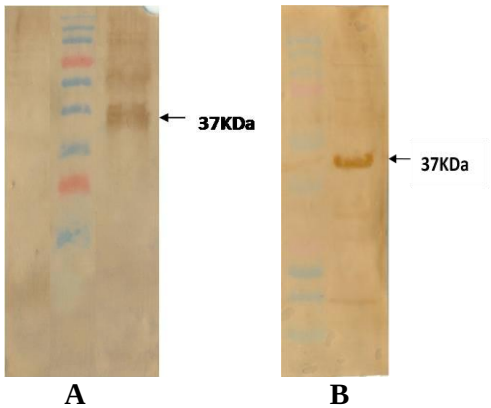


Fig. 2: *Western blot analysis of Babesia bigemina recombinant RAP-1/CT protein using Ni-NTA HRP conjugate (A) and B. bigemina postive bovine serum (B)*

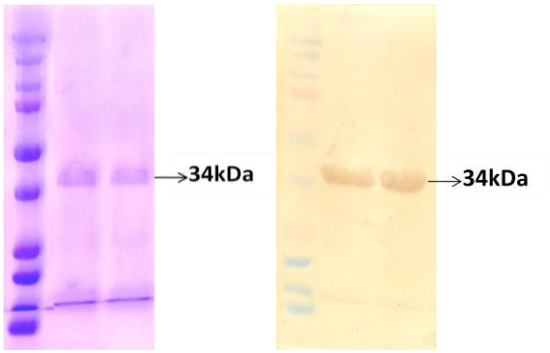


Fig. 3: *Purified Babesia bigemina recombinant P200 protein expressed in E. coli showing the expressed protein at ~34 kDa in SDS-PAGE (A). Western blot analysis of P200 protein using B. bigemina postive bovine serum (B)*

5.2 Molecular/ Serological test for *T.evansi:* Development and laboratory standardization of a nested PCR for detection of *T. evansi* and its field validation.

A nested PCR for *T. evansi* was laboratory standardized. The analytical sensitivity of the different primer combinations were in the range of 0.24 pg/µL to 125 pg/ µL. The analytical sensitivity of nPCR was 60 fg/ µL, whereas the diagnostic sensitivity was equivalent to 1.2 fg/ µL *T. evansi*.A total of 113 cattle blood samples (107 samples from Badaun, Pilibhit and Moradabad, UP and 6 samples from Chhattisgarh) were tested by the nested PCR. All the six blood samples from Chhattisgarh were PCR positive. However, all the animals were clinically infective and were microscopically positive for blood stage parasites.

Development of a diagnostic ELISA for trypanosomosis caused by *T. evansi*

A soluble *T. evansi* whole cell lysate antigen based indirect ELISA was laboratory standardized for serodiagnosis of *T. evansi*infection in cattle. A total of 920 bovine sera samples were collected from five districts of Chhattisgarh of which 27.4% samples were seropositive for *T. evansi*. The samples were collected randomly from both organized cattle farms as well as household rearing units.

5.3 Molecular/ Serological test for *Theileria annulata:* Microscopic and PCR based screening of vector borne haemo-parasitic infections of cattle and buffaloes and collection of biological research materials *(Theileria annulata)*

The blood samples collected from both crossbred and native breed animals were screened for *Theileria annulata* by microscopic examination and PCR assays using the primers specific for cytochrome b gene specific primer pair. Serum samples were collected from animals that are positive and negative for *T. annulata* infection and stored at -20°C for further use.

Expression, purification and confirmation of recombinant TaSP protein of *T. annulata*:

The glycerol stock of *Ta*SP clones which were generated and stored in the Protozoology laboratory, Division of Parasitology were used for the production of recombinant *Ta*SP (r*Ta*SP) protein. The expressed recombinant protein was purified and was confirmed by SDS-PAGE and the molecular weight of the rTaSP protein was found to be 40 kDa. In the western blot format, strong signals were detected against rTaSP when probed with *T. annulata* infected calf serum. Further work is under progress.

Amplification of SPM2 gene of *Theileria annulata*

The coding sequence of SPM2 gene of *T. annulata* was PCR amplified using *de novo* primers. The amplified product was resolved as a single band of 957 bp. The gel purified PCR amplicon was cloned into pjet1.2/Blunt cloning vector.

v. Therapeutic intervention for treatment of disease conditions (Mastitis, diarrhea) caused by AMR

Antimicrobial Peptides

- **Determination of minimum inhibition concentration (MIC) and minimum bactericidal concentration (MBC) of AMPs:**

Three antimicrobial peptides (AMPs) viz., Indolicidin (AMP-1); CAMA (AMP-2); Lactoferricin (17-30) (AMP-3) were evaluated for their MIC and MBC values against three MDR-EAEC field

strains. The observed MIC values µM) of AMP-1, AMP-2 and AMP-3 against MDR-EAEC strains were 32.0, 4.0 and 32.0; while the MBC values (µM) were found to be 64.0, 4.0 and 32.0, respectively.

- **Stability & Safety studies:**

All the three AMPs were found to be stable when subjected to varying temperatures (70°C and 90°C), proteases enzymes (trypsin and proteinase-K) and physiological concentration of salts (150 mM NaCl and 2mM $MgCl_2$). In cytoxicity studies all the three AMPs were safe at 1X and 2X MIC (µM) concentration when evaluated for their cytotoxicity against sheep RBCs, murine macrophage cells (RAW 264.7) and human laryngeal epithelioma cell line (HEp-2), however at 4X MIC (µM) concentration, marginal cytotoxicity were observed (Fig 13 and 14).

- **In vitro Killing kinetic studies of AMPs:** *In vitro* dose and time dependent killing kinetics of all the three AMPs was studied in CA-MH broth by co-incubating each of the AMPs with three MDR-EAEC strains. All the AMPs, i.e., AMP-1, AMP-2 and AMP-3 completely inhibited (no visible growth) the MDR-EAEC counts in 120 min, 30 min and 180 min, respectively. However, a drastic inhibition in the bacterial count was observed when the AMPs were used in combinations. In brief, AMPs-1+2, AMPs-2+3, AMPs-1+3 and AMPs-1+2+3 resulted in complete inhibition of MDR-EAEC strains at 12 min, 30 min, 90 min and 30 min, respectively. However, meropenem (positive treatment control) exhibited similar inhibition at 60 minutes.

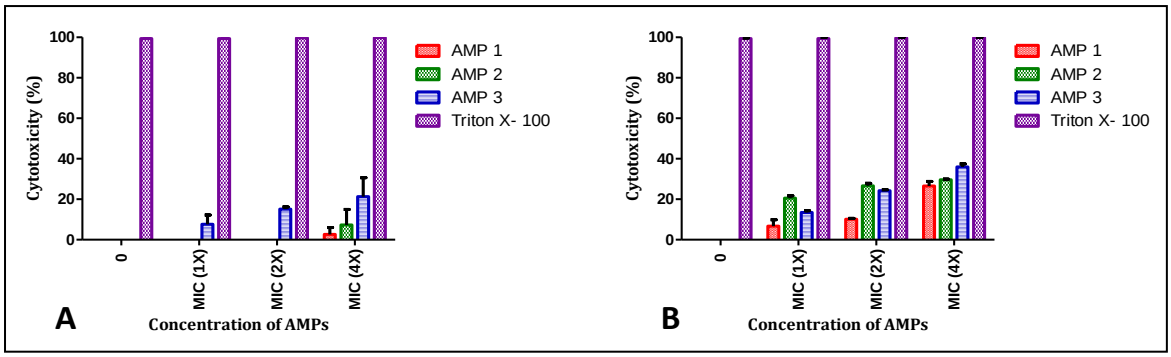


Fig. 13: *In vitro cytotoxicity effect of AMPs on HEp-2 cells (A) and RAW 264.7 cells (B)*

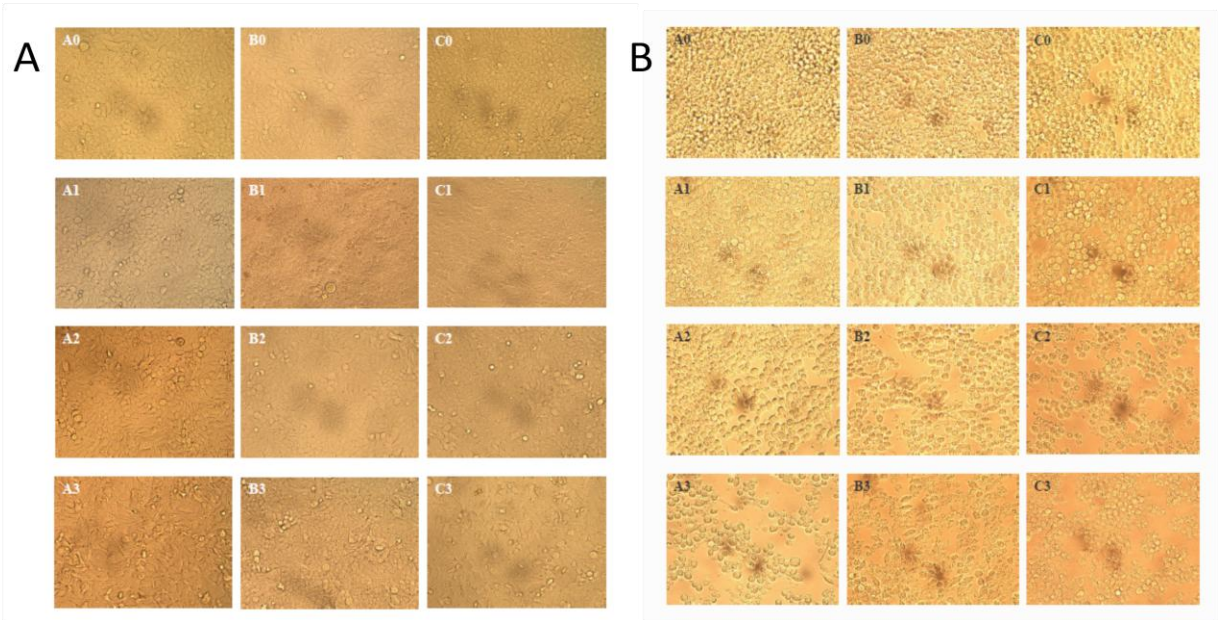
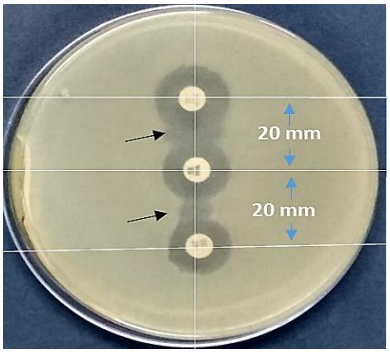


Fig. 14: *In vitro cytotoxicity effects of AMPs on HEp-2 cells (A) and RAW 264.7 cells (B)*

A: AMP-1 treatment **B**: AMP-2 treatment **C**: AMP-3 treatment

A0: Untreated control	B0: Untreated control	C0: Untreated control
A1: MIC (1X)	B1: MIC (1X)	C1: MIC (1X)
A2: MIC (2X)	B2: MIC (2X)	C2: MIC (2X)
A3: MIC (4X)	B3: MIC (4X)	C3: MIC (4X)

Molecular Characterization and development of single platform diagnostic regime for AMR: Optimized Modified double disk approximation assay (mDDA) for detection of ESBL producers



Modified double disk approximation assay to detect ESBL producer. Characteristic distortions /expansions (black arrow) of the inhibition zones towards the middle disk indicative of ESBL production.

Molecular Characterization and development of single platform diagnostic regime for AMR: A total of 52 multi-drug resistant enterobacteriaceae isolates are being investigated for their resistance towards tetracycline, β-lactams, fluoroquinolones and sulfonamides. Most of these isolates exhibited resistance to nalidixic acid, enrofloxacin and ciprofloxacin.
Screened 205 lactating animals for Intra mammary *S. aureus* infection of which 18.5% were positive isolated and Identified 15 S.aureus from sub clinical mastitis cases

Herbal metabolite nanoparticle complex

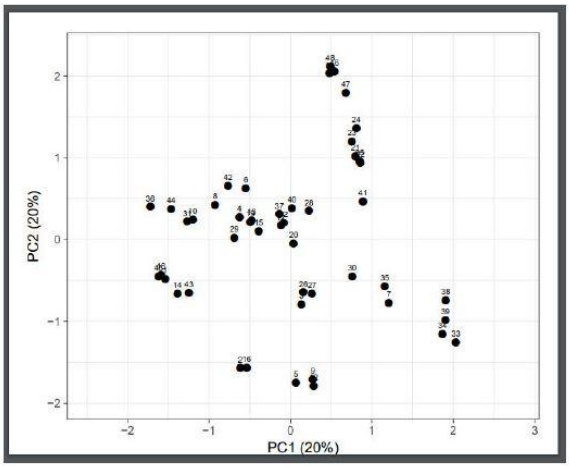
- Active plant metabolite flavone (plant metabolite of *Scutellaria* sp.) + chitosan+ antibiotic (lower generation β lactum) complex nanoparticles the average particle size ranged between 98- 215 nano meters, with PDI-0.98
- The Minimum inhibitory concentration of the flavone of *Scutellaria* sp. was 125µgm against Staphylococcus aureus
- The Phenylpropanoide derivative (essential oil of Cinnamomum) + PolyLactide Co Glycolide + antibiotic (lower generation β lactum) complex nanoparticles the average particle size 210 nano meters of 100% volume, with PDI-1.03
- The Minimum inhibitory concentration of the Phenylpropanoide essential oil of Cinnamomum was 98µgm against *Staphylococcus aureus*

vi. Immuno-nutrition approaches

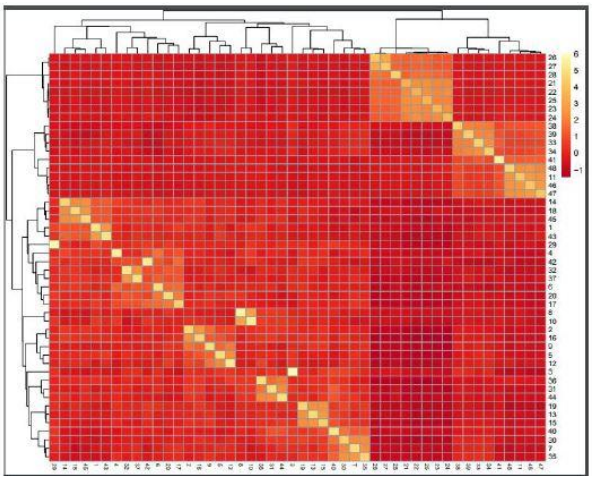
- A total of 69 bacterial isolates were collected from the faeces of young calves and scrutinized through initial screening. Ten isolates short-listed from the primary screening were subjected to a battery of *in vitro* tests to compare their probiotic attributes. Based on the result, two isolates (CPN54 and CPN60) were processed further through 16S rRNA sequencing and identified as *Lactobacillus salivarius*CPN54 and *Lactobacillus salivarius* CPN60
- *In vivo* assessment of *Lactobacillus salivarius* CPN60 is being carried out using laboratory rat as a model to ascertain its mode of action under healthy and colitis conditions

vii. Genomic approaches

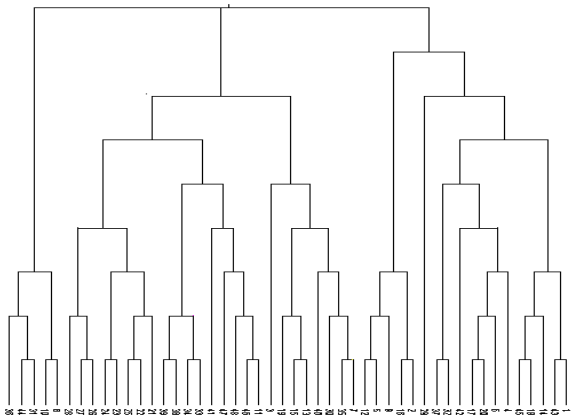
- A total of 48 samples from swine were collected including 35 Crossbreds, 8 Desi and 5 Landrace which was genotyped on Illumina's PorcineSNP60K BeadChip
- An average SNP call rate of 97.78% for Desi pigs suggests the PorcineSNP60K BeadChip is suitable for genotyping indigenous pigs.
- After filtering for Minor Allele Frequency of 0.05, 50244 out of 61565 SNPs were retained for downstream analysis (81.61%).
- Average heterozygosity across samples was 33.3% which is in agreement with the estimates reported for Asian and European pig populations (Iverson, 2019; Zhang and Plastow, 2011)



PCA



Kinship Heat Map



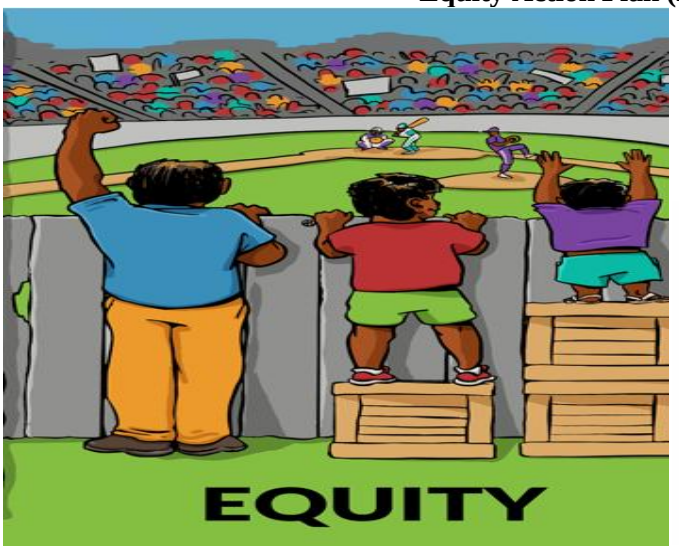
Linear Dendrogram

List of Students working in CAAST-ACLH thrust areas

Sl. No.	Theme Areas	Name of students	Roll Number	Division	Title of thesis
1.	Vaccine & Diagnostic	Ranjitha H.B.	P-2082	BTY	Reverse genetics, Genetic engineering of thermostable FMDV serotype O vaccine
2.	Vaccine & Diagnostic	Dhanesh V.V.	P-1927	VVY	Development of FMDV serotype A negative marker vaccine
3.	Vaccine & Diagnostic	Aparna Madhavan	P-2014	VVY	Development of thermostable FMDV serotype Asia 1 VLPs
4.	Vaccine & Diagnostic	Deepak Praveen Raj S	P-2076	VMC	Generation of thermostable FMDV serotype A VLPs aided by In-silico method
5.	Vaccine & Diagnostic	Sivarama Krishna Gollapalli	P-2013	VVY	Monoclonal antibody based ELISA for quantification of FMDV type O serotype 146 S antigen
6.	Vaccine & Diagnostic	Shanmuganathan S	P-2015	VVY	Production and characterization of Mabs against FMDV serotype A
7.	Vaccine & Diagnostic	Saravanan S	P-1656	BCT	Transcriptome profiling of host response to FMDV infection and study of its immune response
8.	Vaccine & Diagnostic	Renjith Sebastian	P-1638	BCT	FMDV macrophage interactions
9.	Vaccine & Diagnostic	Sravanthi Mannem	P-2121	BCT	Study of Antiviral proteins in FMDV infection

10.	Vaccine & Diagnostic	Dr Mageswary R,	P 1869;	VVY	Construction and evaluation of a genome length cDNA clone of *Peste des petits*
11.	Vaccine & Diagnostic	Dr Joyshikh Sonowal	P2022	BTY	Genetic Engineering and comparative evaluation of hybrid/synthetic Sheeppox virus promoter
12.	Vaccine & Diagnostic	Dr Barkathullah N	M5914	BTY	Development of Thymidine Kinase Negative Vero cells using CRISPR/Cas9 technology
13.	Vaccine & Diagnostic	Dr Krishna Bharali	RN.2060	BTY	Exploration of classical swine fever virus as a recombinant viral vector
14.	Vaccine & Diagnostic	Dr Amitesh Dubey	M5956	BTY	Recombinant CSF/Sheep pox vaccine
15.	Vaccine & Diagnostic	DR Bashit Nazir	M-5918	BTY	Recombinant baculovirus based PCV-2 vaccine candidate
16.	Vaccine & Diagnostic	Dr Marcia Asmi	P-2058	VBM	Pen side diagnostic of *Brucella*
17.	Vaccine & Diagnostic	Dr Mahwash Hira Khan	M-5869	BTY	Penside diagnostic of *Brucella*
18.	Vaccine & Diagnostic	Dr Munazah Shahzad	P-2038	VPY	Development of immunodiagnostic test(s) against Bovine babesiosis
19.	Vaccine & Diagnostic	Dr.VijayakumarJawala gatti;	Roll No. P-1882	VPY	Evaluation of immunoprotective potential of radiation attenuated *Trypanosoma evansi* in bovine calves.
20.	Vaccine & Diagnostic	Dr Sabita Bishen	P-1937	VPY	
21.	Vaccine & Diagnostic	Dr Aquil Mohamad	P-2000	VPY	Diagnostics of *Thileria annulata*
22.	Stem Cell	Dr Tanmoy Mondal	p-1958	VPY	Generation of induced pluripotent stem cells and its depository
23.	AMR	Dr Jess Vergis	P-1620	VPH	Efficacy of Antimicrobial Peptides (AMPs) against multi- drug resistant Enteroaggregative Escherichia coli (MDR-EAEC)
24.	AMR	Dr Bhooimka S.,	P-2039	VPH	Efficacy studies of Antimicrobial Peptides (AMPs) against multidrug resistant-Methicillin resistance Staphylococcus aureus (MDR-MRSA)
25.	AMR	Dr Diksha Gourkhede	M-5884	VPH	In vitro efficacy studies of the Antimicrobial peptides against the multidrug resistant S. Enteritidis and S. Typhimurium
26.	AMR	Dr Himani Agri	M-5886	VPH	Therapeutic intervention for treatment of disease conditions (Mastitis, diarrhea) caused by AMR
27.	Immuno nutrition	Dr Mokshata Gupta	P-2033	AN	Role of autochthonous immunobiotics as immune adjuvant for young dairy calves
28.	Genomics	Dr Akansha Singh	P-2051	AGB	GIWAS in Cattle
29.	Genomics	Dr Arnav	P-2116	AGB	GIWAS in Pig
30.	Development of ICT tools	Dr Pragya Joshi	M-2055	EXT	Development of mobile app on Veterinary clinical care
31.	Development of ICT tools	Dr Amandeep Singh	M-5825	EXT	Development of mobile app Waste Management Guide
32.	Impact assessment	Dr Anupama Jena	P-1953	EXT	Impact assessment of trainings

Equity Action Plan (EAP)



Equity Action Plan (EAP)

Introduction

The Government of India has reserved a total of 15% seats for students belongings to the Scheduled Casts (SC), 7.5% to the Scheduled Tribes (ST), 27% to the Other Backward Class(OBC) 3% to the Physically Challenged (PC) [Divyang] students . The ICAR- Indian Veterinary Research Institute has 633 students, out of which 240 are female & 393 are male. In terms of social category 97 are Scheduled Caste (SC), 45 are Scheduled Tribes (ST), 246 are Other Backward Class (OBC), 10 are Physically Challenged (PC) [Divyang], 3 are from Under Privilege State (UPS) and 2 are Foreign national students. The CAAST- Advanced centre for livestock health project under NAHEP at ICAR-IVRI is basically mandated with the main objectives of human capacity building, State of the Art Infrastructure Development and knowledge generation in the areas of vaccinology, diagnostics, immune nutrition and genomics for enhancing the skill, entrepreneurship and employability. The budgetary provision for this project is Rs. 1998.5 lakh for a period of 4 years starting 2017-18 and ending 2020-21. Under this project main components assigned are Faculty Up-gradation, Student Sandwich programmes, Adjunct and Visiting professorship, organizing distinguished lecture series and development of e-learning modules and ICT tools for skill development of students and faculty. The project has proposed a limited renovation activity *viz.*, renovation of existing challenge shed. The activity is not expected to cause any significant environmental and social impacts. Therefore, the World Bank's Operational Policy on Involuntary Resettlement (OP/BP 4.12) has not been triggered. The institution has students from different backgrounds especially those in low-income and communities inhabited by scheduled caste and scheduled tribes communities. Therefore, the World Bank Operational Policy (OP/BP 4.10) has been triggered**.** ICAR- IVRI has prepared this **Equity Action Plan** (EAP) which addresses issues of gender equality and social inclusion with special attention to the needs of the Scheduled Tribe and the Scheduled Caste students and faculty members fulfilling the requirements of OP 4.10. The EAP identifies key issues and problems affecting academic performance and overall development of students and recommends a set of actions to address the same, which has been discussed in this document.

Project Activities

Sl. No.	Item	Actions	Implementation Agency	Frequency	Monitoring Indicators
i.	To identify weaknesses in all students and take remedial steps	• Diagnostic test (assessment) would be administered to identify the weakness of students and take remedial steps. Tutorial theory/practical classes will be organized for the weak students	ICAR-IVRI, Izatnagar	Annual assessment and continuous improvement classes/ tutorials	Percentage of students moving from weak to moderate and high skills
ii.	To improve language competency, soft skills and confidence levels	• Assessment of the language competency of all students would be done • Remedial workshops/ classes/ tutorials would be organized to empower the students in these skills • English is already a main course in the PG & Ph.D. degree programme and all students have to offer	ICAR-IVRI, Izatnagar	Continuous	Percentage of students moving from weak to moderate and high skills

		the course. But extra tutorials will be organized to improve the English competency • Further, for improving the spoken Hindi competency for students from Southern and NE Region "Hindi Workshops" would be organized.			
iii.	Institution to improve non-cognitive and soft skills including communication and presentation skills through their wide use in curricula / project based work, and where needed, to provide special skills training to students with priority to the weak students	• Perceived assessment of the non cognitive & soft skills of all students in the university would be undertaken. • Workshops would be organized on the identified areas such as viz., technical writing, communication, motivation, leadership & team building, presentation skills etc. especially for the weak students.	ICAR-IVRI, Izatnagar	Continuous	Percentage of students moving from weak to moderate and high skills
iv.	Give young faculty priority in opportunities to upgrade their domain knowledge	EAP would be followed for International faculty training in the CAAST project activities for upgrading domain knowledge. Sufficient care would be taken to give opportunity to the younger faculty. Further, as far as possible, the gender participation and participation of weaker sections would be made while nominating scientists for the International training.	ICAR-IVRI, Izatnagar	Annually	Increase in the percentage o
v.	Training of faculty in subject matter, particularly to improve the performance of weak students	TNA for faculty would be done for the subject matter and remedial courses would be organized	ICAR-IVRI, Izatnagar	TNA would be done for all faculty and continuous trainings would be arranged to improve the skills	Percent of planned training completed against targets Training analysis in terms of number of faculty, % of SC/ST/OBC/Women received training, age group, service years, type, duration of training etc.

vi.	Make campuses physically and socially gender friendly; especially provide adequate and suitable facilities to women students and faculty	The campus would be made physically and socially gender friendly by following: • Ensuring dignified washrooms in every division/ buildings • Ensuing facility of Ramps & railings at required places Additional hostel facilities for girls	ICAR-IVRI Izatnagar	Continuous	Descriptive reports would be provided including number of beneficiaries for various actions
vii.	Hold innovation and Knowledge Sharing through yearly Workshops to improve knowledge sharing	Knowledge Sharing Workshops will be organized in various advanced areas of the thematic focus of the project	ICAR-IVRI Izatnagar	Yearly	• Number of workshops conducted / participants attended and thematic areas covered
viii.	Special efforts for training/ internship/ placement of weak students	For enhancing the placements and for networking with the industry for research and academic purpose, B2B/Industry academia Interface meets would be organized.	ICAR-IVRI Izatnagar	Regular	Number of such interface meets organised
ix.	Establishing GRM	Grievance Redressal Officer has been appointed. The GRM will be popularized through wide publicity by placing banners/posters in the different places of the campus, CAAST website & by keeping complaint / suggestion boxes in the divison and at prominent places. A new email id and phone would be provided to the GRM On receipt of grievances through post/ online/ verbal the complaint will be immediately entered in to complaint register, acknowledged and will be redressed within 10 days from the date of receipt of the complaint. The respective entries would be be made in the complaint register.	ICAR-IVRI Izatnagar	Continuous	Number of grievances received and time taken to resolve
x.	Ensure that institutional	Already ICC is in place Further, a women helpline	ICAR-IVRI Izatnagar	Continuous	Publicity of ICC and women helpline

	mechanisms to protect and address the needs and concerns of women students are established.	number would be created to protect and address the needs of the women students.			among the women faculty and students
xi.	Peer Learning Groups of students	Peer learning groups would be created for various disciplines and joint curricular and extracurricular activities would be promoted	ICAR-IVRI Izatnagar	Continuous	• Number of such groups created. • Activities of the groups • Students feedback on the PLG
xii.	Appointing Student Mentors and Faculty Advisors for Students	Student mentors would be appointed for every 6-8 students in each discipline. Further, faculty advisors would be appointed for 10-15 students for UG programme while for PG & Ph.D. already advisors are allotted to every student.	ICAR-IVRI Izatnagar	Continuous	Mentoring activities by students

Workshops/Tutorials/Lectures under Equity Action Plan

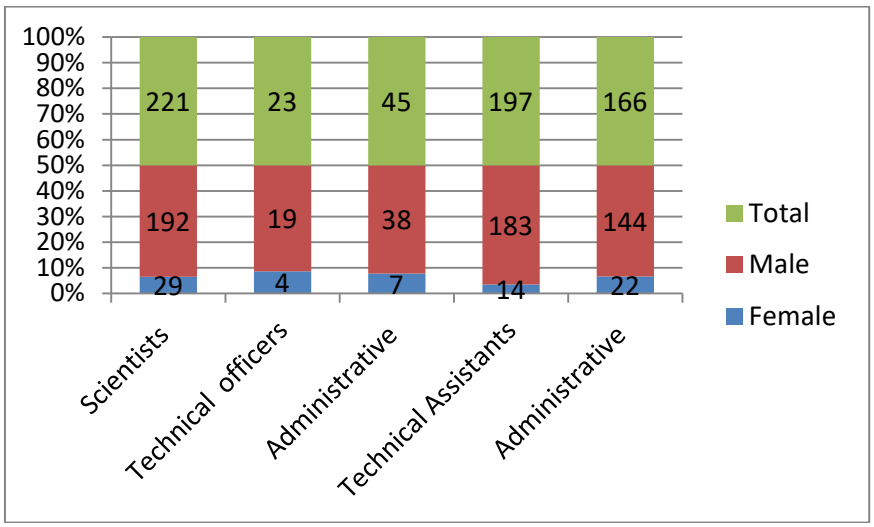
Total Workshops under Equity Action Plan targeted : 10

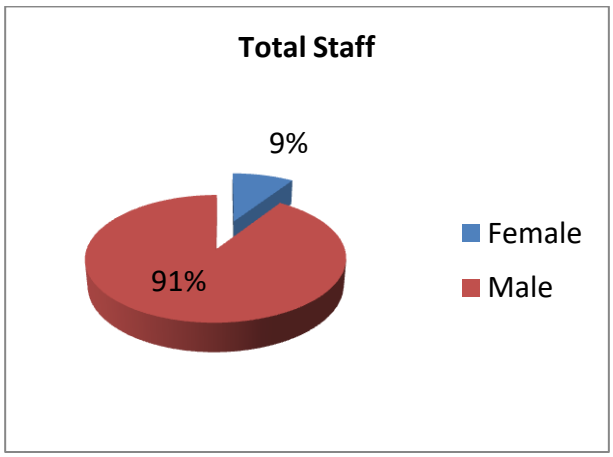
Details of Workshops/Lectures to be organized

Sl.No.	Areas
1.	Workshop/Tutorial of English for weak students
2.	Workshop/Tutorial for Hindi for students from non Hindi belt
3.	Capacity Building & Experiential Learning
4.	Personality Development
5.	Scientific Journalism
6.	Motivation, ethics and values in Life
7.	Leadership and Team Building
8.	Self Defense Classes for Women
9.	Awareness on Traffic Rules
10.	Awareness on Single use plastic
11.	Lecture on Improving excellence in teaching skills
12.	Lecture on Equity Action Plan in Aus

Achievements

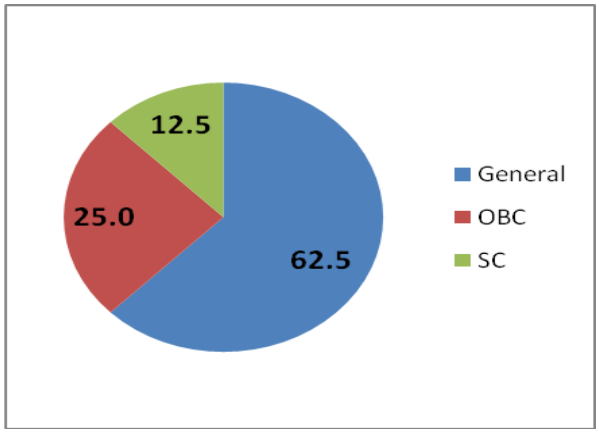
Institutional Staffing

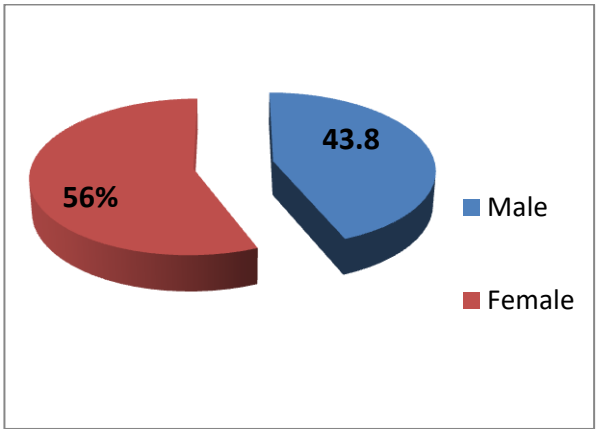




International Level Training of Students and Faculty

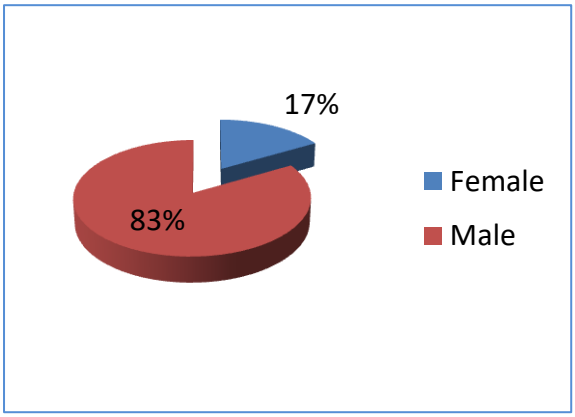
- A total of 16 students (13 Ph.D., 03 M.V.Sc) were selected for 3 months overseas training

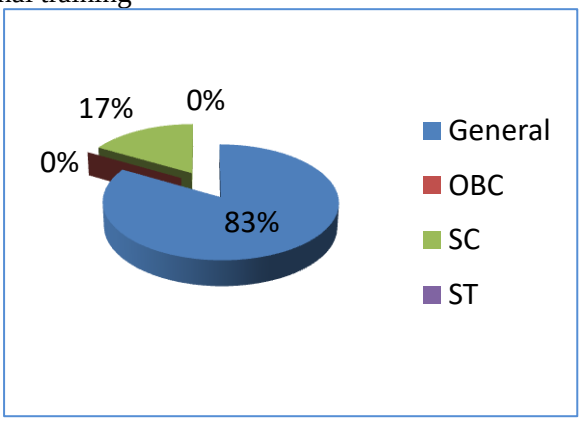




Faculty up gradation through international training

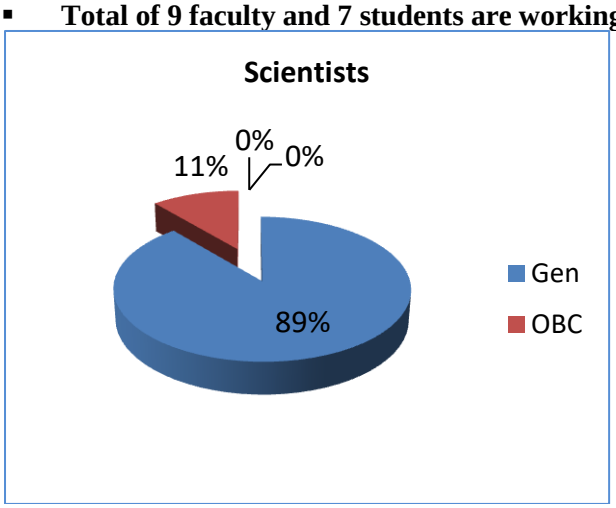
- Total of 6 scientists identified for International training

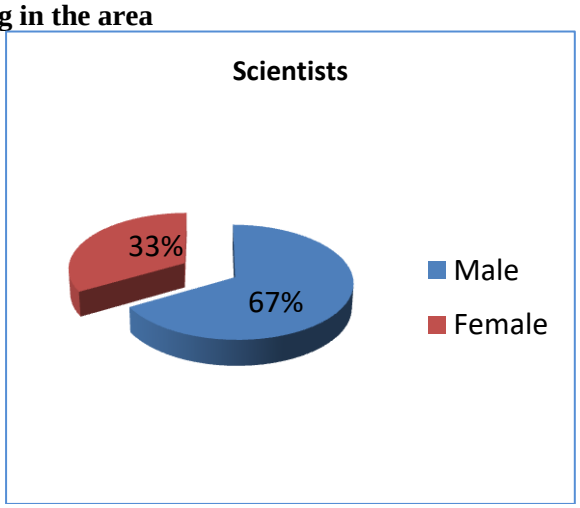


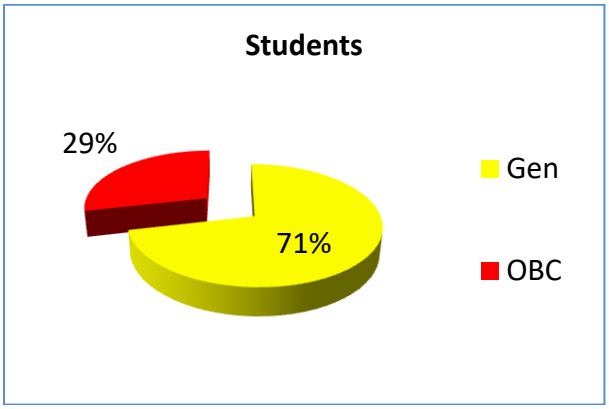


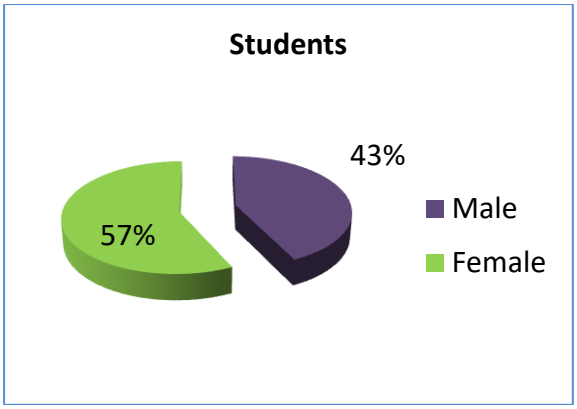
Development of e-learning / ICT tools for effective education

- **Total of 9 faculty and 7 students are working in the area**



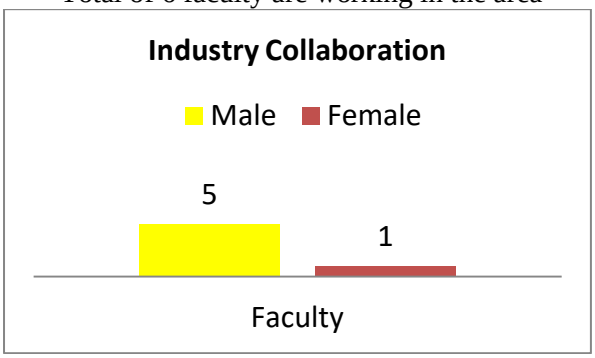


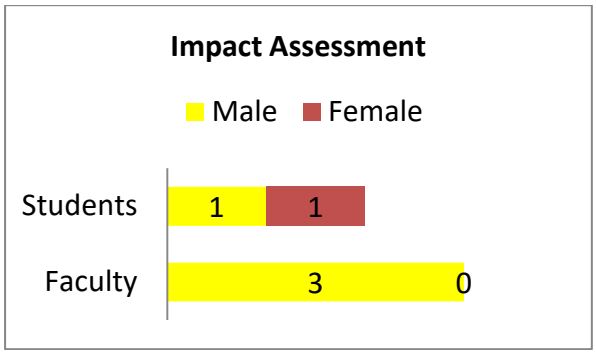




Industry Collaboration and Impact assessment

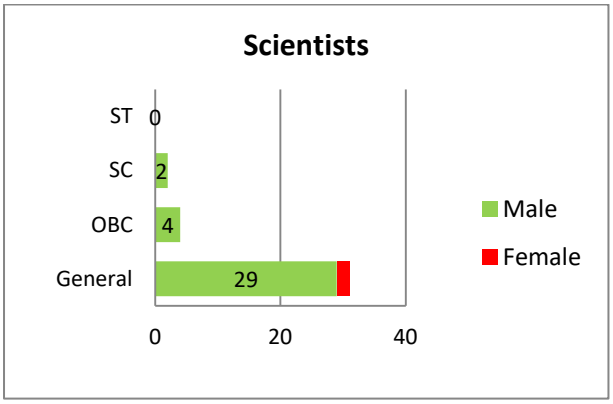
- Total of 6 faculty are working in the area

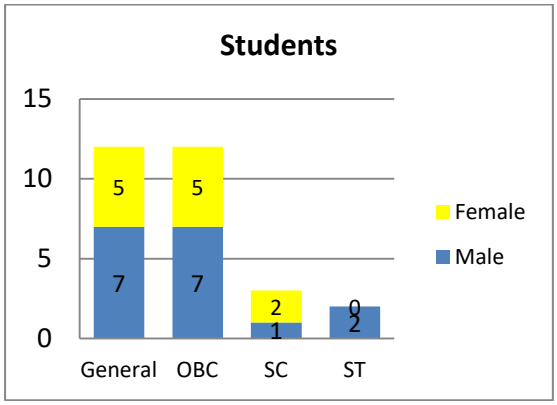




Knowledge Generation through Exposure to Advanced Areas in Livestock Health

- A total of 37 faculty and 29 students are working in various advanced research areas in CAAST-ACLH





Other Initiatives under Equity Action Plan (EAP)

- Slogans for promoting equity placed in university
- Assessment of linguistic and other soft skills of the students in progress
- Facility of ramps and railings is being ensured in all divisions/sections
- Guidelines provided to MRDPC to follow EAP for all recruitment committees
- Initiatives taken up to formulate Peer learning groups for UG and PG students and identification of student mentors
- Self defence classes are being planned for female students/faculty and staff of institute
- Suggestion boxes are being placed in every division /hostels
- For ensuring women safety at workplace against Sexual harassment & gender discrimination, an Internal Complaints Committee (ICC) is in place and available on the institute Website. Awareness in this regard is being made.

Glimpses of facilities / activities under Equity Action Plan

Washrooms for male and female

Saraswati Girls Hostel (Under Construction)

Posters promoting Equity in the University

Posters promoting Equity in the University

Lift in the MLB Building

Deemed University Building (Lift Under Construction)

CAAST –ACLH M&E cell

Ramps/ Railings/ Wheelchairs for Divyang

CAAST-ACLH Office
(Phone and Mobile of Nodal Officers of EAP, ESP & GRO)

Environmental Sustainability Plan (ESP)

Environmental Sustainability Plan (ESP)

Environmental Sustainability Plan (ESP)

Sl. No.	Proposed Interventions/ Activities	Compliances applicable	Possible Environmental Impacts	Mitigation Measures	Scope for the integration of best practices	Resources Required (budget, technical support etc.)
1.	Knowledge Generation through Exposure to Advanced Areas (rDNA, reverse genetics, combination vaccines, biosensor-based diagnostics, herbal-, nanoparticle- and AMP-based-therapeutics, nutraceuticals, and genomics) in Livestock Health* 1. Improved vaccines 2. New vaccines 3. New vaccine candidates 4. Diagnostics 5. Generation of induced pluripotent stem cells and its depository 6. Therapeutic intervention for treatment of disease conditions (Mastitis, diarrhoea) caused by AMR 7. Immuno-nutrition approaches 8. Genomic approaches	1. Environment Protection Act (1986) Rules for the manufacture, use/ import/ export and storage of hazardous microorganism/ genetically engineered organisms or cells, 1989 2. Hazardous Waste (Management and Handling) Rules, 1989 and Amendment Rules, 2000 & 2003 3. Recombinant DNA Guidelines 4. WHO Laboratory safety manual-incorporated into R DNA guidelines 5. NABL Guidelines for residue analysis labs	1. Chances of disease outbreak / toxicity incidences etc in and around the areas among the animals and in some cases in humans	1. Institute Bio-safety committee is in place as per DBT guidelines. The approval of the committee is seeked for all type of experimental works involving Biosafety issues uincluding genetic engineering approval. 2. Institute Animal Ethics Committee is in place which is as per the guidelines of the CPCSEA under the MoE&F 3. The institute has four incinerators for disposal of bio waste with a well-defined system of disposal 4. Institute is also developing modern sewage Treatment Plant and Effluent Treatment Plant for disposal of Bio-Waste keeping in view future needs 5. Use of pathogenic microorganismas or any genetically engineered organism or cells is taken up in labs notified by MoEF: All such work are being approved by the IBSC as per DBT norms & IAEC as per CPCSEA, MoEF guidelines 6. New GLP and GMP are under construction at IVRI Main campus and will be completed by April 2020 7. Employment of concept of physical and biological containment and GLP: The bio containment facilities are available at all campus of IVRI viz., Izatnagar, Mukteswar and Bengaluru 8. General Requirements for the competence of calibration and testing laboratories: The Institute is ISO:9001 certified and the labs fulfils all requirements 9. All the chemicals are procured following all codal formalities and as per government norms/ legislation	All environmental sustainability parameters are well integrated into the programme. Other best practices if needed would be implemented from time to time.	Nil
2.	To develop a globally competitive state-of-the-art infrastructure in teaching and research in the proposed thrust areas	1. Environment Protection Act (1986) Rules for the manufacture, use/import/export and	1. Chances of disease outbreak / toxicity/radiation incidences etc in and around the areas among the animals and in some cases in	1. All the chemicals and equipments are/ will be procured following all codal formalities and as per government norms/legislation. 2. Labs have provision of safe disposal of hazardous waste	All environmental sustainability parameters are well integrated into the programme	Nil

	1. Procurement of high-end equipments to support advanced research, teaching and training in the identified areas	storage of hazardous microorganism/ genetically engineered organisms or cells, 1989 2. Hazardous Waste (Management and Handling) Rules, 1989 and Amendment Rules, 2000 & 2003 3. Recombinant DNA Guidelines, 1990 4. WHO Laboratory safety manual-incorporated into R DNA guidelines 5. NABL Guidelines for residue analysis labs	humans 2. Lack of safeguards poses risk of exposure to harmful chemicals and accidents 3. Safe use of recombination of DNA technology otherwise leads to inappro-priate use of these agents will cause public health harm	3. Research concerning genetically engineered organisms follow the rDNA guidelines and compliances 4. Follow the safety guidelines and compliances		
	2. Renovation of existing infrastructural facilities like challenge animal shed	1. Preservation of trees act 2. National Building Code of India 2005 3. Energy Conservation 4. e-Waste (Manag-ement and Handling) Rules, 2011	1. Site Clearing sometimes leads to loss of greenery by felling trees, clearing vegetation etc	1. Compensatory plantation & additional plantation would be done in /near same site and will take permission from concern Zonal officer if	Solar panels would be fixed in challenge shed as per government norms & procedure for the period of 25 years Renovations would keep in mind possibility of solar electrification Water harvesting structure will be created Fire Safety will be ensured Operations related to civil works would be done in areas away from residential area.	Solar panels: No money required Water harvesting structure: Rs 2 lakhs Fire safety and CCTV:Rs 10 Lakhs
			1. Possibility of use of illegally mines or low quality materials affecting the sustainability of environment and the infrastructure	1. Raw material would be sourced from authentic and approved vendors possessing valid permits		
			1. Lack of solar passive features demands high energy requirements for lighting an air circulation	1. Renovations would keep in mind that structures are solar passive and proper ventilation is there		
			1. Lack of Safety measures poses fire accidents	1. Fire safety measure in buildings		
			1. The construction equipment operation may cause inconvenience to the workers and by passers due to dust, noise etc. Inconvenience and health issues to the workers involved Possibility of involve-ment of child labour.	1. Operations like mixing raw materials should be done in areas where people's movement is less and workers should use masks. Construction equipment that emits noise should not be used in residential areas during night or near schools and hospitals. The workers should be provided with gloves, masks, helmets etc. Use of child labour should be avoided.		

	Note: while filling the above format, Please refer table 2- legal compliances (page no 13) and table 3- impacts and mitigation measures (page 19) in EMF Document

Workshops/ Tutorials/ lectures under Environmental Sustainability Plan

Total Workshops under Environmental Sustainability Plan : 5

1.	Awareness on Single use plastic
2.	Workshop on Bio-security and Bio-safety
3.	Lecture on Environmental Sustainability Plan in AUs

Achievements

- Institute Bio-safety committee duly approved by DBT is in Place. The IBSC monitors all projects being operated in the institute and also take necessary approval from RCGM, if required.
- Institute Animal Ethics Committee (IAEC) is in place which is as per the guidelines of the CPCSEA under the MoE&F
- The institute has well established mechanism for disposal of biowaste and has four incinerators. Institute has developed Sewage Treatment Plant (STP) and Effluent Treatment Plant (ETP) for disposal of Bio-Waste, which are under commissioning
- All the works involving r-DNA techniques and GMOs are monitored by IBSC as per DBT norms & IAEC as per CPCSEA, MoEF guidelines
- The laboratory of IVRI follow good laboratory practices (GLP). The cGMP compliant laboratory is under construction at IVRI main campus and will be completed during 2020-21
- The concept of physical and biological containment and GLPs are in practice in the institute. The biocontainment facilities are available at all campus of IVRI viz., Izatnagar, Mukteswar and Bengaluru
- General Requirements for calibration and testing laboratories: The Institute is ISO:9001 certified and the labs fulfils all requirements
- The chemicals, consumables and other miscellaneous items are procured through well established mechanism following all codal formalities and government norms/legislation (GFR)
- All environmental sustainability parameters are well integrated into the programme
- Civil work is being carried-out without harming existing tress. If necessary trees would be shifted to suitable place and permission would be taken from forest department to replace or remove the tree.
- Additional plantation are done in /and around construction sites and in the institute premises, every year. World Environment Day is celebrated every year.
- Raw material would be sourced from authentic and approved vendors possessing valid permits
- Renovations would keep in mind that structures are solar passive and proper ventilation as per ABSL requirement
- Renovations would keep in mind possibility of solar electrification
- Water harvesting structures have been developed around few buildings and also being developed at new structures
- Provisions for Fire safety in buildings have been made. The institute premises are well protected by the boundary wall and security system monitored by CCTV. The passers are not permitted to roam inside campus. The laboratory buildings are away from the public road. Beside these, workers are provided with protective gowning with gloves and masks. It is ensured that the construction equipment that emits noise is not used in residential areas during night or near schools and hospitals. Use of child labours are strictly prohibited in the campus
- International Yoga Day is celebrated every year on June 21 where in students, faculty and staff take part. Besides these daily Yoga classes for the benefit of students & faculty are conducted
- Blood Donation camps are organized, where students and staff donate the blood. It is under the unsaid agreement with blood bank that in case of emergency, blood would be provided to staff and students
- Regular vaccination of staff and students working on contagious diseases like rabies. Regular vaccination of pets for rabies are carried-out last Saturday of every month free of cost to reduce the incidence
- To create awareness. World Rabies Day, World Veterinary Day, International Yoga Day,World Hygiene Day and other international events are celebrated.
- To increase the knowledge and awareness, IVRI has developed a museum on Veterinary Sciences

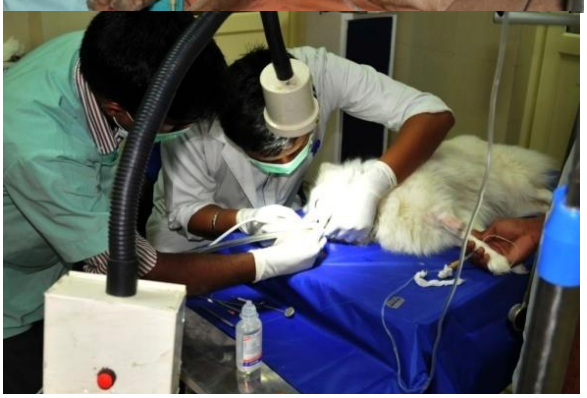
Glimpses of the Environmental Sustainability Plan Activities

GMP/GLP Research & Development (R&D) Block (Under Construction)

BSL3 lab

Incinerators for disposal of bio waste

Surgery performed by students in the Teaching Veterinary Clinical Complex



International Training

Experimental Dairy Farm

Plantation at IVRI Campus Mukteswar

Solar light Panel in Nuclear Research Laboratory

Fire Safety in buildings of the institute

CCTV cameras installed in most of important buildings/ roads

Posters for awareness displayed & Dustbin on road

Green & Clean Campus

Animal Challenge Shed (Renovation work to be started)

National Library of Veterinary Sciences

Newly Constructed Auditorium

Deer Park

A beautiful Aerial View depicting a clean and green IVRI

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