

Self Study Report of MVSc programmes at ICAR-IVRI

6.4. Self Study Report for the MVSc Degree Programme

Introduction

Indian Veterinary Research Institute (IVRI) was established on 9th December, 1889 as Imperial Bacteriological Laboratory at Pune (Maharashtra) and was later shifted to Mukteswar in 1893. Subsequently, for large-scale production of serum and vaccines, Izatnagar, Bareilly (UP) campus was established in 1913.

In 1958 Postgraduate degree programmes were also started. Presently the Institute has been providing quality Master (MVSc) education in 19 disciplines. The Institute has been conferred the status of Deemed to be University with effect from 16th November, 1983 under Section 3 of the University Grants Commission Act (1956).

Objective: To impart quality PG education to meritorious candidates in different disciplines of Veterinary and Animal Sciences and development of human resource in these fields. Basic and strategic research for improvement of animal health for enhanced productivity

Accomplishments: More than 30 batches of students have been successfully awarded with MVSc degree under various disciplines. The students helped in development of various technologies described below.

1. Development of competitive-ELISA diagnostic kit for rinderpest, approved by OIE and validated by IAH, Pirbright, UK.(2001).
2. Creation of P2 facility for FMD vaccine quality control at Animal Experimental Station, Yelhanka, IVRI, Bangalore. (2001)
3. Development of live modified PPR vaccine. (2002)
4. Award of ISO 9001: 2000 Certificate by International Certificate Services Asia to CADRAD. (2005)
5. HSADL, IVRI Campus, Bhopal was recognized as OIE approved Referral laboratory for diagnosis of HPAI.(2009)
6. Establishment of Zonal Technology Management -Business Planning and Development Unit (North Zone). (2009)
7. Conferment of Sardar Patel Outstanding ICAR Institution Award for the year 2009. (2010)
8. Development and commercialization of Sheep pox vaccine using indigenous strain.(2014)
9. Establishment of Training and Education Center at Pune. (2015)
10. ISO 9001:2008 certification for Quality Management system. (2016)
11. Subviral particle based infectious bursal disease (IBD) vaccine. (2019)
12. Live attenuated Classical Swine Fever Cell Culture Vaccine (2020)
13. Brucella abortus S19Δ per Vaccine (2020)

6.4.1. Brief History of the MVSc Degree Programme in Animal Genetics & Breeding.

Division of Animal Genetics was established at this Institute on 12th October, 1941 with the creation of a post of Research Officer (Genetics). A full-fledged Division, having Livestock Farms, Regional Artificial Insemination, Biochemistry and Physiology, Reproduction became functional in July, 1945.

This division has always been a leading national centre for conducting research in the various areas of Animal Genetics and Breeding as well as development of human resources and consultancy services in this discipline. Keeping pace with International developments made in the subject as well as looking into national priorities, significant contributions have been made through a number of research projects undertaken in different areas of Artificial Insemination, Germ Plasm Conservation, Cytogenetics, Blood Groups and Immunogenetics, Quantitative Genetics, Population Genetics, Crossbreeding programme, Molecular Genetics and Genomics.

The regular MVSc programme in Animal Genetics & Breeding was started in 1985.

Objectives:

- To conduct basic and applied research in the field of Animal Genetics and Breeding.
- To develop breeding strategies for genetic improvement of cattle, buffalo, sheep, goat and pigs.
- To impart Post Graduate education and training in the area of Animal Genetics and Breeding

Accomplishments:

- Standardization of insemination techniques and introduction of A.I. for the first time under farm conditions at national level.
- Induced lactation by hormone therapy in heifers and sterile cows.
- Development of semen extender and frozen semen technology in buffalos for the first time in the Country.
- Development of Angora strain of rabbit with an average fiber diameter of 9 μ m.
- Development of high yielding crossbred cattle strains using Holstein Friesian, Brown Swiss and Jersey as exotic semen with Haryana cows.
- Performance evaluation and genetic analysis of various economic traits of Indian livestock and poultry breeds.
- Cytogenetic analysis, blood groups and biochemical polymorphic studies in different livestock breeds.
- Molecular genetic studies for the exploration of DNA polymorphism of growth, production, reproduction, disease resistance and health related traits in various livestock and poultry breeds.
- Genomic breed composition of an admixed population of Vrindavani cattle was established using large-scale SNP data

6.4.2 Faculty Strength:

S.no.	Sanctioned Faculty	Faculty in place	Vacant position	Faculty recommended by the ICAR/UGC/VCI/ other regulatory bodies
1.	Professor*	01	0	ICAR
2.	Associate Professor*	04	0	ICAR
3.	Assistant Professor*	09	01	ICAR

* Faculty are also involved in BVSc & AH and PhD programmes.

6.4.3 Technical and Supporting staff:

Staff	Sanctioned	In Place
Technical*	16	04
Supporting*	21	06

* Technical and supporting staffs are also involved in BVSc & AH and PhD programmes.

6.4.4. Classrooms and Laboratories:

1. Classroom and seminar rooms are available for teaching.
2. Equipment, Laboratories, farm facilities, workshops are mentioned in annexure III

6.4.5. Conduct of Practical and Hands-on-Training:

Practicals (hands-on) are being conducted in all courses. During internal and annual board exams students perform practicals/experimental procedures on their own. Many students attend national and international trainings.

Hands-on- trainings attended by students
1. Basic and Applied Bioinformatics in Animal Sciences (3 Days, 09th to 11th February 2021)
2. Basics of Bioinformatics for Biologists-II (3 Days, November 22-24, 2021)
3. Basics of Bioinformatics for Biologists-II (3 Days, December 13-15, 2021)

6.4.6 Supervision of students in PG Programme:

MVSc students on roll	19
No. of faculties	14

6.4.7 Feedback of stakeholders (Students, parents, industries, employers, farmers etc.):

Feedback proforma is available which need to be submitted by the students at time of obtaining Provisional Degree Certificate (PDC). The Scanned copy of same is attached in Annexure IV.

6.4.8. Student intake and attrition in the programme for last five years:

Year-wise information is provided in the tabular form.

Name of the Degree programme	Actual Student admitted in last five years					Attrition (%)				
	Y1 2016-17	Y2 2017-18	Y3 2018-19	Y4 2019-20	Y5 2020-21	Y1 2016-17	Y2 2017-18	Y3 2018-19	Y4 2019-20	Y5 2020-21
MVSc										
Animal Genetics and Breeding	8	6	6	7	10	0	-50*	-50*	57.14	50

*Negative numbers are due to rejoining of students after their temporary dropping(s).

6.4.9. ICT Application in Curricula Delivery:

Yes the degree programmes are meeting the expectations.

The whole system of registration of courses is on the Academic Management System. Further, the curricula delivery is through use of power point presentations (ppt.) and also using online platforms like the Microsoft teams/ Zoom/ Google meets etc. during the COVID-19 pandemic periods when the students were away from campus.

Furthermore, few e-tutorials, mobile apps and educational videos have been prepared and made accessible for enriching the learning experience of the students.

The university has also launched the augmented reality (AR) and virtual Reality (VR) experience centre with the support of NAHEP & IASRI which will further augment the learning process.

6.4.10. The information pertaining to 6.4.1 to 6.4.9 shall be provided for each one of UG, PG and PhD Degree Programmes, separately, and to be presented College-wise.

We have mentioned the information separately

6.4.11. Since the accreditation of Programmes is related to the All India Admission from ICAR and also having weightage for College accreditation, therefore the data presented in the section 6.4 is liable to the verification at any stage.

6.4.12. Certificate

I, the Dean**Dr Triveni Dutt**..... hereby certify that the information contained in the Section 6.4.1 to 6.4.9 are furnished as per the records available in the college, and degree awarding university.

Signature of Dean of the College with Date & Seal

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संयुक्त निदेशक (शैक्षणिक) एचएम डीए
Joint Director (Academic) Cum Dean
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Indian Veterinary Research Institute
(सम-विश्व विद्यालय)
(Deemed University)
Izatnagar-243 122 (U.P.)
इजतनगर-243 122 (उ.प्र.)

6.4.1. Brief History of the MVSc Degree Programme in Animal Nutrition.

Animal Nutrition Division is one of the oldest seats of systematic research and post-graduate education in the field of animal nutrition in India. It was started in 1921 as a Laboratory of Physiological Chemist at the Imperial Agricultural Research Institute, Pusa, Bihar. In 1923, it was transferred to Bangalore (now Bengaluru) where it formed one of the two wings of the Imperial Institute of Animal Husbandry and Dairying. In 1928, on the recommendations of the Royal Commission on Agriculture in India, it was transferred to Izatnagar, and the status of the laboratory was raised to a full-fledged Division. In 1939, Lord Linlithgow, the then Viceroy and Governor General of India, inaugurated the new building of this Division. Later, four Regional Animal Nutrition Research Laboratories at Anand, Bangalore, Haringhatta and Palampur were started which were subsequently developed into full-fledged centers. Radio isotope tracer techniques used in research under the United Nations Development Programme were carried out for the first time in India in this Division. Respiration calorimeter facility was established in 1980-84 with the help of Swedish International Development Agency to study energy metabolism in farm livestock.

The Division has been instrumental in conducting both fundamental and applied research. The research outcomes of the division have benefited the farmers through applications of the findings in lab to land program. Beside this, post-graduate education and transfer of technologies in the area of animal nutrition are the basic responsibilities of this division.

As a Centre of Advanced Faculty Training (formerly known as Centre of Advanced Studies), this division imparts advanced trainings to the teachers and scientists of State Veterinary/Agricultural Universities and Research Institutes under National Agricultural Research and Education System in India for human resource development.

The regular MVSc programme in Animal Nutrition was started in 1985.

Objective:

- To excel in innovative research, human resource development and technology generation in the field of animal nutrition.
- Feed resource development for optimum health and production of livestock and pets.

Accomplishments:

- Cold process technology for urea molasses mineral block (UMMB)
- Developed Scarcity feed 'UMLD' as survival feed for livestock.
- Developed compressed complete feed blocks (CCFB)
- Developed Feed Block Making Machine.
- Inoculation of buffalo rumen with superior fibre degrading microbes from the rumen of wild animals resulted in better feed utilization.
- Higher compensatory growth can be achieved during recovery phase of buffaloes following fasciolosis on a standard protein ration.

- Widespread contamination with organochloro pesticides residues along with heavy metals was observed in animal feeds and fodder of Indo-gangetic plains.
- Homemade diets of pet dogs in northern and western India are highly imbalanced and inadequate to meet the requirements of energy, protein and minerals for optimum health.
- Several plants showing antimethanogenic activity have been identified.
- Role of functional foods in modulating nutrient utilization, gastro-intestinal parasitism, health effects of sub-clinical heavy metal exposure and other stressful conditions through improvement of antioxidant status has been established.
- Suitable detoxification methods for castor bean meal, cotton seed cake and karanj cake, neem seed cake and jatropha oil cakes were developed.
- Sugarcane bagasse, tops and pith based complete feeds were developed for cattle.
- Strategic feeding of urea treated cereal straws with rice polish to dairy animals during late gestation and lactation resulted in higher birth weight and survivability of calves and milk production in buffaloes.
- A mixture of three plants having antimethanogenic activity showed reduction in methane emission in crossbred calves.
- Integration of strategic supplementation of N within the existing feeding systems significantly improved the growth rate in buffalo calves, heifers and milk production giving a higher (244%) marginal rate of return.
- Urinary excretion of endogenous purine derivatives (PD) was standardized in crossbred cattle, buffaloes, sheep and goats as an index of nutritional status of ruminants
- Developed microbial feed additive for management of diarrhea in calves.
- Process for the preparation of zinc methionine complex
- Process for the preparation of jevsel-101-an organic selenium
- Identified natural feed additives for eco-friendly livestock production through reducing enteric methane production .
- Developed technology for the efficient utilization of tanniniferous feeds by ruminants through rumen microbial manipulation.
- Developed herbal feed additive to reduce methane production in buffaloes (Antimethane)
- Identified an essential oil for inhibition of methane emission in buffaloes (Methane Suppressor)
- Developed probiotic-polyphenol-prebiotic based products for gut health of pet dogs.
- Developed autochthonous probiotics for dogs, pigs and ruminant calves for the gut health improvement.
- Customized phytogetic feed additive for ruminants health and production.
- Developed vegetarian dog food.
- Developed mineral supplement for cattle and buffaloes reared under wheat-rice-sugarcane farming system.

6.4.2 Faculty Strength:

S.no.	Sanctioned Faculty	Faculty in place	Vacant position	Faculty recommended by the ICAR/UGC/VCI/ other regulatory bodies
1.	Professor*	0	01	ICAR
2.	Associate Professor*	01	01	ICAR
3.	Assistant Professor*	09	02	ICAR

* Faculty are also involved in BVSc & AH and PhD programmes.

6.4.3 Technical and Supporting staff:

Staff	Sanctioned	In Place
Technical*	14	08
Supporting*	80	17

* Technical and supporting staffs are also involved in BVSc & AH and PhD programmes.

6.4.4. Classrooms and Laboratories:

1. Classroom as well as seminar rooms are available in the division for teaching.
2. Laboratories, farm facilities, workshops are mentioned in annexure III

6.4.5. Conduct of Practical and Hands-on-Training:

Practicals (hands-on) are being conducted in all courses. During internal and annual board exams students perform practicals/experimental procedures on their own. Many students attend national and international trainings.

6.4.6 Supervision of students in PG Programme:

MVSc students on roll	16
No. of faculties	10

6.4.7 Feedback of stakeholders (Students, parents, industries, employers, farmers etc.):

Feed back proforma is available which need to be submitted by the students at time of obtaining Provisional Degree Certificate (PDC). The Scanned copy of same is attached in Annexure IV.

6.4.8. Student intake and attrition in the programme for last five years:

Year-wise information is provided in the tabular form.

Name of the Degree programme	Actual Student admitted in last five years	Attrition (%)
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MVSc	Y1 2016- 17	Y2 2017- 18	Y3 2018- 19	Y4 2019- 20	Y5 2020- 21	Y1 2016-17	Y2 2017- 18	Y3 2018- 19	Y4 2019-20	Y5 2020-21
Animal Nutrition	8	7	7	7	7	-37.5*	-14.28*	-14.28*	42.85	14.29

*Negative numbers are due to rejoining of students after their temporary dropping(s).

6.4.9. ICT Application in Curricula Delivery:

Yes the degree programmes are meeting the expectations.

The whole system of registration of courses is on the Academic Management System. Further, the curricula delivery is through use of power point presentations (ppt.) and also using online platforms like the Microsoft teams/ Zoom/ Google meets etc. during the COVID-19 pandemic periods when the students were away from campus.

Furthermore, few e-tutorials, mobile apps and educational videos have been prepared and made accessible for enriching the learning experience of the students.

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6.4.12 Certificate

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6.4.1. Brief History of the MVSc Degree Programme in Veterinary Gynaecology and Obstetrics.

The Division of Animal Reproduction was established in fifth five year plan and come in complete existence on 1st August 1975 at IVRI Campus, Izatnagar and Dr S N Luktuke was the first Head of the Division. However, research in the field of animal reproduction was started much earlier when division was part of Animal Genetics and Breeding and there was separate lab for study on Artificial Insemination, Reproductive disorders and Post-graduate laboratory. In the year 1942- a pilot project was started at IVRI to study the feasibility of AI under the guidance of Dr P Bhattacharya with team consisting of Dr S S Pradhu, Dr D P Mukherjee, Dr S N Luktuke, Dr A Roy and Gr Ganjan Singh. In the year 1944, reproduction research chiefly focused on AI, various aspects of anoestrus and use of Pregnant Mare Serum to treat anestrus cattle and buffalo. Masters programme started in Animal reproduction in the year 1971.

Under the Operational Research Project, crossbreeding programme in cattle and buffalo using both liquid as well as frozen semen was started on 5th February 1977 at ORP Centre, Rithoura. In the year 1982, full fledge Germ-Plasm centre was established as integral unit of the Division for production of quality semen from elite bulls and research on various aspects on semen.

At present, division is having the responsibility of research, teaching, training and extension and has seven major laboratories. Besides that divisional scientists are also posted at LPM section and at Referral Veterinary Polyclinic to look after reproduction related activities. At RVP, all scientists and students of the division providing routine as well as 24 h emergency services to the animals presented at RVP. Divisional scientists are key in extension activities especially in animal health camps.

The regular MVSc programme in Veterinary Gynaecology and Obstetrics was started in 1985.

Objective:

- Research in all aspects of Animal reproduction including Gynaecology, Obstetrics, Artificial Insemination, Andrology and Seminology.
- Postgraduate and Undergraduate teaching and training.
- Extension activities by rendering services to the farmers.

Accomplishments:

- An indigenous method called “Tupol Technique” for freezing bull semen.
- A new staining technique to stain different parts of spermatozoa.
- A simple and rapid method known as Crenellation Pattern Technique (CPT) developed for semen evaluation in field conditions.
- A chemical method for Acrosomal Cap Separation.
- “IVRI Crystoscope” for right-time breeding in cows and buffaloes.

- Modified protocol for buffalo semen freezing.
- Pregnancy diagnosis at 21 days post-breeding in goats and buffaloes by ultrasonography.
- Molecular characterization of buffalo COX-2 gene.
- Purification of PDC-109 from bull seminal plasma.
- Early breeding in cow-heifers and buffaloes through Biostimulation.
- Improved freezability of cattle & buffalo semen by reducing oxidative stress through partial deoxygenation of extender, supplementation with cholesterol loaded cyclodextrine and nanopurification of semen.
- Effective new remedies against important reproductive disorders viz. Anestrus (Hormonal: Insulin, Herbal: Currypatta, Ghrit Kumari, Ashok Bark, Methi seeds), Repeat breeding (Hormonal: Insulin), Endometritis (Neem oil, Colostral whey, PMN Cells, Autologous Plasma).

6.4.2 Faculty Strength:

S.no.	Sanctioned Faculty	Faculty in place	Vacant position	Faculty recommended by the ICAR/UGC/VCI/ other regulatory bodies
1.	Professor*	0	0	ICAR
2.	Associate Professor*	03	0	ICAR
3.	Assistant Professor*	06	01	ICAR

* Faculty are also involved in BVSc & AH and PhD programmes.

6.4.3 Technical and Supporting staff:

Staff	Sanctioned	In Place
Technical*	05	03
Supporting*	24	11

* Technical and supporting staffs are also involved in BVSc & AH and PhD programmes.

6.4.4. Classrooms and Laboratories:

1. Classroom is available for teaching.
2. Laboratories, farm facilities, workshops are mentioned in annexure III

6.4.5. Conduct of Practical and Hands-on-Training:

Practicals (hands-on) are being conducted in all courses. During internal and annual board exams students perform practicals/experimental procedures on their own.

6.4.6 Supervision of students in PG Programme:

MVSc students on roll	12
No. of faculties	09

6.4.7 Feedback of stakeholders (Students, parents, industries, employers, farmers etc.):

Feed back proforma is available which need to be submitted by the students at time of obtaining Provisional Degree Certificate (PDC). The Scanned copy of same is attached in Annexure IV.

6.4.8. Student intake and attrition in the programme for last five years:

Year-wise information is provided in the tabular form.

Name of the Degree programme	Actual Student admitted in last five years					Attrition (%)				
	Y1 2016-17	Y2 2017-18	Y3 2018-19	Y4 2019-20	Y5 2020-21	Y1 2016-17	Y2 2017-18	Y3 2018-19	Y4 2019-20	Y5 2020-21
MVSc										
Veterinary Gynaecology and Obstetrics	7	5	5	8	6	-14.28*	-40*	0	50	-16.67*

*Negative numbers are due to rejoining of students after their temporary dropping(s).

6.4.9. ICT Application in Curricula Delivery:

Yes the degree programmes are meeting the expectations.

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6.4.1. Brief History of the MVSc Degree Programme in Livestock Production & Management.

The present Cattle and Buffalo Farm of Livestock Production and Management was established during October 1937 by transferring some Haryana and Murrah buffaloes from Cattle Breeding Farm, Karnal. The basic mandate was to improve the productivity of these animals by selective breeding and to provide facility for other fields of research in the Institute. The productivity of purebreds improved slowly and these animals were also used for artificial insemination during pre-independence period by Dr. P. Bhattacharya and his team.

In 1945, Farm Animal Genetics Section (FAGS) was established and these animals were transferred to FAGS. During the 3rd Five Year Plan i.e. 1.4.1968, an All India Coordinated Research Project for “Studying Behavioural Pattern of Zebu Crossbreds” was started with 2 initial centres. These centres were IVRI, Izatnagar and HAU, Hisar and a base population of 400 Haryana cows at each centre.

Finally, the project was merged into AICRP on Cattle in 1969 with the major objective to evolve dairy cattle breed by crossing native Haryana with semen of elite temperate dairy breeds viz. Holstein Friesian, Brown Swiss and Jersey. Under the project, various crossbred grades were produced and were tested for their production and reproduction traits, growth, heat tolerance and disease resistance and multiplied upto 9 generations.

Murrah buffaloes were also maintained for research and teaching purposes since inception of Cattle and Buffalo Farm. This unit was expanded into an improvement programme on Murrah buffaloes under AICRP on Buffaloes/Network Project on Buffalo improvement. A small herd of pure Holstein Friesian animals were imported from Australia with the major objective of multiplication and improvement of these animals.

The Farm Animal Genetic Section was renamed as Livestock Production Research (Cattle and Buffalo) during 1975. In October, 1997, it was reorganized and existing set up of Livestock Production Research (Cattle and Buffalo) with Swine Production Farm and Sheep and Goat Farm were converted into Livestock Production and Management Section. Presently, scientific staff of the section is also involved in teaching of BVSc, MVSc and PhD students.

The regular MVSc programme in Livestock Production & Management was started in 1985.

Objective:

- To conduct research on production and management aspects of various livestock species.
- To develop technical and scientific manpower for research and management of livestock units in terms of Ph.D., M V Sc. and Diploma.
- To cater to the needs of research material of other Divisions/Disciplines of the Institute.

- To provide platform for inter-disciplinary research programmes.

Accomplishments:

- Developed a crossbred cattle population “Vrindavani” (Holstein Friesian + Brown Swiss + Jersey 50-75% and Haryana 25-50%) suitable to local agroclimatic conditions.
- Developed a new crossbred variety “Landlly” (Landrace 75 % and Local 25 %) of pigs. It was released by Shri Radha Mohan Singh Ji, Hon’ble Union Minister of Agriculture and Farmers Welfare, GOI on occasion of Annual Conference of VCs & Directors at NASC Complex, New Delhi on 8th March 2018.
- Characterized, documented and registered Ghurrah breed of pig (INDIA_PIG_2000_GHURRAH_09008). Registration certificate was received from the Hon'ble Union Minister of Agriculture & Farmers Welfare, Shri Radha Mohan Singh Ji on 12th December 2018 at Krishi Bhawan, New Delhi.
- Characterized, documented and registered Rohilkhandi breed of goat (INDIA_GOAT_2000_ROHILKHANDI_06030). Registration certificate was received from the Hon'ble Union Minister of Agriculture & Farmers Welfare, Shri Radha Mohan Singh Ji on 12th December 2018 at Krishi Bhawan, New Delhi. Group milk feeding (GMF) device with facility to suckle 6 kids at a time was developed to rear orphan kids. GMF had higher body weight gain than bottle feeding system.
- Scope of 50% reduction in floor space as compared to BIS standards was investigated for crossbred pigs without affecting growth performance.
- Inclusion of 15% sugarcane press mud in ration had no deleterious effect on production performance in crossbred pigs.
- Thatch and agronet shade material helped in better relieving the stress during summer season, while only agronet helped in rainy season from the hot and humid condition.
- Total milk production was 15.63% higher in thrice milked cows than twice milked cows. Milk composition did not differ significantly between two treatments except for SNF% which was significantly higher for twice milked cows.
- Open area with sand bed with either concrete or rubber mat in covered area improved animal welfare in terms of decreasing lameness, hoof and leg injuries and increasing lying ruminating time.
- Provision of cooling jacket with high speed air circulator fan helped in reducing microclimate variables favoring ADG, FCR, physiological and important haemato-biochemical parameters of buffalo heifers.

6.4.2 Faculty Strength:

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6.4.3 Technical and Supporting staff:

Staff	Sanctioned	In Place
Technical*	39	15
Supporting*	156	30

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6.4.4. Classrooms and Laboratories:

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No. of faculties	04

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MVSc										

Livestock Production and Management	5	4	4	7	7	0	50	-75*	57.14	28.57
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The university has also launched the augmented reality (AR) and virtual Reality (VR) experience centre with the support of NAHEP & IASRI which will further augment the learning process.

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6.4.1. Brief History of the MVSc Degree Programme in Livestock Products Technology.

Visualizing the importance of livestock products, the Division of Livestock Products Technology (LPT) was established in 1975 to conduct research in the frontier areas of meat and milk science and to develop human resource to match the growing livestock products based industry. The Division is playing a unique role in development of livestock products based industries in the country. At a time when enormous global opportunities have emerged for export of livestock products, the Division of LPT is acting as a nodal agency in catalysing the growth in this sector. During these four decades, concerted efforts and pragmatic approach of scientists of this division has resulted in development of a number of new technologies for meat and milk production, processing and by products utilization. A well-equipped Pilot Plant and Pasteurization Plant have been established with state of art meat and milk processing machines.

The Division of LPT is shouldering the responsibility to generate requisite manpower for research, teaching and industry by offering Master and Doctoral programmes in Livestock Product Technology discipline. So far 114 M.V.Sc. scholars have obtained the degrees and 4 of them were also awarded with the Jawaharal Nehru Award for outstanding post-graduate research. Short term courses and National Seminars in different areas have also been organized for meat personnel and entrepreneurs. The Division has also imparted training to farmers, entrepreneurs, start ups, researchers and academicians. Division has organized more than 40 trainings/entrepreneurial development programmes/workshops/short term courses (Summer/Winter schools), developed more than 40 processes/ products/ technologies and transferred six technologies to twelve entrepreneurs. The Division has published more than 600 research papers, 250 reviews/ technical/ popular articles in reputed national and international journals and 10 books/ monographs/ bulletins. Institute Best Teacher Award has been awarded to three faculty members. Rajendra Prasad Puruskar was received for writing Technical Book in Hindi entitled, “Swachch Maans Utpadan”. The division is continuously providing technical support to APEDA, BIS, MoFPI, DST, FSSAI, NMPPB and other govt agencies on issues related to livestock products sector. The Division has received many appreciations like Chal Vajjayanti, Achal Vajjayanti, Certificate of Appreciation for revenue generation, and best exhibition stalls and continuously bagged one of best division awards for last 7years.

The regular MVSc programme in Livestock Products Technology was started in 1985.

Objective:

- To conduct basic and applied research on all aspects of livestock products from different species of animals.
- To develop appropriate processing technologies for different meat and milk products for value addition, convenience, improved palatability and shelf-life.
- To offer post-graduate education in Livestock Products Technology to cater to the needs of scientific manpower of the nation.

- To organize training programmes for scientific, managerial and technical personnel of slaughter house and meat processing plants.
- To establish proper liaison with livestock products related industry, trade and regulatory bodies at the national level.

Accomplishments:

- Developed more than 40 new/improved processes and technologies for ready-to-eat and ready-to-serve, functional, emulsion, enrobed, shelf-stable, restructured, cured and smoked meat products from chicken, mutton, chevon, buffalo, pork and rabbit meat.
- Identified optimum handling conditions, developed techniques for tenderization and quality improvement of meat and meat products from spent animals/birds.
- Standardized processes for effective utilization and techniques for isolation.
- Developed novel techniques for improvement of microbial quality and shelf life of meat and meat products by using blends of essential oil, natural antioxidants, organic acids, microbial cultures and new packaging methods.
- Evolved packaging systems and sensory criteria for different meat and meat products.
- Standardized the process and formulation for various dairy products viz: low fat paneer, low calories sweets, milk chips, *chhach* powder, milk bread, milk rings, srikhand etc and utilization techniques for dairy by-products.
- Developed simplex, duplex, multiplex PCR for identification of tissue from cattle, buffalo and pig, Carotenoid based assay, LAMP-LFA and RPA-LFA techniques for onsite identification of species origin of tissue.
- Developed Time temperature and quality indicators for quality evaluation and safety assurance of meat and meat products during supply chain.
- Standardized sensitive and specific Real time (TaqMan) PCR, multiplex PCR and LAMP assays for food borne pathogens viz. *Clostridium perfringens*, *Salmonella* spp., *S. aureus* and Verotoxigenic *E. coli*.

6.4.2 Faculty Strength:

S.no.	Sanctioned Faculty	Faculty in place	Vacant position	Faculty recommended by the ICAR/UGC/VCI/ other regulatory bodies
1.	Professor*	0	0	ICAR
2.	Associate Professor*	01	0	ICAR
3.	Assistant Professor*	08	0	ICAR

* Faculty are also involved in BVSc & AH and PhD programmes.

6.4.3 Technical and Supporting staff:

Staff	Sanctioned	In Place
Technical*	06	12
Supporting*	27	10

* Technical and supporting staffs are also involved in BVSc & AH and PhD programmes.

6.4.4. Classrooms and Laboratories:

1. Class and seminar rooms are available for teaching.
2. Laboratories, farm facilities, workshops are mentioned in annexure III

6.4.5. Conduct of Practical and Hands-on-Training:

Practicals (hands-on) are being conducted in all courses. During internal and annual board exams students perform practicals/experimental procedures on their own.

6.4.6 Supervision of students in PG Programme:

MVSc students on roll	12
No. of faculties	09

6.4.7 Feedback of stakeholders (Students, parents, industries, employers, farmers etc.):

Feed back proforma is available which need to be submitted by the students at time of obtaining Provisional Degree Certificate (PDC). The Scanned copy of same is attached in Annexure IV.

6.4.8. Student intake and attrition in the programme for last five years:

Year-wise information is provided in the tabular form.

Name of the Degree programme	Actual Student admitted in last five years					Attrition (%)				
	Y1 2016-17	Y2 2017-18	Y3 2018-19	Y4 2019-20	Y5 2020-21	Y1 2016-17	Y2 2017-18	Y3 2018-19	Y4 2019-20	Y5 2020-21
MVSc										
Livestock Products Technology	5	3	3	5	5	20	-66.67*	-25*	60	40

*Negative numbers are due to rejoining of students after their temporary dropping(s).

6.4.9. ICT Application in Curricula Delivery:

Yes the degree programmes are meeting the expectations.

The whole system of registration of courses is on the Academic Management System. Further, the curricula delivery is through use of power point presentations (ppt.) and also using online platforms like the Microsoft teams/ Zoom/ Google meets etc. during the COVID-19 pandemic periods when the students were away from campus.

Furthermore, few e-tutorials, mobile apps and educational videos have been prepared and made accessible for enriching the learning experience of the students.

The university has also launched the augmented reality (AR) and virtual Reality (VR) experience centre with the support of NAHEP & IASRI which will further augment the learning process.

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6.4.1. Brief History of the MVSc Degree Programme in Poultry Science.

Central Avian Research Institute (CARI) was established on the 2nd November, 1979 at Izatnagar, Bareilly, Uttar Pradesh under the aegis of the Indian Council of Agricultural Research (ICAR) to provide all-round support to the growth of poultry sector. Since its inception, this Institute has been playing an important role by providing need based R&D support for diversified poultry production, processing and marketing, apart from Post-graduate education, training and technology transfer activities for augmenting productivity, production and profitability of the Indian poultry sector. The Institute remains responsive and vigilant to the ever evolving needs of the poultry sector through development of cutting edge technologies targeting specific problems faced by the industry. The R&D accomplishments of the Institute have been widely acclaimed as evident from a long list of prestigious national and international awards and laurels the Institute has been adorned with. Moreover, the Institute has been continuously updating and reorienting its R&D focus abreast with the latest developments taking place globally and in accordance with the changing needs of the domestic poultry sector.

The regular MVSc programme in Poultry Science was started in 1985.

Objective:

- Basic and applied research on productivity enhancement for sustainable production in diverse avian species.
- Human resource development and capacity building.

Accomplishments:

1. Developed improved Japanese quail varieties viz., CARI-Uttam meat type (BW 240g at 5 wk); CARI- Pearl layer (295 eggs/annum) and disseminated all over the country
2. In order to address Wild Life (P) Act related issues, alternate plumage colour quail varieties, viz. White breasted CARI-Ujjawal, brown feather white breasted CARI-Sunehari and all white plumage CARI-Sweta have been developed.
3. Developed and supplied improved variety of turkey viz. CARI-Virat with 16 wk BW of approx. 5 kg (male) and 3.3 kg (female).
4. Three improved varieties of Guinea fowl, viz., Kadambari, Chitambari & Swetambari with about 1kg BW at 12 wk) developed and propagated in rural areas.
5. Developed, field tested and propagated low input, improved indigenous chicken varieties, viz., CARI-Nirbhik, CARI-Shyama, CARI UPCARI, CARI HITCARI for **promoting rural poultry production**.
6. Naked neck and frizzle genes introgressed to develop broiler stock viz. CARI-Tropicana to withstand the harsh tropical climate.
7. Introduced Ankleshwar and Nicobari breeds of native chicken and VANRAJA parents at CARI.
8. Four breeds of ducks viz, Khaki Campbell, White Pekin, *desi* and indigenous Moti are being propagated in coastal areas from CARI, RC, Bhubanweswar; nutritional package developed and AI techniques under standardization.

9. Dual purpose coloured chicken variety, viz., CARI-Debendra having excellent performance and is in great demand in rural areas was popularized.
10. A new diversified poultry species, **Emu** has been recently introduced at the Institute.
11. Chicken layer strain cross - CARI Priya- topped the 31st RSPPT (Bangalore) with 300 eggs/annum, 57.4g egg wt. at 40 wk age. **(AICRP Component)**
12. Broiler cross CARIBRO-Vishal (1.7kg at 6 wk) topped the 30th RSPPT (Gurgaon) during 2009. **(AICRP Component)**.
13. Multicoloured commercial broiler stock viz. CARIBRO DHANARAJA developed and popularized along with other high yielding chicken germplasms developed at the institute.

6.4.2 Faculty Strength:

S.no.	Sanctioned Faculty	Faculty in place	Vacant position	Faculty recommended by the ICAR/UGC/VCI/ other regulatory bodies
1.	Professor*	0	02	ICAR
2.	Associate Professor*	06	0	ICAR
3.	Assistant Professor*	09	07	ICAR

* Faculty are also involved in BVSc & AH and PhD programmes.

6.4.3 Technical and Supporting staff:

Staff	Sanctioned	In Place
Technical*	29	15
Supporting*	85	63

* Technical and supporting staffs are also involved in BVSc & AH and PhD programmes.

6.4.4. Classrooms and Laboratories:

- 1 Seminar as well as classrooms are available for teaching.
2. Laboratories, farm facilities, workshops are mentioned in annexure III

6.4.5. Conduct of Practical and Hands-on-Training:

Practicals (hands-on) are being conducted in all courses. During internal and annual board exams students perform practicals/experimental procedures on their own.

6.4.6 Supervision of students in PG Programme:

MVSc students on roll	17
No. of faculties	15

6.4.7 Feedback of stakeholders (Students, parents, industries, employers, farmers etc.):

Feed back proforma is available which need to be submitted by the students at time of obtaining Provisional Degree Certificate (PDC). The Scanned copy of same is attached in Annexure IV.

6.4.8. Student intake and attrition in the programme for last five years:

Year-wise information is provided in the tabular form.

Name of the Degree programme	Actual Student admitted in last five years					Attrition (%)				
	Y1 2016-17	Y2 2017-18	Y3 2018-19	Y4 2019-20	Y5 2020-21	Y1 2016-17	Y2 2017-18	Y3 2018-19	Y4 2019-20	Y5 2020-21
MVSc										
Poultry Science	10	4	4	7	8	0	-100*	-150*	0	25

*Negative numbers are due to rejoining of students after their temporary dropping(s).

6.4.9. ICT Application in Curricula Delivery:

Yes the degree programmes are meeting the expectations.

The whole system of registration of courses is on the Academic Management System. Further, the curricula delivery is through use of power point presentations (ppt.) and also using online platforms like the Microsoft teams/ Zoom/ Google meets etc. during the COVID-19 pandemic periods when the students were away from campus.

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6.4.1. Brief History of the MVSc Degree Programme in Animal Biochemistry.

Recognizing the importance of biochemical studies in life science research, the division of Biochemistry was established in 1972 during the Fifth Five year plan under the guidance of Dr. C.M. Singh, the then Director of the institute. It was realized that the basic understanding of chemical processes in the cell is essential for every student of biology. The mandate of the division since its inception is to carry out basic and applied research in the areas of animal health and production and to impart post-graduate education. At present in this division there are six scientists. The main focus of the research has been clinical biochemistry, reproductive biochemistry, host-pathogen biology, biochemical toxicology, cancer biochemistry, membrane biochemistry and disease diagnosis. Since its inception, the division has acquired the best research, teaching and training facilities, and takes legitimate pride in teaching more than 100 post-graduate students every year offering 79 credit hours in 40 courses. Division has eight major laboratories; Clinical Diagnostic laboratory, Protein and Nucleic acid Research laboratory, Lipid Research laboratory, Enzymology laboratory, Genetic Engineering of Eukaryotic laboratory, Immunochemistry Laboratory, Carbohydrate Research laboratory, Post-Graduate laboratory and Central Instrumentation facility. The division has the distinction of conducting 15 international training courses under TCS Colombo plan, Ministry of External Affairs, Govt. of India. Research outcomes are published in highly acclaimed journals of international repute. Students of this division are well placed in various state and central government organizations and a good number of them are carrying out research in leading research institutes in country and abroad.

The regular MVSc programme in Animal Biochemistry was started in 1985.

Objective:

- To impart post graduate education in Animal Biochemistry
- To conduct basic and applied research in the areas pertinent to animal health, production and technology.

Accomplishments:

Research Areas: Clinical Biochemistry, Reproductive Biochemistry, Host-pathogen Biology, Biochemical Toxicology, Cancer Biochemistry, Membrane Biochemistry, Disease diagnosis

Salient decadal achievements are as follows:

1972-1980

- Biochemical studies on buffalo milk – Predominant component of buffalo milk lipid was triglyceride, having both short and long chain fatty acids. Notable feature of buffalo milk phospholipids was the higher concentration of sphingomyelin.
- Lipids of buffalo spermatozoa – The buffalo spermatozoa do not utilize endogenous lipids for energy generation.
- Physicochemical properties of buffalo muscles – Buffalo meat had higher moisture content as compared to beef. Moisture and glycogen contents decrease with advancing age. A ~61 kDa meat tenderizing enzyme was isolated from unripe fruits of *Cucumis pubescens* that appears to be related with papain.

1980-1990

- Angiotensin converting enzyme – The presence of enzyme was studied in different animal species and it released during in vitro capacitation of the spermatozoa and it may have a role in sperm activation.
- Enzyme inhibitors in buffalo seminal plasma – Trypsin inhibitor was isolated and characterized and suggested to be involved in semen protein metabolism.
- Buffalo muscle proteins – The skeletal muscle proteins of buffalo were categorized into highly metabolic sarcoplasmic proteins, moderately metabolized myofibrillar proteins and slow metabolic stroma proteins.
- Clinical biochemistry of buffalo – The cationic peptides isolated from buffalo PBM cells were active against gram negative (*E. coli*) and gram positive (*S. aureus*) bacteria.
- Parasite biochemistry – An ELISA for *Dicyocaulus filaria* was developed.

1990-2000

- Biochemical studies on buffalo pituitary – The buffalo anterior pituitary showed the presence of a possible pro-hormone of growth hormone and prolactin.
- Spermatozoa motility inhibitor – The Spermatozoa motility inhibitor was isolated from Fowl semen that showed ant-bacterial property.
- Biochemical toxicology- The biochemical basis of bracken fern toxicity and the hepato-protective effect of Liv 52 and Kumaryasava were studied. Characterization of goat liver glutathione-S-transferase and its role in de-toxification was elucidated.
- Host pathogen biology – Defensins from different epithelial linings of buffalo tissues showed anti-bacterial properties. The *Ocimum sanctum* extracts showed antiviral activity against Bovine herpes virus 1 infected MDBK cells through inhibition of virus adsorption to the cells. The virus was found to induce apoptosis in infected bovine peripheral blood mononuclear cells.

2000-2010

- Matrix metalloproteases and cancer – Different forms of Matrix metalloproteases were identified in canine cancer and their role in metastasis was investigated. An ELISA was developed for MMP- 7, MMP – 11 as diagnostic marker for dog mammary cancer.
- Clinical Biochemistry - Further studies on buffalo defensins were carried out to analyse their role in host defense. The genes related to the innate immunity (TLR2, TLR3 and TLR4) in buffalo, Nilgai, blackbuck and goats were studied. Complete cDNA encoding IL2, IL4, IL18, TNF α and IFN γ in Nilgai were sequenced.
- Host-pathogen biology – Micro array DNA chip for livestock virus detection developed. The feeding of *Ocimum tenuiflorum* and *Curcuma caseia* extracts was found to augment immune responses as oral immunomodulators in mice. Calreticulin of *Haemaphysalis contortus* was identified as the anti-coagulant factor and shown to act as an immunomodulator by binding to complement C1q and the C-reactive protein.

2010-2020

- Matrix metalloproteases (MMPs) in cancer-
 1. MMP-9 as xenogenic canine vaccine was tested for antitumor potential in murine breast cancer model induced by 4TI cancer cell line. Immunization

with recombinant plasmids encoding canine matrix metalloprotease 7 gene alone and combined with interleukin-18 produced both humoral and cell mediated immune responses, inhibited tumor growth and prolonged survival of the treated BALB/c mice in both the prophylactic and therapeutic settings.

2. Antimetastatic effects of phytochemicals as inhibitor of MMP's were studied on breast cancer cell lines. Among urosilic acid, eugenol, apeginin, capcisine and berberine, apeginin was found to be more effective in inhibiting MMP's gene expression and enzyme activity, cell scratch assay and inducing apoptosis in MDA-MBA 231 cancer cell line.
- Host-pathogen biology-
 1. One *fnr* knock out (STM: Δ *fnr*) and one *fnr* codon deoptimised mutant (STM:*dfnr*) strain of *Salmonella typhimurium* were generated and evaluated for *in vitro* growth kinetics under anaerobic conditions and for their *in vivo* colonization in mice wherein both mutant strains showed reduced growth and colonization in mice.
 2. Standardized and employed a battery of genomics and proteomics approaches along with live animal studies to determine the roles of Msr and PIMT in the *Salmonella* virulence. MSR and PIMT deletion mutants of *S. Typhimurium* had reduced virulence.
 3. Mutants for genes encoding for polyamine synthesis (Spermidine synthase, *speE*) and transport (*potD*) as well as involved in repair of Met-SO in periplasmic space (periplasmic methionine sulfoxide reductase, *msrP*) in *S. Typhimurium* were generated. Δ *speE* gene deletion strain showed hypersensitivity to H₂O₂ and defective survival in mice. Δ *potD* mutant strain showed hypersensitivity to macrophages and neutrophils; and defective survival in mice.
 4. GAPDH of *H. contortus* was identified as the complement C3 binding protein; this interaction shuts up the complement cascades and defines a novel survival strategy of the parasite. A 95 amino acids stretch of GAPDH was generated and this smaller fragment had both – the C3 binding site as well as the antigenic region of the enzyme. Further, the fragment stimulated PBMCs *in vitro* and this protein may find therapeutic application.
 5. Immunization of adult goats free of any parasitic infestations with purified *H. contortus* GAPDH showed the presence of anti-GAPDH antibody compared to control animals. On challenge with *H. contortus* larvae, on 7th week post challenge, none of the immunized goats showed fecal egg output whereas control animals showed remarkable egg numbers. The *H. contortus* GAPDH may serve as a potential vaccine candidate.
 6. Vitronectin (Vn) modulates the activity of complement C9, an important component of innate immunity. In addition, Vn also facilitates bacterial binding to host cells leading to infection. In C9 binding site and the bactericidal property of caprine Vn were mapped by generating defined length fragments of the protein. The residues 101-150 of N-terminal part of caprine

vitronectin was found to contribute to antimicrobial activity against *E. coli* and *S. aureus* by modulating the activity of complement C9, an important component of innate immunity, may be of therapeutic application.

- Reproductive biochemistry-

1. Regucalcin was identified as an anti-capacitatory and cryoprotective protein in frozen-thawed buffalo spermatozoa. In addition, reference genes for qRT-PCR data normalization for frozen-thawed buffalo spermatozoa were identified.
2. Relaxin based sandwich ELISA was developed and pregnancy diagnosis in canine serum was attempted. The methodology was found useful for detecting the well-being of the fetus but not reliable for pregnancy diagnosis as such.
3. The presence of Antimicrobial peptide namely, SPAG11B isoforms were detected by RT-PCR from testes and epididymal region of Buffalo.
4. Study of oxidatively damaged proteins and the measures to reduce the protein damage due to cryopreservation in buffalo semen revealed that the supplementation of 1 μ g of recombinant methionine sulphoxide reductase A(rMsrA)/ 50 million spermatozoa in 1 ml of semen improved the frozen-thawed semen quality.
5. Mass spectrometric identification of carbonylated proteins in fresh-extended and frozen-thawed seminal plasma revealed more number of proteins carbonylated in frozen-thawed seminal plasma than the fresh-extended seminal plasma.

- Membrane biology -

1. Multidrug resistance protein 4 (MRP4) coding region in Gyps vulture and domestic chicken were characterized and two transcript variants were identified.
2. Stably transfected MDCK cell lines expressing these MRP4 transcript variants were developed and characterized. Functional evaluation of these cell lines revealed that MRP4 is used as diclofenac efflux transporter in both chicken and vulture, full MRP4 more functional than 19 aa deleted one. Diclofenac was not found to inhibit MRP4-mediated urate efflux in MRP4 expressing cells as compared to mock transfected controls.
3. Identification of other transporters and predicting their ORF in vulture renal transcriptome analysis suggested that the urate secretion in birds may not be unidirectional.
4. Membrane cholesterol regulates the cross talk between caspases and machineries of autophagy. Cholesterol modulation by Methyl- β -cyclodextrins was found to induce cell death via down regulating the caspases-8, which facilitate the induction of autophagic cell death. Further, the depleting membrane cholesterol reduced the metastasis potential of cancer cells.
5. M β CD induced programmed cell death (autophagy) in 4T1 cells was found mediated through P2RX7 hyperactivation after the membrane cholesterol perturbation or lipid raft disruption.

6.4.2 Faculty Strength:

S.no.	Sanctioned Faculty	Faculty in place	Vacant position	Faculty recommended by the ICAR/UGC/VCI/ other regulatory bodies
1.	Professor*	0	0	ICAR
2.	Associate Professor*	03	0	ICAR
3.	Assistant Professor*	08	03	ICAR

* Faculty are also involved in BVSc & AH and PhD programmes.

6.4.3 Technical and Supporting staff:

Staff	Sanctioned	In Place
Technical*	03	04
Supporting*	17	01

* Technical and supporting staffs are also involved in BVSc & AH and PhD programmes.

6.4.4. Classrooms and Laboratories:

1. Two classrooms are available for teaching and seminar.
2. Laboratories, farm facilities, workshops are mentioned in annexure III

6.4.5. Conduct of Practical and Hands-on-Training:

Practicals (hands-on) are being conducted in all courses. During internal and annual board exams students perform practicals/experimental procedures on their own. Many students attend national and international trainings. A comprehensive list is given below:

Division	Name / No. of Students	Hands-on- trainings attended
Animal Biochemistry	Dr M.Hira Khan	Training in Japan under CAAST-ACLH (3 months)

6.4.6 Supervision of students in PG Programme:

MVSc students on roll	06
No. of faculties	11

6.4.7 Feedback of stakeholders (Students, parents, industries, employers, farmers etc.):

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MVSc										
Animal Biochemistry	4	4	2	4	1	-50*	-50*	-150*	50	-300*

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6.4.9. ICT Application in Curricula Delivery:

Yes the degree programmes are meeting the expectations.

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6.4.1. Brief History of the MVSc Degree Programme in Animal Biotechnology.

Biotechnology has tremendous potential to improve food securities in developing countries. Realizing the great potential of biotechnology in the field of animal health and production, the National Biotechnology Centre (NBC) was established at IVRI during VII five year plan by ICAR in collaboration with Department of Biotechnology, Govt. of India and UNDP/FAO in the year 1986 with the emphasis on post-graduate education and training in biotechnology and conducting research in identified areas of immunobiotechnology. Funding from various sources, e.g., ICAR, UNDP/FAO, INDO-US, ILTP (INDO-USSR), ODA (INDO-SWISS), Indo-UK and others helped in creating adequate infrastructural facilities to undertake research in frontier areas of animal biotechnology such as genetic engineering, hybridoma technology, peptide synthesis, protein engineering etc.

In recognition of the contributions made by this centre, ICAR conferred the status of the Centre of Advanced Studies (CAS) in Animal Biotechnology. Later, the National Biotechnology Centre was identified as Centre of Excellence in Veterinary Biotechnology by ICAR under the National Agriculture Technology Programme (NATP) funded by World Bank. It was later designated as Division of Veterinary Biotechnology.

Scientists and students of the division are recognized with number of prestigious awards and fellowships such as BOYSCAST Fellowship, Endeavour Fellowship, Commonwealth Academic Staff Fellowship, DBT Overseas Fellowship, DST-SERB Postdoctoral Fellowship, and Lal Bahadur Shastri Award and Jawaharlal Nehru Award

The regular MVSc programme in Animal Biotechnology was started in 1985.

Objective:

- To conduct research on the basic and applied areas in the field of Animal Biotechnology.
- To impart postgraduate teaching to M.V.Sc. and Ph.D. students in the discipline of Animal Biotechnology.

Accomplishments:

- Developed subviral particle based infectious bursal disease (IBD) vaccine for chickens
- Developed gene-deleted bovine herpesvirus-1 (BoHV-1) as infectious bovine rhinotracheitis (IBR) marker vaccine candidate
- Developed Newcastle disease virus (NDV) strain R2B as a viral vector for vectored vaccine
- Developed recombinant antigen-based ELISA for sero-diagnosis of infectious bursal disease (IBD) and Newcastle disease (ND) of chickens
- Developed classical swine fever virus (CSFV) capsid, E1 and E2 structural proteins as virus-like particles (VLPs) for DIVA-based CSFV marker vaccine candidate

- Established porcine induced pluripotent stem (iPS) cells and mesenchymal stem cell (MSC) lines from bone marrow, umbilical cord and adipose tissues
- Developed multiplex bead based assay for detecting serum biomarkers associated with canine mammary tumours (CMT)
- Developed a self-replicating RNA-replicon-based RNA vaccine vector (pAlpha-MCS) for heterologous gene expression in mammalian cells and immune responses
- Completed genome sequencing of animal viruses, including bovine alphaherpesvirus 1 (KY215944), Classical swine fever virus-lapinized (EU857642) and field (KM262189) strains, Newcastle disease virus-mesogenic R2B (JX316216), lentogenic F (KC987036) vaccine and field (KJ769262) strains, Peste des petits ruminants (PPR) virus Sungri/96 vaccine strain (KF727981)
- Four patents (Patent Nos. 325899, 278655, 278622, 277404) have been granted

6.4.2 Faculty Strength:

S.no.	Sanctioned Faculty	Faculty in place	Vacant position	Faculty recommended by the ICAR/UGC/VCI/ other regulatory bodies
1.	Professor*	0	0	ICAR
2.	Associate Professor*	02	01	ICAR
3.	Assistant Professor*	16	04	ICAR

* Faculty are also involved in BVSc & AH and PhD programmes.

6.4.3 Technical and Supporting staff:

Staff	Sanctioned	In Place
Technical*	13	05
Supporting*	02	07

* Technical and supporting staffs are also involved in BVSc & AH and PhD programmes.

6.4.4. Classrooms and Laboratories:

1. A smart classroom is available for teaching.
2. Laboratories, farm facilities, workshops are mentioned in annexure III

6.4.5. Conduct of Practical and Hands-on-Training:

Practicals (hands-on) are being conducted in all courses. During internal and annual board exams students perform practicals/experimental procedures on their own. Many students attend national and international trainings.

Hands-on- trainings attended by student

Basics for Bioinformatics for Biologists Dec 13-15, 2021

6.4.6 Supervision of students in PG Programme:

MVSc students on roll	12
No. of faculties	18

6.4.7 Feedback of stakeholders (Students, parents, industries, employers, farmers etc.):

Feed back proforma is available which need to be submitted by the students at time of obtaining Provisional Degree Certificate (PDC). The Scanned copy of same is attached in Annexure IV.

6.4.8. Student intake and attrition in the programme for last five years:

Year-wise information is provided in the tabular form.

Name of the Degree programme	Actual Student admitted in last five years					Attrition (%)				
	Y1 2016-17	Y2 2017-18	Y3 2018-19	Y4 2019-20	Y5 2020-21	Y1 2016-17	Y2 2017-18	Y3 2018-19	Y4 2019-20	Y5 2020-21
MVSc										
Animal Biotechnology	0	4	2	3	6	-300*	0	-100*	0	83.33

*Negative numbers are due to rejoining of students after their temporary dropping(s).

6.4.9. ICT Application in Curricula Delivery:

Yes the degree programmes are meeting the expectations.

The whole system of registration of courses is on the Academic Management System. Further, the curricula delivery is through use of power point presentations (ppt.) and also using online platforms like the Microsoft teams/ Zoom/ Google meets etc. during the COVID-19 pandemic periods when the students were away from campus.

Furthermore, few e-tutorials, mobile apps and educational videos have been prepared and made accessible for enriching the learning experience of the students.

The university has also launched the augmented reality (AR) and virtual Reality (VR) experience centre with the support of NAHEP & IASRI which will further augment the learning process.

6.4.10. The information pertaining to 6.4.1 to 6.4.9 shall be provided for each one of UG, PG and PhD Degree Programmes, separately, and to be presented College-wise.

We have mentioned the information separately

6.4.11. Since the accreditation of Programmes is related to the All India Admission from ICAR and also having weightage for College accreditation, therefore the data presented in the section 6.4 is liable to the verification at any stage.

6.4.12**Certificate**

I, the Dean**Dr Triveni Dutt**..... hereby certify that the information contained in the Section 6.4.1 to 6.4.9 are furnished as per the records available in the college, and degree awarding university.



Signature of Dean of the College with Date & Seal

16/1
संयुक्त निदेशक (शैक्षणिक) एयम् डीन
Joint Director (Academic) Cum Dean
भारतीय पशु-चिकित्सा अनुसंधान संस्थान
Indian Veterinary Research Institute
(सम-विश्व विद्यालय)
(Deemed University)
Izatnagar-243 122 (U.P.)
इजतनगर-243 122 (उ. प्र.)

6.4.1. Brief History of the MVSc Degree Programme in Veterinary Extension Education

Division of Extension Education was established at IVRI in the year 1970. In the initial years, division undertook several field extension projects such as ORP on livestock and fodder improvement (1976), Lab to Land program (1979) and 20 point economic program (1983), emphasizing on testing the field applicability of various veterinary and animal science technologies in the farmers' situations. In 1985, when IVRI was granted Deemed University status, the Division started Post-graduate education program in the area of Extension Education. So far, 115 Master's and 95 Ph. D. degrees have been awarded. One of the most important activities of the Division is conducting research on multidimensional issues related to livestock technology transfer through institute funded as well as extramural research projects. The Division also performs some field extension activities mainly to generate inputs for research.

The regular MVSc programme in Veterinary Extension Education was started in 1985.

Objective:

- To conduct research in the areas of extension, communication, training and teaching methods, extension management & rural appraisal to promote livestock development
- To impart postgraduate teaching and advanced training in extension education
- To carry out extension programs in selected villages to develop suitable and feasible extension strategies
- To carry the useful result of applied research in animal husbandry to the farmers & to bring back field problems of the farmers for further research and investigation

Accomplishments:

The Division has undertaken various internal and externally funded projects since its inception for the upliftment of rural community and to achieve synergy among farmers, scientists, extensionists and policy makers. The scientists and students of the Division have contributed to the research achievements of the division through their research projects, National and International level conferences & seminars and have also published research and review papers in high rated journals. Few of the major thrust areas of research projects are:

- ICT based extension
- Organic Animal Husbandry
- Impact assessment of technologies
- Diffusion and adoption of livestock technologies
- Livestock Innovation System
- Women Empowerment
- Extension strategies for Livestock production system
- Livestock service delivery by various agencies

- Market led Extension
- Livelihood security of livestock farmers

6.4.2 Faculty Strength:

S.no.	Sanctioned Faculty	Faculty in place	Vacant position	Faculty recommended by the ICAR/UGC/VCI/ other regulatory bodies
1.	Professor*	0	0	ICAR
2.	Associate Professor*	01	01	ICAR
3.	Assistant Professor*	07	01	ICAR

* Faculty are also involved in BVSc & AH and PhD programmes.

6.4.3 Technical and Supporting staff:

Staff	Sanctioned	In Place
Technical*	06	05
Supporting*	11	03

* Technical and supporting staffs are also involved in BVSc & AH and PhD programmes.

6.4.4. Classrooms and Laboratories:

1. Classroom is available for teaching.
2. Laboratories, farm facilities, workshops are available and mentioned in annexure III

6.4.5. Conduct of Practical and Hands-on-Training:

Practicals (hands-on) are being conducted in all courses. During internal and annual board exams students perform practicals/experimental procedures on their own.

6.4.6 Supervision of students in PG Programme:

MVSc students on roll	09
No. of faculties	08

6.4.7 Feedback of stakeholders (Students, parents, industries, employers, farmers etc.):

Feedback proforma is available which need to be submitted by the students at time of obtaining Provisional Degree Certificate (PDC). The Scanned copy of same is attached in Annexure IV.

6.4.8. Student intake and attrition in the programme for last five years:

Year-wise information is provided in the tabular form.

Name of the Degree programme	Actual Student admitted in last five years					Attrition (%)				
	Y1 2016-17	Y2 2017-18	Y3 2018-19	Y4 2019-20	Y5 2020-21	Y1 2016-17	Y2 2017-18	Y3 2018-19	Y4 2019-20	Y5 2020-21
MVSc										
Veterinary Extension Education	5	3	3	5	4	40	-33.33*	-25*	40	0

*Negative numbers are due to rejoining of students after their temporary dropping(s).

6.4.9. ICT Application in Curricula Delivery:

Yes the degree programmes are meeting the expectations.

The whole system of registration of courses is on the Academic Management System. Further, the curricula delivery is through use of power point presentations (ppt.) and also using online platforms like the Microsoft teams/ Zoom/ Google meets etc. during the COVID-19 pandemic periods when the students were away from campus.

Furthermore, few e-tutorials, mobile apps and educational videos have been prepared and made accessible for enriching the learning experience of the students.

The university has also launched the augmented reality (AR) and virtual Reality (VR) experience centre with the support of NAHEP & IASRI which will further augment the learning process.

6.4.10. The information pertaining to 6.4.1 to 6.4.9 shall be provided for each one of UG, PG and PhD Degree Programmes, separately, and to be presented College-wise.

We have mentioned the information separately

6.4.11. Since the accreditation of Programmes is related to the All India Admission from ICAR and also having weightage for College accreditation, therefore the data presented in the section 6.4 is liable to the verification at any stage.

6.4.12 Certificate

I, the Dean**Dr Triveni Dutt**..... hereby certify that the information contained in the Section 6.4.1 to 6.4.9 are furnished as per the records available in the college, and degree awarding university.

Signature of Dean of the College with Date & Seal

16/1
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Joint Director (Academic) Cum Dean
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6.4.1. Brief History of the MVSc Degree Programme in Veterinary Medicine

The Division of Medicine came to existence in September 1993 following the bifurcation of the Division of Experimental Medicine and Surgery as an independent division. The Division of Medicine established with mandate of conducting clinical research in the emerging areas of veterinary Medicine for better health and welfare of animals; provide quality education to undergraduate and post graduate students and scientific health care services for optimum livestock production and performance. Clinical research of this division is mainly focused to develop clinical diagnostic methods, safe and effective therapeutic and preventive technologies for animal use.

The Division organises training programmes for support staffs, veterinarians, and academicians of various institutions. Besides, Division contributes actively in various extension programmes of JD Extension Education, Krishi Vigyan Kendra (KVK), of the Institute and Institute Village Linkage Programme (IVLP), Ministerial Programs like Sansad Aadarsh Gram Yojna (SAGY) and Mera-Gaon-Mera-Gaurav (MGMG) program. The division extends the expertise in health clinical camps to provide effective treatment to livestock at farmers' door-step and also create awareness amongst the farmers for adoption of scientific animal husbandry practice to harvest the maximum benefits.

Disease investigations with Joint director CADRAD and expert healthcare services to centre for wildlife

The regular MVSc programme in Veterinary Medicine was started in 1985.

Objective: To conduct clinical research and impart education for developing a robust animal healthcare system through

- Evaluation and development of clinical diagnostic methods
- Effective therapeutic and preventive measures for management of animal diseases
- Undergraduate and post graduate teaching and research

Accomplishments:

A. Patent developed and commercialized

1	Skin Drug Technology	1995
2	Area specific mineral mixture	2005

B. Patent applied

1	An herbal product for fluorosis in animals	Application no (123/DEL/2014)
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2	A process of preparing a bioorgano-mineral formulation for the therapy of skin ailments in animal	Application no (2722/DEL/2007)
---	---	--------------------------------

- Invention of Skin Drug Formulation – 1992
- Skin Drug Formulation Patented and sold for Commercialization to Innovetys Pharmaceuticals – 1995
- Patenting and commercialization of Area specific Mineral mixture-2005
- Safety testing of Meloxicam on Gyps vultures and other scavenging birds
- Mapping of lead, cadmium, arsenic and fluoride pollution pockets in different industrial and urban areas
- Amelioration of heavy metal toxicity with use of eco-friendly safer drugs including those from herbal system of medicine
- Mitigation of oxidative stress mediated pathogenesis during disease condition in animals
- Augmenting productivity of dairy animals using area specific mineral mixture

6.4.2 Faculty Strength:

S.no.	Sanctioned Faculty	Faculty in place	Vacant position	Faculty recommended by the ICAR/UGC/VCI/ other regulatory bodies
1.	Professor*	01	0	ICAR
2.	Associate Professor*	01	01	ICAR
3.	Assistant Professor*	13	01	ICAR

* Faculty are also involved in BVSc & AH and PhD programmes.

6.4.3 Technical and Supporting staff:

Staff	Sanctioned	In Place
Technical*	03	02
Supporting*	14**	16**

* Technical and supporting staffs are also involved in BVSc & AH and PhD programmes.

** These staffs are common for Veterinary Medicine, Veterinary Surgery & Polyclinic.

6.4.4. Classrooms and Laboratories:

1. Classroom is available for teaching.
2. Laboratories, farm facilities, workshops are available and mentioned in annexure III

6.4.5. Conduct of Practical and Hands-on-Training:

Practicals (hands-on) are being conducted in all courses. During internal and annual board exams students perform practicals/experimental procedures on their own. Many students attend national and international trainings. A comprehensive list is given below:

Division	Hands-on- trainings attended
Veterinary Medicine	Clinical training to PG/PhD students in the Referral Veterinary Polyclinic
	Internship training of veterinary graduates in the Referral Veterinary Polyclinic

6.4.6 Supervision of students in PG Programme:

MVSc students on roll	14
No. of faculties	15

6.4.7 Feedback of stakeholders (Students, parents, industries, employers, farmers etc.):

Feed back proforma is available which need to be submitted by the students at time of obtaining Provisional Degree Certificate (PDC). The Scanned copy of same is attached in Annexure IV.

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MVSc										
Veterinary Medicine	7	6	6	7	7	0	20	0	14.28	28.57

*Negative numbers are due to rejoining of students after their temporary dropping(s).

6.4.9. ICT Application in Curricula Delivery:

Yes the degree programmes are meeting the expectations.

The whole system of registration of courses is on the Academic Management System. Further, the curricula delivery is through use of power point presentations (ppt.) and also using online platforms like the Microsoft teams/ Zoom/ Google meets etc. during the COVID-19 pandemic periods when the students were away from campus.

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Signature of Dean of the College with Date & Seal

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संयुक्त निदेशक (शैक्षणिक) एवम् डीन
Joint Director (Academic) Cum Dean
भारतीय पशु-चिकित्सा अनुसंधान संस्थान
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6.4.1. Brief History of the MVSc Degree Programme Veterinary Microbiology

Virology:

The Division of Virology is located at Mukteswar, Nainital (Distt.) (Uttarakhand) at a distance of 169 km from the Institute Headquarters. The Division of Virology started as a serology section in 1931, which was later upgraded as “Pathology and Bacteriology” section in 1939 and as “Bacteriology and Virology” section in 1952. A full-fledged Division of “Bacteriology and Virology” was created in 1963 and a specialized “Division of Virology” was subsequently established in 1975. Dr J R Haddow, the British officer was the in-charge of the serology section while Dr B R Rajgopalan was the first Indian in-charge of the combined “Pathology and Bacteriology” section. Dr S Kumar was appointed as the first Head of the Division of the independent Virology Division. The Division presently has seven laboratories viz. PPR Laboratory, Poxvirus Laboratory, Bluetongue Laboratory, Enterorespiratory Virus Laboratory, Biochemistry Laboratory, Clinical Virology Laboratory and Clinical Bacteriology Laboratory. Beside these laboratories, Central Instrumentation Unit (CIU) as well as Experimental Animal Facilities are also available. A well-furnished library with collection of both rare and recent publications is also a centre of attraction. Recently, a well-furnished Central Biotechnology Laboratory equipped with modern scientific instruments came in to existence. The Division also has an excellent auditorium with modern audio-visual aids. Apart from these, a very good Veterinary Science Museum having collection of primitive instruments and vintage surgical instruments are there.

The regular MVSc programme in Veterinary Microbiology was started in 1985.

Objectives:

- Research on animal viruses and viral diseases of livestock and poultry
- Preparation and production of antigens, diagnostic sera, vaccines, nucleic acid probe/s, etc
- Epi-zootiological and pathological studies on viral diseases
- Monitoring, surveillance and diagnosis of economically important diseases in the country
- Post-graduate teaching, research and training
- Extension

Accomplishments:

- Development of antiserum method of treatment for anthrax and rinderpest.
- Invention of a live attenuated vaccine in the form of goat tissue virus for rinderpest.
- Identification of Ranikhet Disease of poultry and development of a potent vaccine.
- Recognition and development of diagnostics and vaccine against South African horse sickness leading to its eradication in mid-sixties from the country.
- Adaptation of tissue culture rinderpest vaccine in lamb kidney culture, which paved the way for rinderpest eradication campaign in the country.

- Development of a monoclonal antibody based ELISA kit for sero surveillance of rinderpest.
- Live attenuated Vero cell based PPR vaccine
- Live attenuated combined PPR and goatpox/sheeppox vaccines
- Live attenuated goatpox, sheeppox, buffalopox, camelpox and orf vaccines.
- MAb based PPR competitive ELISA (c-ELISA) and sandwich ELISA (s-ELISA) kits
- Novel PPRV viral vector has been developed and evaluated to carry foreign genes. The viral vector would be useful for the development of dual vaccines.
- The marker vaccine for PPRV has been developed through reverse genetics. The epitope modified viruses have been rescued successfully.
- Combination vaccines of PPRV and goatpox /Sheeppox.
- Sandwich ELISA kit for detection of bluetongue virus antigen.
- Baculovirus expressed recombinant VP7 based indirect ELISA for bluetongue.
- IgY based competitive ELISA for bluetongue.

Bacteriology & Mycology:

The division of Bacteriology & Mycology came into existence in 1975 after bifurcation from Division of Virology and Bacteriology, Mukteswar and shifted to the Izatnagar campus of IVRI. Due to the urgent need of research work to be carried out on all aspects of different bacterial and mycotic infections, the division was separated and now it is working on most of the important economic diseases of livestock & poultry.

The regular MVSc programme in Veterinary Microbiology was started in 1985.

Objective:

- To conduct basic and applied research on all aspects of health pertaining to bacterial and mycotic diseases of livestock.
- To develop and assimilate the latest modern technologies for the development of economical, reliable, quick and effective immunoprophylactics and immunodiagnosics for the control of animal diseases.
- To provide diagnostic services pertaining to bacterial and mycotic diseases.
- To organize post graduate education and specialized training programmes in the field of bacteriology and mycology.
- To maintain and supply of important bacterial and mycotic cultures, diagnostic antigens and antisera.

Accomplishments:

- Genetically modified S19 strain of *Brucella abortus* (S19 Δ per) as vaccine candidate.
- Whole genome sequencing of *Brucella abortus* S19 Δ per, *Pasturella multocida* (bovine and duck origin) and multidrug resistant *E. coli* isolates.
- Recombinant antigen based latex agglutination test for sero-diagnosis of leptospirosis.

- Freedom status from Contagious Bovine Pleuropneumonia infection in cattle & buffalo obtained from OIE.
- Tube based LAMP for detection of multiple pathogens - *Brucella*, *Leptospira* and BoHV1.
- Sero diagnostic test for Caprine Pleuropneumonia in goats
- Indirect ELISA for detection of antibodies against *P. multocida*.
- Recombinant cocktail comprising rOmpA and rOmpC was evaluated against *Salmonella* challenge.
- Chimeric DNA vaccine construct and recombinant fusion protein generated against bovine brucellosis as candidate antigens.
- Immunoreactive cell-wall associated proteins of *Clostridium chauvoei* were identified.
- Repository of bacterial and fungal cultures.
- Analysis of about 1000 clinical samples of neonates revealed *E. coli*, Group A Rota virus, picobirna virus, *Eimeria* spp. and *Clostridium perfringens* to be the major pathogens
- Multi drug resistant *E. coli* recorded among neonates.
- Generation of *aroA* mutant of *Pasteurella multocida* P52, *cctA* gene mutant of *Clostridium chauvoei* and Δ rfbD of *B. abortus*.
- Multiplex PCR for detection of *Mycoplasma bovis*, *M. bovis genitalium*, *M. leachii*, *M. arginini* and *M. mycoides* subsp *mycoides*.
- Real Time PCR for detection of *M. bovis* and *M. bovis genitalium*.
- Molecular characterization of Indian isolated of *Mycoplasma mycoides* subsp. *capri* by MLST
- Antibio gram profiling of Indian isolates of *Mycoplasma* species of caprine origin.
- Evaluation of immuno-modulatory role of extra cellular vesicles of *Mycoplasma mycoides* subsp. *capri* and *M. bovis* in laboratory animal.
- Several *Salmonella* serovars, namely Billa, Mons, Muenchen, Reinckandorf, Starrenbos, Uganda, Wein, S.I.17:d:1,2, S.1.17:d (Monophasic) were identified for the first time in India.
- PCR assays using *pncA* and *oxyR* for species identification of *Mycobacterium tuberculosis* and *M. bovis*.
- PCR assays using 26S rRNA and ITS-2 genes for identification of *Malassezia* and *Candida*.
- Multiplex PCR for detection of *Malassezia* sp and *Candida* sp standardized
- AMR studies of most common clinical fungi revealed high degree of resistance and existence of MDR strains.
- Phylogenetic analysis of fungal isolates (*Malassezia* sp and *Candida* sp) shown close association between human and animal fungal strains.
- Phylogenetic studies revealed sub clustering within the single *Malassezia* sp and *Candida* species and genetic relatedness with other strains.
- Multilocus sequence typing (MLST) of *P. multocida*, *E. coli* and *C. perfringens*
- AMR studies of most common clinical fungi revealed high degree of resistance and existence of MDR strains.

Immunology:

The Immunology Laboratory from the former Bacteriology and Mycology Division was upgraded as an independent Section of Immunology in the year 1981.

The regular MVSc programme in Veterinary Microbiology was started in 1985.

Objectives:

- Basic and strategic Applied Research in Veterinary Immunology.
- Human Resource Development through Post-Graduate Education and Research; and Under-Graduate Education.

Accomplishments:

- Experimental Rous sarcoma induction protocols have been established in the Lab.
- Novel tumor surface antigens from experimentally induced Rous sarcoma, viz., TFAG and IP.TFAG and subgroup avian leukosis virus A (ALV-A), LSAG and IP.LSAG, have been developed in an attempt to replace currently available major gsAg (p27) based ELISA kits, available in India only as imported costly kits.
- Separation of macromolecules using widely used laboratory methods, viz., native Polyacrylamide gel electrophoresis (PAGE) and SDS-PAGE, have been developed.
- Hyperimmunized serum against TFAG and LSAG have been developed.
- Novel TFAG and IP.TFAG based indirect ELISA and sandwich ELISA have been developed.
- Novel LSAG based indirect ELISA has been developed.
- Variable envelope glycoprotein of MW 85 kDa encoding env gp85 gene based molecular assays viz., PCR, RT-PCR, qPCR, RT-qPCR, have been developed for differentiation of ALV subgroups.
- Virulent meq gene based molecular assays viz., PCR, RT-PCR, qPCR, RT-qPCR, have been developed for identification of virulent MDV in chickens.
- TFAG, as compared major gsAg (p27), was found to be much superior for detection of anti-ALV antibodies in chicken serum samples in an indirect ELISA.
- Novel low MW (6 kDa) T-cell antigen (ESAT-6) was detected in short-term culture filtrate of an Indian field isolate of *M. bovis* (ICC 391, virulent strain), using monoclonal anti-ESAT-6 antibody. Due to its selective presence only in virulent strains, it has potential for specific diagnosis of bovine tuberculosis.
- Poly-lactide-co-glycolide (PLG) microsphere based vaccines for three important viral diseases (viz. RD, IBD and EDS-76) of poultry were developed by encapsulating viral vaccine antigens and their efficacy has been studied.
- g of RD (F) viral antigen was able to induce both humoral, CMI and mucosal (IgA) immunity in poultry, affording ~ 70% protection at week 6 PI. μ Single intranasal dose of experimental microsphere vaccine containing 75
- A bivalent combined vaccine formulation of NDV and IBDV was prepared in PLG microspheres that induced both systemic and mucosal immunity affording protection up to 60% against both the ND and IBD viruses.

- PLG nanoparticles encapsulating outer membrane proteins (OMP) of Salmonella Gallinarum induced mucosal immunity (IgA antibody) after oral immunization in chickens, indicating it could be used as a suitable mucosal vaccine delivery system.
- Chitosan coated cationic PLG nanoparticles have been evaluated for delivery of plasmid DNA encoding Green Fluorescent Protein (pVito-GFP) by transfection of cell culture, which indicated that these nanoparticles can be used ultimately for delivery of DNA vaccines or gene therapy.
- Nano-encapsulated NDV antigens elicited virus specific antibodies with HI titre of 27, maintained up to week 8 PI, affording protection upto 90% , which was almost comparable to that of commercial oil adjuvanted ND vaccine.
- A recombinant penton protein based indirect ELISA has been developed for detection of antibodies against Egg-drop-syndrome (EDS76) in chickens.
- Synergistic interaction of LPS (TLR4 agonist) and resiquimod (TLR7 agonist) in chickens has been demonstrated both in vitro and in vivo.
- Resiquimod was found to induce Th1 as well as Th2 immune responses in chickens.
- Adjuvant potential of resiquimod (R-848) with inactivated NDV vaccine was demonstrated in SPF chickens.
- Resiquimod was proven to have prophylactic potency against vvIBDV challenge in chickens.
- Resiquimod was found to enhance antigen specific systemic as well as mucosal immunity against avian infectious bronchitis in chickens.
- Poly I:C (TLR3 agonist) alone or in combination with Pam3CSK4 (TLR2 agonist) were found to significantly reduce the immunosuppression, when used with an intermediate plus IBDV vaccine in chickens.
- Recombinant protein based immunodiagnostic for detection of canine parvovirus (CPV) and its specific antibodies.
- Partial VP2 gene sequencing of canine parvovirus isolates (2012-2016) revealed predominance of new CPV-2a isolates in Bareilly region.
- Canine parvovirus specific neutralizing avian egg-yolk derived IgY antibodies were developed.
- Host restriction of Salmonella Gallinarum with regard to its capacity to interfere dendritic cell function was established in chickens.
- Role of reactive oxygen species (ROS) in modulation of chicken dendritic cells function was established.

6.4.2 Faculty Strength:

S.no.	Sanctioned Faculty	Faculty in place	Vacant position	Faculty recommended by the ICAR/UGC/VCI/ other regulatory bodies
1.	Professor*	3	0	ICAR
2.	Associate Professor*	12	02	ICAR
3.	Assistant Professor*	27	16	ICAR

* Faculty are also involved in BVSc & AH and PhD programmes.

6.4.3 Technical and Supporting staff:

Staff	Sanctioned	In Place
Technical*	50	24
Supporting*	26	02

* Technical and supporting staffs are also involved in BVSc & AH and PhD programmes.

6.4.4. Classrooms and Laboratories:

1. Classrooms and seminar rooms are available for teaching.
2. Laboratories, farm facilities, workshops are available and mentioned in annexure III

6.4.5. Conduct of Practical and Hands-on-Training:

Practicals (hands-on) are being conducted in all courses. During internal and annual board exams students perform practicals/experimental procedures on their own. Many students attend national and international trainings. A comprehensive list is given below:

Division	Name / No. of Students	Hands-on- trainings attended
Veterinary Microbiology		Cultivation of aerobic, Microaerophilic and anaerobic bacteria, Isolation of bacteria in pure culture, Microscopy, Morphological characterization of bacteria, different staining methods and biochemical tests for identification of bacteria, determination of bacterial number and biomass and standard protocols for antibiotic sensitivity test and detection of MIC.
		Collection, transport and dispatch of clinical samples from various disease conditions. Preservation and storage of bacterial cultures
		Collection and processing of clinical material for isolation of fungi. Lactophenol cotton blue and India ink preparations. Preparation of basal and special fungal media of veterinary importance. Slide culture and cellophane tape technique for fungi. Diagnosis of dermatophytes. Biosafety precautions in handling yeast and dimorphic fungi. Study of gross and microscopic characters of pathogenic fungi, antifungal sensitivity testing.
		Isolation of bacterial LPS, OMP, Peptidoglycans, Capsule, Flagellar antigen, genotyping, phage typing, serotyping of bacteria.
		Detection and identification of Mycotoxigenic fungi and mycotoxins. Method of detection of bacterial endotoxin, production of toxins in suitable media, purification and characterization of toxins, biological characterization in animal and in tissue culture. Toxin neutralization test.

		Extraction of nucleic acids from viruses and bacteria. Restriction endonuclease digestion of DNA and resolution in agarose gel electrophoresis. PCR amplification of DNA. RT-PCR of RNA. Insertion of DNA fragments into plasmid/phagemid/phage vectors. Construction of competent <i>E. coli</i> host cells. Transformation and transfection of competent <i>E. Coli</i> cells. Screening of transformants and isolation of clones. Sequence analysis of clones/PCR amplicons. Use of PCR for infectious disease diagnosis.
	Dr Manikandan, R	Physio-biochemical and biotechnological approaches for optimization of health and reproduction in animals (Dec 1-21, 2020) ABC of scientific writing (Aug 18- Sept 2, 2020)
	Dr Dharshini M	Science Communication (Dec 21, 2021)

6.4.6 Supervision of students in PG Programme:

MVSc students on roll	65
No. of faculties	42

6.4.7 Feedback of stakeholders (Students, parents, industries, employers, farmers etc.):

Feed back proforma is available which need to be submitted by the students at time of obtaining Provisional Degree Certificate (PDC). The Scanned copy of same is attached in Annexure IV.

6.4.8. Student intake and attrition in the programme for last five years:

Year-wise information is provided in the tabular form.

Name of the Degree programme	Actual Student admitted in last five years					Attrition (%)				
	Y1 2016-17	Y2 2017-18	Y3 2018-19	Y4 2019-20	Y5 2020-21	Y1 2016-17	Y2 2017-18	Y3 2018-19	Y4 2019-20	Y5 2020-21
Veterinary Microbiology	20	15	14	16	30	-10*	100	-21.42*	50	56.67

*Negative numbers are due to rejoining of students after their temporary dropping(s).

6.4.9. ICT Application in Curricula Delivery:

Yes the degree programmes are meeting the expectations.

The whole system of registration of courses is on the Academic Management System. Further, the curricula delivery is through use of power point presentations (ppt.) and also using online platforms like the Microsoft teams/ Zoom/ Google meets etc. during the COVID-19 pandemic periods when the students were away from campus.

Furthermore, few e-tutorials, mobile apps and educational videos have been prepared and made accessible for enriching the learning experience of the students.

The university has also launched the augmented reality (AR) and virtual Reality (VR) experience centre with the support of NAHEP & IASRI which will further augment the learning process.

6.4.10. The information pertaining to 6.4.1 to 6.4.9 shall be provided for each one of UG, PG and PhD Degree Programmes, separately, and to be presented College-wise.

We have mentioned the information separately

6.4.11. Since the accreditation of Programmes is related to the All India Admission from ICAR and also having weightage for College accreditation, therefore the data presented in the section 6.4 is liable to the verification at any stage.

6.4.12

Certificate

I, the Dean**Dr Triveni Dutt**..... hereby certify that the information contained in the Section 6.4.1 to 6.4.9 are furnished as per the records available in the college, and degree awarding university.



Signature of Dean of the College with Date & Seal

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6.4.1. Brief History of the MVSc Degree Programme Veterinary Parasitology

The Division of Parasitology is intertwined with the history of the Indian Veterinary Research Institute when one realizes that one of the first problems handled by the Institute was determining the etiology of 'surra', a haematropic disease of horses caused by *Trypanosoma evansi*. During the early part of the century, the equine-stud problems on surra, filariasis and the once-mistaken role of insects in the transmission of rinderpest attracted the attention of researchers. In order to address the above issues, a Section of Protozoology comprising of Protozoology and Entomology was created in 1931 with the Director as In-charge and by 1939; this Section was renamed as Veterinary Zoology with a Parasitologist as In-charge. Subsequently, by the year 1954, the Section of Parasitology was elevated to the status of a full-fledged research Division.

The regular MVSc programme in Veterinary Parasitology was started in 1985.

Objective:

- To conduct basic and applied research on parasitological problems of national importance.
- Impart post-graduate education and training.
- To provide subject matter specialist services.

Accomplishments:

- Life cycle of different parasites viz. *Schistosoma nasale*, *Gastrodiscoides hominis*, *Gigantocotyle explanatum* and *Fasciolopsis buski* was elucidated.
- The monumental work on *Schistosoma indicum* and *Orientobilharzia dattai*, the blood flukes of domestic animals by Dr. H.D. Srivastava and Dr. S.C. Dutt awarded the prestigious 'Rafi Ahmad Kidwai Memorial Award' in 1964-65.
- The lung worm vaccine 'Difil' (*Dictyocaulus filaria* irradiated larva) developed. The vaccine was found helpful in reducing the incidence of lungworms in sheep and goats in the temperate Himalayan region. A Regional Centre of IVRI for mass production of irradiated "Lungworm Vaccine" (first metazoan parasite vaccine) was established at Srinagar in 1973.
- The infectivity and immunogenicity of *T. annulata* infected bovine lymphoblastoid cells in *in vitro* culture were evaluated and complete attenuation was discernible at 50 passage level. The degree of protective immunity was established by laboratory and field trials. The technology of "Live attenuated schizont vaccine of *T. annulata*" was released by Technology Release Committee (TRC) of IVRI, Izatnagar.
- The first generation Anti-tick technology has been transferred to Ajay Biotech India Ltd., Pune for its commercialization.
- Two anti-tick formulations have been developed, characterized and validated under the National Agriculture Science Fund supported programme. Large stage validation is in progress.

- Microaerophilous stationary phase (MASP) culture technique using *Babesia bigemina* (Mexican isolate) was successfully adopted and vaccine protocol for laboratory scale was standardized. The immunomodulatory role of *Mycobacterium phlei* in bovine babesiosis was demonstrated.
- Diagnostic antigens for early detection of fasciolosis were identified and a dot-ELISA kit having high sensitivity and specificity was developed and evaluated under field conditions.
- Pure (cloned) line of a north Indian *Eimeria tenella* isolate has been generated, characterized and is being maintained in the laboratory.
- Five anti-tick vaccine candidates have been identified by RNAi technology and these are being evaluated as multi antigen vaccine under the experimental challenge condition
- For monitoring of acaricide resistance in ticks a number of protocols have been established and validated in ten Indian states. Specific mutation in sodium channel and in acetyl cholinesterase 2 genes and over-expression of esterases, monooxygenases and glutathione S-transferases have been implicated as possible resistance mechanism.

6.4.2 Faculty Strength:

S.no.	Sanctioned Faculty	Faculty in place	Vacant position	Faculty recommended by the ICAR/UGC/VCI/ other regulatory bodies
1.	Professor*	0	0	ICAR
2.	Associate Professor*	04	0	ICAR
3.	Assistant Professor*	05	08	ICAR

* Faculty are also involved in BVSc & AH and PhD programmes.

6.4.3 Technical and Supporting staff:

Staff	Sanctioned	In Place
Technical*	08	05
Supporting*	52	05

* Technical and supporting staffs are also involved in BVSc & AH and PhD programmes.

6.4.4. Classrooms and Laboratories:

1. A classroom is available for teaching.
2. Laboratories, farm facilities, workshops are available and mentioned in annexure III

6.4.5. Conduct of Practical and Hands-on-Training:

Practicals (hands-on) are being conducted in all courses. During internal and annual board exams students perform practicals/experimental procedures on their own. Many students attend national and international trainings. A comprehensive list is given below:

Division	Hands-on- trainings attended
Veterinary	Use of statistical tools for the analysis of data
Parasitology	Bioinformatics approaches for the identification of diagnostic and vaccine targets
	Hands on training on equipment handling

6.4.6 Supervision of students in PG Programme:

MVSc students on roll	11
No. of faculties	09

6.4.7 Feedback of stakeholders (Students, parents, industries, employers, farmers etc.):

Feedback proforma is available which need to be submitted by the students at time of obtaining Provisional Degree Certificate (PDC). The Scanned copy of same is attached in Annexure IV.

6.4.8. Student intake and attrition in the programme for last five years:

Year-wise information is provided in the tabular form.

Name of the Degree programme	Actual Student admitted in last five years					Attrition (%)				
	Y1 2016-17	Y2 2017-18	Y3 2018-19	Y4 2019-20	Y5 2020-21	Y1 2016-17	Y2 2017-18	Y3 2018-19	Y4 2019-20	Y5 2020-21
Veterinary Parasitology	8	6	6	7	4	-25*	0	-16.67*	28.57	-50*

*Negative numbers are due to rejoining of students after their temporary dropping(s).

6.4.9. ICT Application in Curricula Delivery:

Yes the degree programmes are meeting the expectations.

The whole system of registration of courses is on the Academic Management System. Further, the curricula delivery is through use of power point presentations (ppt.) and also using online platforms like the Microsoft teams/ Zoom/ Google meets etc. during the COVID-19 pandemic periods when the students were away from campus.

Furthermore, few e-tutorials, mobile apps and educational videos have been prepared and made accessible for enriching the learning experience of the students.

The university has also launched the augmented reality (AR) and virtual Reality (VR) experience centre with the support of NAHEP & IASRI which will further augment the learning process.

6.4.10. The information pertaining to 6.4.1 to 6.4.9 shall be provided for each one of UG, PG and PhD Degree Programmes, separately, and to be presented College-wise.

We have mentioned the information separately

6.4.11. Since the accreditation of Programmes is related to the All India Admission from ICAR and also having weightage for College accreditation, therefore the data presented in the section 6.4 is liable to the verification at any stage.

6.4.12

Certificate

I, the Dean**Dr Triveni Dutt**..... hereby certify that the information contained in the Section 6.4.1 to 6.4.9 are furnished as per the records available in the college, and degree awarding university.



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6.4.1. Brief History of the MVSc Degree Programme in Veterinary Pathology

The Division of Pathology, earlier existed as the Disease Investigation Section since 1939 at Izatnagar, got independent status on 6th September, 1963. In fact, it's journey began from IVRI, Mukteswar, where it was functional from 1931 to 1945 in the name of the Section of Pathology, Serology and Bacteriology and then Section of Pathology and Bacteriology. The first account of diagnostic pathology was on 'kumri' initiated by Dr G.H.K. Mac Alister, an appointed Pathologist at Mukteswar Campus, in 1914. Subsequently, Dr Hugh Cooper published the first description of 'Ranikhet Disease' and Dr S. Dutta described the pathology of EBH and a number of new parasitic diseases. Later on, MCF, IBR, Chlamydial abortions, JD, Maedi/Visna, and a number of other infectious and non-infectious diseases of livestock and poultry were studied by eminent scientists under the Headship of Late Captain S.B.V. Rao, Drs Late B.S. Rajya, N.S. Parihar, Late P.K.R. Iyer, M.C. Prasad, Late O.P. Paliwal, R. Somvanshi and Rajendra Singh. Many of its pathologists, Drs G.C. Mohanty, M.C. Prasad, Lal Krishna, Nem Singh, Late H.K. Pradhan, S. Gopal Krishna S.C. Mukherjee and B.N. Tripathi also served the Institute/ the ICAR in the capacity of Directors, Joint Directors, ADG (AH) and DDG (AS). The Division, during its 58 years of existence, has made significant contributions in understanding the pathogenesis and pathology of important animal and poultry diseases, development of various diagnostic tests and vaccines, and human resource development through various programs. Presently, the Division is engaged in research related to retroviral diseases in small ruminants, Japanese encephalitis, porcine sapelovirus, cancer biomarkers in animals and important poultry diseases, etc. using conventional and molecular techniques. Besides, the Division also performs the work of diagnostic pathology of livestock, poultry, pets and wildlife diseases, histopathological evaluation of slides pertaining to various projects of the institutes, postgraduate teaching, training, research and maintenance of the Registry of Veterinary Pathology Museum. The museum houses more than thousand pathological specimens including neoplasms of various organ systems, which are being digitalised. The Division runs several out funded and institute funded projects with interdisciplinary and inter-institutional collaboration. The Division also provides consultancy to different agencies regarding livestock and poultry health management through timely precise diagnosis.

The regular MVSc programme in Veterinary Pathology was started in 1985.

Objective:

- Conducting research on economically important animal and avian diseases.
- Providing disease investigation facilities and diagnostic services to different agencies.
- Imparting postgraduate teaching, training and research.

Accomplishments:

- Malignant catarrhal fever, Infectious bovine rhinotracheitis, *M. agalactiae* in goat mastitis, *M. bovigentialium* in cattle with granular vulvo- vaginitis, porcine

circovirus-2, and porcine Parvovirus reported for first time in India.

- Chlamydial abortions in animals and its association with pneumonia, arthritis and encephalitis established.
- Japanese encephalitis virus isolated from stillborn piglets with hydrocephalus and hydranencephaly first time and was sequenced.
- Pathogenesis of Streptococcus suis was established in laboratory mice model.
- Maedi / Visna virus propagated in sheep choroid plexus culture cells.
- Molecular prevalence and pathology of various diseases like JD, Swine influenza, CSF, Jaagsiekte sheep retrovirus, BRV, BCoV, BPV, EBH were established by using conventional and recent techniques like AGID, ELISA, PCR, Realtime PCR, ISH, histopathology, IHC, TEM etc.
- A modified Periodic Acid Schiff reagent developed which reduced the maturing time from 4 days to 4 hrs.
- Cancer biomarkers p53, c-Myc, PCNA, hTERT, cadherins and fibronectin were studied in canine species. AgNORs, PCNA, Ki-67, c-Myc, c-erbB2 and ER- α markers were studied in spontaneous canine and induced rat mammary tumors. Prevalence of triple negative canine mammary tumours were investigated
- Mycotoxicoses: Ochratoxin-A and aflatoxin B1 contamination detected in common feeds/ ingredients in various states. Teratogenic effects T-2 and Citrinin in rats and rabbits was determined. Mannan oligosaccharide and Ascorbic acid along with AT-A were found to ameliorate the toxic effects.
- Registry of Pathology houses more than 1020 gross pathological specimens and 1163 color transparencies. The repository has system-wise (10) catalogue of all pathological specimens. Digitalization of specimens initiated.

Avian Disease Laboratory

- Developed MATSA test for Marek's disease, COFAL kit for ALSV infection, Dot-ELISA kit for RD vaccinal immunity etc.
- Developed thermostable IBD vaccine strains and EDS-76 vaccine strain.
- A new histochemical technique for the differentiation of quail heterophils and eosinophils in tissues.
- Production, standardization and testing of live cell culture vaccines against MD, IBD, Reo, IB, ILT and Turkey pox, inactivated, oil-based tissue culture and/or embryo origin vaccines against ND, IBD, Reo, EDS-76, IBH and DVH, combined inactivated vaccine against ND, EDS-76 and IBD. Reovirus, vvIBDV and ALV subgroup "A" isolated for the first time in the country.
- Multiplex PCR for MDV, ALV-A and REV, a LAMP test for MDV-1 oncogene meq and a novel diagnostic technique slide ELISA for NDV detection developed.
- Role of virally modified exosomes in Marek's disease viral replication in activated T-cells has been elucidated in vitro.

6.4.2 Faculty Strength:

S.no.	Sanctioned Faculty	Faculty in place	Vacant position	Faculty recommended by the ICAR/UGC/VCI/ other regulatory bodies
1.	Professor*	0	01	ICAR
2.	Associate Professor*	0	03	ICAR
3.	Assistant Professor*	10	07	ICAR

* Faculty are also involved in BVSc & AH and PhD programmes.

6.4.3 Technical and Supporting staff:

Staff	Sanctioned	In Place
Technical*	13	05
Supporting*	32	09

* Technical and supporting staffs are also involved in BVSc & AH and PhD programmes.

6.4.4. Classrooms and Laboratories:

1. Classrooms are available for teaching.
2. Laboratories, farm facilities, workshops are available and mentioned in annexure III

6.4.5. Conduct of Practical and Hands-on-Training:

Practicals (hands-on) are being conducted in all courses. During internal and annual board exams students perform practicals/experimental procedures on their own.

6.4.6 Supervision of students in PG Programme:

MVSc students on roll	13
No. of faculties	10

6.4.7 Feedback of stakeholders (Students, parents, industries, employers, farmers etc.):

Feedback proforma is available which need to be submitted by the students at time of obtaining Provisional Degree Certificate (PDC). The Scanned copy of same is attached in Annexure IV.

6.4.8. Student intake and attrition in the programme for last five years:

Year-wise information is provided in the tabular form.

Name of the Degree programme	Actual Student admitted in last five years					Attrition (%)				
	Y1 2016-17	Y2 2017-18	Y3 2018-19	Y4 2019-20	Y5 2020-21	Y1 2016-17	Y2 2017-18	Y3 2018-19	Y4 2019-20	Y5 2020-21
MVSc										
Veterinary Pathology	9	6	6	9	3	0	50	-83.33*	33.33	33.33

*Negative numbers are due to rejoining of students after their temporary dropping(s).

6.4.9. ICT Application in Curricula Delivery:

Yes the degree programmes are meeting the expectations.

The whole system of registration of courses is on the Academic Management System. Further, the curricula delivery is through use of power point presentations (ppt.) and also using online platforms like the Microsoft teams/ Zoom/ Google meets etc. during the COVID-19 pandemic periods when the students were away from campus.

Furthermore, few e-tutorials, mobile apps and educational videos have been prepared and made accessible for enriching the learning experience of the students.

The university has also launched the augmented reality (AR) and virtual Reality (VR) experience centre with the support of NAHEP & IASRI which will further augment the learning process.

6.4.10. The information pertaining to 6.4.1 to 6.4.9 shall be provided for each one of UG, PG and PhD Degree Programmes, separately, and to be presented College-wise.

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6.4.12 Certificate

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6.4.1. Brief History of the MVSc Degree Programme in Veterinary Pharmacology

The history of research in Pharmacology and Toxicology at Indian Veterinary Research Institute dates back to 1959 with the establishment of the Poisonous Plants Laboratory in the Animal Nutrition Division. In the year 1962, Indigenous Drugs Laboratory was established to pursue research on Indian medicinal plants. With the establishment of the Division of Physiology and Pharmacology in the year 1969, these laboratories were transferred to the newly created Division, where research work in different areas of Pharmacology and Toxicology, along with postgraduate teaching, was continued. During the V Five-Year Plan (in 1974), the discipline was given a separate status as the Division of Pharmacology and Toxicology. The activities of the Division since its inception were mainly (i) research in the areas of pharmacology, plant chemistry and toxicology, (ii) post-graduate teaching and (iii) disease investigation and consultancy. During the V Five-Year Plan, the Divisional activities were categorized into five main areas of research namely, research on indigenous drugs, experimental pharmacology, biopharmaceutics, chemotherapy and toxicology. Besides, there were post-graduate teaching and consultancy and advisory services. The Division has the distinction of developing herbal drugs, experimental models for pharmacological research, delineation of molecular mechanisms of action of various drugs and endogenous substances, establishment of dosage regimens of drugs in small and large animals, safety evaluation of toxicants, management practices for toxicities in animals, etc. The outcome of research has culminated into a large number of research publications in prestigious national and international journals. The technologies generated by the Division have been submitted in the form of patents. Out of three patents, one has been granted; provisional patent number has been assigned to the other and third is in examination process. As regards to human resource development, the students passing out from the Division are well placed in India and abroad in academics, research, private sector and field.

The regular MVSc programme in Veterinary Pharmacology was started in 1985.

Objective:

- To provide an infrastructure for rapid development of knowledge and expertise in different basic and applied branches of Pharmacology and Toxicology, particularly related to animal health and production.
- To develop drugs from natural/synthetic sources.
- Safety evaluation of xenobiotics and to suggest suitable measures to combat the toxicity and to develop therapeutic agents for various types of poisons.
- To impart PG teaching in Pharmacology and Toxicology.

Accomplishments:

- Process patent for herbal formulation against mange in animals (granted)
- Process patent of indigenous herbal formulation for diarrhea in animals (with NBA)

- Herbal formulation for the treatment of haemonchosis in sheep (with IPO)
- Products such as Mangol, Mange cure, Ringworm cure Burn cure Diarrhea cure anti-haemonchosis formulation for sheep have been developed.
- P1-purinoreceptors were identified in pre- and post-ganglionic cholinergic nerve fibers in chick oesophagus.
- Pre-treatment of Dalbergia sissoo leaf extract improved the myocardial injury in rats.
- Alcoholic extract of Entada pursaetha was found to have protective effect on inflammatory bowel disease (IBD) in mice and analgesic activity in monosodium iodoacetate (MIA)-induced osteoarthritis in rats.
- Arsenic was found to aggravate the pathogenesis of painful inflammatory conditions and reduce the therapeutic efficacy of ketoprofen in chronically arsenic-exposed subjects.
- Diltiazem HCl, a calcium channel blocker showed protective effect to rats from cadmium induced toxicity.
- Toxicodynamic interactions of arsenic with anilofos, malathion, chlorpyriphos, endosulfan or ochratoxin was determined.
- Atorvastatin and Candesartan ameliorated arsenic-induced cardiovascular
- Betulinic acid, a triterpenoid prevents acute lung and kidney injury reflecting its potential to have protective role in polymicrobial sepsis in mice

6.4.2 Faculty Strength:

S.no.	Sanctioned Faculty	Faculty in place	Vacant position	Faculty recommended by the ICAR/UGC/VCI/ other regulatory bodies
1.	Professor*	0	0	ICAR
2.	Associate Professor*	0	01	ICAR
3.	Assistant Professor*	10	0	ICAR

* Faculty are also involved in BVSc & AH and PhD programmes.

6.4.3 Technical and Supporting staff:

Staff	Sanctioned	In Place
Technical*	02	01
Supporting*	16	04

* Technical and supporting staffs are also involved in BVSc & AH and PhD programmes.

6.4.4. Classrooms and Laboratories:

1. Classroom is available for teaching.
2. Laboratories, farm facilities, workshops are available and mentioned in annexure III

6.4.5. Conduct of Practical and Hands-on-Training:

Practicals (hands-on) are being conducted in all courses. During internal and annual board exams students perform practicals/experimental procedures on their own.

6.4.6 Supervision of students in PG Programme:

MVSc students on roll	08
No. of faculties	10

6.4.7 Feedback of stakeholders (Students, parents, industries, employers, farmers etc.):

Feed back proforma is available which need to be submitted by the students at time of obtaining Provisional Degree Certificate (PDC). The Scanned copy of same is attached in Annexure IV.

6.4.8. Student intake and attrition in the programme for last five years:

Year-wise information is provided in the tabular form.

Name of the Degree programme	Actual Student admitted in last five years					Attrition (%)				
	Y1 2016-17	Y2 2017-18	Y3 2018-19	Y4 2019-20	Y5 2020-21	Y1 2016-17	Y2 2017-18	Y3 2018-19	Y4 2019-20	Y5 2020-21
MVSc										
Veterinary Pharmacology	6	3	2	5	2	-16.67*	-100*	-300*	40	0

*Negative numbers are due to rejoining of students after their temporary dropping(s).

6.4.9. ICT Application in Curricula Delivery:

Yes the degree programmes are meeting the expectations.

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इजतनगर-243 122 (उ.प्र.)

6.4.1. Brief History of the MVSc Degree Programme in Veterinary Physiology

Dr. F.C. Minett, then Director of the Indian Veterinary Research Institute decided to have a new section of Physiology under a Senior Physiologist in the decade forties. But due to one reason or the other the decision did not take a shape. Subsequently, a definite proposal was submitted by Dr. D.N. Mullick, then section officer, Physiology Section, Animal Nutrition Division on October 10, 1963 for setting up of the 'Division of Animal Physiology & Pharmacology' at the Indian Veterinary Research Institute, Izatnagar in the III Five Year Plan (1964-65 to 1968-69). In the mentioned proposal, ten sections, namely Energy Metabolism, Reproductive Physiology, Endocrinology & Lactation Physiology, Growth and Work Production, Climatology, Physiological Nutrition, Animal Behavior, Hematology, Physiology of Birds and Pharmacology & Toxicology, were proposed.

The Indian Council of Agricultural Research in consultation with the Ministry of Finance approved the establishment of the Division of Physiology & Pharmacology as preparatory action for the IV Five Year Plan and was formally established in March 1970. Later on Division of Pharmacology & Toxicology and Biochemistry was separated and the existing division was renamed as Division of Physiology & Climatology. On the basis of achievements in research and teaching, the division was recognized as Center for Advanced Studies (CAS) in Veterinary Physiology on 2nd March 1995 by Indian Council of Agricultural Research and later re named as Centre for Advanced Faculty Training (CAFT) in Veterinary Physiology on tenth February 2010. The centre is having the responsibility of teaching and research with mandate of training scientists and professors of NARES. Division has five major laboratories; Climatology Laboratory & Psychrometric Chamber, Endocrinology Laboratory, Reproductive Physiology Laboratory, Digestive Physiology & Biocalorimetry Laboratory and Cell & Neurophysiology Laboratory. Division has a library of its own, facilities of having Committee Room/Class Room and a full-fledged experimental animal sheds. At present in this division there are eight scientists; divisional research is focused on various aspects of Animal Physiology for better health and production. Research outcomes are being published regularly in highly acclaimed scientific journals of repute, division has applied two patents, one technology for the commercialization, developed a number of concepts, products, processes and technologies. These have been recognized through various awards of National and International repute. Division has received best division award for four times during the last decade and has organized forty eight refresher courses under CAS/CAFT, till date, meant for training of the faculties from different parts of the country. Students of this division are well placed in various state and central government organizations and a good number of them are carrying out research in leading research institutes in country or abroad. It is marching ahead towards the Nation building through the focused research and finer academic inputs.

The regular MVSc programme in Veterinary Physiology was started in 1985.

Objective:

- Basic and applied research in Physiology and Climatology

- Imparting training through Center for Advanced Faculty Training (CAFT) in Veterinary Physiology
- Teaching and mentoring UG, PG and PhD students in Veterinary Physiology.

Accomplishments:

- FSH & LH were isolated and purified from buffaloes pituitaries and developed bioassay for the same.
- Biologically active PMSG were prepared from blood collected from pregnant mare and bioassay of PMSG was standardized.
- Steroid impregnated intrauterine sponges suitable for goats were developed for the first time in India.
- Antibodies against rbST were raised and ELISA was developed.
- A 3D culture protocol developed for ex vivo preantral follicles culture in buffalo.
- Method for estimation of steroids from fecal samples was standardized and found very use full for wild life.
- A cryopreservation protocol for oocytes/embryos and stem cells have been developed.
- Supplementation of sodium bicarbonate, KCl and Zinc sulphate were found to reduce summer stress in buffalo. Melatonin was found to produce heat stress reliving effect through interaction with hormones and acting as antioxidant.
- HSP70.1 investigated as molecular biomarker of heat stress in goat and buffalo.
- Mesenchymal stem cells were isolated & characterized from murine, caprine, bubaline and canine species from adult bone marrow, amniotic fluid, amniotic membrane, Wharton's jelly, cord blood and MSCs were successfully used for clinical applications like paralysis, skin wounds and bone injury etc.

6.4.2 Faculty Strength:

S.no.	Sanctioned Faculty	Faculty in place	Vacant position	Faculty recommended by the ICAR/UGC/VCI/ other regulatory bodies
1.	Professor*	0	0	ICAR
2.	Associate Professor*	0	02	ICAR
3.	Assistant Professor*	08	01	ICAR

* Faculty are also involved in BVSc & AH and PhD programmes.

6.4.3 Technical and Supporting staff:

Staff	Sanctioned	In Place
Technical*	10	07
Supporting*	36	06

* Technical and supporting staffs are also involved in BVSc & AH and PhD programmes.

6.4.4. Classrooms and Laboratories:

1. Classroom is available for teaching.
2. Laboratories, farm facilities, workshops are and mentioned in annexure III

6.4.5. Conduct of Practical and Hands-on-Training:

Practicals (hands-on) are being conducted in all courses. During internal and annual board exams students perform practicals/experimental procedures on their own. Many students attend national and international trainings.

6.4.6 Supervision of students in PG Programme:

MVSc students on roll	15
No. of faculties	08

6.4.7 Feedback of stakeholders (Students, parents, industries, employers, farmers etc.):

Feedback proforma is available which need to be submitted by the students at time of obtaining Provisional Degree Certificate (PDC). The Scanned copy of same is attached in Annexure IV.

6.4.8. Student intake and attrition in the programme for last five years:

Year-wise information is provided in the tabular form.

Name of the Degree programme	Actual Student admitted in last five years					Attrition (%)				
	Y1 2016-17	Y2 2017-18	Y3 2018-19	Y4 2019-20	Y5 2020-21	Y1 2016-17	Y2 2017-18	Y3 2018-19	Y4 2019-20	Y5 2020-21
MVSc										
Veterinary Physiology	7	4	4	7	7	-14.28*	-100*	-50*	42.85	71.43

*Negative numbers are due to rejoining of students after their temporary dropping(s).

6.4.9. ICT Application in Curricula Delivery:

Yes the degree programmes are meeting the expectations.

The whole system of registration of courses is on the Academic Management System. Further, the curricula delivery is through use of power point presentations (ppt.) and also using online platforms like the Microsoft teams/ Zoom/ Google meets etc. during the COVID-19 pandemic periods when the students were away from campus.

Furthermore, few e-tutorials, mobile apps and educational videos have been prepared and made accessible for enriching the learning experience of the students.

The university has also launched the augmented reality (AR) and virtual Reality (VR) experience centre with the support of NAHEP & IASRI which will further augment the learning process.

6.4.10. The information pertaining to 6.4.1 to 6.4.9 shall be provided for each one of UG, PG and PhD Degree Programmes, separately, and to be presented College-wise.

We have mentioned the information separately

6.4.11. Since the accreditation of Programmes is related to the All India Admission from ICAR and also having weightage for College accreditation, therefore the data presented in the section 6.4 is liable to the verification at any stage.

6.4.12

Certificate

I, the Dean**Dr Triveni Dutt**..... hereby certify that the information contained in the Section 6.4.1 to 6.4.9 are furnished as per the records available in the college, and degree awarding university.



Signature of Dean of the College with Date & Seal

16/1
संयुक्त निदेशक (शैक्षणिक) एवम् डीन
Joint Director (Academic) Cum Dean
भारतीय पशु-चिकित्सा अनुसंधान संस्थान
Indian Veterinary Research Institute
(सम-विश्व विद्यालय)
(Deemed University)
Izatnagar-243 122 (U.P.)
इजतनगर-243 122 (उ.प्र.)

6.4.1. Brief History of the MVSc Degree Programme in Veterinary Public Health

The Division of Veterinary Public Health was established in the year 1971 with the main objective of applying professional veterinary skills, knowledge and resources for solving the human health problems with the ultimate goal of protection and improvement of human health.

Division of VPH has the honour of serving as the FAO/WHO Collaborating Centre for Research and Training in Veterinary Public Health for South-east Asia region (1985-1997) and as a registered source of environmental information under INFOTERRA (1992-1998), United Nations Environment Programme. The Division has the distinction of being recognized as a Nodal agency for organizing scientific meetings on behalf of WHO/FAO as well as publication and dissemination of information and assistance to WHO/FAO programme

The regular MVSc programme in Veterinary Public Health was started in 1985.

Objective:

- Research on the prevention and control of foodborne infections and intoxications
- Research on the prevention and control of various zoonoses
- Collection, processing and analysis of data on occurrence of zoonoses and foodborne diseases
- Training in Veterinary Public Health
- Publication and Dissemination of information

Accomplishments:

- Discovered a new and potent *Brucella* phage – Izatnagar (Iz) phage Gr 6.

Diagnostic technologies generated

- Developed lateral flow assay, LAT, IgG and IgM ELISA for serodiagnosis of JE in pigs
- Developed LAT for differentiating typical/atypical EAEC
- Peptide-based (com1 and Ybgf and DnaK) LAT for serodiagnosis of Q fever
- Modified Agglutination Test (MAT) for sero-diagnosis of toxoplasmosis in man and animals
- LAT for detection of *L. monocytogenes* in enriched food samples as well as sero-diagnosis of listeriosis
- Developed indirect ELISA for listeriosis using synthetic peptides (LLO-1 & LLO-2)
- Developed com1 gene-based LAMP for detection of *Coxiella burnetii*
- Developed IgG ELISA for serodiagnosis of JE in equines
- Improved enrichment broths/media for isolation of *Salmonella* spp., *Listeria* spp., *Aeromonas* spp. and *Campylobacter* spp.

Diagnostic assays standardized

- PCR protocols for *Salmonella*, *Aeromonas*, *Listeria*, *Brucella*, *Campylobacter*, *S. aureus*, *Arcobacter* and diarrhoeagenic *Escherichia coli* pathotypes.
- Rapid 16S rRNA RFLP approach for identification of eight enteric bacterial

pathogens at genus level

- LAMP test for *Arcobacter butzleri* and *Salmonella* spp.
- RT-PCR for human and bovine rotavirus & JE virus
- RT-LAMP/Real Time RT- PCR targeting NS1 gene for JE virus
- Trans-PCR/Com1/ Real Time PCR for *Coxiella burnetii*
- Immunoassays (FAT/ELISA/slide agglutination test) for *Salmonella*, *Aeromonas* & *Listeria* spp.

Findings documented

- Ameliorative effect of Curd and Arjuna feeding on atherosclerosis lesions in lab animals
- Genotyping & partial sequencing of rotavirus revealed presence of reassortant & uncommon strains
- Predominance of Enteroaggregative *E. coli* from diarrhoeal cases of human infants and young animals
- *Campylobacter* in biofilms exhibited many fold resistance against antibiotics than planktonic cells
- Antimicrobial effect of probiotics (LAB) reported against multi-drug resistant-EAEC
- Antimicrobial resistance genes detected in *S. aureus*, *E. coli*, *Salmonella* & *Campylobacter* spp.

Patents filed

- Recombinant NS1 protein based indirect IgG ELISA for sero-surveillance of Japanese Encephalitis, and kit thereof. Application No. 201611024016. Published on 16.02.2018
- A chitosan based biopreservative mix for buffalo meat mince at 5±1°C. Application No. 2144/DEL/2007

6.4.2 Faculty Strength:

S.no.	Sanctioned Faculty	Faculty in place	Vacant position	Faculty recommended by the ICAR/UGC/VCI/ other regulatory bodies
1.	Professor*	0	0	ICAR
2.	Associate Professor*	01	01	ICAR
3.	Assistant Professor*	07	02	ICAR

* Faculty are also involved in BVSc & AH and PhD programmes.

6.4.3 Technical and Supporting staff:

Staff	Sanctioned	In Place
Technical*	06	03
Supporting*	13	02

* Technical and supporting staffs are also involved in BVSc & AH and PhD programmes.

6.4.4. Classrooms and Laboratories:

1. Classroom is available for teaching.
2. Laboratories, workshops are available and mentioned in annexure III

6.4.5. Conduct of Practical and Hands-on-Training:

Practicals (hands-on) are being conducted in all courses. During internal and annual board exams students perform practicals/experimental procedures on their own. Many students attend national and international trainings.

Division	Hands-on- trainings attended
Veterinary Public Health	Basic Course on Use of Bioinformatics Tools in Veterinary Science Research
	Computational Approaches in Biotechnology for Beginners
	Basics of Bioinformatics for Biologists
	Hands on training on equipment handling

6.4.6 Supervision of students in PG Programme:

MVSc students on roll	17
No. of faculties	08

6.4.7 Feedback of stakeholders (Students, parents, industries, employers, farmers etc.):

Feedback proforma is available which need to be submitted by the students at time of obtaining Provisional Degree Certificate (PDC). The Scanned copy of same is attached in Annexure IV.

6.4.8. Student intake and attrition in the programme for last five years:

Year-wise information is provided in the tabular form.

Name of the Degree programme	Actual Student admitted in last five years					Attrition (%)				
	Y1 2016-17	Y2 2017-18	Y3 2018-19	Y4 2019-20	Y5 2020-21	Y1 2016-17	Y2 2017-18	Y3 2018-19	Y4 2019-20	Y5 2020-21
MVSc										
Epidemiology	3	0	0	0	0	-100*	-200*	0	0	0
Veterinary Public Health	7	7	7	0	8	0	-100*	-14.28	0	25

*Negative numbers are due to rejoining of students after their temporary dropping(s).

6.4.9. ICT Application in Curricula Delivery:

Yes the degree programmes are meeting the expectations.

The whole system of registration of courses is on the Academic Management System. Further, the curricula delivery is through use of power point presentations (ppt.) and also

using online platforms like the Microsoft teams/ Zoom/ Google meets etc. during the COVID-19 pandemic periods when the students were away from campus.

Furthermore, few e-tutorials, mobile apps and educational videos have been prepared and made accessible for enriching the learning experience of the students.

The university has also launched the augmented reality (AR) and virtual Reality (VR) experience centre with the support of NAHEP & IASRI which will further augment the learning process.

6.4.10. The information pertaining to 6.4.1 to 6.4.9 shall be provided for each one of UG, PG and PhD Degree Programmes, separately, and to be presented College-wise.

We have mentioned the information separately

6.4.11. Since the accreditation of Programmes is related to the All India Admission from ICAR and also having weightage for College accreditation, therefore the data presented in the section 6.4 is liable to the verification at any stage.

6.4.12

Certificate

I, the Dean**Dr Triveni Dutt**..... hereby certify that the information contained in the Section 6.4.1 to 6.4.9 are furnished as per the records available in the college, and degree awarding university.

Signature of Dean of the College with Date & Seal

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इज्जतनगर-243 122 (उ.प्र.)

6.4.1. Brief History of the MVSc Degree Programme in Veterinary Surgery & Radiology

The division was created as Division of Experimental Medicine and Surgery in 1975 to undertake research pertaining to medicinal and surgical management of diseases of livestock and pet animals and to prepare animal models for research in allied subjects. A full-fledged Division of Surgery was established after bifurcation of Division of Experimental Medicine and Surgery in 1993.

Veterinary Surgery is one of the dynamic and enterprising areas of veterinary science research, teaching and practice. This is a discipline where coalescence of knowledge and skill is essential to render quality services to the farmers, pet owners and animal welfare organizations. The Division of surgery at ICAR-IVRI, Izatnagar has been contributing significantly to animal health through development of surgical devices, techniques and concepts, and standardization and application of diagnostic imaging techniques. The division has conducted extensive research in a wide range of specialized areas like diagnostic imaging, orthopaedic and soft tissue surgery, surgery of special senses, and anaesthesia and pain management. The cutting edge technologies like stem cell therapy and regenerative medicine, biomaterials and reconstructive surgery have taken the research and practice in veterinary surgery to new horizons. Biotechnological approaches have been integrated with surgical interventions to give a new impetus to research in veterinary surgery for better health management and welfare of the animals. The enigma of surgery has always attracted creative young minds to this discipline that has led to the development of safe, user friendly, efficacious, and need based technologies.

The regular MVSc programme in Veterinary Surgery & Radiology was started in 1985.

Objective:

- To conduct research in upcoming and clinically relevant areas of Veterinary Surgery, Anaesthesia and Diagnostic Imaging.
- To develop Human Resource for Research, Teaching and Clinical Surgery through postgraduate teaching and organising various short term training courses.
- To provide clinical services to the Clients at The Referral Veterinary Polyclinics, IVRI.
- To prepare experimental animal models for allied research.
- To participate in the extension activities of the Institute and to provide consultancy services to different agencies.

Accomplishments:

- Bone plates were developed from bovine horn. Metallic interlocking nails and designer locking plates were developed for the internal fixation of fractures in different long bones of cattle and buffaloes.
- Different designs of circular external skeletal fixators were developed for fracture

fixation in large animals. A novel bilateral linear external fixator was developed for fracture management of distal extremities in large animals and was patented. Unique hybrid fixators were developed for the management of compound fracture of tibia bone in large animals.

- A novel technique of epoxy-pin fixation was developed for treatment of open contaminated fractures in small animals, birds, small ruminants, foals and calves.
- The techniques of application of bone marrow derived mesenchymal stem cells and bone marrow nucleated cells to accelerate healing of skin wounds, bone fractures, articular cartilage defects, nerve and spinal cord injuries were developed. Allogenic stem cell therapy was successfully used for the first time in India to treat spinal cord injuries in paraplegic dogs.
- The concept and technique of preemptive analgesia was developed using ketamine, α -2 agonists, opioids, NSAIDs and local anaesthetics.
- Techniques of spinal and epidural anaesthesia for ruminants were developed using different alpha-2 adrenergic agonists, local anaesthetics and ketamine. A unique combination of xylazine and ketamine was developed for the first time for epidural analgesia.
- Different biomaterials were developed from skin, bovine diaphragm, pericardium, aorta, small intestinal sub-mucosa, cornea, blood vessels, urinary bladder, gall bladder and bone. Composite scaffolds were prepared by seeding the fibroblasts/mesenchymal stem cells on different biomaterials.
- A minimally invasive technique of percutaneous tube cystostomy along with urine acidifier was developed for calves and goats. A novel 'no-scalpel tube cystostomy' was developed for goats for field use. A technique of para-anal tube cystostomy was developed for management of urolithiasis in bullocks.
- Chemotherapy, immunotherapy and surgical protocols were developed for the management of horn cancer, penile tumours and canine mammary tumours.
- Cholecystography technique for the evaluation of hepatic insufficiency in goats and contrast radiographic techniques for evaluation of intestinal healing were developed. Ultrasonographic reference values and diagnostic indicators were reported for affections of heart, kidney and liver in small animals.

6.4.2 Faculty Strength:

S.no.	Sanctioned Faculty	Faculty in place	Vacant position	Faculty recommended by the ICAR/UGC/VCI/ other regulatory bodies
1.	Professor*	0	0	ICAR
2.	Associate Professor*	03	0	ICAR
3.	Assistant Professor*	08	02	ICAR

* Faculty are also involved in BVSc & AH and PhD programmes.

6.4.3 Technical and Supporting staff:

Staff	Sanctioned	In Place
Technical*	01	02
Supporting*	14**	16**

* Technical and supporting staffs are also involved in BVSc & AH and PhD programmes.

** These staffs are common for Veterinary Medicine, Veterinary Surgery & Polyclinic.

6.4.4. Classrooms and Laboratories:

1. Classroom is available for teaching.
2. Laboratories, farm facilities, workshops are available and mentioned in annexure

6.4.5. Conduct of Practical and Hands-on-Training:

Practicals (hands-on) are being conducted in all courses. During internal and annual board exams students perform practicals/experimental procedures on their own. Many students attend national and international trainings.

6.4.6 Supervision of students in PG Programme:

MVSc students on roll	15
No. of faculties	11

6.4.7 Feedback of stakeholders (Students, parents, industries, employers, farmers etc.):

Feedback proforma is available which need to be submitted by the students at time of obtaining Provisional Degree Certificate (PDC). The Scanned copy of same is attached in Annexure IV.

6.4.8. Student intake and attrition in the programme for last five years:

Year-wise information is provided in the tabular form.

Name of the Degree programme	Actual Student admitted in last five years					Attrition (%)				
	Y1 2016-17	Y2 2017-18	Y3 2018-19	Y4 2019-20	Y5 2020-21	Y1 2016-17	Y2 2017-18	Y3 2018-19	Y4 2019-20	Y5 2020-21
MVSc										
Veterinary Surgery & Radiology	7	6	6	9	5	-28.57*	0	0	80	0

*Negative numbers are due to rejoining of students after their temporary dropping(s).

6.4.9. ICT Application in Curricula Delivery:

Yes the degree programmes are meeting the expectations.

The whole system of registration of courses is on the Academic Management System. Further, the curricula delivery is through use of power point presentations (ppt.) and also using online platforms like the Microsoft teams/ Zoom/ Google meets etc. during the COVID-19 pandemic periods when the students were away from campus.

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6.4.12

Certificate

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Signature of Dean of the College with Date & Seal

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Joint Director (Academic) Cum Dean
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(सम-विश्व विद्यालय)
(Deemed University)
Izatnagar-243 122 (U.P.)
इजतनगर-243 122 (उ.प्र.)

6.4.1. Brief History of the MVSc Degree Programme in Biostatistics

Division of Livestock Economics and Statistics was initially started as Central Statistical Section in 1957-58 with the aim to assist the research workers in statistical planning of experiments/projects and analysis & interpretation of data. This Section took the responsibility of teaching Statistics as a minor subject to Post-Graduate students since the inception of affiliation of IVRI to Agra University. This section grew into a full-fledged Division of Livestock Economics and Statistics in 1975.

Information Technology added to the name of the Division of Livestock Economics and Statistics in the year 2004 on the recommendation of QRT of the institute and the name of the division was changed to Division of Livestock Economics, Statistics and Information Technology.

The regular MVSc programme in Biostatistics was started in 1985.

Objective:

- To conduct research, PG Education and Transfer of Techniques / Methods in Bio-Statistics and Livestock Economics applicable to animal sciences research.

Accomplishments:

The overall (expected) economic losses due to morbidity and mortality from FMD outbreak during 1983-87 were calculated as 3.16% and 0.94% of the average price value of animals, respectively.

- The stratified random sampling was found to be better sampling technique for estimating conception and adoption rates of AI in bovines under field conditions.
- The traditional Discriminant analysis underestimates the probability of misclassification when parameters are substituted by their estimates.
- The coupling procedure with combination of linear Discriminant function (LDF) & Quadratic Discriminant function in case of unequal covariance matrices and the multinomial method & LDF in case of categorical data in animal sciences provide better results.
- The categorical analysis of variance (CATANOVA) provides the size of test more close to the actual value than the Chi-square method and thus the former is more appropriate for analysis of discrete data in animal sciences than the traditional chi-square method.
- The modified tests, HSD* (tukey) test or Bonferroni* correction are more appropriate for all multiple comparisons and Dunnett t-test is appropriate for comparing all treatments with a control. All these tests protect the experiment-wise error rate.
- The mixed model approach provides better method for detecting the real effect of diseases on the milk yield than the traditional procedure.
- The average annual economic losses calculated due to different diseases in cattle in India (1991-2005) was highest due to FMD (74.3%) followed by HS (19.2%), BQ (5.2%) and Anthrax (1.3%).

- During 1991-2005, PPR disease in goats in India accounted for maximum (34.5%) economic loss followed by FMD (14.3%), sheep and goat pox (14.1%), CCP (6.4%), enterotoxaemia (6.1%), fascioliasis/distomatosis (5.0%) and anthrax (2.0%) to the average animal loss.
- During 1991-2005 The average annual economic losses due to different diseases in sheep in India was maximum due to Bluetongue (60.8%) followed by PPR (7.1%), Sheep and Goat Pox (3.5%), FMD (2.4%), Enterotoxaemia (1.9%), Fascioliasis / Distomatosis (0.9%) and Anthrax (0.6%).
- Considering the number of incidence and deaths due to FMD reported by Govt. of India during 2006-10 in cattle, buffaloes, sheep, goats & pigs, the highest loss was observed due to milk loss (47.51%) followed by reduction in growth/body weight (12.26%), treatment cost (9.76%) and work power (7.92%).
- Considering 2.42% incidence rate and 5.51% case fatality rate of FMD (published papers during 2011-12). The cattle, buffaloes, goats, sheep and pigs contributed 50.92%, 40.03%, 6.64%, 2.00% and 0.41% respectively to the total expected economic loss.
- The value of Import and Export of India's livestock & livestock products in the year 2009-10 contributed 0.32% and 2.25% to India's total Import and Export respectively.
- The annual growth rate of Import and Export value of dairy products in India was -4.39% and 37.99% respectively during 2001-08. There was 49.38% annual growth rate in the net trade (Export – Import) of India's dairy products.

Methodologies/Models Developed

- Stochastic model for estimating economic losses due to FMD
- Models for estimating economic losses due to mastitis under farm and field conditions.
- Sampling methodology to study the effectiveness of AI in bovines under field conditions.
- Discriminant analysis under non-optimal conditions in animal sciences.
- Nonlinear growth models for studying the population/body growth and future prediction.
- Regression method for analysis of interrupted growth of animals.
- Linear & nonlinear models for estimation of lactation curves in animals.
- Nonlinear models for estimation of poultry egg production curves during first year of production.
- Repeated measures ANOVA for continuous data from incomplete repeated measures designs.
- Variance components analysis from unbalanced nested random models.
- CATANOVA for analysis of nominal data from cross, nested and repeated measures designs.
- Heritability estimation from unbalanced/heteroscedastic data under random models.
- Analysis of Variance for rank data from cross, nested and repeated measures designs
- Multinomial logistic ANOVA procedure to study the effects of different factors on morbidity/ mortality pattern of livestock diseases.

- Mixed model approach to study the effect of diseases on production parameters
- Methodology for economic evaluation of important livestock diseases in cattle, sheep & goats.
- Sampling of milk records for estimation of lactation milk yield.
- The Mixed model approach with unstructured covariance matrix is recommended to compare the effect of diseases on milk production.
- Appropriate statistical models to study the factors associated with disease pattern and occurrence of diseases in cattle and buffalo by applying chi-square, and logistic/multinomial logistic ANOVA methods.
- The computing procedures using SAS were developed for different topics specially for Estimation of Genetic Parameters in half and full sib models, analysis of interrupted growth models and mixed model analysis for repeated measurements.

Honours & Awards

- Kheti Puraskar (1993).
- Institute Best Teacher Award (1995).
- ISCA Best Poster Presentation Award (2000).
- ISCA Best Poster Presentation Award (2001).
- Award of Merit of IVRI (2001).
- Best Paper Award (2004).
- Chal Vaijayanti Puruskar (2013-14)

6.4.2 Faculty Strength:

S.no.	Sanctioned Faculty	Faculty in place	Vacant position	Faculty recommended by the ICAR/UGC/VCI/ other regulatory bodies
1.	Professor*	0	0	ICAR
2.	Associate Professor*	01	0	ICAR
3.	Assistant Professor*	0	03	ICAR

* Faculty are also involved in BVSc & AH and PhD programmes.

6.4.3 Technical and Supporting staff:

Faculty	Sanctioned	In Place
Technical*	06	02
Supporting*	0	0

* Technical and supporting staffs are also involved in BVSc & AH and PhD programmes.

6.4.4. Classrooms and Laboratories:

1. Classroom is available for teaching.
2. Laboratories are available and mentioned in annexure III

6.4.5. Conduct of Practical and Hands-on-Training:

Practicals (hands-on) are being conducted in all courses. During internal and annual board exams students perform practicals/experimental procedures on their own. Many students attend national and international trainings. A comprehensive list is given below:

Division	Name / No. of Students	Hands-on- trainings attended
Biostatistics	60	Practical Class
		Hands on training on molecular techniques
		Training on fundamental of biosafety and biosecurity
		Hands on training on equipment handling

6.4.6 Supervision of students in PG Programme:

MVSc students on roll	02
No. of faculties	01

6.4.7 Feedback of stakeholders (Students, parents, industries, employers, farmers etc.):

Feedback proforma is available which need to be submitted by the students at time of obtaining Provisional Degree Certificate (PDC). The Scanned copy of same is attached in Annexure IV.

6.4.8. Student intake and attrition in the programme for last five years:

Year-wise information is provided in the tabular form.

Name of the Degree programme	Actual Student admitted in last five years					Attrition (%)				
	Y1 2016-17	Y2 2017-18	Y3 2018-19	Y4 2019-20	Y5 2020-21	Y1 2016-17	Y2 2017-18	Y3 2018-19	Y4 2019-20	Y5 2020-21
MVSc										
Biostatistics	1	2	2	0	1	-100*	-50*	50	-100*	-100*

*Negative numbers are due to rejoining of students after their temporary dropping(s).

6.4.9. ICT Application in Curricula Delivery:

Yes the degree programmes are meeting the expectations.

The whole system of registration of courses is on the Academic Management System. Further, the curricula delivery is through use of power point presentations (ppt.) and also using online platforms like the Microsoft teams/ Zoom/ Google meets etc. during the COVID-19 pandemic periods when the students were away from campus.

Furthermore, few e-tutorials, mobile apps and educational videos have been prepared and made accessible for enriching the learning experience of the students.

The university has also launched the augmented reality (AR) and virtual Reality (VR) experience centre with the support of NAHEP & IASRI which will further augment the learning process.

6.4.10. The information pertaining to 6.4.1 to 6.4.9 shall be provided for each one of UG, PG and PhD Degree Programmes, separately, and to be presented College-wise.

We have mentioned the information separately

6.4.11. Since the accreditation of Programmes is related to the All India Admission from ICAR and also having weightage for College accreditation, therefore the data presented in the section 6.4 is liable to the verification at any stage.

6.4.12

Certificate

I, the Dean**Dr Triveni Dutt**..... hereby certify that the information contained in the Section 6.4.1 to 6.4.9 are furnished as per the records available in the college, and degree awarding university.



Signature of Dean of the College with Date & Seal

16/1
संयुक्त निदेशक (शैक्षणिक) एचएम डीन
Joint Director (Academic) Cum Dean
भारतीय पशु-चिकित्सा अनुसंधान संस्थान
Indian Veterinary Research Institute
(सम- विश्व विद्यालय)
(Deemed University)
Izatnagar-243 122 (U.P.)
इजतनगर-243 122 (उ. प्र.)

6.4.1. Brief History of the MVSc Degree Programme in Livestock Economics

Division of Livestock Economics and Statistics was initially started as Central Statistical Section in 1957-58 with the aim to assist the research workers in statistical planning of experiments/projects and analysis & interpretation of data. This Section took the responsibility of teaching Statistics as a minor subject to Post-Graduate students since the inception of affiliation of IVRI to Agra University. This section grew into a full-fledged Division of Livestock Economics and Statistics in 1975.

Information Technology added to the name of the Division of Livestock Economics and Statistics in the year 2004 on the recommendation of QRT of the institute and the name of the division was changed to Division of Livestock Economics, Statistics and Information Technology.

The regular MVSc programme in Livestock Economics was started in 1985.

Objective:

- To conduct research, PG Education and Transfer of Techniques / Methods in Bio-Statistics and Livestock Economics applicable to animal sciences research.

Accomplishments:

The overall (expected) economic losses due to morbidity and mortality from FMD outbreak during 1983-87 were calculated as 3.16% and 0.94% of the average price value of animals, respectively.

- The stratified random sampling was found to be better sampling technique for estimating conception and adoption rates of AI in bovines under field conditions.
- The traditional Discriminant analysis underestimates the probability of misclassification when parameters are substituted by their estimates.
- The coupling procedure with combination of linear Discriminant function (LDF) & Quadratic Discriminant function in case of unequal covariance matrices and the multinomial method & LDF in case of categorical data in animal sciences provide better results.
- The categorical analysis of variance (CATANOVA) provides the size of test more close to the actual value than the Chi-square method and thus the former is more appropriate for analysis of discrete data in animal sciences than the traditional chi-square method.
- The modified tests, HSD* (tukey) test or Bonferroni* correction are more appropriate for all multiple comparisons and Dunnett t-test is appropriate for comparing all treatments with a control. All these tests protect the experiment-wise error rate.
- The mixed model approach provides better method for detecting the real effect of diseases on the milk yield than the traditional procedure.
- The average annual economic losses calculated due to different diseases in cattle in India (1991-2005) was highest due to FMD (74.3%) followed by HS (19.2%), BQ (5.2%) and Anthrax (1.3%).

- During 1991-2005, PPR disease in goats in India accounted for maximum (34.5%) economic loss followed by FMD (14.3%), sheep and goat pox (14.1%), CCP (6.4%), enterotoxaemia (6.1%), fascioliasis/distomatosis (5.0%) and anthrax (2.0%) to the average animal loss.
- During 1991-2005 The average annual economic losses due to different diseases in sheep in India was maximum due to Bluetongue (60.8%) followed by PPR (7.1%), Sheep and Goat Pox (3.5%), FMD (2.4%), Enterotoxaemia (1.9%), Fascioliasis / Distomatosis (0.9%) and Anthrax (0.6%).
- Considering the number of incidence and deaths due to FMD reported by Govt. of India during 2006-10 in cattle, buffaloes, sheep, goats & pigs, the highest loss was observed due to milk loss (47.51%) followed by reduction in growth/body weight (12.26%), treatment cost (9.76%) and work power (7.92%).
- Considering 2.42% incidence rate and 5.51% case fatality rate of FMD (published papers during 2011-12). The cattle, buffaloes, goats, sheep and pigs contributed 50.92%, 40.03%, 6.64%, 2.00% and 0.41% respectively to the total expected economic loss.
- The value of Import and Export of India's livestock & livestock products in the year 2009-10 contributed 0.32% and 2.25% to India's total Import and Export respectively.
- The annual growth rate of Import and Export value of dairy products in India was -4.39% and 37.99% respectively during 2001-08. There was 49.38% annual growth rate in the net trade (Export – Import) of India's dairy products.

Methodologies/Models Developed

- Stochastic model for estimating economic losses due to FMD
- Models for estimating economic losses due to mastitis under farm and field conditions.
- Sampling methodology to study the effectiveness of AI in bovines under field conditions.
- Discriminant analysis under non-optimal conditions in animal sciences.
- Nonlinear growth models for studying the population/body growth and future prediction.
- Regression method for analysis of interrupted growth of animals.
- Linear & nonlinear models for estimation of lactation curves in animals.
- Nonlinear models for estimation of poultry egg production curves during first year of production.
- Repeated measures ANOVA for continuous data from incomplete repeated measures designs.
- Variance components analysis from unbalanced nested random models.
- CATANOVA for analysis of nominal data from cross, nested and repeated measures designs.
- Heritability estimation from unbalanced/heteroscedastic data under random models.
- Analysis of Variance for rank data from cross, nested and repeated measures designs
- Multinomial logistic ANOVA procedure to study the effects of different factors on morbidity/ mortality pattern of livestock diseases.

- Mixed model approach to study the effect of diseases on production parameters
- Methodology for economic evaluation of important livestock diseases in cattle, sheep & goats.
- Sampling of milk records for estimation of lactation milk yield.
- The Mixed model approach with unstructured covariance matrix is recommended to compare the effect of diseases on milk production.
- Appropriate statistical models to study the factors associated with disease pattern and occurrence of diseases in cattle and buffalo by applying chi-square, and logistic/multinomial logistic ANOVA methods.
- The computing procedures using SAS were developed for different topics specially for Estimation of Genetic Parameters in half and full sib models, analysis of interrupted growth models and mixed model analysis for repeated measurements.

Honours & Awards

- Kheti Puraskar (1993).
- Institute Best Teacher Award (1995).
- ISCA Best Poster Presentation Award (2000).
- ISCA Best Poster Presentation Award (2001).
- Award of Merit of IVRI (2001).
- Best Paper Award (2004).
- Chal Vaijayanti Puruskar (2013-14)

6.4.2 Faculty Strength:

S.no.	Sanctioned Faculty	Faculty in place	Vacant position	Faculty recommended by the ICAR/UGC/VCI/ other regulatory bodies
1.	Professor*	0	0	ICAR
2.	Associate Professor*	0	01	ICAR
3.	Assistant Professor*	02	02	ICAR

* Faculty are also involved in BVSc & AH and PhD programmes.

6.4.3 Technical and Supporting staff:

Staff	Sanctioned	In Place
Technical*	06	0
Supporting*	06	01

* Technical and supporting staffs are also involved in BVSc & AH and PhD programmes.

6.4.4. Classrooms and Laboratories:

1. Classroom is available for teaching.
2. Laboratories are available and mentioned in annexure III

6.4.5. Conduct of Practical and Hands-on-Training:

Practicals (hands-on) are being conducted in all courses. During internal and annual board exams students perform practicals/experimental procedures on their own. Many students attend national and international trainings. A comprehensive list is given below:

Division	Name / No. of Students	Hands-on- trainings attended
Livestock Economics	30	Practical Class
		Hands on training on molecular techniques
		Training on fundamental of biosafety and biosecurity
		Hands on training on equipment handling

6.4.6 Supervision of students in PG Programme:

MVSc students on roll	06
No. of faculties	02

6.4.7 Feedback of stakeholders (Students, parents, industries, employers, farmers etc.):

Feedback proforma is available which need to be submitted by the students at time of obtaining Provisional Degree Certificate (PDC). The Scanned copy of same is attached in Annexure IV.

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Livestock Economics	3	3	3	1	4	66.67	-66.67*	33.33	0	50

*Negative numbers are due to rejoining of students after their temporary dropping(s).

6.4.9. ICT Application in Curricula Delivery:

Yes the degree programmes are meeting the expectations.

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Signature of Dean of the College with Date & Seal

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भारतीय पशु-चिकित्सा अनुसंधान संस्थान
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