GURU ANGAD DEV VETERINARY AND ANIMAL SCIENCES UNIVERSITY

Ludhiana-141004 Punjab, India

Annual Report

2019-20

GURU ANGAD DEV VETERINARY AND ANIMAL SCIENCES UNIVERSITY
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Guru Angad Dev Veterinary and Animal Science University, Ludhiana

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PREFACE

Dr. Inderjeet Singh
Vice-Chancellor

It gives me immense pleasure to present before you the Annual Report of Guru Angad Dev Veterinary and Animal Sciences University, Ludhiana for the period 2019-20. A kaleidoscopic view of the various activities and achievements of the university in the area of teaching, research, extension and infrastructure development undertaken during the last one year have been presented through this report. The university ranked 1st among the State Veterinary Universities of India and 8th among the Agricultural/Veterinary Universities/ICAR Research Institutes for the year 2018. A new College of Veterinary Science at Rampura Phul, has started functioning. For improved learning outcomes, skill and entrepreneurship, a World-Bank funded Institutional Development Plan (IDP) under National Agricultural Higher Education Project is operational in the university. Total 561 students (352 male and 209 female) were admitted in different UG and PG programmes. The University has one of the finest Veterinary Hospital well equipped with state of the art equipment and laboratories. During the year 33118 clinical cases of Small and Large animals were presented and 19503 clinical samples were tested at Veterinary Hospital. During the year 2019-20, a total of 146 research and other schemes were operational in the university out of which 54 are funded by different funding agencies including ICAR, DST, DBT, SERB, etc. Major research projects include Canine Research Centre & Networks, Niche Area of Excellence and Climate Resilient Livestock Production. GADVASU has developed collaborations with several international institutes and transferred technologies to industry and entrepreneurs

GADVASU students participated in various activities including Inter University Sports Tournaments, Annual Athletic Meet, cultural activities, youth festivals, NCC and NSS at university and at all India level and brought laurels to the university. Three NCC cadets participated in various equestrian activities during Republic Day camp and won one Gold Medal, three Bronze Medal and one Runner-up trophy in tent pegging event.

The future thrust would be job oriented quality education, need and problem based research, establishing and strengthening close linkages with the stakeholders including livestock and fish farmers, and related industries for increasing income through productivity enhancement, value addition and ensuring quality and safety of animal based foods while protecting environment using sustainable production systems.

I sincerely hope that Annual Report 2019-20 would serve as a valuable source of information to the professionals of the Livestock, Dairy and Fishery Development Organizations and other Institutions of Higher Learning in the country.

Vice-Chancellor

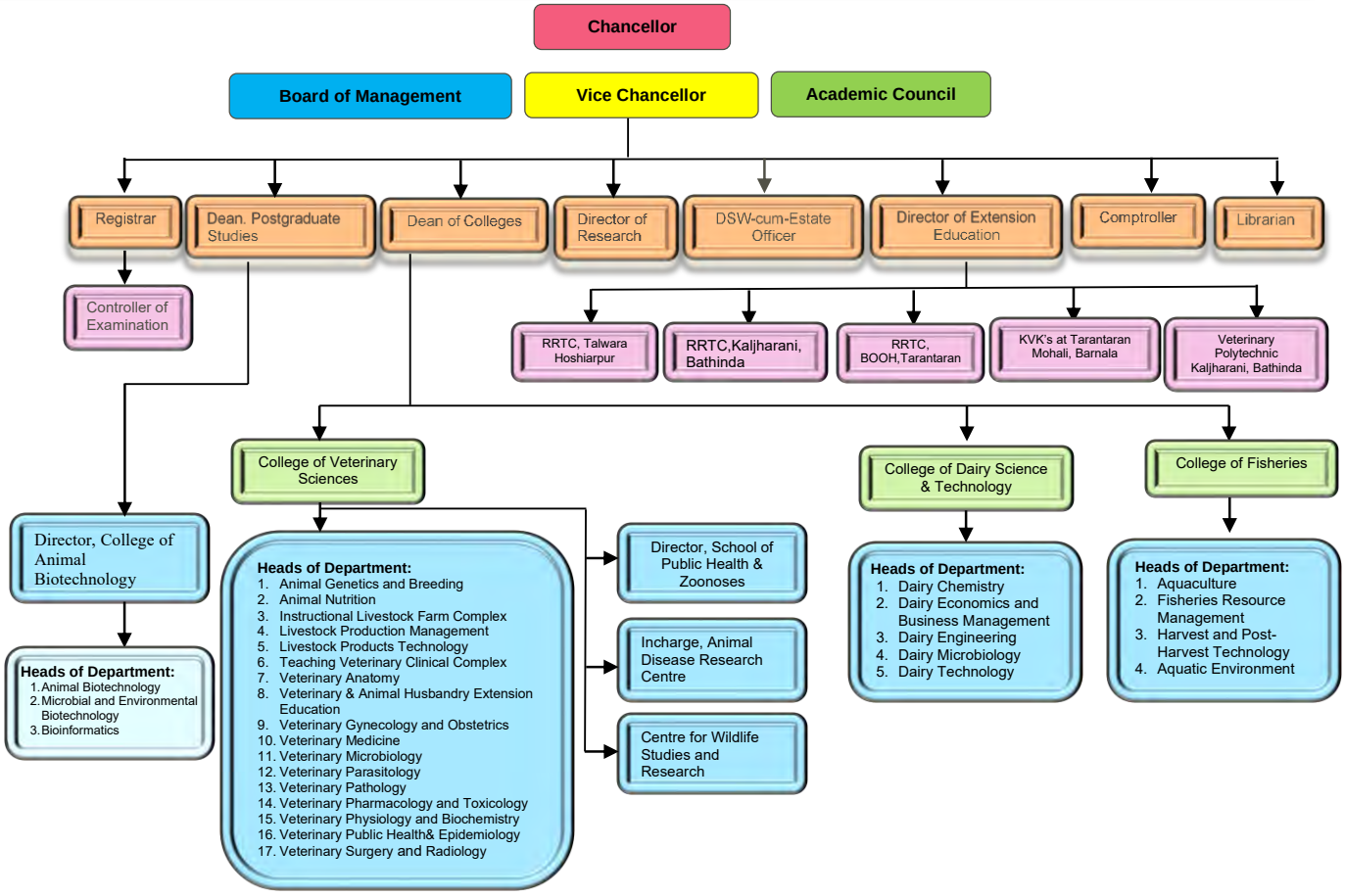
CONTENTS

ABOUT THE UNIVERSITY

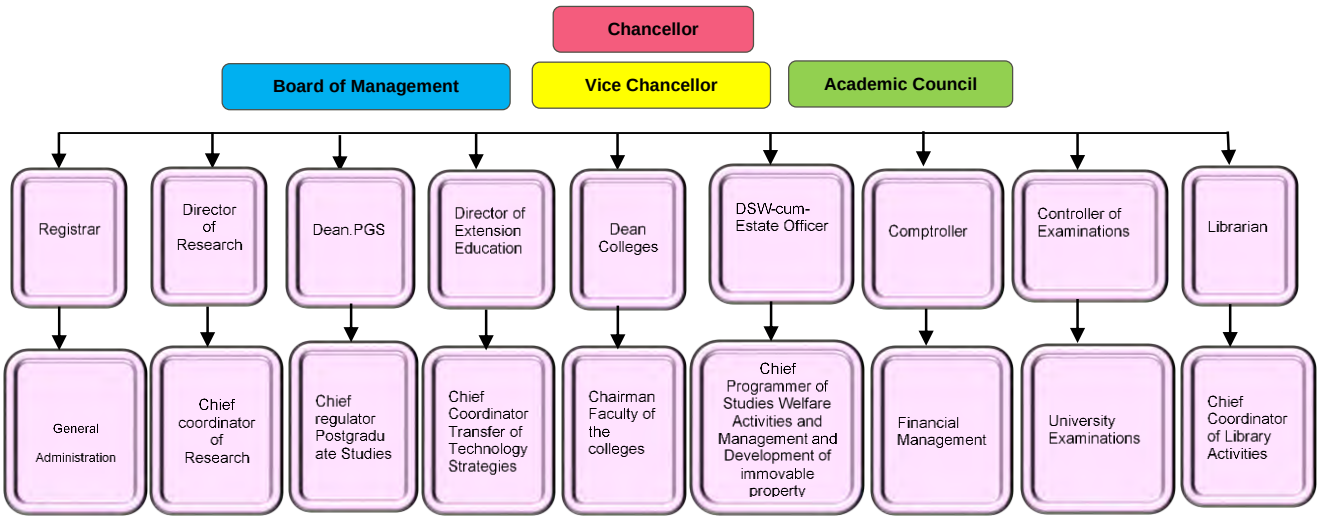
Guru Angad Dev Veterinary and Animal Sciences University was established on 9th August, 2005 at Ludhiana and started functioning from 21st April, 2006 with only one College of Veterinary Science which was established in 1969 and shifted from Punjab Agricultural University to Guru Angad Dev Veterinary and Animal Sciences University. The university has grown remarkably since its inception and is already among the top Veterinary and Agricultural Universities in the country. In order to produce highly efficient and skilled human resource for giving further boost to activities of livestock, dairy and fishery sectors in Punjab, the University has established College of Fisheries, College of Dairy Science and Technology, College of Animal Biotechnology and Veterinary Polytechnic for teaching, research and extension in the respective fields. Regional Livestock Research and Training Centres at Kaljharani (Bathinda), Talwara (Hoshiarpur) and Booh (TaranTaran) were established for catering to the specific needs of the area. Three Krishi Vigyan Kendras have been established at Taran Taran, Barnala and Mohali districts of Punjab for technology assessment, refinement and demonstration. The University has been recognized by the University Grants Commission (UGC) to receive central assistance under section 12(B) of UGC Act, 1956. GADVASU got accreditation from UGC and ICAR and has been admitted as a regular member of the Association of Indian Agricultural Universities (AIAU) and Association of Indian Universities (AIU). Indian Council of Agricultural Research (ICAR) has accredited the university and four constituent colleges viz. College of Veterinary Science, College of Fisheries, College of Dairy Science and Technology and College of Animal Biotechnology for a period of 5 years (up to 31.03.2023) with grade 'A'. The School of Animal Biotechnology was upgraded to College of Animal Biotechnology w.e.f. 25.03.2019. The ICAR has ranked GADVASU as overall 8th among the Agricultural/Veterinary Universities/ICAR Research Institutes and 1st among the State Veterinary Universities of India for the year 2018. The University was established with the following goals and objectives:

1. To provide adequate supply of well-trained universally competent veterinary, animal husbandry, dairy and fishery professionals including Master's and Doctorate level specialists capable of handling animal health and production aspects according to the needs of the State.
2. To undertake multi-disciplinary research in priority areas to address the problems of veterinary, animal husbandry, dairy and fishery sectors.
3. To foster faculty development by providing them opportunities to participate in appropriate training programs, conferences, workshops, seminars, symposia, etc. and avail opportunities in exchange programs.
4. To provide continuing professional education in veterinary, animal, dairy and fishery sciences.
5. To provide consultancy, expert opinion and specialist services to livestock owners, government, and other agencies for Livestock Policy Formation.
6. To run Multi-specialty Veterinary Hospital for treatment of animals and to provide clinical training to the students.
7. To encourage cooperation and collaboration with other departments, colleges, universities, and industries, both at national and international levels.
8. To undertake extension education activities to extend the knowledge and technology to the end users, i.e., farmers, industry, government, marketing sector, etc.

ORGANIZATIONAL SETUP



Functional Chart



The functioning of the university is governed by the following bodies focused at education, research and extension activities:

- Board of Management
- Academic Council
- Committee on Students' Welfare
- Research Advisory Committee
- Extension Education Advisory Committee
- Resident Instruction Committee
- Postgraduate Committee
- Board of Studies

The Board of Management is the highest administrative body which controls the finances and assets of the university, appointments of all officers and teachers and provides overall guidance on running of the university. The Academic Council administers the academic functions of the university and is responsible for maintenance of standards of institution, education and examination. Committee on Students' Welfare regulates various students' activities. Research Advisory Committee regulates the allocation of funds for research, conditions for accepting grants and other matters regarding research programmes of the university. Extension Education Advisory Committee coordinates university extension programmes with the state and the centre and devises ways and means to implement university extension education programmes. Resident Instruction Committee makes recommendations to the Academic Council concerning the new curricula and arrangement, alteration and abolition of existing curricula. Postgraduate Committee examines the courses and curricula for postgraduate students recommended by the Board of Studies before submission to Academic Council. Board of Studies proposes to the Academic Council through Resident Instruction Committee, the courses of study and curricula for various teaching programmes. The board also reviews from time to time the standards of teaching and evaluation of students.

Ranking by ICAR

Year	Rank
2017	1st among the Agricultural/Veterinary Universities/ICAR Research Institutes and 1st among the State Veterinary Universities of India.
2018	8th among the Agricultural/Veterinary Universities/ICAR Research Institutes and 1st among the State Veterinary Universities of India.

ADMINISTRATION

Board of Management

Honorary Chairman

- His Excellency Shri V. P. Singh Badnore, Chancellor and Governor of Punjab, Chandigarh.

Working Chairman

- Dr. A. S. Nanda, Vice-Chancellor, Guru Angad Dev Veterinary and Animal Sciences University, Ludhiana.

Ex-officio Members

- Shri Karan Avtar Singh, IAS, Chief Secretary to Government of Punjab, Chandigarh.
- Shri Raj Kamal Chaudhuri, IAS, Secretary, Department of Animal Husbandry, Fisheries & Dairy Development, Punjab, Chandigarh.
- Shri Vishwajeet Khanna, IAS, Additional Chief Secretary (Development), Department of Agriculture, Punjab, Chandigarh.
- Shri Anirudh Tewari, IAS, Principal Secretary, Department of Finance, Chandigarh.
- Dr. Inderjeet Singh, Director of Animal Husbandry, Punjab, SAS Nagar (Mohali).
- Sh. Inderjit Singh, Director, Dairy Development, Punjab, SAS Nagar (Mohali).
- Dr. Madan Mohan, Director and Warden of Fisheries, Punjab, SAS Nagar (Mohali).
- Dr. Joy Krushna Jena, Deputy Director General (Animal Sciences), ICAR, New Delhi.
- Dr. H. K. Verma, Director of Extension Education, Guru Angad Dev Veterinary and Animal Sciences University, Ludhiana.

Special Invitee

- Dr. B.S. Dhillon, Vice-Chancellor, Punjab Agricultural University, Ludhiana.
- Shri Kamaldeep Singh Sangha, IAS, Managing Director, Milkfed, Punjab, Chandigarh
- Dr. N K Singh (ICAR Awardee), Associate Professor, Department of Veterinary Parasitology, Guru Angad Dev Veterinary and Animal Sciences University, Ludhiana.

ACADEMIC COUNCIL

Chairman

- **Dr. A. S. Nanda**, Vice-Chancellor, Guru Angad Dev Veterinary and Animal Sciences University, Ludhiana.

Members

- **Dr. P. S. Brar**, Dean, College of Veterinary Science
- **Dr. J. P. S. Gill**, Director of Research
- **Dr. Sanjeev Kumar Uppal**, Dean Postgraduate Studies
- **Dr. Sanjeev Kumar Uppal**, Dean, College of Dairy Science and Technology
- **Dr. H. K. Verma**, Director of Extension Education
- **Dr. Kulbir Singh Sandhu**, Dean, College of Fisheries
- **Dr. G. S. Dhaliwal,** Dean, College of Veterinary Science, Rampura Phul
- **Dr. Shashi Nayar**, Professor-cum-Head, Department of Veterinary Physiology & Biochemistry
- **Dr. Jitender Mohindroo,** Professor-cum-Head, Department of Veterinary Surgery & Radiology
- **Dr. P. N. Dwivedi ,** Professor-cum-Head, Department of Dairy Microbiology
- **Dr. Meera D Ansal**, Professor-cum-Head, Department of Aquaculture
- **Dr. R. S. Sethi,** Professor-cum-Head, Department of Animal Biotechnology

Special Invitees

- **Dr. Satyavan Rampal**, Director, Student Welfare-cum-Estate Officer
- **Dr. N. S. Sharma**, Controller of Examinations
- **Dr. Ramneek,** Director, College of Animal Biotechnology (Additional charge)
- **Dr. V. K. Gandotra,** Officer on Special Duty (OSD), Veterinary College at Rampura Phul
- **Dr. N K Singh**, Associate Professor, Department of Veterinary Parasitology

Secretary

Dr. Sushil Prabhakar, Registrar, GADVASU, Ludhiana.

Officers of the University

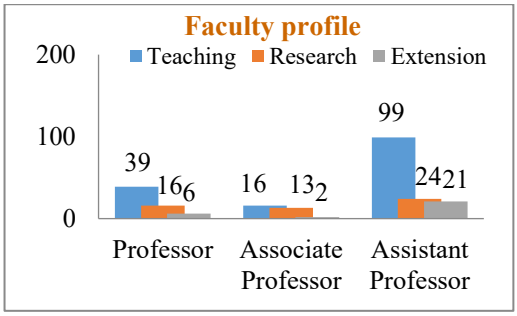
Vice-Chancellor	Dr. Amarjit Singh Nanda
Registrar	Dr. Sushil Prabhakar
Dean, Postgraduate Studies	Dr. Sanjeev Kumar Uppal
Director Students' Welfare-cum-Estate Officer	Dr. Satyavan Rampal
Director of Research	Dr. J. P. S. Gill
Director of Extension Education	Dr. H. K. Verma
Dean, College of Veterinary Science	Dr. Prakash Singh Brar
Dean, College of Dairy Science and Technology	Dr. Sanjeev Kumar Uppal
Dean, College of Fisheries	Dr. Kulbir Singh Sandhu
Comptroller	Dr. Amarjit Singh

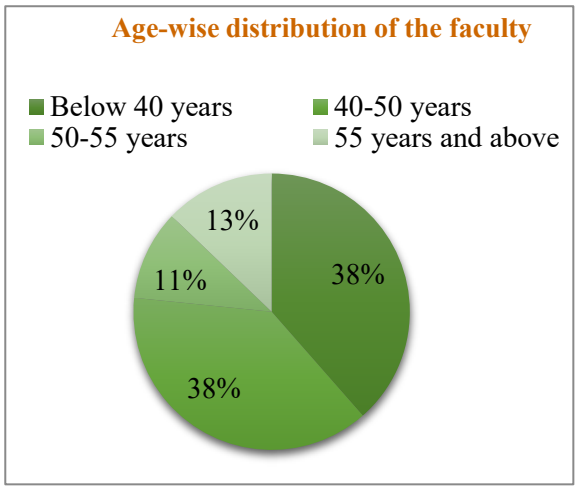
FACULTY PROFILE

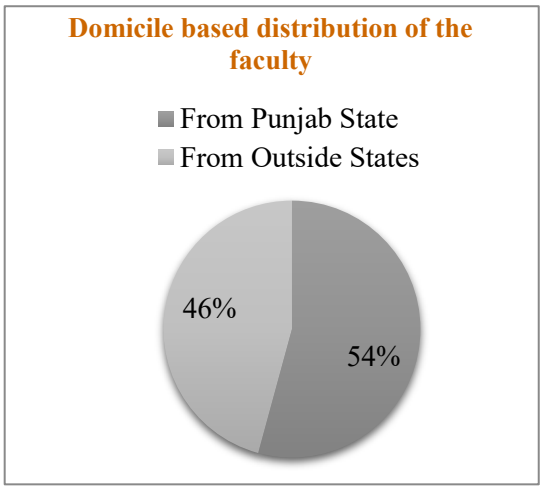
Presently, the total faculty strength in the constituent colleges / institutes of the university is 236, out of which 61 are Professors or equivalent (one on contract), 31 Associate Professors or equivalent and 144 Assistant Professors or equivalent. About 154 faculty members (one on contract) are in the teaching schemes, 53 in the research schemes and 29 in the extension schemes. At university level, 23% of the faculty is female, 85 % of the faculty holds doctoral degree and 54% faculty is from Punjab. The university has a young faculty with 38% faculty members below 40 years of age.

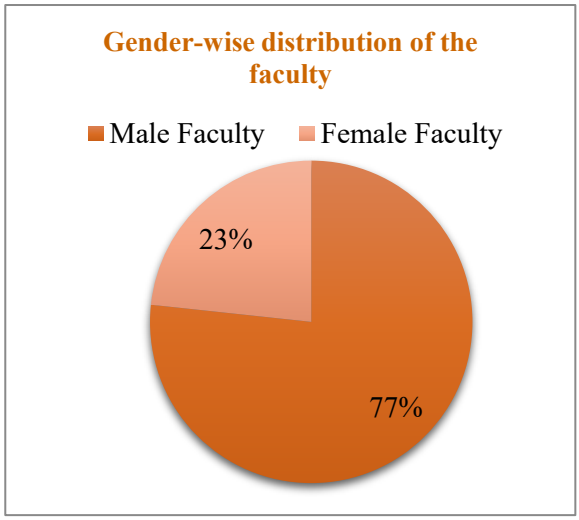
Faculty strength

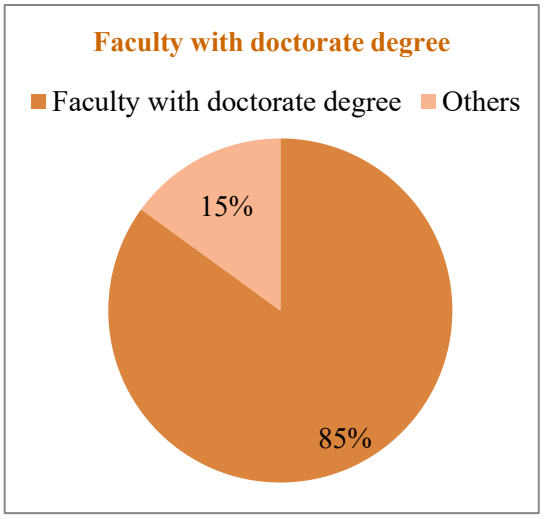
	Professor	Associate Professor	Assistant Professor	Total
Teaching	39	16	99	154
Research	16	13	24	53
Extension	06	02	21	29
Total	**61**	**31**	**144**	**236**







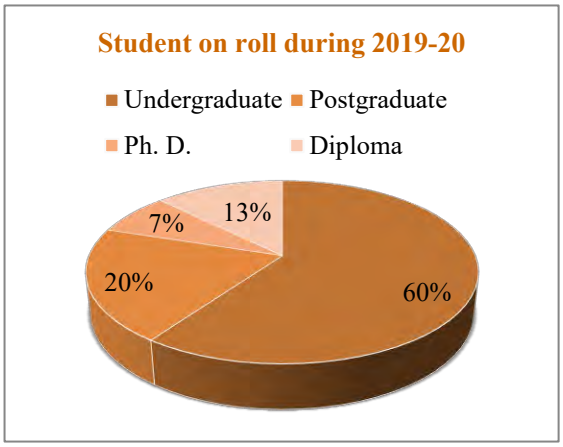


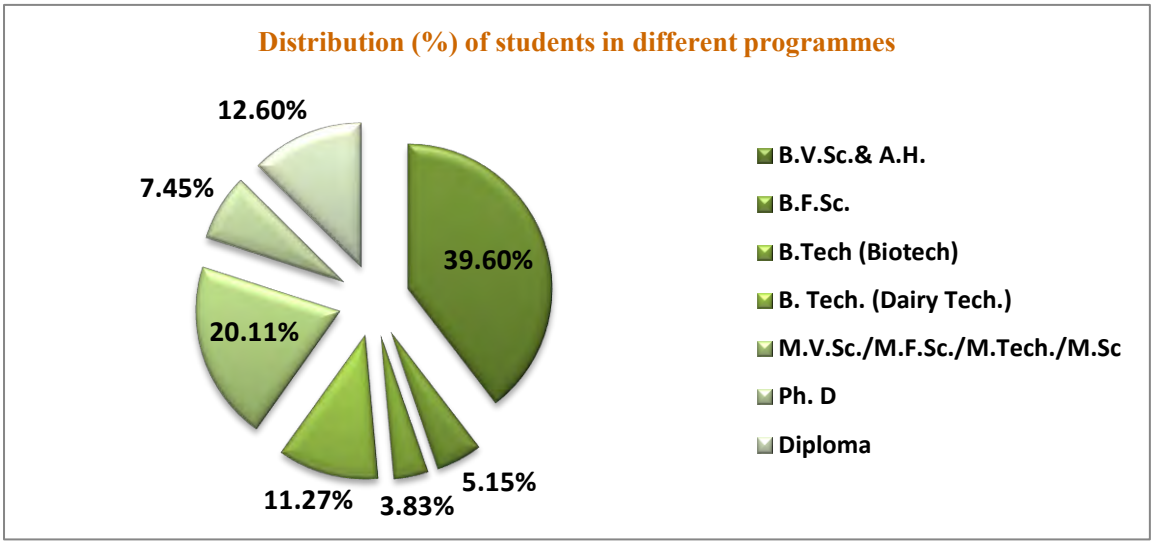


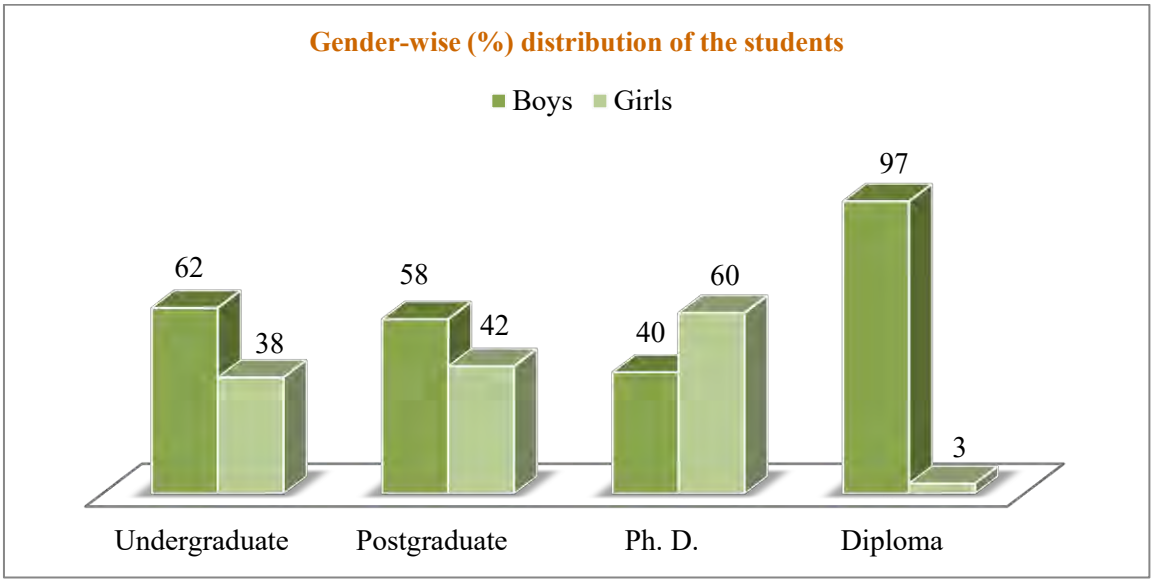
STUDENTS' PROFILE

Students enrolled in various programmes and their gender wise distribution in courses

Programmes	Boys	Girls	Total
B.V.Sc. & A.H. (Ludhiana)	308	179	487
B.V.Sc. & A.H. (Rampura Phul)	48	34	82
B.F.Sc.	34	40	74
B. Tech. (Dairy Tech.)	114	48	162
B. Tech. (Biotechnology)	25	30	55
MV.Sc./ M.F.Sc./ M.Tech./M.Sc.	167	122	289
Ph. D	43	64	107
Diploma*	175	06	181
Total	**914**	**523**	**1437**







FINANCIAL REPORT

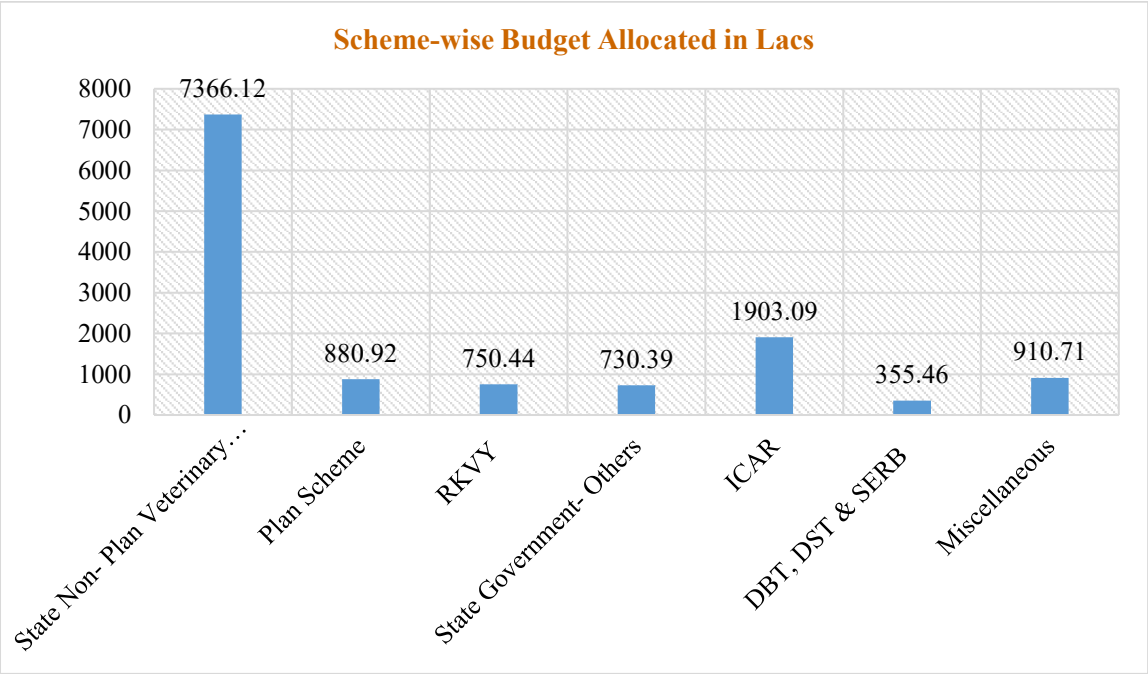
During the financial year 2019-20, the university was allocated a total grant of Rs. 12897.13 lacs which included Rs. 7366.12 lacs under State Non-Plan Veterinary Schemes, Rs. 880.92 lacs under Plan schemes, Rs. 750.44 lacs under RKVY Schemes and Rs. 730.39 lacs under other State Government Schemes. In addition, the university also received Rs. 1903.09 lacs under ICAR Schemes/ Projects, Rs.355.46 lacs from DBT, DST & SERB schemes and Rs. 910.71 lacs from miscellaneous agencies.

The total expenditure of the university for the year 2019-20 was 11,682.60 lacs, which included Rs. 7892.89 lacs under State Non-Plan Veterinary schemes, Rs. 588.68 lacs under Plan schemes, Rs. 621.07 lacs under RKVY schemes, Rs. 382.08 under State Government Schemes, Rs. 1736.05 lacs under ICAR Schemes/Projects and Rs.287.35 lacs under DBT, DST & SERB schemes and Rs. 174.48 lacs under miscellaneous schemes.

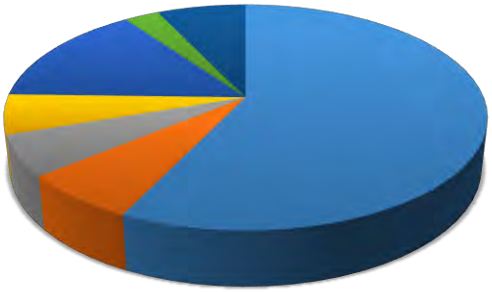
Financial statement indicating budget allocated and amount spent (Rs. in lacs) under various schemes/projects during financial year 2019-20

Schemes	Total Budget Allocated*	Expenditure
State Non- Plan Veterinary Schemes	7366.12	7892.89
Plan Scheme	880.92	588.68
RKVY	750.44	621.07
State Government (Others)	730.39	382.08
ICAR	1903.09	1736.05
DBT, DST & SERB	355.46	287.35
Miscellaneous	910.71	174.48
Total	**12897.13**	**11,682.60**

*Allocated budget includes the budget revalidated, grant received, and income generated

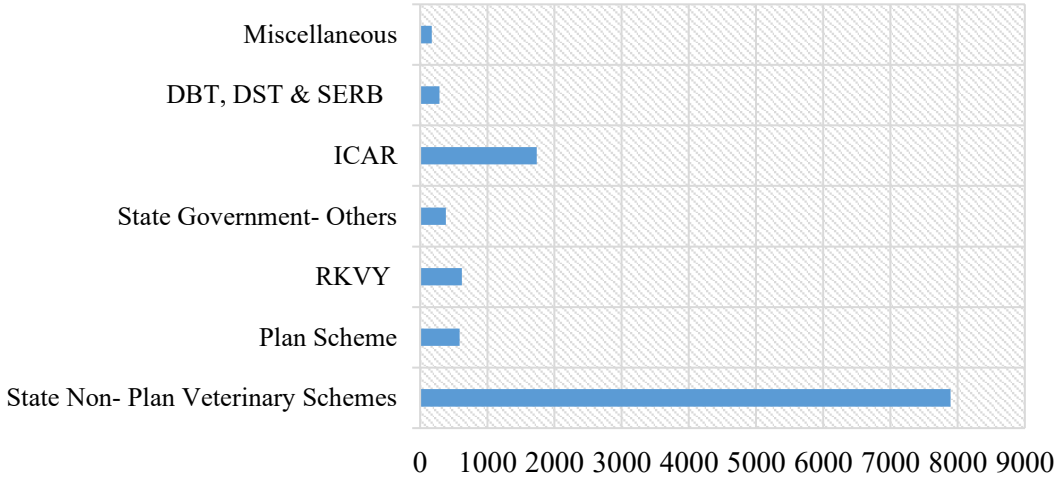


Scheme-wise Budget Allocated in Lacs

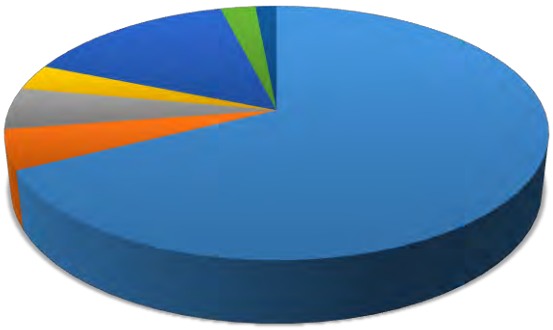


- State Non- Plan Veterinary Schemes
- Plan Scheme
- RKVY
- State Government- Others
- ICAR
- DBT, DST & SERB
- Miscellaneous

Scheme-wise Expenditure in Lacs



Scheme-wise Expenditure in Lacs



- State Non- Plan Veterinary Schemes
- Plan Scheme
- RKVY
- State Government- Others
- ICAR
- DBT, DST & SERB
- Miscellaneous

ACADEMIC UNITS

There are five constituent colleges, viz. College of Veterinary Science Ludhiana, College of Dairy Science & Technology, College of Fisheries and College of Animal Biotechnology which are imparting undergraduate and postgraduate teaching in various disciplines. The College of Veterinary Science, Rampura Phul has started functioning from the academic year 2019-20 and is imparting undergraduate education. Besides, the university has established School of Public Health & Zoonoses to generate scientific expertise and address various health and environment related issues. Three Regional Livestock Research & Training Centres at Kaljharani (Bathinda), Talwara (Hoshiarpur) and Booh (Taran Taran), and three Krishi Vigyan Kendras at Booh (Taran Taran), Barnala and Mohali are established to cater to the area specific requirements of the livestock owners. Apart from that university has two affiliated colleges viz; Khalsa College of Veterinary and Animal Sciences Amritsar and Baba Hira Das ji College of Veterinary Pharmacy Badal.

College of Veterinary Science, Ludhiana

The College of Veterinary Science, Ludhiana was established in November 1969 at main campus of Punjab Agricultural University, on re-organization of the Punjab State and the formation of a separate Haryana state. The College was shifted to the Guru Angad Dev Veterinary and Animal Sciences University (GADVASU) Ludhiana in 2005.

The college carries out teaching, research and extension education programmes pertaining to livestock production and health. It is recognized by the Veterinary Council of India (VCI) and has been accredited by the Indian Council of Agricultural Research (ICAR) with an overall score of 5. The College is a centre of Regional, National and International excellence in research and learning in animal health and production. It caters to the needs of Punjab by carrying out teaching, research and extension education programmes pertaining to livestock production and health and has been instrumental in ushering an era of 'White Revolution' in the State.

The college has 17 departments, and all the departments have excellent teaching and research laboratory facilities and adequate infrastructure for the undergraduate and postgraduate teaching and research, a well-equipped Veterinary Teaching Hospital to cater to the demands of large and small animal health care. The college also has Animal Disease Research Centre to provide disease diagnosis and advice treatment to the farmers and Directorate Livestock Frams has an elite dairy herd and poultry farm which provide adequate facilities for teaching and research. In addition, the college also has the first Collaborative Research Centre of India for Veterinary Ayurveda. It was established in the college in the year 2017 by the Central Council of Research in Ayurvedic Sciences (CCRAS), Ministry of AYUSH, Govt of India. In 2018, an intramural research project has been awarded for Rs 40 lakhs by Ministry of AYUSH to establish a medicinal plant garden at GADVASU for demonstration and to create awareness among farmers and general public about the use of medicinal plants.

The Department of Livestock Products Technology of the college has successfully launched first Public Private Partnership project of Instructional Poultry Processing Plant in collaboration with Shiva Poultry equipments, Barnala for daily operations, management and maintenance of the unit. It is a model unit that serves the society by ensuring availability of quality meat for consumers and prevents the spread of zoonotic diseases. It also promotes clean meat practices with the assurance of animal welfare-ethics by minimizing the stress on birds.

The college has also been granted DBT-GADVASU Canine Research Centre and Networks project in 2018 in collaboration with TANUVAS with a project monitoring unit at GADVASU. A budget of Rs.138.9225 (One crore thirty eight lakhs ninety two thousand two hundred fifty only) has been sanctioned for the 'Project Monitoring Unit' (PMU) for three years.

The University has bagged prestigious Institutional Development Plan (IDP) project entitled "Institutional Development Plan for Improved Learning Outcome, Skill and Entrepreneurship at GADVASU" worth Rs. 30 crores for a period of 24 months starting August 2019. It is an ICAR and World Bank sponsored project, under National Agricultural Higher Education Project (NAHEP). NAHEP has been formulated by ICAR with a total cost of Rs 1100 crores for five years starting from 2017-18. The project is on 50:50 cost sharing basis between the World Bank and Government of India. For GADVASU, Dr Parkash Singh Brar is the Principal Investigator and he

is assisted by team of Co-investigators.

This is the only veterinary college in India having three ICAR Centres of Advanced Faculty Training in the Departments of Veterinary Surgery and Radiology, Veterinary Gynaecology and Obstetrics and Veterinary Pathology. In addition, the departments of Teaching Veterinary Clinical Complex, Veterinary Medicine, Livestock Products Technology and Livestock Production Management have experiential learning projects

The college offers following programmes of veterinary education:

- B.V.Sc. & A.H. (5½ years)
- M.V.Sc. (2 years)
- Ph.D. (3 years)

The programme leading to the award of the B.V.Sc. & A.H. degree is designed to equip graduates with the knowledge and skills essential for a veterinary career.As per Minimum Standards of Veterinary Education -2008, the programme is divided into three phases. The pre-clinical phase, undertaken in years one and two, provides education in basic sciences such as anatomy, physiology and biochemistry, as well as in animal husbandry through intramural learning. The para-clinical phase, undertaken in years three and four, includes bridging subjects between the pre-clinical and clinical phases, such as Pathology, Microbiology, Parasitology, Pharmacology and basic clinical science. The clinical phase (Surgery, Medicine and Gynaecology) starts in the fourth year and culminates in the fifth and final year. At the end of course work the students undergo a compulsory rotating internship programme of six (5.0 year programme) and twelve (5.5 year programme) calendar months envisaging on the job training in animal production technology, diagnostic laboratories and hospital practice. The Veterinary Council of India has revised the Minimum Standards of Veterinary Education in 2016 (MSVE-2016) and now the preclinical phase is undertaken in first year, paraclinical phase in 2nd and 3rd professional. The clinical phase starts in 4th professional which has duration of one and half year. At the end of course work students will have to undergo internship programme of one year. The various departments of the College, aided by teaching veterinary hospital ensure competence in basic and applied aspects through clinical practice. The successful completion of B.V.Sc. & A.H. programme entitles the graduates for registration with the Punjab State Veterinary Council/Veterinary Council of India as registered veterinary practitioners.

Student intake capacity

Programme of Study	Number of Seats
B.V.Sc & A.H (5½ years)	• 60 –For residents of Punjab State and Chandigarh on the basis of CET of GADVASU • 09 - Candidates nominated by VCI • 16 - Self financed seats • 15 - NRI seats
M.V.Sc. (2 years)	• 72 - For residents of Punjab State and Chandigarh • 46 - ICAR nominee on the basis of ICAR entrance test • 10 - NRI seats • 02 Self-financed seats two in each discipline
Ph.D. (3 years)	• 30 - For residents of Punjab State and Chandigarh. • 30 - ICAR nominee on the basis of ICAR entrance test • 05 - NRI seats • 02 Self-financed seats in each discipline

College of Veterinary Science Rampura Phul

The College of Veterinary Science Rampura Phul started functioning from the year 2019 as one of the constituent college of the Guru Angad Dev Veterinary and Animal Sciences University,

Ludhiana (Punjab). The college has the requisite facilities as prescribed by VCI for first professional B.V.Sc.& A.H. The college offers following programme of veterinary education

Student intake capacity

Programme of Study	Number of seats
B.V.Sc & A.H (5½ years)	• 68- for residents of Punjab State and Union Territory of Chandigarh on the basis of CET of GADVASU • 12- Self financed seats

College of Dairy Science and Technology

The College of Dairy Science and Technology was established in the year 2008 at Ludhiana as one of the constituent colleges of the Guru Angad Dev Veterinary and Animal Sciences University, Ludhiana. The major objective of the college is to produce trained human resource through its undergraduate and post graduate programmes to meet the technical manpower requirements of dairy and food processing industries, government departments and R&D organizations. Development of new technologies in the field of milk processing and dairy products development as well as their transfer to end users is another important objective of the College of Dairy Science and Technology. Presently, the college is offering a 4-year programme in B. Tech. (Dairy Technology) and a 2-year programme in M. Tech. (Dairy Technology, Dairy Engineering, Dairy Microbiology) along with M. Sc. (Dairy Economics). The courses offered at the college ensure overall development of students as highly professional dairy specialists through modern education, research and training in dairy science and technology.

Student intake capacity

Programme	Available seats
B.Tech. (Dairy Technology) (4 years)	52-for residents of Punjab State and Union Territory of Chandigarh
	8-Nominees of the ICAR
	2-NRI candidates
	10- Candidates from other states
	3- Self Financed seats
M.Tech. (Dairy echnology, Dairy Engineering, Dairy Microbiology and Dairy Chemistry)	9-For residents of Punjab State and Chandigarh 5-Nominees of the ICAR
M.Sc. Agricultural Economics (Animal Husbandry)	2- For residents of Punjab State and Chandigarh 1-Nominees of the ICAR
Ph.D. (DairyTechnology)	2- For residents of Punjab State and Chandigarh 1- Nominees of the ICAR
Ph.D. (Dairy Engineering)	1- For residents of Punjab State and Chandigarh 1- Nominee of the ICAR
Ph.D. (Dairy Microbiology	1- For residents of Punjab State and Chandigarh 1- Nominee of the ICAR
Ph.D. Agricultural Economics (Animal Husbandry)	1- For residents of Punjab State and Chandigarh 1- Nominee of the ICAR

The four year B. Tech. (Dairy Technology) programme is a unique job oriented course for the overall professional development of dairy specialists to meet the requirements of industry, research and development. The programme follows the course curriculum as recommended by the 4 th and 5th Deans committee constituted by the Indian Council of Agricultural Research, New Delhi. As per recommendations of 4th Dean's committee the programme has been structured into eight semesters. The first six semesters include the courses (theory and practicals) on Dairy Technology, Dairy Engineering, Dairy Chemistry, Dairy Microbiology and Dairy Economics & Business Management. Seventh and eighth semesters include in-plant training practicals on different aspects

of Dairy Technology. The programme has now been restructured as per recommendations of 5th Dean's committee and Student READY programme has been introduced in semester break during 1st and 2nd semesters. The college has introduced course on Energy Conservation and management (DE 324) to sensitize the students on this important aspect. M.Tech. and M.Sc. programmes in the College of Dairy Science and Technology have been started to strengthen the research programmes of the college. The college has introduced Ph.D. programme in Dairy Technology. Under both undergraduate and postgraduate programmes, the students are exposed to every aspect of equipment designing, technology of product making and quality assurance.

College of Fisheries

To provide an effective human resource and technical and outreach backup to the fisheries sector of the state for further expansion and development in terms of productivity and sustainability, College of Fisheries, GADVASU, was established in April, 2008. College was started to develop qualified human resource in fisheries, to carry out basic, applied and adaptive research for higher fish productivity and to disseminate the developed technologies to farmers and entrepreneurs for commercial adoption. The college is well equipped with both laboratories and farm facilities to carry out teaching, research and extension activities efficiently. The college offers the following programmes

Student intake capacity

Programme	Available seats
B.F.Sc. (4 years)	47- For residents of Punjab and Chandigarh 8- Nominees of the ICAR 3- NRI seats 15- candidates from other states 2- Self financed seats
M.F.Sc. (Aquaculture), M.F.Sc. (Fisheries Resource Management) M.F.Sc. (Aquatic Environment Management), M.F.Sc. (Aquatic Environment Management)	10 - For Residents of Punjab and Chandigarh 4- Nominees of the ICAR
Ph.D. (Aquaculture) Ph.D. (Fisheries Resource Management)	4- For Residents of Punjab and Chandigarh. 02 - Nominees of the ICAR
Diploma in Inland Fisheries	5 - For nominated inservice candidates

Since its establishment in 2008, the College of Fisheries, GADVASU has registered commendable academic growth and has made significant contributions in the development of the fisheries sector of the state through an efficient 'Lab to Land' extension programme.

The curriculum of the four year UG degree programme (B.F.Sc.) has been adopted as per recommendations of the 5th Deans' Committee of the Indian Council of Agricultural Research (ICAR) from academic session 2016-17 and is divided into eight semesters. During the first six semesters, courses (theory and practical) cover taxonomy, anatomy, physiology, biology, biochemistry, culture techniques, nutrition, breeding, disease management, aquatic ecology, genetics, biotechnology, culture and capture fisheries resources and their management, post-harvest technology, marketing and trading, economics and statistical methods and extension education. Under Student READY Program, the students take up 'In-Plant Training Program' during the 7th semester, which includes practical training at aqua-farms, hatcheries, feed industry, fish markets and processing/value addition units etc., while during the 8th semester students undergo on-campus 'Experiential Learning, Skill Development and Project Development Programs'. The curriculum of M.F.Sc (Aquaculture, Fisheries Resource Management and Aquatic Environment Management) and Ph.D. (Aquaculture, Fisheries Resource Management and Aquatic Environment management) is also based on ICAR regulations covering both theory and research in the field of advanced technologies. One year Diploma in Inland Fisheries is offered to the sponsored in-service candidates of the State Fisheries Department.

College of Animal Biotechnology

The Department of Animal Biotechnology was established in February, 2008 under the aegis of PGIVER. In view of the progress made by the department, and the opportunities available in biotechnology, the university established the School of Animal Biotechnology in September 2010. In 2019 University established College of Animal Biotechnology by upgrading the School of Animal Biotechnology with the mandate to integrate and strengthen research in various facets of molecular biology with the aim of improving livestock productivity and health, and to produce professionally trained manpower.

The broad mandates of the College of Animal Biotechnology include:

- To produce qualified human resource in animal biotechnology.
- To generate scientific expertise and human resource in various facets of animal biotechnology
- To develop specialized and state of the art facilities for research in cutting edge fields of biotechnology
- To undertake research in different areas of molecular biology and biotechnology for improving animal health and productivity.

Presently the college is offering B.Tech. (Biotechnology), M.V.Sc./ M.Sc. (Animal Biotechnology) and Ph.D. (Animal Biotechnology). The M.V.Sc./M.Sc. and Ph.D. programs in Animal Biotechnology follow the course curriculum as recommended by the Indian Council of Agricultural Research for the Animal Biotechnology group.

Student intake capacity

Programme	Available seats
B.Tech (Biotechnology)	40 - for residents of Punjab State and Union Territory of Chandigarh 10- Residents from other states
M.V.Sc./M.Sc. (2 years) Animal Biotechnology (for veterinarians)/ Biotechnology (for non-veterinarians)	2-for veterinary graduates 4-Nominee of the ICAR 10- for non-veterinarians
Ph.D. (3 years)	4- Preference to Veterinary/ Animal Biotechnology postgraduates 2- Nominated by ICAR

Postgraduate Institute of Veterinary Education and Research

Postgraduate Institute of Veterinary Education and Research (PGIVER) was established in 2007 to give impetus to specialized and need-based research and imparting training to graduates of various disciplines. The basic objectives are to develop and strengthen postgraduate education, research and training programs. The priority areas are molecular biology, biotechnology, diagnostics, bioinformatics, communication technology including computer education and business management. The other objectives of PGIVER include strengthening of embryo transfer technology for better productivity in relation to milk, meat and disease resistance, development of molecular techniques for production of better diagnostics, genetically defined marker vaccines and transgenic organisms for producing animal products of superior quality and identification of physiological, biochemical, molecular and cytogenetic markers for early selection of animals and poultry for increased production and quality products.

Veterinary Polytechnic, Kaljharani (Bathinda)

With an aim to produce trained supporting man power capable of handling livestock health and production, GADVASU established a Veterinary Polytechnic at Kaljharani, District Bathinda in 2010 for imparting Diploma in Veterinary Science & Animal Health Technology. The diploma has been designed for the training of Veterinary pharmacists to support and complement Veterinary practitioners in a better way, in order to provide better care and guided treatment to animals within Veterinary hospitals, Veterinary colleges, Research institutes, etc.

Student intake capacity

Programme	Available seats
Diploma in Veterinary Science & Animal Health Technology (2 years)	80-For residents of Punjab State and Chandigarh 02-For residents of Kaljharani, Bathinda

Placement Cell

The Placement Cell of the university acts as a unit for liaison between the students and the recruiting agencies. The role of placement cell starts as early as organizing the resume of the students and providing the technical guidance according to the interests and talents of the student to choose the area of work. The main objectives of the Placement Cell include:

- To create a database of the alumni who have achieved a landmark in the society.
- To create a database of the probable recruiters including industries and different organizations.
- To act as a liaison unit for plugging the gap between industry and fresh professionals to speed up the process of recruitment.
- To organize informative seminars to make the students aware about the opportunities abroad and for their preparation for the qualifying examinations.

The Placement Cell of the university is putting efforts for the on-campus and off-campus placement of the university students. During the period under report, various vacancies advertised by recruiting agencies were circulated among the eligible candidates using university website, email and social media. The placement committee also organised placement awareness camps during Pashu Palan Mela of the university. Placement cell also provided placement data to the Directorate, Employement Generation and Tarining, Punjab from time to time. Detail of placements of passed out students during 2019-20 is as below:

S. No.	Name of the College	No. of students passed out	Govern-ment Services	Industry/ Pvt. sector	Self Employed/ Consultancy	Further /Higher Education	Others/ Abroad
1.	College of Veterinary Sciences, Ludhiana	175	52	38	06	39	32
2.	College of Fisheries, Ludhiana	24	01	-	-	09	02
3.	College of Dairy Science & Technology, Ludhiana	35	-	01	-	04	02
4.	College of Animal Biotechnology, Ludhiana	06	05	-	-	-	-
5.	Veterinary polytechnic, Kaljharani Bathinda	76	0	01	17	01	01
Total		**316**	**58**	**40**	**23**	**53**	**37**

Nodal Cell, ICAR

The university has established a Nodal Cell to coordinate various activities of the Education Division of the ICAR and the university under the scheme “Strengthening and Development of Higher Education in India.” The ICAR nodal cell functions as a Single Window System and provides all the requisite information to the Agricultural Education Division of ICAR. The Dean, Postgraduate Studies, Dr. Sanjeev Kumar Uppal has been designated as the Nodal Officer and Dr Suresh Kumar Sharma, Professor of Veterinary Pharmacology and Toxicology as the Incharge, Nodal Cell.

TEACHING

Educational Programme(s)

Entrance tests conducted by GADVASU for admission to its various programs in 2019-20

Test	Date of test	Number of applications received	Number of candidates appeared in the test
Veterinary Entrance Test (VET-GADVASU 2019) for admission to B.V.Sc. & A.H. programme of the university	20.06.2019	1974	Total 1836 (Male candidates-1041; Female candidates-795)

Students appearing in VET-GADVASU (2019)

Admissions in undergraduate and postgraduate programmes in academic session 2019-20

Program	Boys	Girls	Total
B.V.Sc. & A.H. (COVS Ludhiana)	59	41	100
B.V.Sc. & A.H. (COVS Rampura Phul)	48	34	82
B.F.Sc.	10	11	21
B. Tech. (Dairy Technology)	43	28	71
B.Tech (Biotechnology)	11	13	24
M.V.Sc./ M.F.Sc. M.Sc.(ABT)/M. Tech.	82	56	138
Ph.D.	11	24	35
Diploma in Veterinary Science & Animal Health Technology (Veterinary Polytechnic Kaljharani)	88	02	90
Grand Total	**352**	**209**	**561**

College of Veterinary Science

The total number of students admitted in the College of Veterinary Science for the session 2019-20 was 233 which included 100 in B.V.Sc. and A.H., 108 in M.V.Sc. / M.Sc. and 25 in Ph.D. program. During the period under report 175 students passed out from the college which included 71 under graduate students, 89 M.V.Sc. students and 15 Ph. D scholars.

Courses taught

The undergraduate students of the college were offered courses as per the course curriculum of Veterinary Council of India. The 1st, 2nd and 3rd professional B.V.Sc. & A.H. students were offered courses as per Veterinary Council of India – Minimum Standards of Veterinary Education Degree Course (B.V.Sc & A.H.) Regulations, 2016 whereas 3rd , 4th and 5th professional B.V.Sc. & A.H. students were offered courses as per Veterinary Council of India – Minimum Standards of Veterinary Education Degree Course (B.V.Sc & A.H.) regulations, 2008. The 3rd ,4th and 5th year students were offered 22 courses in the Semester I and 16 courses in Semester II as per VCI regulations-2008 whereas first , second and third year students were offered 15 courses according to the VCI regulations-2016. Postgraduate students were offered courses in their respective major, minor and supporting fields as approved by the Dean, Post graduate studies.

Scholarships / Fellowships

The university awards merit scholarships to students for academic excellence. During 2019-20, university merit scholarship was given to 50 undergraduate, 34 Master's and 17 Ph.D. students. Eight undergraduate students admitted through an all India entrance examination were awarded National Talent Scholarship whereas 49 postgraduate students received National Talent Scholarship. Dr G S Khush Foundation Scholarship was received by 6 undergraduate students. Junior Research Fellowship of ICAR was awarded to 2 M.V.Sc students and India Afghanistan fellowship was received by one M.V.Sc. student. ICAR-Senior Research Fellowship was awarded to 3 Ph.D. students. ICMR-JRF was received by one Ph.D. student. Three Ph.D. students received India- Africa Fellowship.

Internship

Eighty seven (87) students of B.V.Sc. & A.H. 2015 batch were registered for internship programme. Students underwent clinical and practical training in 6 departments (Veterinary Medicine, Animal Disease Research Centre, Veterinary Surgery and Radiology, Veterinary Gynaecology and Obstetrics, Directorate of Livestock Farms, and Veterinary Pathology and Teaching Veterinary Clinical Complex) for a period of 6 months.

Teaching Veterinary Clinical Complex

The college has a well-established teaching Veterinary Clinical Complex. The complex has a Primary Unit and specialized unit to treat large animals. New Multispecialty Veterinary Hospital has been established for small animals with state of the art facilities. The hospital has the facility for indoor wards for small and large animals and separate rooms for the attendants. The hospital is being supported by clinical diagnostic laboratory and radiographic unit.

Clinical cases registered and clinical samples tested in the hospital from April 2019 to March 2020

Clinical cases registered		**Clinical samples tested**	
Small animals	25929	Pathology	11063
Large animals	7189	Parasitology	3963
Total	33118	Biochemistry	4477
		Total	19503

All India Study Tour

The compulsory educational tour of 2015 batch of B. V. Sc & A.H students was conducted from 30-12-2019 to 12-01-2020. A total of 96 students, including 70 boys and 26 girls, along with five teachers visited the various institutions of Veterinary Science of eminence in Southern India. The contingent visited Veterinary colleges of Hyderabad, Bengaluru and Mumbai. They also visited Bird sanctuaryBanda, Goa. The students were exposed to the working of various animal health institutions, vaccine institutes, livestock farm etc. It was a learning experience related with not only academics but the students were also exposed to the different cultures, languages, food habits, festivals and other customs of Southern India. Overall the compulsory educational tour was educative in many aspects in real sense.

Theses / Dissertations

Ph. D. (Veterinary and Animal Sciences)

Year	Name of the Student (Major Advisor)	Thesis/Dissertation Title
COVS, Ph.D.		
2019	Arshad Hussain Mir (Dr. V. K. Dumka)	Evaluation of genotoxic and cytotoxic potential of synthetic progestins and its amelioration by *Dalbergia sissoo* and *Calotropis gigantea* leaf extracts.
2019	Rashmi Thakur (Dr. B. B. Singh)	Seroprevalence and molecular detection of *Toxoplasma gondii* in pigs and poultry in Punjab and surrounding areas with special emphasis on its public health and significance.
2019	Atul Singh Parihar (Dr. Navdeep Singh)	Evaluation of echocardiography as diagnostic tool for thoracic affections in bovines.
2019	Rabyia Javed (Dr. Deepti Narang)	Studies on the diagnosis of bovine tuberculosis using fluorescence polarization assay and *in situ* hybridization.
2019	Jasutkar Ravindra Krishnarao (Dr. Rajesh Jindal)	Effect of amla powder *(Emblica officinalis)* supplementation on metabolic profile and reproductive performance of buffaloes in relation to heavy metal exposure with special reference to Ni and Cr
2019	Deepesh Kumar (Dr. S. K. Mahajan)	Comparative evaluation of total intravenous anaesthesia vis a vis inhalation anaesthesia in equine.
2020	Rindhe Sandeep Narayan (Dr. M. K. Chatli)	Bioactive biodegradable films infused with bacteriophages for the extension of storage stability of fibre enriched chicken nuggets.
2020	Nishchal Dutta (Dr. H. S. Banga)	Patho bio-molecular approaches in detection of meat borne pathogens in chicken.
2020	Insha Mir (Dr. Parminder Singh)	Aflatoxin contamination in cattle feed value chain and its impact on milk quality in Punjab.
2020	Kondampati Kasturi Devi (Dr. S.P.S. Saini)	Effect of different anaesthetic protocols on the plasma levels and disposition kinetics of Ampicillin-Cloxacillin combination in horses.
2020	B. Srinu (Dr. J. S. Bedi)	Epidemiological study on the anthropogenic disseminated environmental pollutants in the aquatic ecosystem and their association with antimicrobial resistance emergence.
2020	Deepti Sharma (Dr. J. Mohindroo)	Ultrasonographic evaluation of canine liver and kidney with special reference to shear wave elastography in health and disease.
2020	Nimbalkar Vidya Gajanan (Dr. H. K. Verma)	Adoption and impact of dairy farming technologies in Punjab.
2020	Beenish Qureshi (Dr. S. K. Mahajan)	Studies on application and evaluation of specialised surgical techniques for canine corneal disease with special reference to keratoplasties.
2020	Neelam Tandia (Dr. Navdeep Singh)	Echocardiographic and electrocardiographic studies in bovine suffering from gastrointestinal affections.
COVS, Master's		
2019	Mahesha C (Dr. Arun Anand)	Diagnosis and surgical management of dental and mandibular affections in small animals.

Year	Name of the Student (Major Advisor)	Thesis/Dissertation Title
2019	Ramandeep Singh (Dr. Vandana Sangwan)	"Clinical study on the association of prostate gland affections with perineal hernia in dogs".
2019	Akshita Chadda (Dr. Y. S. Jadoun)	A study on women empowerment through livestock based self help groups (SHGs) in Ludhiana district of Punjab.
2019	Priya (Dr. Mandeep Singla)	Effect of total mixed ration manoeuvre on the performance of beetal kids under stall-fed.
2019	Himasri Das (Dr. Gurpreet Kaur)	Studies on prevalence and molecular characterization of Canine Parvovirus antigen types.
2019	Keshav Kumar (Dr. N. S. Sharma)	Molecular detection of antibiotic resistance genes and virulence genes in *Escherichia coli* isolates from sheep and goat faeces.
2019	Gurkirpal Singh Mago (Dr. Pallavi Verma)	Stabilization of canine femur fracture by static and dynamic intramedullary interlocking nailing.
2019	Omranjit Singh (Dr. D. K. Gupta)	Ultrasonographic evaluation of infected udder and teat disinfection for prevention of mastitis in dairy cows.
2019	Kanchan Arya (Dr. Swaran Singh Randhawa)	Determination of milk somatic cell count in buffaloes and its relation to udder infection and physiological states of production.
2019	Megha G K (Dr. B. B. Singh)	Studies on the risk of *taenia solium* exposure from pork produced in Punjab, India.
2019	Raj Sahoo (Dr. Shashi Nayyar)	Effect of supplementation of fenugreek seeds and probiotic on metabolic profile and milk production in lactating goats during summer season.
2019	Kishor Kumar D. G (Dr. Rajdeep Kaur)	Comparative evaluation of cefquinome in treatment of clinical cases of dystocia in cattle and buffaloes.
2019	Raut Akash Babasaheb (Dr. S.P.S. Saini)	Pharmacokinetics and comparative clinical efficacy of ceftiofur and ampicillin in buffaloes undergoing surgery for diaphragmatic hernia.
2019	Anmoldeep Singh (Dr. Arun Anand)	Clinical studies on the hospital prevalence and surgical management of canine obstructive urolithiasis.
2019	Tejpal Singh (Dr. Ashwani Kumar)	Linear external skeletal fixator for the stabilization of open long bone fracture in dogs.
2019	Darshan M (Dr. Swaran Singh Randhawa)	Evaluation of lower respiratory tract affections in horses.
2019	Supriya G. S (Dr. S. K. Uppal)	Study on renal failure in dogs with emphasis on blood parasites.
2019	Rashmi K R (Dr. Sikh Tejinder Singh)	A study on risk factors and long term effects of bovine calfhood diseases.
2019	Kantale Rushikesh Ambadas (Dr. Wagh Rajesh V.)	Study on antioxidant potential of *Piper betle* and *Spinacia oleracea* leaf extracts in chicken sausages.
2019	Punya Shree H. N (Dr. Nitin Mehta)	Development of thyme essential oil bioactive nanoemulsion for storage stability of pork nuggets.
2019	Navgeet Singh (Dr. Shahbaz Singh Dhindsa)	Studies on conventional and modified estradiol based synchronization methods in relation to postpartum fertility in buffaloes.

Year	Name of the Student (Major Advisor)	Thesis/Dissertation Title
2019	Raja Partap Singh (Dr. Kirti Dua)	Clinico-therapeutic study of ectoparasitic and gut-inhabiting endoparasitic infections in zoo carnivores.
2019	Amanjot Singh (Dr. Saloni Singla)	Physicochemical characterization and pharmacodynamics studies of cefquinome loaded nanoparticle.
2019	Harpreet Singh (Dr. M. K. Lonare)	Toxicological investigation of carbendazim and imidacloprid on mesenchymal stem cells derived from buffalo bone-marrow.
2019	Mahantswamy K Mallikerimath (Dr. S.P.S. Ghuman)	Induction of estrus followed by fixed-time AI as a tool to reduce non-productive period of anestrus buffalo.
2019	Chamadia Bilal (Dr. R. S. Grewal)	Effect of tannin treatment on protein protection of soybean meal and performance of buffalo heifers.
2019	Haneet Kaur (Dr. M. Wadhwa)	Effect of supplementing *Acacia arabica* bark (Babul chall) dry extract in total mixed ration (TMR) on the performance of lactating buffaloes.
2019	Halburge Mayuresh Ashokrao (Dr. M Wadhwa)	Effect of supplementing *Syzygium cumini* (Jamun; Fruit) in total mixed ration (TMR) on the performance of lactating cross bred cows.
2019	Pravin Sharma (Dr. J. S. Lamba)	Nutritional evaluation of *Moringa oleifera* as alternate protein source in goats.
2019	Arashdeep Kaur (Dr. Prahlad Singh)	Effect of organic trace mineral supplementation on postpartum reproduction in primiparous buffaloes.
2019	Guranshpreet Singh Sethi (Dr. V. K. Gandotra)	Clinical evaluation of canine pyometra and its treatment.
2019	Randhir Singh (Dr. S.P.S. Ghuman)	Use of hyaluronidase for hastening cervical dilation in successfully detorted uterine torsion affected buffaloes.
2019	Kuldeep Singh (Dr. J. Mohindroo)	Ultrasonographic evaluation of canine gastrointestinal tract in health and disease.
2019	Ramandeep Kaur (Dr. Navdeep Singh)	Echocardiographic evaluation of effects of Xylazine in dogs undergoing elective procedures.
2019	Vinny Anna Varghese (Dr. Rahul Kumar Udehiya)	Clinical application of adipose derived mesenchymal stem cells for the management of osteoarthritis in dogs.
2019	Shafiullah Kazemi (Dr. Lokesh K. M)	Prevalence and antimicrobial resistance profiling of *Enterococcus* Spp; from meat samples in Punjab, India.
2019	Bhupinder Jit Singh Brar (Dr. H.S. Banga)	Immunohistochemical localization of important meat borne pathogens in chevon.
2019	Gurpreet Kour Tulla (Dr. Raman Narang)	Studies on the estimation of phenotypic, genetic and environmental trends in murrah herd.
2019	Ankita Tiwari (Dr. A.P.S. Sethi)	Nutritional practices adopted by dog owners in South West Punjab.

Year	Name of the Student (Major Advisor)	Thesis/Dissertation Title
2019	Mandeep Kaur (Dr. Jasmine Kaur)	Nutritional evaluation of corn germ meal as an alternate protein source in crossbred calves.
2019	Harmanpreet Kaur (Dr. Opinder Singh)	Histomorphological and histochemical studies on pig spleen.
2019	Kirpal Singh (Dr. Varinder Singh)	Histomorphochemical studies on hepatic architecture of pig.
2019	Navjot Singh Dhillon (Dr. Ranjna S Cheema)	Evaluation of heparin binding proteins in relation to sperm function traits in beetal goat bucks.
2019	Vishnu Velayudhan (Dr. G. S. Dhaliwal)	Risk factors associated with fading puppy syndrome in canines.
2019	Jasmine Kapoor (Dr. H. S. Banga)	Pathological studies on ocular affections in bovine.
2019	Harnoor Singh (Dr. Tarunbir Singh)	Use of arthroscopy for diagnosis and treatment of hind limb arthropathies in bovine.
2019	Teerath Raj Kulaste (Dr. Mudit Chandra)	Development of a multiplex PCR for the identification of antibiotic resistance genes in mastitis causing microorganisms.
2019	Palpreet Singh (Dr. Simrinder Singh Sodhi)	Genetic evaluation of murrah buffaloes for reproductive disorders
2019	Rahul (Dr. Sandeep Sodhi Kakkar)	Effect of *Terminalia arjuna* on antioxidant status, metabolic profile and milk production in lactating goats in summer.
2019	Arham Quraishi (Dr. Paviter Kaur)	Molecular detection of antibiotic resistance genes and virulence genes in *Staphylococcus* spp. isolated from goat milk.
2019	Raman Vohra (Dr. Puneet Malhotra)	Genetic analysis of milk composition and its relation with production traits in murrah buffaloes.
2019	Opinder Singh (Dr. Udeybir Singh)	Nutritional practices adopted by the dog owners in the Central Punjab.
2019	Ishaan (Dr. Sikh Tejinder Singh)	"mmune status and physical performance of buffalo calves fed on fresh or frozen colostrum or colostrum replacer.
2019	Pallavi Chauhan (Dr. Shukriti Sharma)	Studies on blood typing and blood transfusion in dogs.
2019	Deeksha Pandit (Dr. M. S. Bal)	Seroprevalence and spatial distribution of toxoplasmosis in small ruminants of Punjab.
2019	Navpreet Kaur (Dr. N. K. Singh)	Development of multiplex PCR assay for simultaneous detection of various canine tick borne haemoparasites.
2019	Rahuljeet Singh Hundal (Dr. L. D. Singla)	Epidemiology of coccidiosis and therapeutic efficacy of anticoccidial drugs in small ruminants of north Punjab.
2019	Bhavrit Singh (Dr. Wagh Rajesh V.)	Development and storage stability of spent hen chicken sausages incorporated with kiwi fruit by-products.

Year	Name of the Student (Major Advisor)	Thesis/Dissertation Title
2019	Harsimranjeet Singh Sandhu (Dr. O. P. Malav)	Studies on dietary trends followed by dog owners in sub-mountainous zone (Kandi region) of Punjab.
2019	Avantika Sharma (Dr. Kuldip Gupta)	Studies on erythrocytic indices and morphology vis-à-vis disease conditions of dogs.
2019	Gagandeep Kaur (Dr. Amarjit Singh)	Studies on diagnostic and prognostic evaluation of leukocytic alterations in different pathological conditions of dogs.
2019	Harmandeep Singh (Dr. Jaswinder Singh)	A study on dairy farmer's perception and practices in relation to the concept of eco-health in Punjab.
2019	Harmanjeet Singh Sidhu (Dr. S. K. Kansal)	Exploration of pig rearing practices in relation to animal welfare and marketing channels followed by farmers in Punjab.
2019	Marcelo Zinnia Steffanie (Dr. Sujata Turkar)	Study on obesity associated disorders and its nutritional management in canines.
2019	Bhupinder Kaur (Dr. T. S. Rai)	Studies on aflatoxins in milk and feed from cases of reproductive tract disorders in cattle and sheep.
2019	Navdeep Kaur Dhaliwal (Dr. Deepti Narang)	Detection of potential biomarkers in the diagnosis of mycobacterial infections in cattle and buffaloes.
2019	Gurpreet Kaur (Dr. Sandeep Kaswan)	Performance and welfare assessment of beetal goats fed on linear vis-à-vis hexagonal feeders.
2019	Kiranjeet Kaur (Dr. Raj Sukhbir Singh)	Prevalence and clinico-therapeutic studies on canine babesiosis.
2019	Preeti (Dr. Sushma Chhabra)	Studies on prevalence, diagnosis and therapeutic management of pododermatitis in dogs.
2019	Palak (Dr. A. P. S. Brar)	Evaluation of neutrophil indices and morphology vis-à-vis diagnosis and prognosis of important buffalo diseases.
2019	Isha Sekhri (Dr. Mudit Chandra)	Prevalence and pattern of antimicrobial resistance in *Pseudomonas aeruginosa* isolated from mastitic milk.
2019	Jasleen Kaur (Dr. Swaran Singh Randhawa)	Diagnosis and therapeutic management of canine respiratory affections.
2019	Shubham Beri (Dr. Neetu Saini)	Study on systolic and diastolic functions in dogs with congestive heart failure.
2019	Gurleen Kaur (Dr. Gursimran Filia)	Molecular detection of mycobacterium tuberculosis complex and analysis of cytokine profiles associated with bovine tuberculosis.
2019	Inderjeet Singh (Dr. Gursimran Filia)	Ante mortem diagnosis of co-infection of bovine tuberculosis and paratuberculosis.
2019	Rajwent Singh (Dr. A. K. Arora)	Detection of antimicrobial resistance and virulence-associated genes among group B Sterptococci isolate from bovine milk having mastitis.

Year	Name of the Student (Major Advisor)	Thesis/Dissertation Title
2019	Sundus Gazal (Dr. Paviter Kaur)	Characterization and comparative analysis of bacteriophages lytic to Brucella.
2019	Gurjinder Singh (Dr. Gurpreet Singh Sachdeva)	Impact of ground flax seed on *in-vitro* methane mitigation, rumen profile and metabolic status of male buffalo calves.
2019	Harsimran Singh (Dr. R. S. Aulakh)	Assessment of current practices and related risks associated with bovine carcass disposal in Punjab, India.
2019	Kabal Singh Brar (Dr. Ravi Kant Gupta)	Effect of supplementation of *Phyllanthus niruri* L. on the performance of beetal kids.
2019	Harnoor Kaur Dawra (Dr. Ashwani Kumar Sharma)	Epidemiological studies on common equine diseases in Punjab.
2020	Nitika Sharma (Dr. C. S. Randhawa)	Diagnostic evaluation of transtracheal wash, bronchial veolar lavage and ultrasonography in lower respiratory tract affections of cattle.
2020	Sukhwinder Singh (Dr. Rajesh Kasrija)	Training need assessment of goat farmers in Punjab.
2020	Shemsher Singh (Dr. Lokesh K. M)	Assessment of pesticide residues in milk, feed and water samples from dairy farms of Ludhiana, Punjab.
2020	Dhanush G S (Dr. C. K. Singh)	Study on pathological alterations in ganglia of rabid animals.
2020	Hassandeep Singh Sohi (Dr. B. S. Sandhu)	Studies on efficacy of intradermal rabies vaccination in cattle/buffalo.
2020	Dilbagh Singh (Dr. Kirti Dua)	Retrospective study on the diseases and their therapy in felids under captivity.
2020	Rana Partap Singh Brar (Dr. Simarjeet Kaur)	Studies on lactation curve models in Murrah buffaloes at organized herd.
2020	Navjot Kaur (Dr. Manjinder Sharma)	Effect of bio-antioxidants on cryopreservation of buffalo bone marrow derived mesenchymal stem cells.

College of Dairy Science and Technology

During the session 2019-20, the total admissions made in various programs were 83, which included 71 in B.Tech. (Dairy Technology),09 in M.Tech. (Dairy Technology) and 03 in Ph.D. Out of these, 50 were male and 33 were female students. During this period 27 undergraduate and 08 postgraduate students passed out.

Courses Taught

The undergraduate students were offered courses as per the recommendations of 5th Deans' Committee constituted by ICAR, New Delhi. The B. Tech. students were offered 137 credit of teaching courses and 35 credits of Practical training/ Field work. Postgraduate students were offered courses in their respective major, minor and supporting fields as approved by the Dean, Post graduate studies.

Scholarships/Fellowships

University Merit Scholarship was awarded to twenty eight (20) undergraduate and seven (07) postgraduate students. Five (05) undergraduate and two (02) postgraduate students received National Talent Scholarship. Five undergraduate students received Dr G S Khush Foundation Scholarship. Tweleve students received Post Matric Scholarship.

All India Study Tour: At the the end of the course curriculum, students are required to go for a mandatory educational tour to various dairy plants across the country to get valuable knowledge and exposure of dairy sector across the states. The objective is to provide education with quality and excellence to our students promptly and exclusively. Educational Tour of final year (2016 batch) of B.Tech. (DT) was organized from 3rd January to 10th January 2020 under the supervision Dr. Sunil Kumar & Dr Namita Rokana

Theses / Dissertations

Name of the Student (Major Advisor)	Thesis/Dissertation Title
CODST, Master's	
Gagandeep Singh (Dr. S. Sivakumar)	Process optimization for the development and characterization of nanobiocomposite film using nanoparticles.
Harsimran Riar (Dr. Nitika Goel)	Vitamin fortification to yoghurt using nanotechnology based approach.
Irmandeep Kaur (Dr. Rekha Chawala)	Development of vitamin A fortified *Lassi* using natural fruit pulps.
Mukul Sain (Dr. Amandeep Sharma)	Study on development of solar energy based thermal reservoir for milk processing.
Nishant Arora (Dr. Sunil Kumar)	Development and characterization of caseinates as fat replacer.
Charanjit Singh (Dr. Gopika Talwar)	Engineering intervention in mechanization of mozzarella cheese manufacture.
Harpreet Kaur (Dr. Inderpreet Kaur)	A study of value addition of milk at farm level in Punjab state.
Navjot Singh (Dr. Varinder Pal Singh)	Examining the profitability and marketing pattern of various livestock based integrated models in Punjab.

College of Fisheries

Courses offered to UG/PG students

During the session 2019-20, thirty four (34) students were admitted to the various programmes which included 21 students in B.F.Sc., 11 students in M.F.Sc. and 02 student in Ph.D. During this period 19 undergraduate and 05 postgraduate students passed out.

Courses Taught

The undergraduate students were offered courses as per the recommendations of 5th Deans' Committee constituted by ICAR, New Delhi. The B.F.Sc. students were offered 70 courses. Postgraduate students were offered courses in their respective major, minor and supporting fields as approved by the Dean, Post graduate studies.

Scholarships / Fellowships

University Merit Scholarship was awarded to thirteen (13) undergraduate and six (06) postgraduate and two (02) doctorate students. Four (04) undergraduate and two (02) postgraduate students received National Talent Scholarship. Three students received Mata Ind Kaur award and Dr G S Khush Foundation Scholarship.

All India Study Tour:

- Under the Student READY program, all India Study Tour of final year B.F.Sc students (Course No. SR-ST 411) was conducted from 18th October to 4th November, 2019.
- A total of 12 number of students (6 boys+ 6 girls) visited different institutes *viz.* ICAR-Central Institute of Fisheries Education (CIFE) at Mumbai; ICAR-Central Institute of Fisheries Technology (CIFT), Cochin; ICAR-Central Marine Fisheries Research Institute (CMFRI) at

Cochin; CSIR-National Institute of Oceanography (CSIR- NIO) at Cochin; ICAR-Central Institute of Freshwater Aquaculture (CIFA) at Bhubaneswar; Regional center of ICAR-CIFE at Salt lake, Kolkata and ICAR-Central Inland Fisheries Research Institute (CIFRI) Barrackpore, Kolkata.

- Govt. institutes such as Centre for Marine Living Resources and Ecology (CMLRE), Cochin, Ministry of Earth Science, GOI; Marine Products Export Development Authority (MPEDA), Ministry of Commerce and Central Institute of Fisheries Nautical and Engineering Training (CIFNET), Ministry of Agriculture & Farmer's Welfare, GOI at Cochin, Kerala were also visited by students for practical exposure to marine fisheries activities.
- An exposure visit of marine fishing harbor at Cochin was also conducted to provide deep insight of fish landing, identification of various marine fishes (Sharks, Skates, Rays, Tuna, Sail fish, Groupers, Snappers, Mackerel, Sardine, Shrimps, Loligo, Cuttel fish etc.), post- harvest handling of fishes, fishing vessel arrangement and functioning of various navigational equipment's like- Echo-sounder, GPS, wireless radio, etc.



B.F.Sc. Final Year Students on All India Study Tour – 2019

Outside State Study Tour (6-days) of Final Year B.F.Sc Students

- Under the student READY program a short outside State Study Tour of 6 days was conducted for twelve B.F.Sc. final year students of College of Fisheries, from 9th to 14th December, 2019, with an objective to provide extensive practical exposure to graduating students in cold water fisheries.

- During this educational tour, the students visited Directorate of Coldwater Fisheries Research (ICAR-DCFR), Bhimtal, Uttarakhand, where students attended expert lectures on mahseer and trout breeding and visited various laboratories (Diagnostic virology lab, Diagnostic labs, Aquaculture lab, Nutrition lab, Geo-informatics lab, Molecular biochemistry lab, Molecular genetics lab) to understand various research activities for conservation of cold water fisheries.
- Students also visited the aquarium unit, museum, re-circulatory aquaculture system (RAS) and mahseer hatchery of the directorate, besides having an interactive session with the Director of DCFR.

Theses / Dissertation

Year	Name of the Student (Major Advisor)	Thesis/Dissertation Title
COF, Ph.D.		
2019	Abhishek Srivastava (Dr. Meera D Ansal)	Effect of ashwagandha (*Withania somnifera*) root powder and amla (*Phyllanthus emblica*) fruit powder supplemented feeds on survival, growth, health and brood stock development of an Indian major carp, *Labeo rohita* (HAM).
2019	Prem Kumar (Dr. Vaneet Inder Kaur)	Identification and standardization of probiotic culture and its impact on growth performance of Indian Major Carp, *Labeo rohita* (HAM) with or without prebiotic supplementation.
2020	Harsimranjit Kaur (Dr. Meera D Ansal)	Effect of garlic (*Allium sativum*) and aloe (*Aloe vera*) supplemented feeds on survival, growth, health, flesh quality and brood stock development of Indian major carp, *Labeo rohita* (HAM).
COF, Master's		
2019	Amandeep Kaur (Dr. Vaneet Inder Kaur)	Effect of turmeric, *curcuma longa* (Linn) supplemented diets on growth performance and health status of Indian major carp, rohu, *labeo rohita*(Ham)
2019	Sumeet Rai (Dr. Anuj Tyagi)	Isolation and characterization of *Aeromonas hydrophila* lytic bacteriophages from aquatic environment.

College of Animal Biotechnology

The School of Animal Biotechnology, established in February, 2008 was upgraded to College of Animal Biotechnology and entrusted with the following broad mandates:

- To undertake teaching and training in various facets of animal biotechnology
- To generate scientific expertise and human resource
- To develop specialized and state of the art facilities for research in cutting edge fields of biotechnology

Academics and Teaching:

Total number of students admitted for the session 2019-20 was 40 which included 24 students in B.Tech (Biotechnology), 10 students in M.V.Sc. / M.Sc. and 5 in Ph.D. programs. During this year 04 students successfully completed their Master's program and 02 students completed their doctorate programme. A total of 29 courses were offered during the year which included 17 courses for UG, 08 for Master's and 04 course for PhD students.

Scholarships / Fellowships

University Merit Scholarship was awarded to three postgraduate and two doctorate students.

Theses / Dissertations

Ph.D. (Animal Biotechnology)

Year	Name of the Student (Major Advisor)	Thesis/Dissertation Title
COABT, Ph.D.		
2019	Tajeshwar Preet Kaur (Dr. Ramneek)	Effects of xanthosine on goat mammary glands in relation to histology, alveolar cell differentiation, mammary stem cells and gene expression.
2019	Mohan Jairath (Dr Dipak Deka)	Molecular detection and development of porcine circovirus (PCV2) virus-like particles as potential vaccine candidate.
COABT, Master's		
2019	Beakal Mindaye Tadesse (Dr. J. S. Arora)	Studies on polymorphism of fecundity genes in goat.
2019	Astha Sharma (Dr. B.V. Sunil Kumar)	Association of small heat shock protein (HSPBI) expression with age at sexual maturity in layer chicken under heat stress.
2019	Princepal Singh (Dr. Satparkash Singh)	Expression analysis of serum amyloid –A (SAA) mRNA in chicken and quails in response to bacterial stress.
2019	Manpreet Kaur (Dr. Neeraj Kumar Singh)	Molecular Characterization of structural genes of classical swine fever virus (CSFV).

Leptospira Laboratory

Ph.D. student receiving International travel support award during International conference of American Association of Veterinary Anatomists at Banff, Canada

Veterinary Polytechnic Kaljharani, Bathinda

GADVASU established Veterinary Polytechnic & Regional Research and Training Centre (VP & RRTC) at Village Kaljharani, District Bathinda in the year 2010. Veterinary Polytechnic was established to impart education in Diploma in Veterinary Science and Animal Health Technology to support the veterinary services through trained para-veterinary staff. The trainees after completing diploma course shall be able to coordinate and work under the supervision of registered veterinary practitioners to provide better healthcare to animals in Veterinary Hospitals, Veterinary Colleges, Research and Training Institutes, Cooperative Sector and Non-Government Organizations. Majority of pass out students have been appointed in the Department of Animal Husbandry, Cooperative Sector, GADVASU, Private sector and some Non-Government Organizations. Post Matric Scholarship of Punjab State Govt. for SC/BC/OBC and Minority students was given to eligible students.

RESEARCH

Undertaking need based research on different aspects related to production and health of various livestock species, poultry and fisheries forms an integral part of the mandate of the university. During the year 2019-20, a total of 71 research project proposals were submitted to various funding agencies, viz. Department of Biotechnology, Department of Science and Technology including SERB, Indian Council of Agricultural Research, Central Council for Research in Ayurvedic Sciences, NABARD and others.

During the year 2019-20, a total of 146 research schemes were operational in the university as detailed below:

Non-Plan	54
ICAR	21
DBT	20
DST	07
SERB	06

Revolving Fund	15
RKVY	06
Miscellaneous & Others	17
Total	**146**

Research Highlights

A. College of Veterinary Science

1. Livestock Farms

(i) Cattle Breeding: The Crossbreeding Project for the genetic improvement of cattle maintained at Dairy Farm of GADVASU showed an upward trend in all the milk production traits. The average 305-day milk yield and peak yield were recorded at 5448 kg and 25.8 kg, respectively. The average 305-day milk yield and complete lactation yield of the elite herd being used for the production of future crossbred bulls was 6472 kg and 7178 kg, respectively. The maximum lactation milk yield of a crossbred cow was found to be 10373 kg. The average age at first calving in crossbred cattle is achieved to 26.6 months. The 5 breeding bulls/male calves, 37778 doses of crossbred cattle semen (36555 frozen and 1223 liquid) and 7045 doses of Sahiwal Cattle semen were supplied to the Gaushalas, farmers and other dairy development agencies of the state during last year.

Cattle- Field Progeny Testing: Directorate of Livestock Farms, GADVASU, Ludhiana is one of the centers in the country to conduct All India Coordinated Research Project (AICRP) on a field progeny testing program of crossbred cattle. The project is running with the collaboration of the Indian Council of Agricultural Research (ICAR) Institute, viz; Central Institute for Research on Cattle, Meerut. Since the inception of the project (1994), a total of 154508 AIs have been done using 332 test bulls with an average conception of 44%. A total of 124 villages have been covered by 32 AI centers in Ludhiana under the project. During the year (2019-20) a total of 6225 AIs have been done using 41 test bulls, and conception rate was 48%. Under the project, 1813 successful calvings were recorded out of which 897 female progenies were registered in the database for future performance recording. The average first lactation 305 days milk yields of the crossbred progenies in the adopted villages increased from about 3000 Kg in the year 2006 to 3787kg in 2019 by supplying high-quality semen of test bulls (about 25% improvement). The project has helped to lower the age at first calving of the crossbred animal in the area from 1191 days to 833 days (30% improvement since inception). The Field Progeny Testing Project has a major contribution in changing the scenario of dairy farming in the adopted villages in Ludhiana district by providing technical knowhow, germplasm and motivation to farmers. The supply of high pedigreed male calves, semen of high genetic potential test bulls and progeny tested bulls to the

farmers in the villages adopted under the Field Progeny Testing Project has helped in improving their economic level. The improvement in both milk production as well as age at first calving is found to be highest in the field operational area of GADVASU among all Field Progeny Testing centers in the country for crossbred cattle. Under SC-SP head of the projects, 200 farmers have been benefitted.

(ii) Buffalo Breeding

(a) Murrah: The genetic improvement of buffaloes is being done through progeny testing of bulls. The All India Coordinated Research Project (AICRP) on Buffalo breeding is in operation at this center since 1971. The best buffalo bulls are selected based on performance of daughters produced at GADVASU Ludhiana; NDRI Karnal; CIRB Hisar; CCS HAU Hisar and IVRI Izzatnagar and in the villages around Hisar, Ludhiana and Karnal.

The average 305-day milk yield of the general herd of buffaloes was 2841 kg with a lactation milk yield of 2937 kg. The average 305-day milk yield, complete lactation milk yield and peak yield of elite herd, which is used for the production of future young sires were 3497 kg, 3669 kg and 18.3 kg, respectively. The maximum 305 day milk yield and day peak yield for individual animal were recorded as 3602 kg and 22.8 kg, respectively in the herd.

Bull no. M 2234 and M 2269 from this center ranked 1st and 2nd, respectively at the national level among all the progeny tested bulls in the set no. 13. In the current set (18th), 04 buffalo bulls were selected for progeny evaluation at the National level under the Network Project on Buffalo Improvement. A total of 53369 semen (52268 frozen and 1101 liquid) doses were supplied to the farmers and other dairy development agencies for the improvement of Murrah buffalo population in the state. The 37 buffalo breeding bulls/bull calves were also made available.

Frozen semen of test bulls was provided to 28 AI Centers covering 110 villages adopted under the Field Progeny Testing Programme of Network project on Buffalo Improvement (Murrah), and the daughters born were ear-tagged for future recording of their milk production. During 2019-20, 8690 AIs with 4307 (49.6%) conceptions were undertaken. A total of 3235 calvings with 1555 female calves occurred.

(b) Nili Ravi: Nili Ravi breed of buffalo is considered to be one of the major milch breeds of Asia. Under the ongoing conservation plans adopted by Ministry of Animal Husbandry and Dairying, Govt. of India, the Nili Ravi breed has been earmarked for Punjab. Under the ongoing conservation and improvement project on Nili Ravi Buffaloes, Nili Ravi animals were procured from their native breeding tracts. These animals are being maintained and worked for up-gradation and genetic improvement. Present herd strength of Nili Ravi Buffaloes is 138 with 98 breed-able

buffaloes. The average 305 day and complete lactation milk yields were 2477 kg and 2594 kg, respectively. Nili Ravi buffalo (No. 2873) produced 3871.2 kg milk in 305 d lactation length with a peak yield of 20.5kg, which is comparable to the best yield of any of the buffalo breeds. Dissemination of germplasm being one of the foremost priorities. During the year, 22 breeding bull/bull calves and 12722 semen doses were supplied for the improvement of Nili Ravi buffalo population in state.

(iii) ETT

During the period under report, ovum pickup (OPU) based *in vitro* embryo production facilities were strengthened and used for the propagation of Sahiwal cows as per the mandate of DADF, GOI. Under this, a total 30 OPU sessions were conducted, 421 cumulus-oocyte complexes (COCs) were retrieved, 281 were subjected to *in vitro* maturation (IVM), *in vitro* fertilization (IVF) and *in vitro* culture (IVC) resulting in the production of 12 blastocysts. In addition, 65 transferable embryos were produced by conventional superovulation and embryo collection. A total of 8 *in vitro* produced and 35 *in vivo* produced embryos were transferred to the synchronized recipients and 12 pregnancies were established. The remaining embryos were frozen for future use.

(iv) Poultry

(a) Broiler Breeding: Directorate of Livestock Farms, GADVASU, and Ludhiana is one of the centers in the country for All India Coordinated Research Project (AICRP) on Poultry breeding. Under the project the coloured broiler (IBL-80) has been developed at the University. It has the potential to attain average 6-week body weight of 1700g with a feed efficiency of 1.9 and the mortality of less than five percent. During the current year, 94,699 number of broiler germplasms have been supplied benefitting 450 farmers from across the Punjab state. The farm has also collected Punjab Brown local germplasm from Gurdaspur district of the state and is focusing on its conservation and improvement through genetic selection.

PB2 Male

PB2 Female

(b) Layer Breeding: At the Poultry Research Farm, two colored layer breeds, namely Rhode Island Red (RIR) and Punjab Red have been maintained as parent stock. The RIR stock was introduced by procuring hatching eggs from CARI, Izatnagar and CPDO, Chandigarh and Bhuvneshwar in 2001-02. Punjab Red layer poultry stock for the production of brown shelled eggs has been developed. The efforts were made to increase the population size of the stock at directorate and to popularize the stock among farmers and government agencies. During the current year (2019-20), a total of 93265 nos. of layer germplasm have been supplied which included 65905-day old chicks, 21280 hatching eggs and 3285 adult breeding birds. Under the layer breeding, indigenous poultry breeds like Kadaknath, Desi cross are also maintained for the desi egg production and for crossbreeding program to enhance immunity and hardiness of commercial birds.

Brooding of layer chicks

Grower bird (Punjab red)

(c) Quail Breeding: Average five week bodyweight of the commercial crosses is about 192 g. A strain of quails with white plumage has also been developed under the name "Punjab White Quail". The average egg weight is about 13g and these eggs are used for preparation of pickles. Quails are less susceptible to common diseases of poultry and need no vaccination against common poultry diseases as in other poultry species. The university supplies quail eggs and 5-week old birds. During the year, 4850 chicks and 1721 adult birds were supplied. Quail section of the directorate of Livestock farms is developing facilities to impart training on quail husbandry.

2. Animal Genetics and Breeding

Analysis of 618 calving records of 459 Murrah buffaloes with reproductive problems from 2007-2018 showed overall incidence of dystocia, retention of placenta (ROP), anestrus, repeat breeding (RB), postpartum abnormal discharge (PPAD) and abortion as 0.9, 0.3, 3.3, 9.3, 12.3, 13.3 and 6.2 percent, respectively. The heritability estimates for dystocia, ROP, anestrus, RB, abortion and PPAD were 0.04, 0.10, 0.05, 0.074, 0.085 and 0.121, respectively. A high relation was found between the occurrence of abortion and ROP (rank correlation 0.99±0.02). The Powell and Freeman's method was found better for genetic trend estimation.

Studies on lactation in Murrah buffaloes showed that the fat percentage had a high heritability value of 0.587±0.166 which shared a high negative genetic correlation with milk yiled as -0.990±281. The milk Fat globule (MFG) size was found to be significantly smaller uring mid lactation compared to early and late lactation stages. The Polynomial Regression Function (PRF) was found to be most suitable lactation curve model to describe 305 days lactation.

3. Animal Nutrition

(i) Feed samples from starch and distillery industry, fruit and vegetable processing industry were evaluated and their inclusions in dog feeds through *in-vitro* analysis were assessed. These can be used as dog feed ingredients to economize the feed cost.

(ii) Management of obesity through nutritional interventions showed significant improvement in body condition score of dogs. Body weight of dogs reduced by 9 per cent without affecting the hematological or biochemical parameters. High protein and high fiber formulated diets helped in managing the obesity.

(iii) *In vitro* studies were carried out to investigate the effect of dried distillers grains with solubles (cereal milling by-product) as a substitute for soybean meal (SBM) in the diet of buffaloes. SBM comprising 6% of the whole diet (total mixed ration; TMR) was substituted by rice dried distillers' grains with solubles (RDDGS). RDDGS substitution at 25, 50 and 75%

significantly increased *in vitro* dry matter disappearance and organic matter disappearance. The NH_3-N decreased with the increasing level of RDDGS in the TMRs. The relative proportion (%) of acetate declined and that of propionate increased with the increasing level of RDDGS in the TMRs and subsequently the A: P ratio declined with RDDGS inclusion beyond 25% level replacing SBM in the TMR. No significant effect of RDDGS inclusion was observed on methane production. The fermentation efficiency increased with the increasing level of RDDGS in TMRs. In conclusion, RDDGS could replace up to 75% of the soybean meal in the TMR of buffaloes which is equivalent to 4.5% of the whole dietary DM.

(iv) Effects of dietary supplementation of Amla fruit (Indian gooseberry) pomace (EFP), a waste from fruit processing plants and rich in polyphenolic compounds were investigated for ruminal fermentation, nutrient utilization, methane production, and milk production performance in buffaloes. An *in vitro* experiment was conducted using 0 to 50 g/kg of EFP (six treatments) to select an optimum dose for feeding of buffaloes. Organic matter (OM) degradability, total volatile fatty acid concentration and acetate proportion decreased, but propionate proportion increased at the higher doses (> 30g/kg). Methane production also decreased at the higher doses (≥ 20 g/kg). In the *in vivo* study, 10 lactating buffaloes were randomly allotted into control and EFP groups (n = 5/group). The control group was fed a total mixed ration, whereas the EFP group was fed the control ration along with EFP at 20 g/kg of dry matter (DM) intake for 120 days. This study revealed that feeding of EFP at 20 g/kg DM intake increases milk production and decreases methane production and intensity without impacting health of buffaloes and FA profiles of milk.

(v) This study was conducted to explore the nutritional potential of different varieties of sugarcane tops silages 3 enriched with molasses or bacterial inoculants as unconventional feed resource. Tops of four sugarcane varieties 4 i.e. Co 118, CoJ 88, CoPb 93 and CoPb 92 recommended for cultivation in India for cultivation were collected and evaluated for their chemical composition. Results revealed that molasses-based sugarcane tops silages had overall good ensiling potential as compared to bacterial treated silages. The molasses-based silages with sugarcane tops variety CoPb 92 followed by variety CoPb 93 have higher potential as unconventional feed resource for livestock.

4. Livestock Production Management

(i) Standardization of Breeding and Management Practices to Improve Beetal Goat Production in Punjab

(a) Effect of hay based and fresh fodder based total mixed ration (TMR) feeding on the performance of Beetal kids under stall-fed conditions: Final body weight was higher in hay and fresh fodder based TMR fed kids by 17.30% and 5.81%, respectively over the control group under conventional feeding system, though not differed significantly. The hay and fresh fodder based TMR feeding also improved the daily average body weight gain along with significant higher average dry matter (g/kg LBW) intake, feed conversion ration and protein efficiency ratio. Variations in haematological, biochemical indicators and faecal parasitic load of kids enrolled under the different treatment groups were within physiological limits, indicating no harmful effect of TMR feeding. Total mixed ration/complete diet feeding (hay based) improved the performance of kids under stall-fed conditions.

(b) Effect of feeder type on performance of Beetal goats under stall-fed conditions: Beetal does and bucks had much improved welfare and marginally better performance indicators at linear feeder than hexagonal feeder. Negative impact of regrouping or mixing also diminished earlier at linear feeder than hexagonal feeder in both sexes though intensity was lower in bucks. Injuries were relatively more at hexagonal feeder than linear feeder after mixing of goats. Wastage of feed was also marginally lesser at linear feeder. Oral supplementation of *Phyllanthus niruri* L. in Beetal kids accelerated the ruminal activity by enhancing the ruminal microflora and fermentative activity. On the basis of above findings, a long linear feeder has been designed and fabricated to suit the needs of goats. It will be convenient to handle, labour efficient and will reduce wastage of feed. It will also satisfy behavioural needs of goats under stall-fed system. Such feeder will increase profitability of the goat farmers rearing goats under stall-fed system.

5. Livestock Products Technology

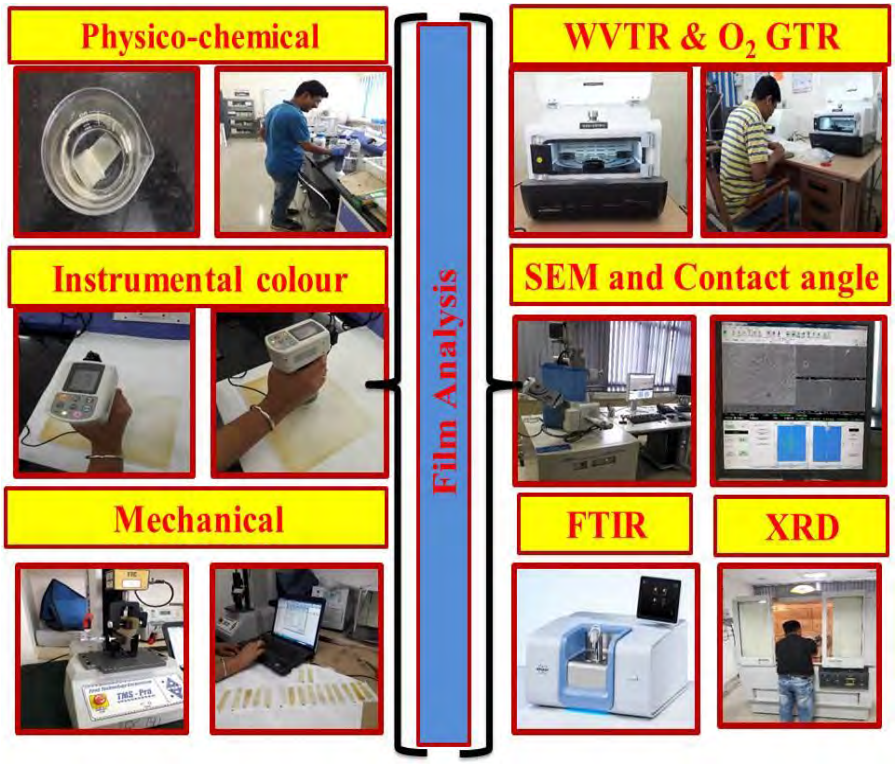
(i) Nano and Micro Encapsulation of natural bioactive compounds for the enhancement of preservative and processing functionality of meat products: Various natural agents like essential oils, plant extracts, etc. had been encapsulated in polymer matrices ensuring their protection from thermal degradation and controlled release. Thereafter, they were incorporated in meat products at optimum levels and it was found that these encapsulated agents were able to control oxidative, sensory and microbial deterioration much better than crude forms for a sustained period of time. It ensures utilization of these natural agents in lower doses due to encapsulation without any detrimental effect on sensory properties.

(ii) Development of biodegradable biocomposite films: Critical environmental concerns entailed by petroleum derived conventional plastics have posed serious challenges due to their non-biodegradable nature. Hence, utilization of various biodegradable materials prepared from agriculture by products, marine and food industry waste are the preferable choice for development of environmental friendly packaging solutions. Various natural sources viz. gelatin, starch, whey protein concentrate, etc. had been used for development of packaging films. In addition, incorporation of various antioxidant and antimicrobial compounds in these films for extension of shelf life of livestock products had also been tried. Even, coliphages were isolated and incorporated in biodegradable films and they were found to be effective in increasing shelf life of meat products. Silver and titanium nanoparticles (NP) had been developed and its incorporation in biodegradable films has also been studied. It was found that these NP favorably affected the biodynamic characteristics of films and also led to the extension of shelf life of meat products wrapped in them.

(iii) Development of pet foods utilizing slaughter industry byproducts: Various slaughter industry byproducts like liver, heart etc. have been utilized efficiently for the development of pet foods. Their acceptability studies have also been carried out and it was found that they were at par with the commercial formulations available and above all, the cost of production of these pet foods was far lesser than one available in markets. This is a promising area for utilization of animal industry byproducts which has a vast scope for entrepreneurship development with a push to environmental sustainability.

(iv) Extension of storage life of functional meat products: Various bioactive phytoextracts viz. extract of cinnamon, mulethi, oregano, pineapple leaves, arjuna tree bark, watermelon rind powder, etc. have been developed for incorporation in meat products and thereby extension of storage life of functional meat products (chevon rolls, chevon nuggets and patties, pork patties). Various time-temperature combinations and solvent concentrations (organic and inorganic) were standardized for extraction of phytochemicals and they were added in meat products at suitable levels after sensory evaluation and then their storage stability studies were conducted. It was found that incorporation of these phytoextracts exert a significant positive effect in extending shelf life of meat products without compromising sensory properties.

(v) Poultry Processing Plant under Public Private Partnership Mode: A Poultry Processing Plant with an industrial partner is under operation at GADVASU. It helps in imparting industrial exposure to both Undergraduate & Post Graduate students along with practical training of the farmers and budding entrepreneurs. This project has been initiated as Revenue Generation Model for training of the farmers/students for quality harvesting of poultry meat and processing of these products for value addition. Further, interested partners may see it as a window to scale up their developed technologies.



6. Veterinary Gynaecology and Obstetrics

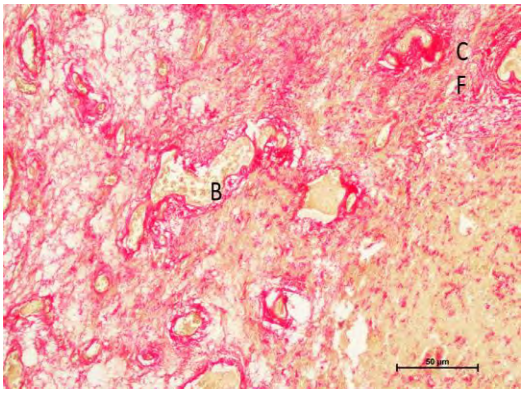
(i) Evaluation of ovarian and fertility responses: A comparison of pregnant and non pregnant buffaloes revealed large sized dominant follicle in pregnant ones on the day of FTAI. An ovulatory response of 100 and 80% following 0 day GnRH administration was observed whereas 96 and 80% buffaloes ovulated following EB injection with a corresponding conception rate of 58.33 and 45%. A non-significantly higher conception rate was achieved by incorporating G6G presynchronization strategy prior to Heatsynch.

(ii) Fertility of Beetal bucks in relation to heparin binding proteins: The qualitative and quantitative traits of spermatozoa and association of these traits with fertility of the beetal bucks were assessed. Percentage of bucks for normal values for volume, sperm concentration, individual motility and viability was enhanced to 100%, 92.9%, 50% and 85.71% during winter indicating an improvement in the semen quality during winter in comparison to summer. The dose of 150 µg SP-HBP was found most effective dose for *in vitro* capacitation and acrosome reaction.

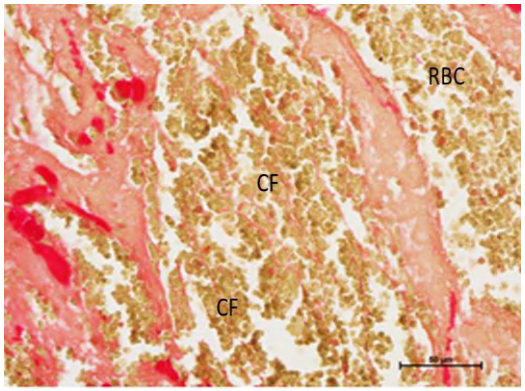
(ii) Effect of peripartum organic zinc and copper supplementation on blood metabolic and hormonal profiling of primiparous buffaloes: Supplementation of organic trace minerals significantly improved the total protein and non-esterified fatty acid levels in blood thus helps in proper mobilisation and utilisation of body reserves but it did not affect the blood hormonal profile significantly.

(iii) Retrospective and prospective analysis of risk factors associated with Fading Puppy Syndrome: The results revealed that majority (71.42%) of the small breeds experienced FPS belonged to second parity or more. In case of large breeds, majority (57.15%) of the bitches experienced FPS in their first parity. Timely deworming and vaccination may decrease the risk of FPS. Abdominal bulging and fetal asphyxia were the major symptoms warranting fetal death.

(iv) Use of hyaluronidase for hastening the cervical dilatation in successfully detorted uternine torsion affected buffaloes: The impact of intracervical hyaluronidase revealed that the time taken from the occurrence of uterine torsion to complete cervical dilatation was significantly high in control buffaloes as compared to hyaluronidase-treated buffaloes. Hyaluronidase treatment helps in shortening the interval between detorsion of a buffalo to complete cervical dilatation. It increases the survivability of foetuses.



Parafin section of cervix (Non dilated) showing Propria submucosa with closely placed and darkly stained collagen fibres (CF) and blood vessels (BV). Picrosirius Red; magnification ×400



Parafin section of cervix (Hyaluronidase-complete dilated) showing propria submucosa with distantly placed collagen fibres (cf), haemorrhages (RBCs) and congested blood vessels. Picrosirius Red; magnification ×400

(v) Effect of flaxseed supplementation on metabolic profile and reproductive performance of prepubertal gilts: The study revealed that bodyweight and daily BW gain were more in gilts fed 1.0% flaxseed on DM basis. Gilts supplemented 1.0% flaxseed attained puberty and expressed estrus at breeding significantly earlier than in their contemporary mates. Supplementing flaxseed (1.0%) in diet improved body composition variables, age at onset of puberty and reproduction in prepubertal gilts.

(vi) Incidence of physio-pathological reproductive issues in canines: Among pathological conditions (27.04%), transmissible venereal tumor (TVT) in male and female dogs was major pathological problem (9.6%) followed by pyometra (7.69%) and vaginal hyperplasia (3.13%). Out of diseases of gestation and parturition, dystocia (32.6%) was the major reproductive issue warranting attention of the owners and professionals.

(vii) Effects of intra-uterine infusion of proteolytic enzymes on cytokines and uterine inflammation in subclinical endometritic (SCE) buffaloes: Buffaloes with SCE had greater uterine concentrations of interleukin (IL)-1β, IL-8 and tumor necrosis factor (TNF)-α; but lesser IL-10 than negative control (NC) group on 21 and 28 dpp. The results indicated a reduction in endometrial inflammation and days nonpregnant after proteolytic enzyme treatment in buffaloes with subclinical endometritis.

(viii) Efficacy of Intrauterine Hydrogen Peroxide and Povidone Iodine Administration to Treat Endometritic Mares: On the basis of three intrauterine treatments, post-treatment cure rates based on clear vaginal mucus were 60%, 80% and 40% in Group I (0.5% povidone iodine intrauterine), II (3%, 60 ml hydrogen peroxide) and III (normal saline intrauterine), respectively. The conception rates were higher in Group I and II versus Group III (55.5%, 66.6% vs 50%, respectively). The intrauterine hydrogen peroxide and povidone iodine treatment proved beneficial to treat endometritic mares.

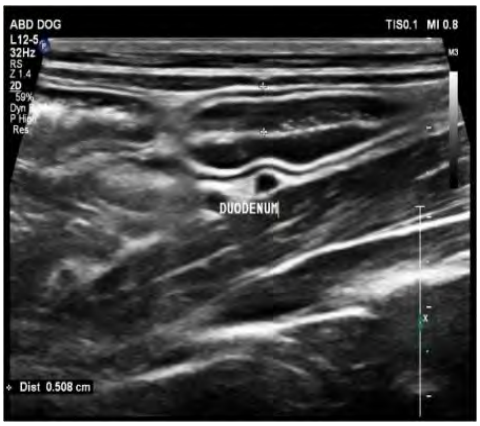
(ix) Estrus Induction by Hormonal and Nutritional Approaches in Canines: Twenty female dogs of different breeds were subjected to hormonal (eCG @ 5 IU/kg daily for 10 days followed by hCG 500 IU intramuscularly on day 11) and nutritional treatments (tab Nutrich @ one tab daily for 15 days and tab Evion LC @ 1 tab daily for 15 days one month before start of breeding season). Following treatment, five and four animals conceived, respectively.

(x) *In vitro* evaluation of cryopreserved dog spermatozoa using Tris-citric acid-fructose buffer and different cryoprotectants: Different combinations of penetrating intracellular CPAs, i.e., glycerol (G), ethylene glycol (EG), propylene glycol (PG), dimethyl formamide (DM), and methyl acetamide (MA) and extracellular [egg yolk (EY), egg yolk plasma (EYP), low-density lipoproteins (LDL), and coconut water (CW)] in Tris-citric acid-fructose buffer (T) for Labrador dog semen cryopreservation were compared. Glycerol at a concentration of 7% in TEY and 4 h ET were optimum for successful canine semen cryopreservation.

7. Veterinary Surgery and Radiology

(i) Ultrasonographic evaluation of gastrointestinal tract in healthy and diseased canine: The morphometry of various segments of GIT in different age groups was established in dogs. Wall thickness and wall layering were important criteria for diagnosis of various GIT disorders. Ultrasonography had high specificity and sensitivity in diagnosis of various GIT affections in dogs.

Normal fundus in dog

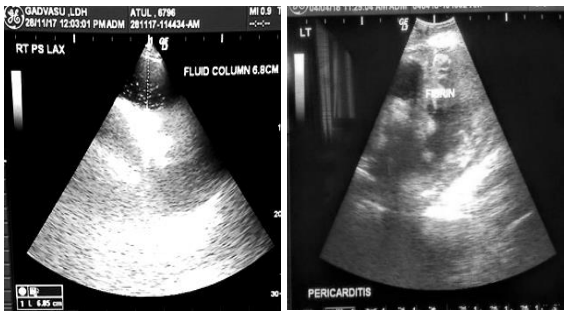


Healthy duodenum with all 4 layers

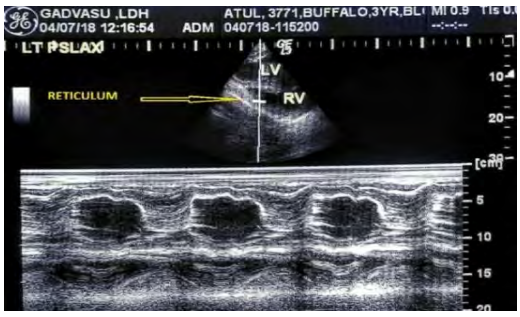
USG of gastric Foreign Body

Gastric Foreign Body

(ii) Echocardiographic studies in diseased conditions in bovine: The left ventricle dimensions were significantly decreased in cattle and buffalo affected with DH. The End Diastole Volume and Stroke Volume were significantly decreased in cattle and buffalo affected with pericarditis and DH. The ECG and Echocardiography collectively can be helpful in early diagnosis of pericarditis in bovine. No functional change was seen in bovine affected with DH and pleural effusions.



B-Mode ultrasonography in pericarditis

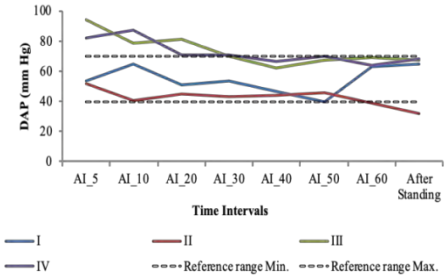


Echocardiography in diaphragmatic hernia Buffaloes

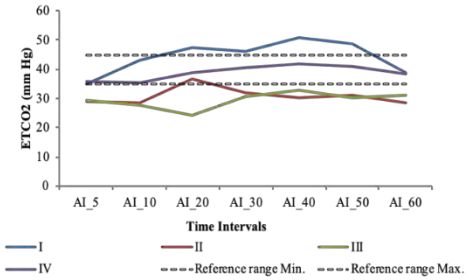
(iii) Echocardiographic and Electrocardiographic studies in bovines suffering from gastrointestinal affections: LVIDd, PVIDs, EDV, ESV, SV and CO were significantly decreased in DH buffaloes. There was significant increase in FS of DH buffaloes. No structural and functional changes of heart were detected in cases of peritonitis and intestinal

obstruction in both cattle and buffaloes. There is delayed QRS complex along with increased duration of T wave in ECG of buffaloes and cattle affected with DH.

(iv) **Comparative evaluation of total intravenous anesthesia (TIVA) vis a vis inhalation anesthesia in equine:** Better anesthetic maintenance was seen in Isoflurane groups as compared to TIVA groups but better recovery parameters were observed in TIVA groups. TIVA was found to be efficacious with minimal cardiopulmonary, hemodynamic, haemato-biochemical effects on surgical equine patients. Overall quality of recovery was good to excellent with TIVA protocols. Continuous rate of infusion of either xylazine (1mg/kg/hour) or dexmedetomidine (7µg/kg/hour) in combination with midazolam (1mg/kg/hour) and ketamine (4mg/kg/hour) as TIVA is recommended for achieving and maintaining a surgical plane of anaesthesia for procedure up to 1 hour. All the drug combinations are suitable to maintain anaesthesia, with good cardiovascular and good to excellent recovery conditions in clinical cases.

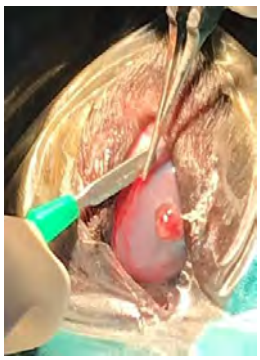


Arterial blood pressure



$EtCO_2$

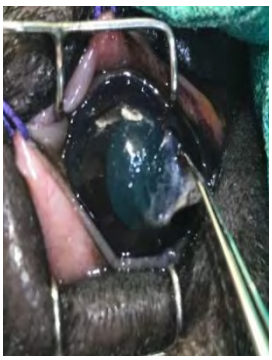
(v) **Application and evaluation of specialised surgical techniques for canine corneal disease with special reference to keratoplasties:** Autogenous sliding lamellar keratoplasty was easy and effective technique for management of corneal defects in terms of restoration of vision and tectonic outcome. Homologous keratoplasty was found effective for tectonic outcome. Full thickness keratoplasty resulted in good tectonic outcome. Superficial keratectomy was found to be easy and less time consuming for management of pigmentary keratitis in dogs. Conjunctival pedicle grafting was found to be effective for the repair of descemetocele and ulcers.



Partial laminar keratoplasty for ulcer

Placement of superficial cornea on ulcer

Removal of superficial cornea with beaver

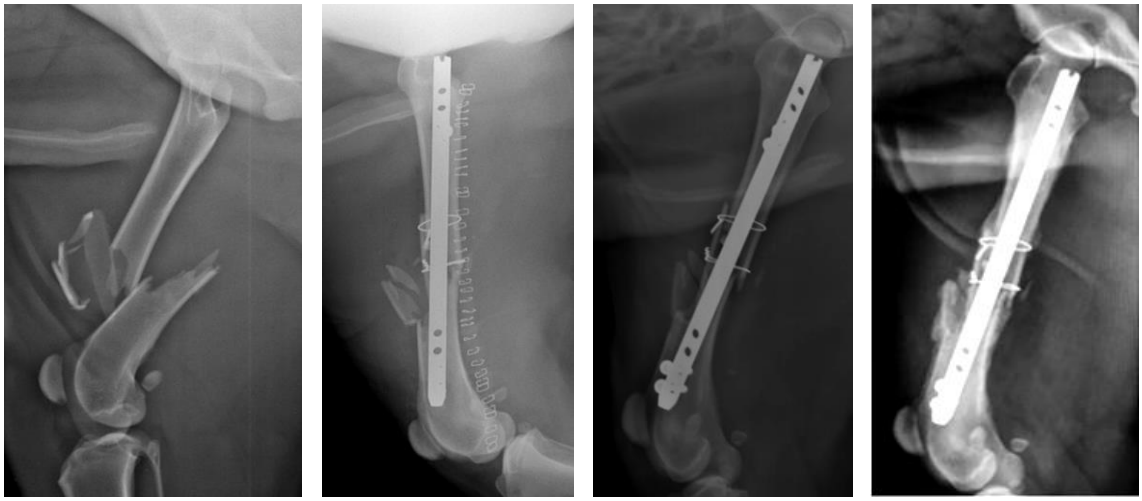


Removal of pigment layer by superficial kerectomy

Pedicle conjunctival grafting for treatment of descemetocele in a pug

Homologous penetrating corneal grafting in a deep central ulcer

(vi) Stabilization of Canine femur fracture by static and dynamic intramedullary interlocking nailing: Static intramedullary interlocking nailing could be successfully used in multiple comminuted fractures after anatomical reconstruction of the bone using ancillary techniques.



Preoperative | **Immediate postoperative** | **15 days postoperative** | **30 days postoperative**

Radiograph of a femur fracture repaired using static intramedullary Interlocking Nailing

Preoperative | **Immediate postoperative** | **15 days postoperative**

Radiograph of a femur fracture repaired using Dynamic intramedullary Interlocking Nailing

Dynamic intramedullary interlocking nailing is suitable for repair of simple femur fractures and was having significantly faster rate of bone union as compared to groups with static fixation.

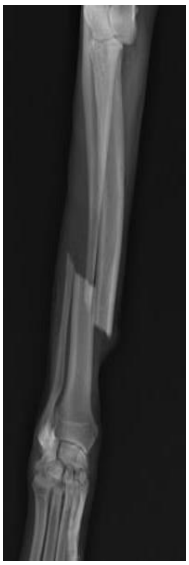
(vii) Use of Arthroscopy for diagnosis and treatment of Hindlimb Arthropathies in bovine: Stifle joint had good space for arthroscopic evaluation of joint structures and lesions. Best entry points to stifle are: Medial femoropatellar portal, Medial femorotibial portal and Lateral femorotibial portal.

Arthroscopic portals for stifle, hock and fetlock

Fetlock joint arthroscopy in bovine

(viii) Linear external skeletal fixator for stabilization of open long bone fracture in dogs: Linear external skeletal fixators are indicated for the management of early presented cases of open long bone fracture associated with small wound in dogs.

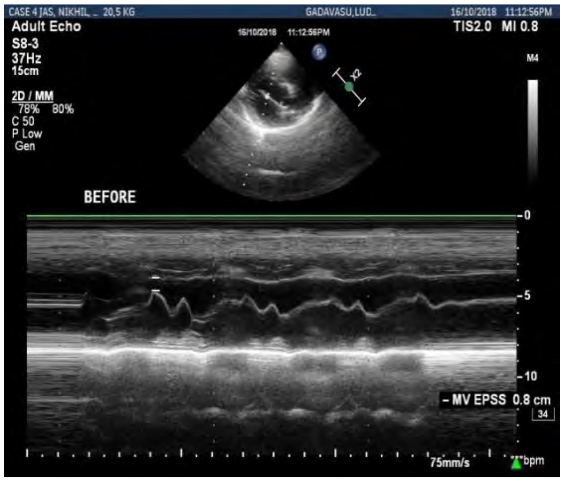
Type I linear fixator Compound tibia fracture repaired with external skeletal fixator

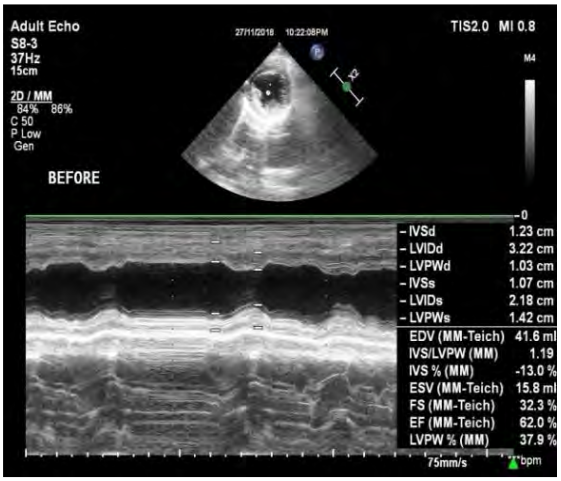


Type III linear fixator

(ix) Clinical study on the association of prostate gland affections with perineal hernia in dogs: Prostate gland affections may not be the primary etiology to perineal hernia in dogs. Increased length of the prostate is better indicator of prostatomegaly than the depth. Conventional technique of perineal herniorrhaphy has very good long term success rate. Straining while defecation with or without re-occurrence may persists after herniorrhaphy, unrelated to prostatomegaly.

(x) Echocardiographic evaluation of effects of xylazine in dogs undergoing elective procedures: Left ventricular echocardiographic parameters in 30 dogs were recorded, measured and analyzed to study the effects of xylazine on heart. After xylazine administration, a significant decrease in heart rate, FS%, EF%, SVml was observed, but no remarkable valvular regurgitation was found. Electrocardiographic findings revealed that there was significant bradycardia after xylazine administration.





(xi) Diagnosis and surgical management of dental and mandibular affections in small animals: Orthopaedic wiring with or without acrylic was found suitable technique for the surgical repair of mandibular fracture. Complications are more in cases which are presented after 5 days and in cases of open fracture.

(xii) Hospital prevalence and surgical management of canine obstructive urolithiasis: A total of 43 cases were operated for uroliths presented to clinics during this period with history of partial urinary blockade. Cystotomy (n=37), Urethrostomy (n=4) and urethrotomy (n=2) procedures were performed. Hospital prevalence of obstructive urolithiasis was 0.25%. All three techniques were equally good in management of urolithiasis in dogs

(xiii) Clinical application of adipose derived mesenchymal stem cells for the management of osteoarthritis in dogs: The dogs treated with intra-articular injection of chondrocytes observed significant improvement in lameness and pain sensation. The regenerative cell therapy decreases patient discomfort and functional disability.

(xiv) Development of novel implants and materials for Orthodontic procedures in small animals: Dental lab for undertaking root canal and crown therapy in dogs has been established. This lab includes dental work station and dental radiography facility using latest modalities like x-rays and Portable dental digital IOPA X-ray machine. Digital dental radiography of different teeth in different breeds of dogs was standardized. Approach to single rooted and multiple rooted strategic teeth was established. Root canal treatment (RCT) procedures standardized and applied clinically. Procedure to convert crown impressions into dental models using Dye stone standardized.

(xv) Development of new suture materials and implants for Canine arthropathies: Good success was obtained with fish line monofilament nylon suture material for distal humeral condylar fractures and elbow joint arthropathies. Cost effective indigenously procured suture materials were useful for the treatment of arthropathies requiring high suture strength.

8. Veterinary Medicine

(i) Current Culture Sensitivity Pattern of Clinical Mastitis in State: A total of 1368 quarter foremilk samples from 465 dairy animals (964 from 341 cows and 404 from 124 buffaloes) brought by visiting dairy farmers throughout the state were subjected to culture sensitivity testing so as to undertake the rational therapy of mastitis. Overall, 50.44 per cent quarters were bacteriologically positive. The organisms isolated from the affected quarters comprised, in overall for cows and buffaloes, coagulase-negative staphylococci 56.37%, coagulase-positive staphylococci 37.83%, *Pseudomonas* & Gram negative spp. 2.17%, *Streptococcus* spp. 2.32%, *Corynebacteria* spp. 0.58% and others 0.73%. Testing of isolated bacteria for drug sensitivity revealed, in overall, Ceftriaxone-tazobactum as the most effective drug (88.64%) followed by Ceftrioxone-salbactum (85.29%) and Enrofloxacin (76.52%). On the other hand, least effective drugs were Ampicillin (27.76%) followed by Penicillin (32.11%).

(ii) **Determination of Milk Somatic Cell Count in Buffaloes and its Relation to Udder Infection and Physiological States of Production:** The physiological levels of milk SCC, its phenotypic relation with udder infection, milk production and milk composition and variation over the parities, lactation stage and season were studied. The milk average SCC in buffaloes was observed as 100×10^3 cells/ml. Streptococcal intra mammary infection resulted in highest milk SCC with a mean value of 710×10^3 cells/ml. *Staphylococcus aureus* resulted in a moderate rise (464×10^3 cells/ml) and CoNS in mild rise (224×10^3 cells/ml) in milk SCC. The SCC was high at fresh calving (118×10^3 cell /ml), decreased significantly at 35-42 d (69×10^3cell/ml) and increased in the late lactation (94×10^3cell/ml). The mean SCC was higher in the hot and humid season (142×10^3 cell/ml) and lowest in winter and autumn season ($75-76\times10^3$ cell/ml).

(iii) **Comparison of post milking and pre + post milking teat dipping:** A split herd design experiment was undertaken on an organized dairy farm to test the benefit of pre-milking in addition to post-milking teat disinfection on new mastitis levels. A Lactic acid based germicidal pre-dip was applied manually using foaming cups, over a complete lactation. Post milking teat disinfection was done using Povidone iodine based germicidal post milking dip (Povidone Iodine: Glycerin 4:1). There was a significant reduction in the values of Log_{10}SCC in the post milking teat disinfection group, while the changes in CMT, EC, and pH were non significant. In pre + post milking teat disinfection group, there were no significant changes in any of the milk parameters. There was increase in prevalence of specific SCM from 33.3% to 62.5% in control group. In post milking teat disinfection, there was significant reduction in specific SCM prevalence (46.15%). In pre + post milking teat disinfection also, there was significant reduction in prevalence of specific SCM (33.33%).

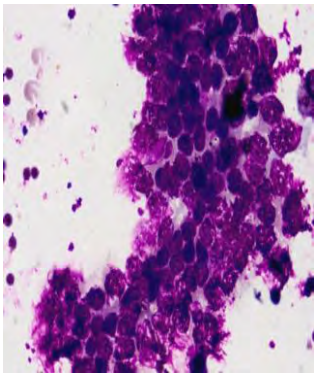
(iv) **Establishment of blood bank and blood grouping unit in dogs:** Blood from dogs of different breeds was typed to know the prevalent blood types in common breeds of the region. On the basis of Hb concentration, cases of severe anaemia were classified further into five groups. Fresh whole blood and stored blood transfusion was performed in 87 canine anaemic patients but could not be performed in several other anaemic patients due to non-availability of donor dogs. Immediate transfusion reaction such as fever, tachycardia, shivering was recorded in two patients and hence transfusion had to be stopped with administration of ancillary therapy.

(v) **Etiology, diagnostic and therapeutic modalities for canine renal diseases:** A total of 66 dogs with serum creatinine levels of ≥ 1.4 mg/dL and BUN ≥ 28 mg/dL were monitored. Hypertension was observed in 45 dogs. Hemato-biochemical parameters revealed anemia, low TEC, low PCV, high TLC, elevated SCr, BUN and Pi. Total protein, Alb and albumin to globulin ratio were lower than normal. Ultrasonographic examination revealed hyperechoic renal cortices in 34 out of 47 dogs and loss of corticomedullary differentiation in 7 dogs. Values of urine SDMA and cardiac troponin I increased with increase in stage of renal failure. Most of the dogs did not respond to conventional medicinal treatment.

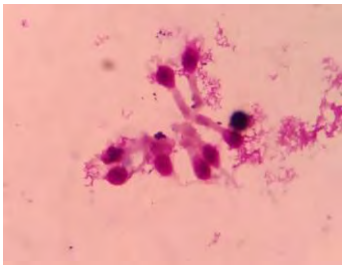
(vi) **Diagnosis and Therapeutic Management of Canine Respiratory Affections:** Transtracheal wash (TTW) method was standardized in dogs with more than 10kg body weight. TTW cytology in anthracosis dog revealed increased number of neutrophils and macrophages with engulfed blackish pigment and lymphoid cells; and severe eosinophilia in Eosinophilic Bronchopneumopathy. Absolute neutrophilia, hyperfibrinogenemia and hypoxemia were the most common findings in dogs with respiratory infections. *Staphylococcus aureus, E. Coli* and *Klebsiella* sp. were the organisms isolated from the TTW fluid in majority of the dogs. Terbutaline @ 1.25-5mg/dog was effective in dogs suffering with chronic bronchitis. Prognosis was guarded in lung tumours, undiagnosed nodular interstitial pneumonia and bacterial bronchopneumonia dogs.

Collection of transtracheal wash (TTW) in a dog

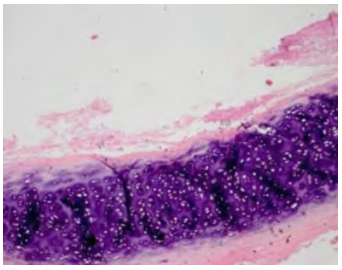
Thoracic ultrasonograph of dog with histiocytic sarcoma showing cavitory lesion (1.24 x 1.17 cm) on left caudal lung lobe



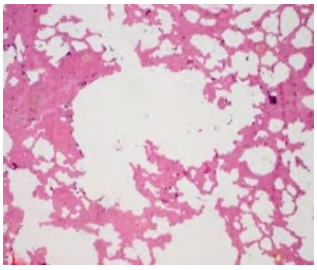
Hyperplasia of epithelial cells in TTW of dog with chronic bronchitis-100x (Leishman staining)



Ciliated columnar epithelial cells from transtracheal wash in a healthy dog -100x (Leishman staining)



Histopathology of tracheal tissue showing sloughing of tracheal epithelium in chronic bronchitis-10x (Hematoxylin and Eosin staining

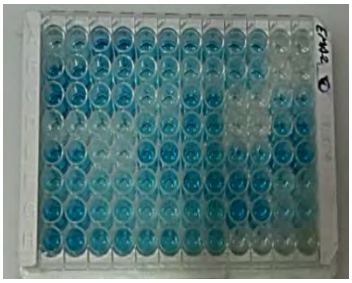


Histopathology of lung tissue showing lung emphysema and thickening of interlobular septa in chronic bronchitis -10x (Hematoxylin and Eosin staining)

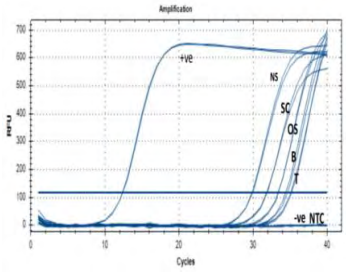
(vii) Obesity associated disorders and its nutritional management in canines: The overall prevalence of associated disorders in overweight/obese dogs was highest of dermatological disorders (32%) followed by cardiac disorders (18%), orthopaedic disorders (15%), respiratory disorders (12%), endocrine disorders (12%), urinary disorders (09%) and neoplastic disorders (02%).

(viii) Epidemiological Studies on Common Equine Diseases in Punjab: The maximum hospital prevalence of equine diseases/conditions were of digestive system (32.68%), musculo-skeletal system (25.44%) and reproductive system (14.25%); followed by wounds and abscesses (8.3%), hoof disorders (5.26%), integumentary system (3.7%), eye and ear conditions (2.8%) and respiratory system (2.6%); while the least number of cases were recorded from renal and urinary system (1.75%), hernias (1.32%), neurological diseases (1.1%) and other miscellaneous diseases (0.66%). From 456 clinical cases presented at hospital, 83 diseases/conditions of equids were diagnosed, which included colic (23.5%) as the most common condition, followed by fractures (7.7%), idiopathic lameness (7%), lacerations (5.5%), enteritis (5%), endometritis (3.9%), laminitis (3.5%), irregular molars (2.9%), arthritis (2%), abscess (1.8%), lumps (1.8%) and pneumonia (1.8%). The farm prevalence of the most common diseases/conditions in equines were lameness (33.6%), colic (27.1%), nervous system disorders (17.8%), vices like pica (13.1%), skin diseases (3.7%), reproductive system disorders (1.9%), renal and urinary system disorders (1.9%) and pneumonia (0.9%).

Bronchopneumonia in a horse showing consolidation of lungs



ELISA plate indicating positive results of *T. equi*



Real Time PCR of postmortem samples, nasal and ocular swabs

The prevalence of equine haemoprotozoan diseases in various agroclimatic zones of Punjab accounted for *Theileria equi* (78.4%) and *Trypanosoma evansi* (17.9%). Three outbreaks of nervous form of Equine Herpes virus-1 from two far apart districts were diagnosed by using qPCR and VNT serological tests with 5.5% prevalence of EHV-1 in the equine population of Punjab.

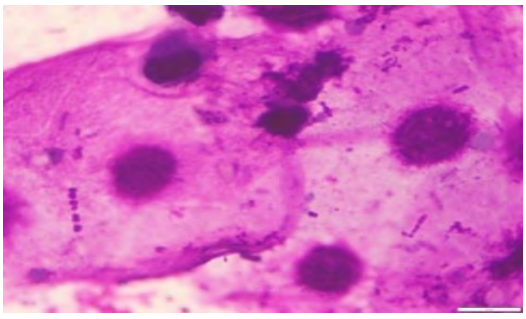
Facial nerve deficit

Rotation of nostril

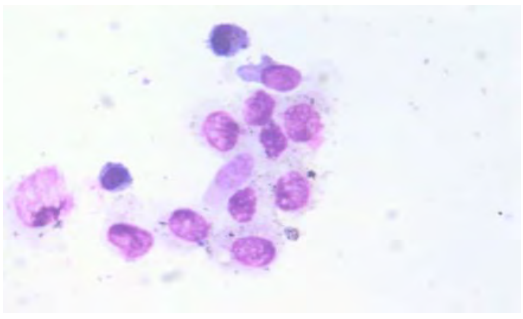
Paralysis and Seizures

Various neurological signs of EHM affected horses

(ix) Diagnostic Evaluation of Transtracheal Wash, Bronchoalveolar Lavage and Ultrasonography in Lower Respiratory Tract Affections of Cattle: Total nucleated cell number in TTW smears was 21.8±7.60 cells/hpf. Differential cell counts in TTW smears showed primarily neutrophils (41.4±5.45%) followed by macrophages (32.0±4.38%), respiratory epithelial cells (17.5±4.11%) and lymphocytes (8.55±2.67%). Bronchoalveolar lavage smears contained macrophages (63.3±6.89%), neutrophils (10.3±3.82%), respiratory epithelial cells (16.5±3.36%) and lymphocytes (4.64±1.23%). Higher cell population was seen in tracheal wash smears as compared to bronchoalveolar lavage smears.



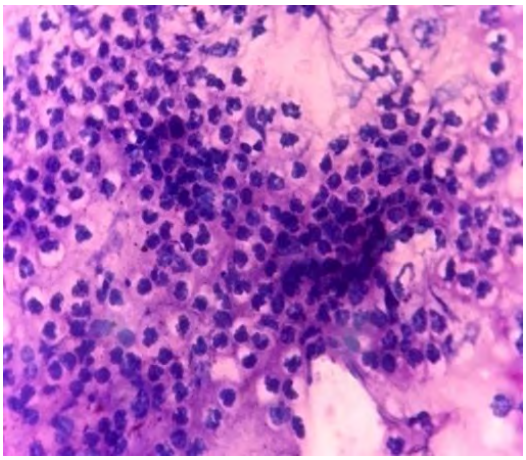
Photomicrograph of TTW smear showing squamous epithelial cells in healthy cow (Leishman x 100)



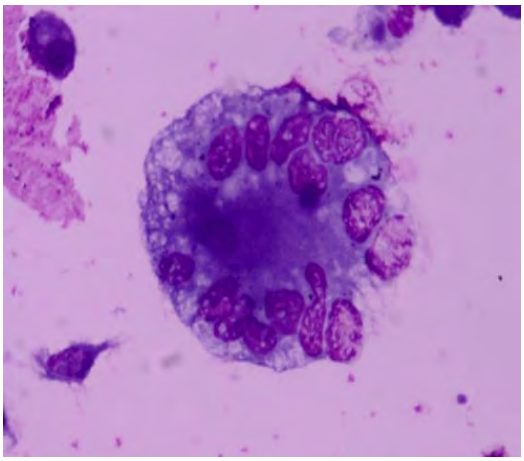
Photomicrograph of BAL smear showing a lot number of macrophages in healthy cow (Leishman x 100)

(x) Evaluation of lower respiratory tract affections in horses: Diagnosis of *Rhodococcus equi* pneumonia in foals, Bacterial pneumonia, Heaves, Interstitial pneumonia and *Rhodococcus equi* pneumonia in an adult horse were confirmed on the basis of transtracheal wash and broncholaveolar lavage cytology and/or culture and isolation, supported by clinical,

radiographic and ultrasonographic examination. Both septic and non-septic purulent inflammation was observed in TTW and BAL fluid cytology based on the nature of the neutrophils (degenerated or nondegenerated). Overall in pneumonic patients, four fold increases in neutrophils were appreciated in TTW and fifteen fold in BAL fluid of diseased animal in comparison to healthy animals. Leukocytosis and hyperfibrinogenemia was observed in most of the infectious pneumonia groups. Hypoxemia was the only important finding in the arterial blood of most of the patients.



Smears from TTW showing degenerated neutrophils in bacterial pneumonia due to *Klebsiella* organisms in a horse (Leishman stain-100x)



Smears from BAL showing Langhans giant cell (Horse shoe shape) in interstitial pneumonia in a horse (Leishman stain 100x)

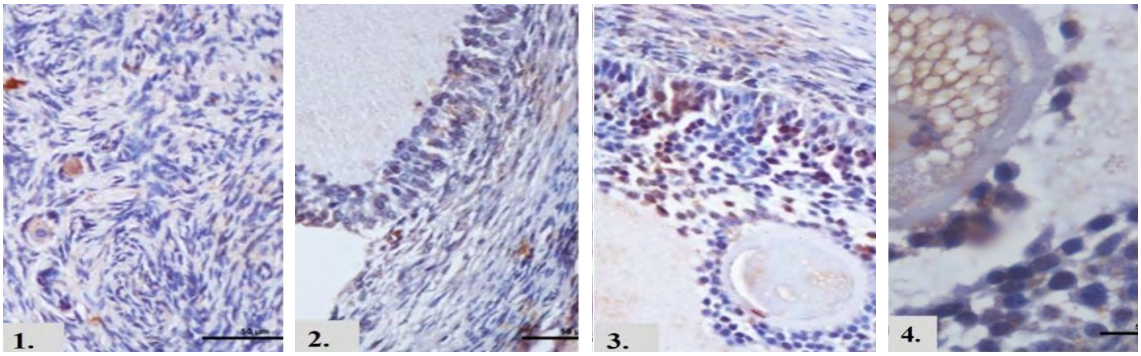
(xi) Prevalence, diagnosis and therapeutic management of pododermatitis in dogs: Pododermatitis constitutes 12.89% of canine dermatological cases. Prevalence of pododermatitis has strong negative correlation with environmental temperature. Bacterial infection is the most prevalent cause of pododermatitis followed by atopy and demodicosis. *Staphylococcus* spp. is the main bacterial agent responsible for pododermatitis. Acetate tape impression is equally effective as deep skin scraping in diagnosing pododemodicosis. Cytological examination is a useful diagnostic tool for identification of bacteria and yeast organisms. Clindamycin is highly effective antibacterial drug in treatment of bacterial pododermatitis.

(xii) Systolic and diastolic functions in dogs with congestive heart failure: In pugs, only ESV was significantly affected by body weight. In healthy Labradors, significantly higher value of LVPWd was observed in males as compared to females. Dilated cardiomyopathy (DCM) and pericardial effusions were more prevalent in male Labrador dogs, mainly of >5 years. Out of 49 dogs affected with cardiac diseases, DCM was diagnosed in 29 and pericardial effusions in 8 dogs. After treatment, a significant increase in value of FS% and EF% and pulmonary artery velocity were observed in dogs with DCM.

9. Veterinary Anatomy

(i) Reproductive Anatomy

Immunolocalization of HSP 27 protein concerning follicular atresia: HSP 27 protein was immunolocalized in the cytoplasm of the oocyte of primordial and primary follicles in buffalo ovary. In the summer season, only two out of 10 antral follicles were positive for the HSP while in winter 5 out of 10 antral follicles were positive for HSP protein. Thus, expression of HSP 27 was inversely correlated with the higher temperature or heat stress and can be considered as indicator of protein for healthy follicles.



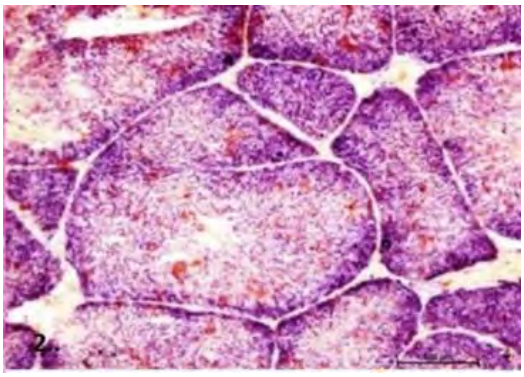
Immunolocalization of HSP 27 in ovary of buffalo

(ii) Forensic Anatomy

Histomorphological study on hair: Histomorphological study conducted on hair of cattle, buffalo, horse, goat, pig and dog revealed that medulla composition was unicellular in all except dog. Medulla was amorphous in buffalo and pig; uniseriate in cattle and goat; multiseriate in horse; vacuolated in dog; continuous in buffalo, cattle and horse; interrupted in goat; fragmented in dog; stripped in pig. The margins were irregular in buffalo and horse; straight in cattle, goat and pig; and regular in dog. Scanning electron microscopic study revealed that cuticle scale margin was rippled in buffalo and pig, crenated in cattle and goat and smooth in horse and dog. Cuticle scale margin shape was chevron in buffalo, regular in cattle, goat, dog and irregular in horse and pig. Interscale distance was maximum in dog (10.23±0.26µm). The DNA was extracted from skin, Gel electrophoresis of the amplified PCR product revealed band size of 87 bp, 456 bp, 890 bp, 84 bp, 72bp and 703 bp in cattle, buffalo, horse, pig, goat and dog respectively.

(iii) Histomorphological study

(a) Sistomorphochemical study on pig liver: Study conducted on liver of 12 pigs revealed that the size of hepatocytes in periportal area (15.18±0.28 µm) was significantly more than size of hepatocytes in centrilobular area (12.36±0.25 µm). The average no. of Kupffer cells in periportal region (27.7±0.76) was significantly more than centrilobular area (17.1±0.72). A cast of portal vein was prepared which revealed that vein divided into three main branches; Right lateral vein, Right medial vein and Left medial vein. Periportal hepatocytes exhibited a strong activity of phosphatases and different oxidoreductases whereas nonspecific esterases activity was more in centrilobular hepatocytes.



Strong AKPase activity in periportal hepatocytes. X 100

Photograph of cast of bile duct (yellow colour) and portal vein (blue colour)

(b) Enzyme Histochemistry of Spleen of Pig (*Sus scrofa*): The histoenzymic distribution of phosphatases and oxidoreductases in pig spleen revealed variability in activity of different enzymes in spleen which can be correlated with maturation of lymphocytes and development of different metabolic pathways.

10. Veterinary Microbiology

(i) Antibiotic resistance: Prevalence and pattern of antimicrobial resistance and molecular characterization of genes encoding resistance against different antibiotics was studied in various pathogens isolated from different animal species. *Staphylococcus aureus* was the most predominant organism isolated from mastitis animals followed by *Klebsiella pneumoniae*, *E. coli* and *Streptococcus* spp. Antibiotic sensitivity test revealed that *Staphylococcus* spp. sensitive to sparfloxacin, tetracycline, gentamicin, vancomycin and doxycycline and resistant to amoxicillin.

Antibiotic resistance in *Staphylococcus* spp. isolated from goat milk revealed highest resistance to penicillin G followed by oxacillin, methicillin and vancomycin. Presence of *tet*K gene encoding the tetracycline efflux pump was found to be highest followed by *bla*Z (β-lactamase resistance), *mec*A (methicillin resistance) and *tet*M tetracycline resistance. Highly significant correlation was found between phenotypic and genotypic resistance in case of methicillin, oxacillin and penicillin resistance.

RAPD analysis (Fig.2) of *Streptococcus agalactiae* isolates from bovine mastitis demonstrated informative banding pattern suggestive of intraspecific genetic diversity. Antibiogram revealed higher resistance against oxytetracycline and co-trimoxazole followed by ampicillin and penicillin.

Pulse field gel electrophoresis (PFGE) profile of ESBL positive *E. coli* isolates indicated that they could be grouped into four major clusters which included isolates from different places, suggesting wider expansion of these bacteria among animal species. High diversity in genotypes indicated the possibility of clonal spread in the population.

(ii) Bovine Tuberculosis: Fluorescence Polarization Assay (FPA) and Peptide nucleic acid - fluorescence in situ hybridization (PNA-FISH) were standardized for detection of Bovine Tuberculosis**.** FPA revealed that a cut off value of more than >125 mP gave maximum discrimination between positive TB reactors and negative bTB animals. PNA-FISH for specific visualization of *Mycobacterium bovis* and *Mycobacterium avium* in cattle and buffaloes was performed (Fig.1). Isolates of *M. bovis* (isolated from suspected cases of bovine tuberculosis) were reconfirmed by PNA FISH.

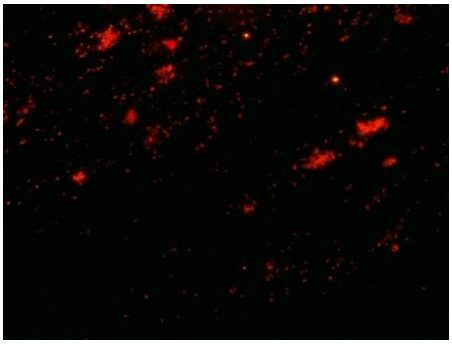
Adenosine deaminase activity was evaluated for diagnosis of bovine tuberculosis. Average ADA values were 12.55 U/L in CID Positive, 14.8 U/L in IFN-γ positive, 18.36 U/L in animals positive by both IFN- γ and CID, 10.57 U/L in CID negative animals and 10.59 U/L in IFN-γ negative animals.

Real time PCR was used to study the gene expression profile of IL-4, IL-10, IFN- γ and TNF-α indicated there was not much difference in the expression levels of IL-4 and TNF-α in PPD-B stimulated PBMCs from TB reactor animals. However, IFN-γ expression was upregulated in stimulated PBMCs of all the positive reactors and was down regulated in non-reactors.

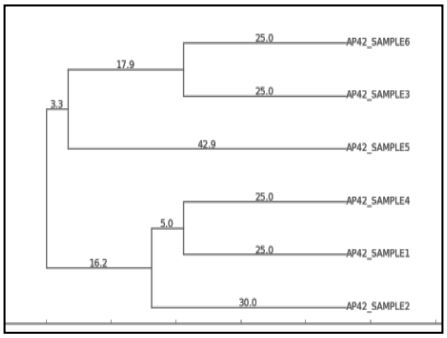
(iii) Brucellaphages: Use of bacteriophages is a recent approach to control brucellosis. Two bacteriophages isolated from sewage samples collected from different dairy farms lysed *Brucella abortus* strain 19, *B. abortus* strain 99 and field isolates of *B. abortus* but did not lyse heterologous bacterial species viz. *Staphylococcus aureus*, *Streptococcus agalactiae*, *Salmonella* spp, *Escherichia coli* and *Pseudomonas aeruginosa*. Electron microscopic studies revealed that both phages were tailed and belonged to order *Caudovirales,* family *Siphoviridae*. Physico-chemical characteristics of the isolated phages were studied.

(iv) Canine Parvovirus: Prevalence of Canine parvovirus (CPV) and its antigenic types revealed per cent positivity 68.62% in Punjab, 80.55% in Assam and 54.54% in M.P. CPV positive cases were observed in 35% (49/140) of vaccinated dogs. Antigenic typing by Real Time PCR indicated more samples were positive for CPV 2a antigenic type.

(v) Aflatoxins in milk and feed from cases of reproductive tract disorders in cattle and sheep: Amount of aflatoxin in feed samples ranged from 4 to 52 ppb and 4 feed samples had aflatoxins levels above the permissible limit (30 ppb).



Visualization of *M. bovis* by PNA FISH (MTBC- cy3) probe in cytological smear of infected bovine lung.



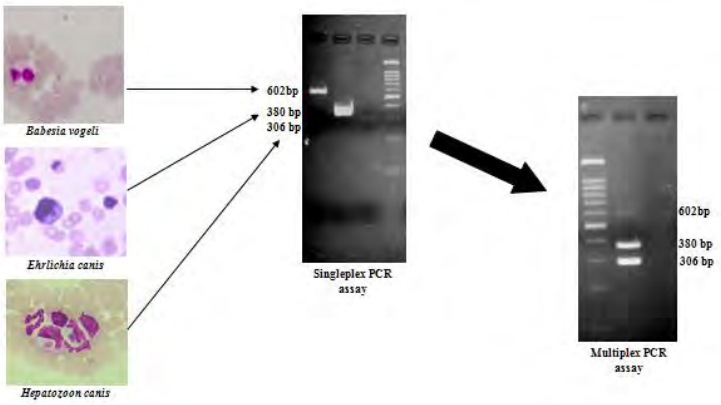
Dendrogram showing genetic similarity analysis of *S. agalactiae* isolates by RAPD using primer AP42

11. Veterinary Parasitology

(i) Detection of amitraz resistance in Rhipicephalus (Boophilus) microplus ticks of Punjab: Adult immersion test and Modified Larval Packet Test were standardized for detection of amitraz resistance in cattle tick *R. (B.) microplus*. Bioassays revealed low levels of amitraz resistance in cattle tick population and map of amitraz resistance was generated.

(ii) Genotyping of amitraz resistance in R. (B.) microplusticks of Punjab: Pioneer work on characterization of octopamine receptor gene (target site of amitraz) of *R.* (*B.*) *microplus* from India and presence of non-synonymous SNP at position 157 (T8P) which may have role in amitraz resistance was reported from Punjab. Genotyping of amitraz resistance by PCR-RFLP assay revealed percentage of resistant alleles in range of 50.0-57.2 indicating its moderate distribution in the populations.

(iii) Multiplex PCR assay based detection of canine tick-borne haemoparasites: Microscopic examination of stained 322 blood smears from dogs of various districts of Punjab revealed the prevalence of *B. vogeli* (0.31%), *E. canis* (0.93%) and *H. canis* (1.86%). Multiplex PCR assay of the above samples revealed *B. vogeli* (0.93%), *E. canis* (10.24%) and *H. canis* (4.65%) with concurrent infection of *E. canis* & *H. canis* (1.86%) and *B. vogeli* & *E. canis* (0.31%). Various risk factors *viz*. age, breed, sex, season and location were studied. Prevalence of *E. canis* was significantly associated with locations by multiplex PCR assay.

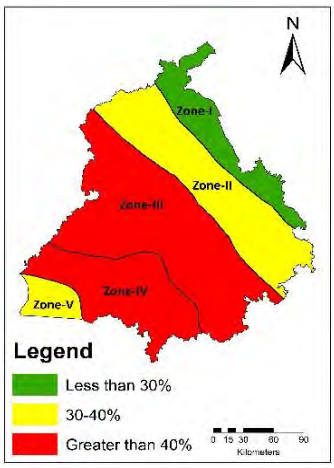


Multiplex PCR assay for detection of *B. vogeli*, *E. canis* & *H. canis* infections

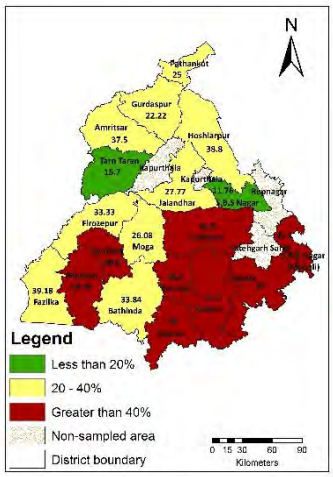
(iv) Epidemiology of coccidiosis and therapeutic efficacy of anticoccidial drugs in small ruminants of northern Punjab: High prevalence rate and high intensity of infection in young animals, coupled with the high prevalence of pathogenic species, showed that eimeriosis is a potential risk for small ruminants raised under intensive as well as extensive systems in South west region of Punjab state. *Eimeria parva* was the most prevalent in sheep and *Eimeria arloingi* was the most prevalent in goats. Toltrazuril alone and in combination with amprolium was more effective anticoccidial chemotherapeutic agent in terms of early reduction of oocysts, faster clinical recovery and improvement in body weight gain.

(v) Seroprevalence and spatial distribution of toxoplasmosis in small ruminants of Punjab: Seroprevalence of *T. gondii,* (40.58%) was higher in ovines (42.85%) as compared to caprines

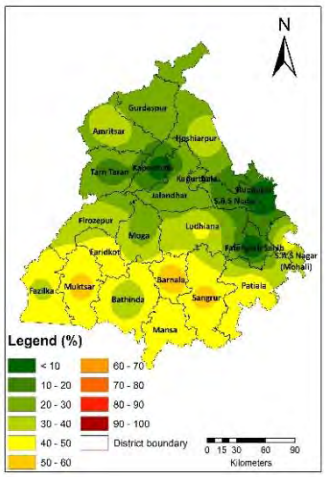
(39.60%). Spatial distribution and predictive seroprevalence data showed higher chances of occurrence of disease in agroclimatic zones III, IV especially in districts adjoining Haryana and Rajasthan states. Seropostivity of toxoplasmosis was significantly associated with history of abortion. Goats with history of abortion were 1.72 times more at risk to *T. gondii* infection. Similarly, in sheep with the history of abortion were 2.74 times more at risk to toxoplasmosis as compared to sheep with no history of abortion. Goat and sheep farms with frequent access to cats were 2.03 times and 4 times more at risk as compared to farms where cats access was limited. Application of nested PCR for detection of *T. gondii* DNA from tissue samples revealed mild infection (6.13%) in small ruminants indicating possible zoonotic risk for the people in the region. Nested PCR may be applied for diagnosis of *T. gondii* from aborted foetus collected from small ruminants.



Spatial distribution of seroprevalence of *T. gondii* in different agroclimatic zones of Punjab state



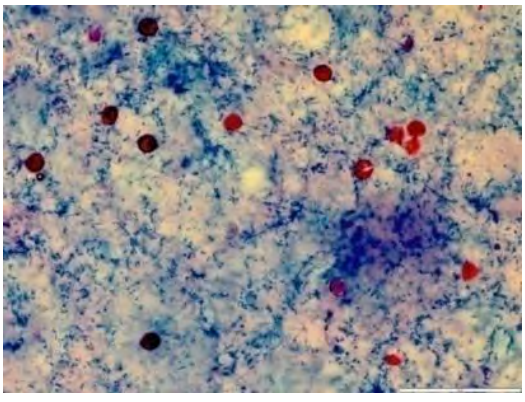
Spatial distribution of seroprevalence of *T. gondii* in small ruminants of Punjab state



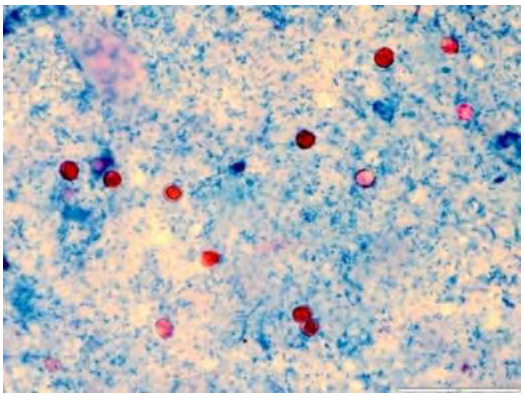
Predictive seroprevalence of *T. gondii* in small ruminants of Punjab State

12. Veterinary Pathology

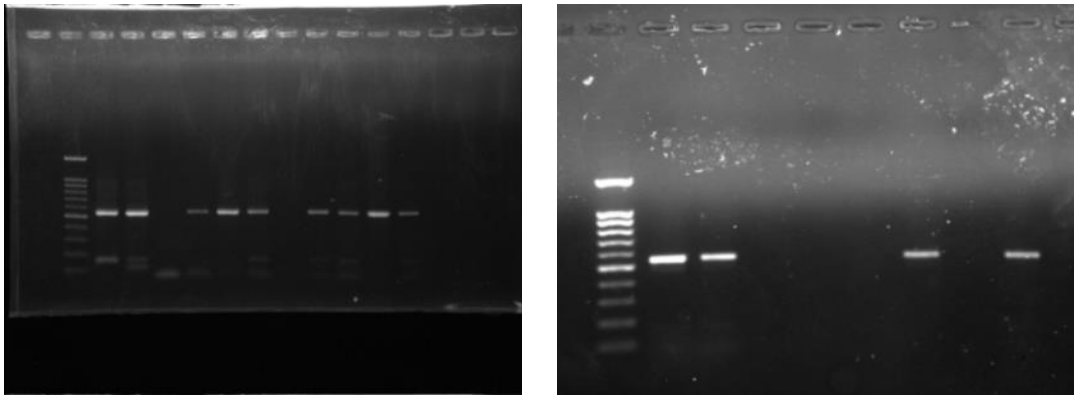
(i) Studies on bovine calf diarrhea with special reference to *Cryptosporodium parvum:* Histopathology of 100 tissue samples from calves suffering from diarrhea was done. Histopathological sections of intestines revealed haemorrhage, severe congestion, infiltration of mononuclear cells, denudation of mucosa, sloughing of villous epithelial cells, fusion of villi and hyperplasia of crypt epithelium. Using Ziehl Neelsen staining, *Cryptosporodium parvum* oocysts were also demonstrated. With the help of PCR technique, amplification of COWP gene was done which yielded a 550 bp product. In addition, immunohistochemical demonstration of five organisms (Cryptosporidium, bovine rotavirus, *Salmonella spp.*, *Escherichia coli* and *Clostridium perfringens*) in the paraffin embedded sections of intestines was standardized.



***Cryptosporidium parvum* oocyst.**

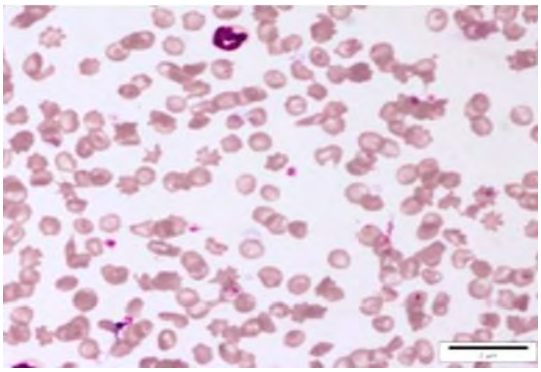


Modified Ziehl-Neelsen (ZN) staining. 1000X

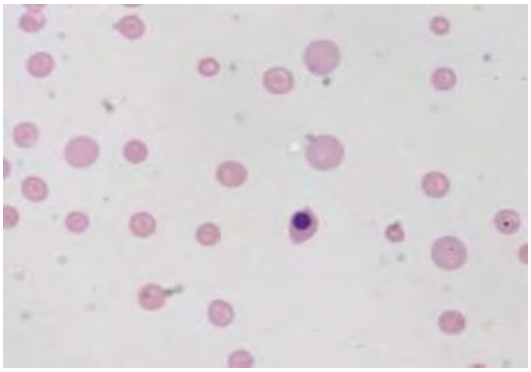


Amplification of COWP gene (550 bp) of *Cryptosporidium parvum*

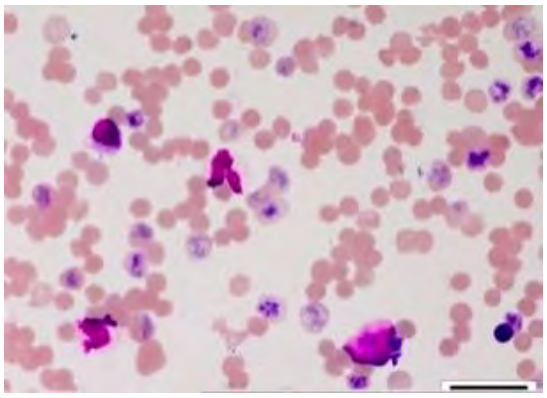
(ii) **Erythrocytic abnormalities vis-a vis disease conditions in dogs**: A study was conducted to study an association between erythrocytic abnormalities and disease condition in dogs. The most common abnormality observed was normocytic normochromic anemia and it was associated with kidney failure. Out of the different erythrocytic abnormalities hypochromasia, microcytosis and spherocytosis were the most common. A significant positive correlation was observed between occurrence of polychromatophils and liver damage; acanthocytes, stomatocytes & polychromatophils and kidney damage; occurrence of echinocytes & polychromatophils and concurrent liver & kidney damage. Mean HDW values were significantly higher in dogs suffering from liver damage. A good correlation was observed between presence of codocytes, schistocytes, echinocytes, polychromatophilic RBCs and leukocytosis; stomatocytes & polychromatophilic RBCs with leukopenia. In addition, acanthocytes, echinocytes and schistocytes were common in cases of lymphoma.



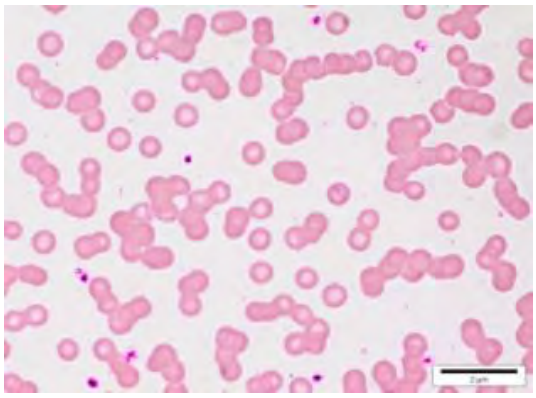
Blood smear of showing acanthocytes



Blood smear of dog showing nucleated RBCs



Peripheral blood smears revealing reticulocytes



Peripheral blood smear revealing agglutination

13. Veterinary Pharmacology & Toxicology

(i) Characterization and molecular mechanisms of antimicrobial resistance in selected bacteria from different animal species and determination of antimicrobial efficacy to prevent emergence of drug resistance in livestock: Cefquinome loaded nanoparticles were prepared by three methods i.e. Solid lipid nanoparticles (SLNs), Chitosan nanoparticles (CNPs) and Bovine serum albumin (BSA) nanoparticles. These methods were then further studied for various characterization parameters. The characterization parameters involved estimation of particle size. The best characteristics were noted for BSA nanoparticles. The zeat potential, entrapment efficiency and drug loading were +10.4 mV, 62.50±5.40% and 12.26±0.70%, respectively, for BSA, nanoparticles. The release kinetics for the formulations were also carried out yielding 47.7±0.04% release for BSA nanoparticles at the end of 24hrs. Stability studies including pH change, optical density for colorimetric estimations and viscosity studies for the three preparations was also done revealing stable formulations.

(ii) Toxicity Studies on Insecticides in Livestock: Combined effect of carbendazim (CBZ) and imidacloprid (IMI) was evaluated on cell morphology, viability, biochemical and antioxidant markers, oxidative stress markers, apoptosis and cell senescence in buffalo bone marrow derived mesenchymal stem cells (bMSCs). The bMSCs were exposed to various inhibitory concentrations of the insecticides (IC_{25}, $IC_{12.5}$ and $IC_{6.25}$) and combinations of $IC_{12.5}$ and $IC_{6.25}$ of CBZ and IMI. Results revealed significant reduction in % cell viability and anti-oxidant markers (GPx, SOD, CAT, GST) whereas, significant increase in LPO, O^{2-} radical and biochemical parameters (ALP, CK-MB) in dose dependant manner. Reactive oxygen species (ROS) positive cells, cells with loss of $\Delta\Psi m$, % apoptotic index and senescent cells were significantly increased in CBZ and IMI alone and combinational groups. Findings suggested that CBZ and IMI induced cytotoxicity in bMSCs mediated via lipid peroxidation (LPO), ROS production, altered $\Delta\Psi m$ and lower antioxidant status which was further responsible for cellular damage, apoptosis and senescence process. Moreover, co-existence of CBZ and IMI in a medium induced additive or synergistic effect on cell toxicity even at low doses.

(iii) Development of Medicinal Plant Garden for Veterinary Ayurveda Research and Nursery for the cultivation of selected medicinal plants: A medicinal plants garden has been established at the University in collaboration with Central Council for Research in Ayurvedic Science (CCRAS), Ministry of AYUSH, New Delhi under the country's first Collaborative Research Centre for Veterinary Ayurveda at GADVASU.

Gudhal

Aloevera

Ashwagandha

Gloye

Shatavari

The plantation of nearly 76 species of medicinal plants has been completed and presently there are more than 3500 medicinal plant samplings in this garden. Collection of seeds from selected plant species of the garden was conducted and seeds were propogated. More than 1100 natural saplings were raised for distribution.

Gloye

Nirgundi

Shatavari

Saplings of Medicinal Plants raised

14. Veterinary Physiology and Biochemistry

(i) Effect of supplementation of fenugreek seeds and probiotic on metabolic profile and milk production in lactating goats during summer season: The supplementation of fenugreek seeds and probiotic individually as well as in combination with summer stressed Beetal goats resulted in significant increase in Hb, TEC, vitamin C and vitamin E whereas significant reduction in SOD activity, levels of MDA, GSH, ALT, AST and blood glucose were observed. The supplementation of fenugreek seeds individually proved to be the most economical.

(ii) Effect of Terminalia arjuna on antioxidant status, metabolic profile and milk production in lactating goats in summer: Oral supplementation of bark of *Terminalia arjuna* to goats in summer significantly decreased lipid peroxidation and increased Super Oxide dismutase activity and increased concentration of Vitamins C and E contents of goats indicating decrease in oxidative damage and replenishing of antioxidant status. *Terminalia arjuna* bark supplementation in beetal goats in summer season had immunostimulatory effects. Thus present study suggests ameliorative potential of supplementation with *Terminalia arjuna* in alleviation of adverse effects of summer stress in lactating goats.

(iii) Effect of bio-antioxidants on cryopreservation of buffalo bone marrow derived mesenchymal stem cells: Cell viability was significantly increased with addition of Curcumin (CUR) and Resveratrol (RES) alone or in combination than the control group. Study revealed significant reduction in oxidative stress parameters (LPO, Total protein content, O_2^- radical production and ROS) and cytotoxicity markers (ALP, LDH and CK-MB), while, the levels of cellular antioxidants (GSH, GPx, SOD and CAT) were found to be significantly increased in CUR/RES alone and in combination groups as compared to control group. Apoptotic index, percent necrotic cells and percent dead cells were significantly decreased in bio-antioxidant treated groups. Addition of bio-antioxidants (CUR/RES alone or in combination) in cryopreservation medium have improved the post thaw cell recovery through suppression of oxidative stress generated and apoptosis during freeze-thaw cycle.

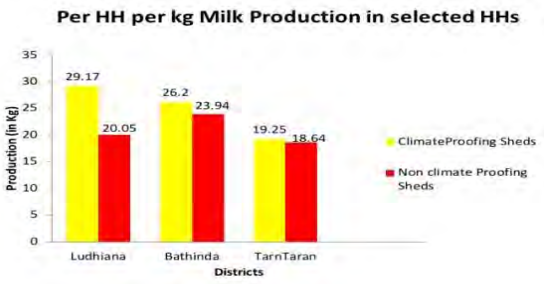
15. School of Public Health & Zoonoses

(i) Antibiotic resistance studies: In Punjab, about 40% (out of 185) milk samples were found contaminated by M1 aflatoxin with ELISA kit. Out of total 711 meat samples, (493 chevon and 218 mutton samples), 71 meat samples were found positive for *Enterococcus sp.* The anthropogenic activities in aquatic community ponds were observed and residues of antibiotics, pesticides and heavy metals were noticed in fish ponds, water and fish samples. Phenotypic and genotypic resistance profile of *E. coli* isolates reflected that 41.94% (26) showed multi antibiotic resistance (MAR). The MAR index divided into >0.2 and <0.2 which indicates high risk and <0.2 indicates low risk to humans and animals, respectively. The relative frequency of resistance genes detected was: *tet A* (17) >*tet B* (13) >*sul II* (11) >*tet C* (9)= *qnr S* (9) >*qnr B* (8) >*sul I* (7) >*qnr A* (6). Heavy metal induced multi antibiotic resistance was observed in 17 *E.coli* isolates after exposure to heavy metals (Cd, Cu, Pb and Ni).

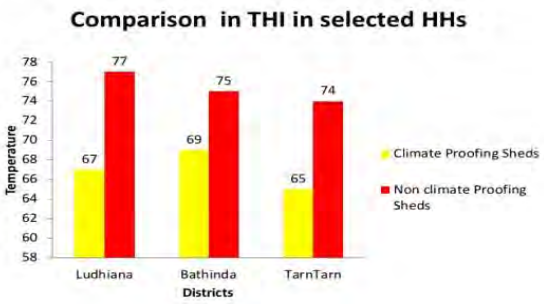
(ii) Prioritization of Zoonotic Diseases in bovines of Punjab: A total of 14 *Listeria* spp. were isolated from bovine clinical cases with the prevalence of *Listeria* spp. as 4.65% and *L. monocytogenes* as 1.99%. A total of 5 *Listeria* spp. were isolated from dairy farm associated environment with the prevalence of *Listeria* spp. as 1.81% and *L. monocytogenes* as 0.72%. The main species identified were *L. monocytogenes* (serotype 4b, 1/2b, 1/2a), *L. ivanovii*, *L. innocua* and *L. grayi*. Although prevalence of *L. monocytogenes* was low but detection of

pathogenic *L. monocytogenes* isolate from a case of nervous disorder indicates potential zoonotic threat. Detection of haemolytic isolates from water and soil samples indicates the ubiquitous presence of *L. monocytogenes* and chances of food chain contamination.

(iii) Climate resilient sheds: Milk production was found to be more in Climate resilient sheds as compared to non-climate resilient sheds.

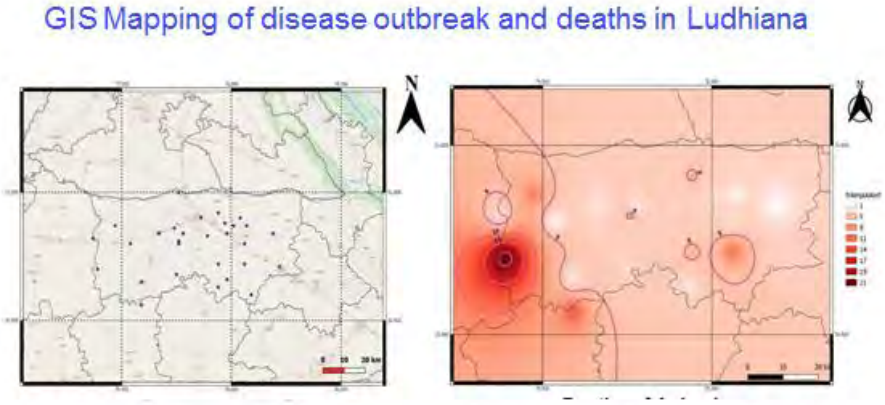


Comparison of production of milk (in kgs) for climate proofing sheds *versus* non-climate proofing sheds



Comparison of THI (temperature humidity index) for climate proofing sheds *versus* non-climate proofing sheds

On calculation of THI (temperature humidity index), it was found that THI was less in Climate Resilient Sheds as compared to non-climate resilient sheds. Statistical analysis (ARIMA and Mixed regression model) showed weak relationships between the disease outbreaks and meteorological variables with R^2 value of 0.093, however, relation between Temperature Humidity Index (THI) and disease outbreak was significant (p=0.012) with One-way ANOVA analysis. Risk analysis was done to categorize the probability of disease outbreaks in 6 risk levels – No Risk, Very low risk, Low risk, Moderate risk, High risk, Very high risk for taking suitable control measures by utilizing resources. FMD and HS were categorized under moderate risk to high risk category while haemoprotozoans were covered under Very low risk to low risk category.



Animal Disease Incidence in Ludhiana (FMD, HS, Theileria, Trypanosoma)
Disease occurrence was closer and frequent nearer dense settlement areas

Interpolated map of deaths caused by animal diseases from 2006 to 2016 in Ludhiana
The highest death zones were situated away from city. This can attributed to lack of animal healthcare availability in remote areas

16. Animal Disease Research Centre

A total of 36 outbreaks of different bacterial, viral, parasitic diseases and toxicities were attended and successfully controlled during 2019-2020. Disease data from the state was provided to NIVEDI for developing database for forecasting of infectious diseases. Routine diagnostic tests for the diseases like tuberculosis, Johne's disease and brucellosis was carried out to make the farmers aware of diseases and take necessary precautions to prevent the same. Economic analysis was calculated for infectious disease outbreaks.

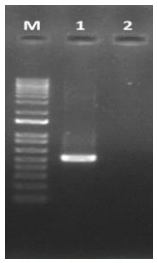
17. Centre for Wild Life Studies and Research

A retrospective study was conducted on diseases of felids at zoological park, Chhatbir. Leptospirosis, renal failure and pelvic limb paralysis were the common medical problems. Treatment of leptospirosis with doxycycline was effective. Pelvic limb paralysis responded well to treatment with antibiotic and nonsteroidel anti-inflammatory drugs. Abortion and pyometra were

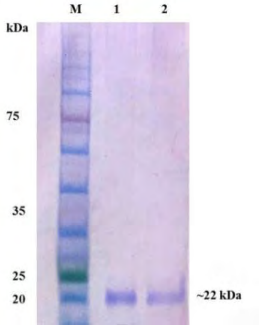
principal reproductive disorders and responded well to empirical antibiotic therapy. Parasitic infestations were prevalent in spite of drug prophylaxis. Change of drug to albendazole was effective in the control of gastrointestinal parasites. Wounds and lameness was the common surgical conditions which recovered well with the standard treatment followed at the zoo.

B. College of Animal Biotechnology (COABT)

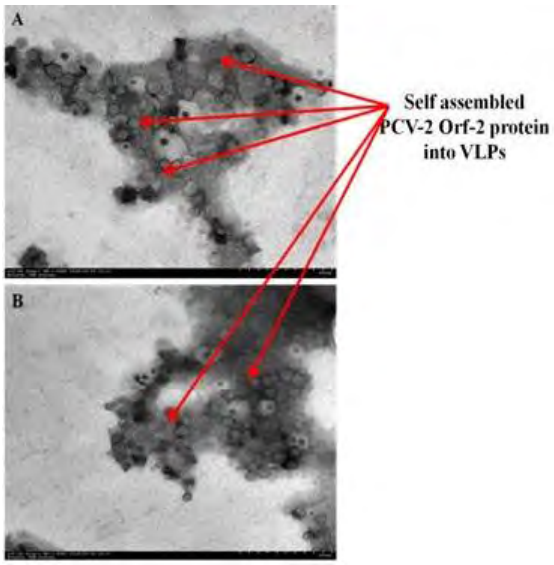
(i) Cloning and sequence analysis of Serum Amyloid A (SAA) gene from poultry birds: The SAA gene was PCR amplified to get amplicons of approximately 521 bp in chicken. The amplicon was cloned into a pGEMT-Easy cloning vector and upon sequence analysis, it was observed that the SAA gene from chicken and quails was having homology differences with other species.



(ii) Expression and purification of chicken HspB1: Heterologous expression and purification of chicken HspB1 were carried out to standardize indirect ELISA for estimating the serum levels of the protein in different varieties of layer chicken. Serum HspB1 concentration increased significantly in heat-stressed birds. A significant association was found between the increase in serum HspB1 concentration and delay in sexual maturity of all the birds under heat stress. HspB1 mRNA and protein expression were found to be associated with age at sexual maturity in Punjab Red and RIR layers under heat stress.



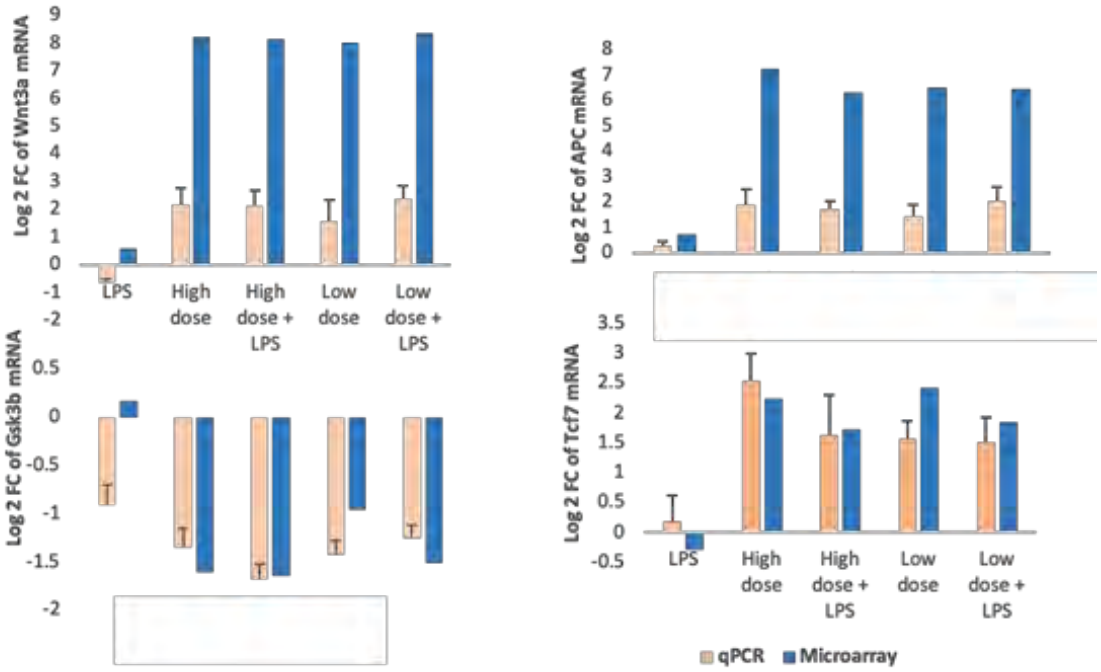
(iii) ELISA for the detection of porcine circovirus: An indirect ELISA was developed for the detection of porcine circovirus 2 (PCV-2) specific antibodies in the pig sera samples. HiFive insect cell line was transfected and selected against Zeocin antibiotic for development of stable cell line constitutively expressing the secretory form of the PCV-2 capsid proteins which then self-assembled to form VLPs. These VLPs were then purified and evaluated as a potential diagnostic and vaccine candidate. Insect cell-expressed recombinant PCV-2 capsid (Orf-2) protein-based virus-like particles (VLPs) were used as coating antigen and the indirect ELISA procedure was standardized for detection/sero-surveillance of PCV-2 specific antibodies in the pig sera samples. Also, porcine circovirus 2 (PCV-2) virus-like particles (VLPs) was tested and evaluated as a Potential Vaccine Candidate in mice model.



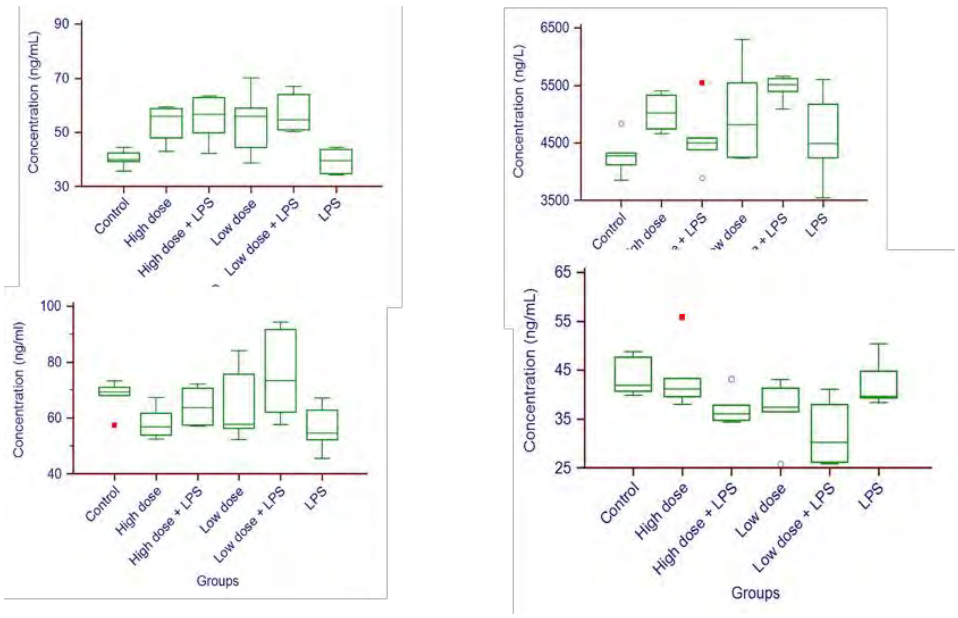
Transmission Electron Micrograph (TEM) depicting the self-assembly of PCV-2 *Orf-2* capsid protein as VLPs

(iv) Transcriptome profiling of mice lung revealed dysregulation of canonical Wnt signaling in response to 2, 4-D and endotoxin co-exposure: Chronic exposure to high (37mg/kg) dose and low (18.5mg/kg) dose of 2,4-D alone or in combination with LPS caused the induction of

oxidative stress. Further, the canonical Wnt signaling pathway was identified as one of the top dysregulated pathways in response to 2,4-D and endotoxin co-exposure in mice lungs, and the key genes of this pathway were altered both at mRNA and protein level. The protein concentration of Wnt3a and APC in the plasma may also be used as an indicator of 2,4-D induced lung damage.



mRNA expression of Wnt3a, APC, Gsk3b, and Tcf7 through Microarray and qPCR in different groups of mice.



Box and Whisker's plot depicting plasma concentration of Wnt3a, Apc, Gsk3b, and Tcf7 in different groups of mice.

C. College of Dairy Science & Technology (CODST)

1. Dairy Technology

(i) Vitamin A enrichment for *lassi* with mango and beetroot powder: Vitamin A enrichment for lassi with fruit or vegetable sources was undertaken with an aim to increase the micronutrient in terms of vitamin A from natural sources. Four different powders like mango, beetroot, carrot and sweet potato were undertaken to visualize changes in product

characterization. Significant results with respect to increase in vitamin A content has been achieved via fortification and sensory results showed wider acceptability at mass level. Mango and beetroot powdered lassi were acceptable at 5 and 3%, respectively whereas, carrot and sweet potato was acceptable at 7.5% concentration.

(ii) Composite films: They were developed from a variety of sources and developed film showed good overall properties for usage in dairy products like Mozzarella cheese. To avoid the drawbacks of individual biodegradable polymers and also to enhance the shelf life of mozzarella cheese, Composite biodegradable packaging material was prepared with optimized level of Whey protein concentrate, Whey protein isolate, Carrageenan, Corn starch, PLA (poly lactic acid) and PVA (poly vinyl alcohol) along with nanoparticles like Zinc oxide, Silver for improving the physico chemical, mechanical and antimicrobial properties of the developed film. Antimicrobial activity of the film was determined through MIC studies against *E.coli* and *B. cereus*.

2. Dairy Engineering

(i) Double Jacketed 3-layer Milk Can: It has been designed to study the feasibility of supplying chilled milk to consumer through milkmen. The capacity of the can is 40 litre of milk. The outermost layer is of insulation and helps to maintain the temperature of cooling.

(ii) Small scale paneer making unit: To is to meet the requirements of small scale milk processors. It consists of inverted cylinder with tapered bottom for easy unloading of the coagulated milk. A foot operated paneer press is also developed to replace the pneumatic press which otherwise need an air compressor. This will save the cost of compressor and other recurring cost of maintenance of air compressors.

(iii) Milk chilling and storage equipment: A 500 litres capacity equipmet was developed to study the use of thermic oils. It consists of two parts; one is to chill the thermic oil to the sub-zero temperature; and second is a double jacketed milk storage cavity. The success of this experiment would lead to enhance the chilling rate of milk as the thermic fluid would provide greater heat transfer rates as compared to the latent heat of water.

(iv) Solar trough: It was designed to be used for generation of hot water using thermic fluid as heating medium. It is developed to provide an energy source for processing of milk into various milk products. It is expected that the developed setup would replace the boiler requirements for supply of steam for hot water generation. The use of solar energy is expected to reduce fuel cost by more than 60% on year basis. Limitations would be the limited working hours, but for a small-scale milk processor it would be most suitable technology under Punjab State conditions. It is under evaluation.

(v) A prototype of ultra-sonication-based homogenizer with hybridized multi-processing kettle (Hybrid-MPK): It has been designed and fabricated for the processing of milk and liquid based milk products. This kettle is capable of processing milk to high degree of mixing index for better mixing of ingredients and could prevent separation of cream during transportation and storage. The processing kettle attached to sonication unit is a kind of multiprocessing kettle (thermal fluids based) in which farmers can process multiple dairy products at farm level. The developed mechanism is movable and is made up of stainless steel (SS-316-inner body & SS-304-outer body). Wide range of the dairy products viz. raw milk, flavoured milk, curd and ghee could be processed in this developed module.

3. Dairy Microbiology

Antioxidant potential of Lactic Acid Bacteria isolated from different sources has shown promising results. This study was carried out with an aim to isolate indigenous *Lactobacillus* spp. strains having anti-oxidative potential. Healthy human mother milk, goat milk, infant faeces and curd samples were explored for lactobacilli. Identitification of isolates was

ascertained by genus specific PCR and MALDI-TOF based analysis. Reference probiotic and pathogenic strains were included for comparative analysis. Intact cells and cell free supernatant of test cultures were used as sample for screening anti-oxidative potential through DPPH, FRAP and ABTS assays. Intact cells in general displayed significant DPPH radical scavenging and FRAP activity. All *Lactobacillus* isolates showed moderate ABTS radical scavenging activity for both intact cell and cell free supernatant preparation. On comparative analysis with reference probiotic strains, three isolates viz. *Lactobacillus delbruekii* C6, *Lactobacillus fermentum* HM16J and *Enterococcus faecalis* IF22J were selected for further validating anti-oxidative potential under *in vitro* cell line conditions *via* studying expression of pro-inflammatory and anti-inflammatory markers in *Lactobacillus* induced STC-1 cells. *Lactobacillus* HM16J significantly reduce TNF-α secretion, besides increasing anti-inflammatory IL-10 under test conditions. The shortlisted isolates can be used as potential anti-oxidants in pharmaceutical or in food industry however, their validating for the probiotic potential, anti-oxidant efficacy under *in vivo* conditions and safety assessment is yet to be completed.

4. Dairy Chemistry

(i) Development of paper based dry reagent strip for detection of common adulterants in milk: The existing milk adulteration detection methods are based on the wet chemistry and include basic experimental techniques. Though, these methods work well and have been validated in the milk system, there is need of rapid, sensitive, cheaper and accurate detection test of the adulterants as a routine analysis. Dry reagent chemical tests are an attractive alternative to conventional wet chemical methods. Paper based dry reagent strip were developed to detect the common adulterants in milk. It can be used for detection of neutralizer and urea in milk. It can detect added Neutralizers in milk within one minute by appearance of red colour on the strip and assay is sensitive enough to detect 0.07% of sodium hydroxide while milk samples adulterated with urea were detected within 2 minutes by appearance of red or pink colour on the test strip. The limit of detection was found to be 900 ppm of total urea in milk. The developed paper based dry reagent strips may be used to check presence of adulterants in milk at house hold level, at collection centres and in dairy industries. Developed strips are easy to use, sensitive, cheaper and accurate detection test of the adulterants as a routine analysis.

5. Dairy Economics and Business Management

Department is actively involved in the research activities related to livestock sector of the state with more emphasis on dairy sector. Department contributes significantly in policy making of university as well as at state level. The major activity of the department is to generate data on the economic viability of the different enterprises so that farmers can utilize this information for the livestock farming. In year 2019-20 Model of investment was developed by the department. In this model, different livestock enterprises were ranked according to the profitability with the assumption of fixed investment. It empowers the farmers to make a logical decision for entrepreneurship in livestock sector.

Through another study cost benefit analysis of various value-added dairy products at farm level in Punjab was worked out to support the framers in taking an informed decision about the product matrix for value addition of milk. This will be helpful in promotion of value addition of milk and income augmentation of dairy farmer.

Sustainability of production system is another very important research area where the department is contributing through studies. The adoption of multiple farm enterprises in an integrated manner can ensure a substantial income generation to sustain the livelihood of farmers over the income from self-standing enterprises. For the identification of integrated models, economics of various livestock based integrated models has been worked out.

D. College of Fisheries (COF)

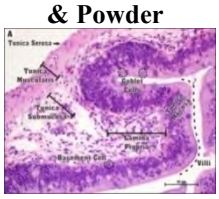
Aquaculture Nutrition

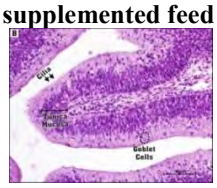
(i) Herbal Feed Additives: With an objective to develop eco-friendly fish feeds for enhanced productivity and disease resistance, efficacy of herbal supplements (Turmeric, Moringa, Garlic, Ginger and *Aloe vera*) was evaluated in different species.

(a) Turmeric: Feed supplementation with turmeric powder @ 0.5% improved survival (28.57%), growth (28%), health, flesh quality (increased protein and decreased lipid levels), gut health (total bacterial count) and enzymatic activities (amylase and lipase) in Indian Major Carp, rohu, *Labeo rohita*. Challenge study of turmeric fed fish with pathogenic bacteria, *Aeromonas veronii* indicated reduced mortality with 50, 62.5, 75 and 87.5% RPS (relative percent survival) as compared to control fish at 0.5, 1.0, 1.5 and 2.0% inclusion levels, respectively. The results revealed practical utility of turmeric powder as an effective growth promoter and immunostimulant for prophylactic treatment in an aquaculture system at 0.5% inclusion level. However, in the presence of pathogenic bacteria (*A. veronii*) turmeric showed its ameliorative effect at higher inclusion level (2.0%), which was otherwise found deleterious for fish growth and hence, needs further investigation to understand the involved mechanisms.

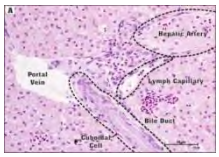
Turmeric Rhizome & Powder

Turmeric supplemented feed

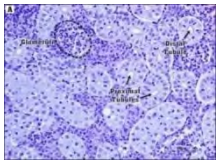


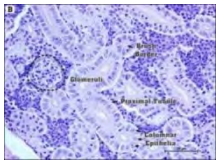


Intestine



Liver





Kidney

Histomicrograph of intestine, liver and kidney of *L. rohita* after 120 days feeding A=No turmeric, B=0.5% turmeric

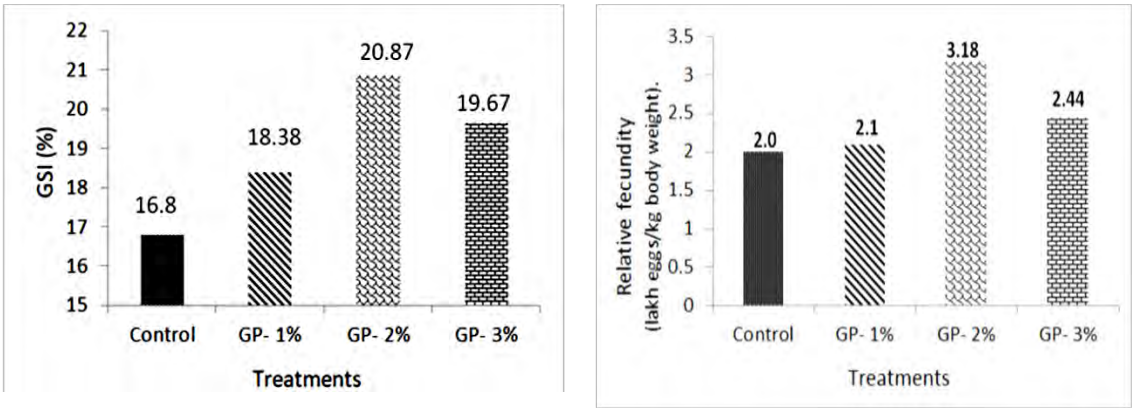
(b) Garlic: Garlic supplementation @ 2% (20g/kg feed) in grow out feed of one of the priced carp species *L. rohita* (rohu), resulted in 57.67, 24.79 and 39.6% higher net weight gain (NWG), specific growth rate (SGR) and flesh protein content ($p \leq 0.05$), as compared to control, respectively and also boosted the immunity of the fish (Hb, Ht, total proteins, albumins, globulins, Ig, SOD and LPO). Although, garlic supplementation increased the feed cost by 29.23%, but garlic induced significant growth increment compensated for the cost, indicating that garlic powder can be incorporated in rohu, fingerlings feed @ 2% for higher production, improved flesh quality and more income.

Further, garlic powder incorporation in rohu brood stock feed @ 2% also served as an efficient growth promoter, immuno-stimulant and reproductive supplement with an anticipated potential of producing 59% higher fry per kg brood stock, due to enhanced GSI, fecundity, egg quality and milt quality (milt yield, spermatocrit, motility etc.), with 6.3% less feed cost per fry production as compared to control.

Garlic Cloves

Garlic Powder

Garlic Supplemented Pellted Feed



GSI and relative fecundity enhancement in Garlic fed *L. rohita* brood stock

(c) Aloe vera: *A. vera* leaves powder supplementation @ 3% in grow out feed of *L. rohita* (rohu), resulted in 48.19%, 21.37% and 24.59%, higher NWG, SGR and protein content over control with better feed conversion ratio, protein efficiency ratio and immunity of fish (Hb, Ht, total proteins, albumins, globulins, Ig, SOD and LPO). Further, *A. vera* supplementation @ 3% reduced the feed cost by 2.98%, indicating that it can be incorporated in rohu, fingerlings feed for higher production, improved flesh quality and higher income thereof.

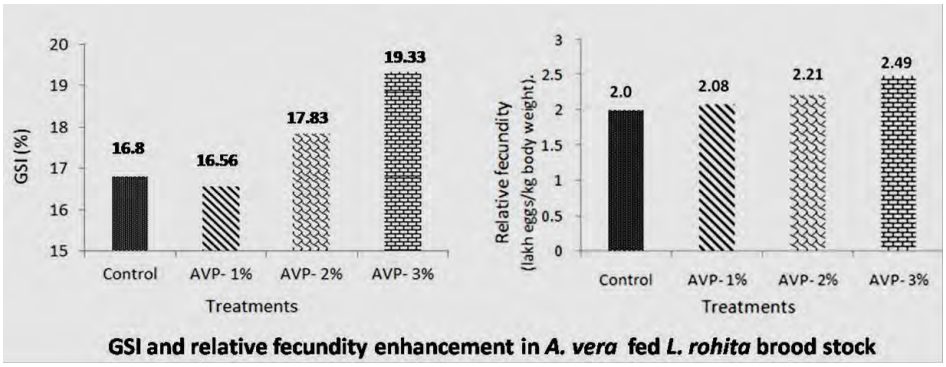
Further, *A. vera* leaves powder incorporation in rohu brood stock feed @ 3% also served as an efficient growth promoter, immuno-stimulant and reproductive supplement with an anticipated potential of producing 24.50% higher fry per kg brood stock, due to enhanced GSI, fecundity, egg quality and milt quality (milt yield, spermatocrit, motility, etc.) with 10.36% less feed cost per fry production as compared to control.

Fresh *A. vera* leaves

Dried *A. vera* leaves

***A. vera* Leave Powder**

***A. vera* Supplemented pellet feeds**



GSI and relative fecundity enhancement in *A. vera* fed *L. rohita* brood stock

(d) Moringa leaf powder: To improve growth and health of euryhaline fish Nile Tilapia (GIFT), *Oreochromis niloticus*, Moringa (*Moringa oleifera*) leaf powder (MLP) was incorporated in the grow out feed. MLP improved fish survival, growth and health of fish at all inclusion levels (5-15%), but best results were obtained at 12.5% incorporation level, which resulted in 7% higher survival and 57% higher growth of fish. It also improved immunological parameters (respiratory burst and lysozyme activities) and metabolic enzymes (AST and ALT) in the fish.

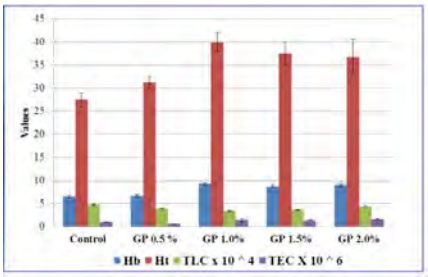
Further, efficacy of MLP as feed additive for enhancing growth, immunity and reproductive potential in live bearing ornamental fish, black molly, *Poecilia sphenops* was also evaluated. MLP supplementation improved fish survival, growth and reproductive potential at all inclusion levels

(5-15%) but best results were obtained at 12.5% level viz., fish growth (136%), reproductive efficiency in terms of GSI (54%), relative fecundity (34%), fry production (80%) and fry survival (13%).

(e) Ginger: Ginger (*Zingiber officinale*) powder (GP) supplementation in fingerlings feed (@ 1%) of pangas catfish (*Pangasianodon hypophthalmus*), improved survival (5.68%), growth (70.8%) and the immunological parameters (Hb and Hct) of fish under pond cages culture system (stocking density of 35/m^2).

Pangas culture under pond cage aquaculture System

Ginger supplemented floating pangas feed



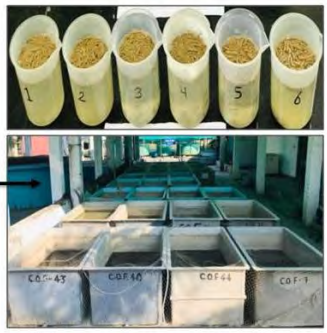
Improved immunological parameters in ginger fed fish

Utilization of non-conventional feed resource in fish feed formulation

(a) Fish silage: To develop low cost grow out feeds for high value pangas catfish (*P. hypophthalmus*), efficacy of fish silage (prepared from fish processing waste) as a protein feed source was evaluated. The results revealed successful replacement (100%) of fish meal, with significant improvement in survival (5.38%), growth (49.96%) and health of fish. It also reduced feed cost by 51%.

Fish waste

Silage preparation



Fish feeding with silage supplemented pellet feeds

(b) Castor cake: To develop low cost grow out feed for Amur carp (*Cyprinus carpio haematopterus*), castor seed cake (CSC) was tested to replace costly feed ingredient soybean meal @ 5-20%. It was found that CSC can be incorporated in Amur carp feed up to 15% inclusion level for higher economic returns owing to 34% higher growth, better FCR of 1.31 (control 1.68) and improved PER of 2.77 (Control 1.90).

(c) *Eichhornia* Silage: To utilize one of the nuisance aquatic weed (*Eichhornia)* as a potential feed resource in aquaculture nutrition, *Eichhornia* silage was used in formulating feed of a cosmopolitan fresh water carp, Common carp (*Cyprinus carpio*). The experimental trials

revealed that *Eichhornia* silage can replace conventional energy source (rice bran) by 40% (8.60% feed cost reduction) with 28.73% higher yield, 35.48% higher net profit and about 25% increment in flesh protein content.

Eichhornia

Chopped *Eichhornia*

Fermented *Eichhornia*

Dried *Eichhornia* Silage Powder

***Eichhornia* Sillage incorporated pellet feed**

(ii) Meat quality improvement through nutritional interventions: With an objective to produce fish with enhanced nutritive value, pangas catfish was fed with feeds supplemented with fish silage (animal protein source) and linseed meal. Replacement (50%) of plant ingredients (groundnut and soybean meal) with fish silage in diet of pangas grow-out diet revealed significant improvement in fish growth (59.68%), health status and flesh quality, with significant reduction in feed cost (22.79%) and increment in net profit (62.18%). Sensory evaluation of products (fish fingers and fillet), prepared from the pangs fed on diet having fish silage (50% replacement of plant ingredients) and 5% linseed meal, showed improved acceptability with an overall score of 9.0.

Flesh Quality Wet wt. basis	Control	Exp. Feed
Total Proteins	12.51^{b}	13.85^{a}
Total Lipids	3.63^{b}	8.12^{a}
Ash	1.19^{b}	1.32^{a}
Moisture	76.46^{a}	76.28^{a}

Pangas fish products prepared from experimental fish

Sensory Evaluation Score	Control	Exp. Feed
Flavour	7.56^{b}	8.67^{a}
Crispiness	7.22^{b}	8.89^{a}
Juiciness	6.89^{b}	8.67^{a}
Texture	6.68^{b}	8.67^{a}
Taste	7.11^{b}	8.56^{a}
Overall Score	8.00	9.00^{a}

Sensory evaluation of fish fingers by team of panelists

(iii) Vermicompost Application in Aquaculture Nutrition: Different additional substrates (ripen pumpkin, bottle gourd and papaya slurry) were used to evaluate its effect on quantity and quality of vermicompost and earthworm (*Eisenia fetida*) produced during vermicompositing. As compared to control treatment (without additional substrate), the organic carbon, nitrogen (N), phosphorus (P), potassium (K) contents in vermicompost was enhanced by 3.65-7.17%, 31.78-98.37%, 12.95-22.33% and 40.16-77.36% with ripen pumpkin, bottle gourd and papaya slurry substrates, respectively. Among all substrates, highest values of organic carbon, N, P and K values (47.85%, 1.06%, 0.52%, 0.43%, respectively) with maximum number of earthworms (35.29% higher than control) having highest protein content (40.14%) were recorded with papaya based substrate. It offers practical utility in enhancing nutritive value of vermicompost and earthworms for utilization in agriculture (vermicompost as manure) and aquaculture (vermicompost as manure and earthworms as feed).

Vermicomposting with different additional vegetable substrates for earthworm feeding

(iv) Aquaculture Technology Innovations

(a) Overwintering: To reduce the cost of overwintering of high value temperature sensitive Pangas catfish (*P. hypophthalmus*) for brood stock development under climatic conditions of Punjab, *in-situ* indigenous poly-house was designed to evaluate its efficacy in terms of survival and growth of fish during the period of overwintering. The said poly-house trapped solar energy effectively to maintain the preferred water temperature (>20^0C) for overwintering of fish during the winter months (November to March), with 100% survival, 20.7% length increment and 31.66% weight increment between November, 2019 to February, 2020, which was 17% higher than traditional poly-house. Additional benefits included less labour requirement and no water exchange requirement, due to which about 80% operational cost was saved as compared to conventional poly-house overwintering. The said innovations will help in reducing the brood stock production cost significantly in northern India and hence, enhance the possibility of developing pangas hatchery in the State at farmers/ entrepreneurs level. Further, farmers who are bound to sell pangas fish before onset of winter can also adopt the technology to store their stock for marketing over an extended period in winters for higher economic returns.

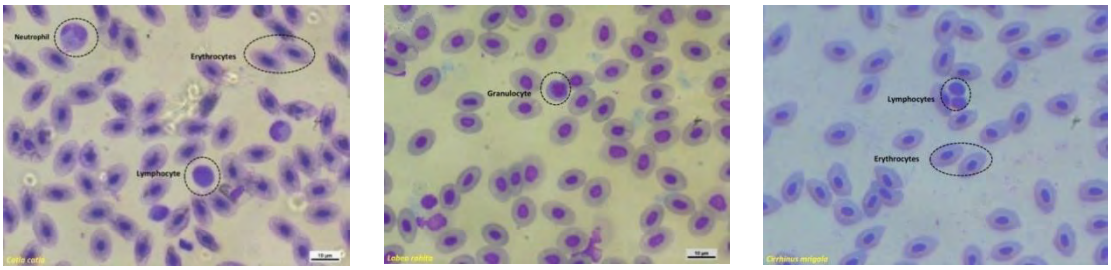
(b) Culture system and species diversification: As a climate change resilience/adaptive measure, culture systems were modified to ameliorate impacts of climate change on aquaculture. For the said purpose, culture trials viz; i) mono-culture in poly-lined pond for efficient water management through seepage loss reduction and ii) poly-culture in deep pond (water depth 6-7 feet) for protection against extreme temperature fluctuations, were initiated to assess its relative capacities to absorb climate change challenges (water shortage and extreme temperatures) hampering aquaculture productivity. Monoculture of Amur carp (fast growing common carp strain with delayed maturity) in poly-lined pond is under progress. Carp-pangas poly-culture trial in 1-acre pond, with extra stocking of pangas @ 20% produced an extra 500 kg pangas harvest (worth market price of Rs. 60,000/-) after 6 months of culture period. Intercropping produced additional pangas fish without disturbing the carrying capacity of the pond at any time during the culture period.

Pangas Harvest from Carp-Pangas Poly Culture Pond

Poly-lined Pond – Seepage Loss Reduction

(v) Fish Physiology and Endocrinology

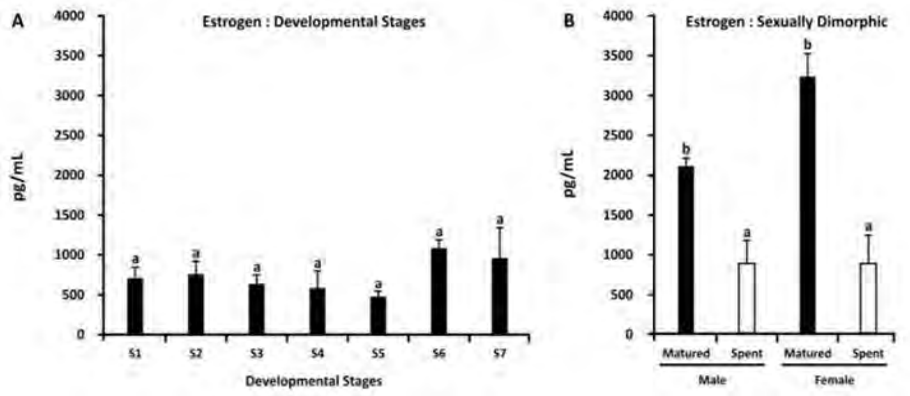
(a) Indian Major Carps: Comparative hematological (TEC, TLC, Hb, Hct) observations of Indian major carps (catla, rohu and mrigal) were made to develop diagnostic and species identification marker in aquaculture. Differences among species in respect to blood cell morphology were also recorded. It would be best utilized as a quick diagnostic tool for health assessment in wild and cultured fish.

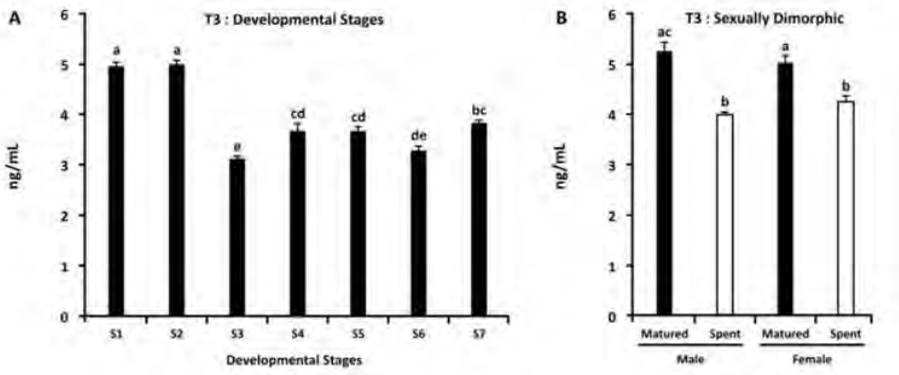


Catla (*Catla catla*) **Rohu (*L. rohita*)** **Mrigal (*Cirrhinus mrigala*)**

Representative blood cell morphologies in Indian Major Carps

(b) Giant Murrel: Baseline studies on haematology and hormones profile of high value murrel species, *Channa striatus* (immature and matured fish of both genders) under captive conditions were conducted. The blood indices, reproductive hormones and growth hormones fluctuated under controlled conditions. Hence, it needs further investigation for nutritional interventions during pre-maturation developmental stages (S1- S7, fish length and weight -14.16 to 34.28cm and 44 to 388 gm, respectively) and maturity stages, so as to enhance the courtship behavior of the fish for successful breeding under captivity.

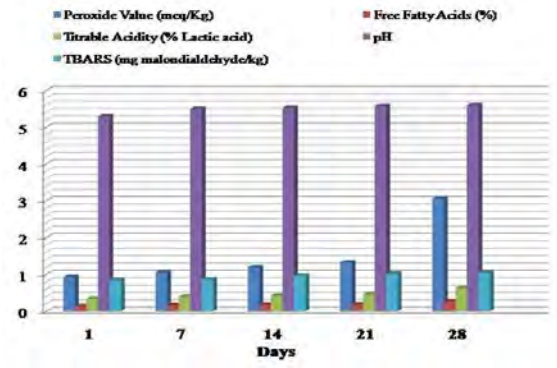




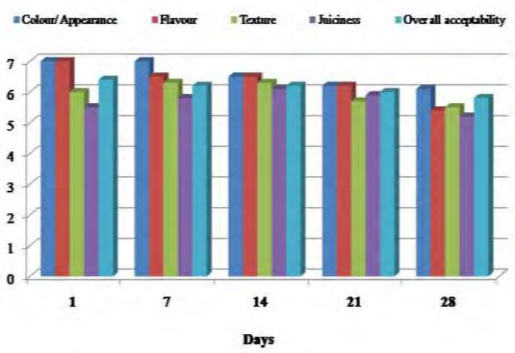
(vi) Post-Harvest Processing/Value Addition

(a) Shelf Life Enhancement: To enhance shelf life of value-added fish product "Ready to Eat Fish Balls", prepared from carp mince, storage trials were conducted under refrigerated temperature (5±2°C). For this purpose, proximate composition, oxidative stability and sensory

characteristics of the product was evaluated over for a period of 35 days. The results reveal that "Ready to Eat Fish Balls prepared from carp mince remained fit for consumption up to 21 days at refrigerated temperature (5±2°C).



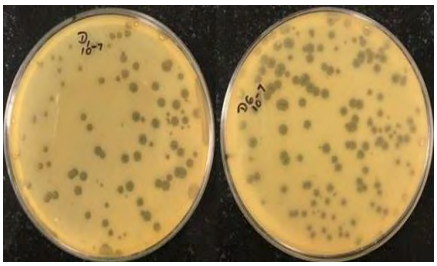
Oxidative stability parameters of fish balls under aerobic storage at 5±2°C



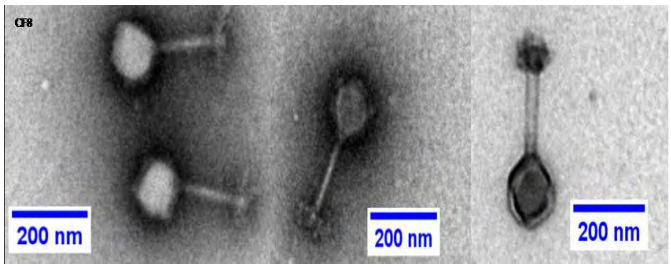
Sensory characteristics of fish balls under aerobic storage at 5±2°C

(vii) Aquaculture Health Management

(a) Phage Therapy: To combat the ecological impacts of chemical use for health management in aquaculture, phage-based approach for control of aquatic bacterial pathogens was up scaled for developing an eco-friendly health management protocol in aquaculture. For this purpose, lytic phages against *A. hydrophila* and *Vibrio parahaemolyticus* were isolated and characterized for *in vitro* and *in vivo* evaluation against bacterial pathogens. Twelve (12) *A. hydrophila* and ten (10) *V. parahaemolyticus* specific phages were isolated. Out of these, 7 phages have been completely characterized in terms of morphology, host range and whole genome sequencing. During preliminary trials, feed based application of *A. hydrophila* phage resulted in improved survival (RPS 61%) in disease challenged carp fish rohu, *L. rohita* Ham. After further trials, these phages can be used for control of bacterial pathogens in aquaculture environment without disturbing the natural host microbiota and also help in reducing the use of chemotherapeutics/antibiotics in aquaculture.



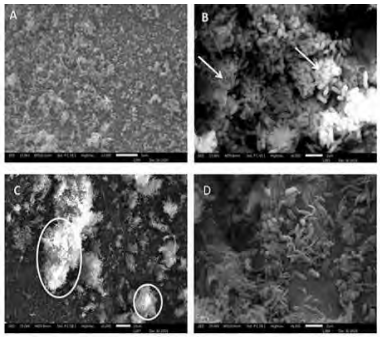
Detection of *Aeromonas hydrophila* phage lytic activity by plaque assay



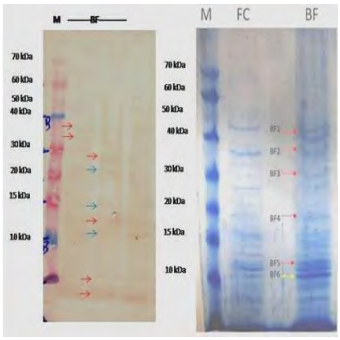
Transmission electron micrographs of *A. hydrophila* phages after staining with 2% phosphotungstic acid.

(b) Nano-particle based novel oral bio-film recombinant vaccine: In order to develop an eco-friendly disease management protocol for aquaculture, work was initiated to develop nanoparticle based novel oral bio-film recombinant vaccine from protective biofilm of *Aeromonas hydrophila* antigens. Bio-film of *A. hydrophila* cells was characterized through electron microscopy, while 6 and 30 novel biofilm proteins were detected through SDS PAGE and 2D electrophoresis, respectively. Through reverse vaccinology approach, 9 protective proteins were detected by western blot analysis and 1189 proteins were identified by in-gel digested nano LCMS method. Seven (07) proteins viz., outer membrane protein BamA OS (90kDa), major adhesion protein (AHA1/OmpA1) and TonB dependent receptor, B3 serine proteins, serine protease (75kDa), Chaperone protein, Putative outer membrane potein (48kDa), were identified as potential candidates. All the identified proteins were subjected to biological process analysis through bioinformatics and majority of protein detected in the

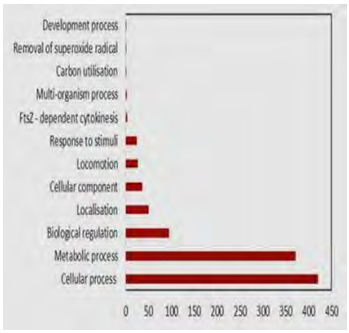
samples were involved in cellular, metabolic process and biological regulation. Further, chitosan nanoparticles fed @ 1g/kg feed showed significant increase ($p<0.05$) in the NBT, lysozyme and myeloperoxidase activity in fish as compared to control group and hence, is able to protect the fish (*L. rohita*) from the *A. hydrophila* infection.



Scanning Electron Microscope images of free cell and bio film cells of *A. hydrophila*.

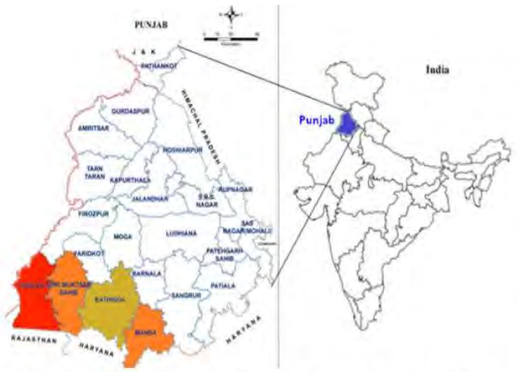


Protective bio-film vaccine protein detection by western blot analysis

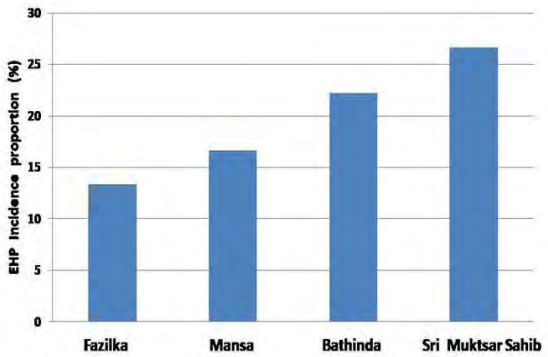


Overall biological process identified proteins through bioinformatics analysis

(c) Disease Surveillance: For sustainable development of aquaculture in Punjab regular monitoring of shrimp (in inland saline water areas of south west districts) and fish farms was done under National Surveillance Program for Aquatic Animal Diseases (NSPAAD) under NFDB-ICAR collaborative project. Total 66 shrimp farms and 41 finfish farms were monitored under the said surveillance program. Haepatopancreatic microsporiodiosis due to *Enterocytozoon hepatopenaei (*EHP) infection was detected/reported in the all the shrimp farming districts of Punjab, with relative predominance in the order of Sri Mukstar Sahiab > Batinda > Fazilka > Mansa. All the EHP positive farms were managed successfully by the university through technological interventions to curtail stock loss due the said infection. However, no incidence of shrimp viral disease was detected even by third level of diagnosis (PCR) in the cultured shrimp.



South west districts under disease surveillance in South West Districts



EHP incidence Proportion (%) in south west districts

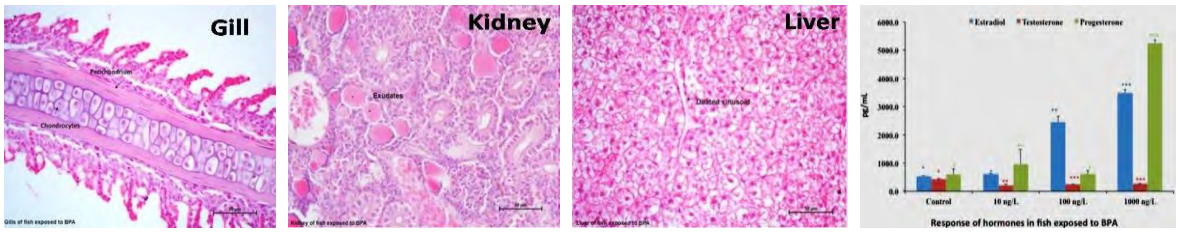
(viii)Aquatic Environment Management

(a) Biomarkers for pollution: To identify some potential biomarkers for pollutions in aquatic environment, effect of an endocrine-disrupting estrogen-mimic Bisphenol-A (BPA) was studied in a cosmopolitan fish species, *C. carpio* (common carp). Effect was recorded in respect to key transcripts expression, growth hormone levels and tissue histomorphology of exposed fish. For this purpose, fish were exposed to environmentally relevant concentrations of BPA (10, 100, and 1000 ng/L) for 28 days.

- The study on the selected transcripts expression revealed significantly decreased (*cyp19a1a*, *cyp19a1b, c3*) and increased (*vtg*) response at higher concentrations. With the increasing BPA concentrations, the steroidogenic hormones increased significantly, however the growth hormones, T_3, T_4 and TSH reduced significantly with BPA exposures.
- Histo-morphological studies revealed altered micro-architecture of chondrocytes and haemorrhages in gills, while fluid accumulation, reduced lumen and degeneration of

tubules were noticed in kidney. Dilated sinusoids, binucleated hepatocytes and inflammation were prominent in liver tissue.

- The investigation revealed that the cosmopolitan *C. carpio* is found suitable model for biomarker studies to assess the aquatic health status either in laboratory or natural environments around the year. Collectively, vitellogenin, steroidogenic transcripts, hormones and histopathological studies could be used as an early warning biomarker for aquatic pollution studies.



Histological and hormonal changes in BPA exposed fish

(b) River Health Assessment: Ecological monitoring of river systems and wetlands of Punjab conducted to assess pollution status and its impact on aquatic fauna, including fish to evaluate potential threats requiring remedial action.

Sampling Spots (09) selected on River Beas Stretch in Punjab

River Beas: Under PPCB funded project, river ecology in terms of water quality parameters (pH, D.O., BOD, COD, total alkalinity, total hardness, conductivity, turbidity, free carbon dioxide, nitrate-N, Ammonical-N, soluble phosphates, ionic composition), plankton diversity (phytoplankton and Zooplankton) and presence of potential contaminants (heavy metals, pesticides and microbial load), was assessed on monthly basis (April, 2019 to Feb., 2020). For this purpose, 9 spots were selected (Talwara, Dasuya, Kiri Afgana, Tanda, Beas, Gagrewal, Goindwal, Karmuwala, Harike Pattan), starting from entry of the river in the State at Talwara, District Hoshiarpur up to its confluence with river Sutlej at Harike Pattan, District Tarn Taran. The results revealed seasonal and location variation along downstream course of the river from Talwara to Harike.

- Comparative BOD levels were higher at Talwara, Kiri Afgana, Tanda, Beas, Karmuwala and Harike as compared to other 3 spots (Dasuya, Gagrewal and Goindwal). Overall higher levels of BOD were observed during summer (April to June) and monsoon (July and August) as compared to post monsoon (September- November) and winter (December – March). The range of BOD levels in Beas river recorded were 0.17-2.54 mg/l, 0.25-5.07 54 mg/l, 0.51-4.91mg/l and 0.23-3.02 mg/l in winter, summer, monsoon and post monsoon, respectively.
- Overall higher level of NH_3 was observed during winter (December – March) as compared to summer (April to June), monsoon (July and August) and post monsoon (September-November) period. The range of NH_3 level in Beas river was recorded as 0-1.65 mg/l, 0.02-1.08 mg/l, 0.01-0.25 mg/l, 0.11-0.34 mg/l in winter, summer, monsoon and post monsoon period, respectively.
- Overall higher levels of total coliforms were recorded in summer (April to June) and post monsoon (September- November) season as compared to winter (December to March). The range of total coliforms during winter, summer, monsoon and post monsoon seasons were recorded as <3->1100 and 4 - >1100, 4->1100, 48- >1100 MPN/100ml and fecal coliforms were recorded 2->1100, 3- 1100, 4-1100, 4- 1100 MPN/100ml, respectively.
- Higher total and faecal coliform levels at village Karmuwala (Dolphin hotspot), Dasuya and Beas Bridge needs to be carefully monitored. Hence, discharge of untreated sewage into the river at these spots is a matter of concern.

Site -1 (S-1): River Sutlej at Ropar Headworks at its entry point Punjab.

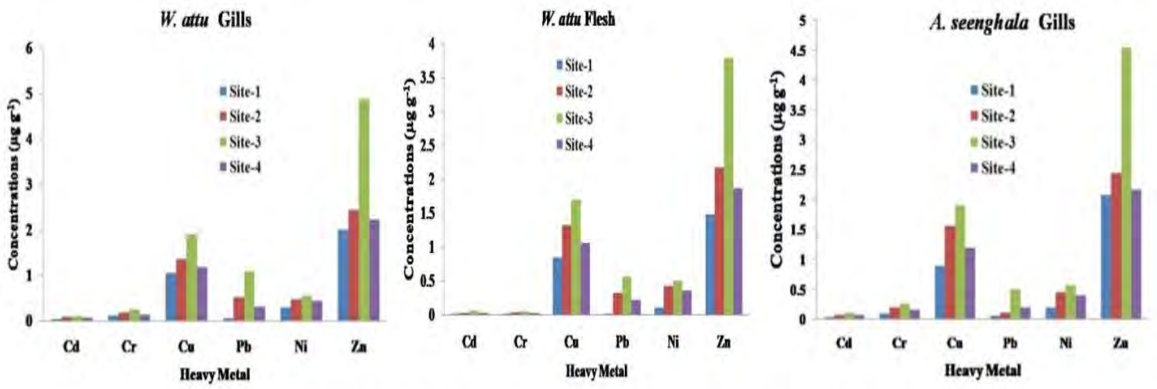
Site-2(S-2): River Sutlej stretch at Phillaur, Ludhiana, before confluence of Buddha Nallah

Site-3(S-3): River Sutlej downstream after confluence of Buddha Nallah near village Wallipur Kalan.

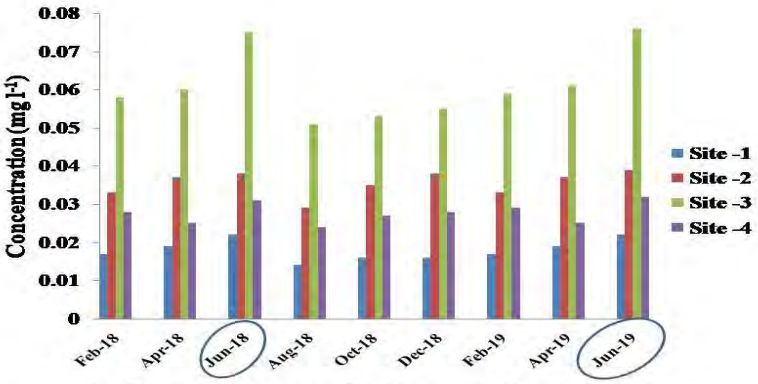
Site-4 (S-4): Harike-Pattan at the meeting point of river Sutlej and Beas.

River Sutlej: To assess ecological health of River Sutlej along its course in Punjab, four spots (S-1 to S-4) from entry of the river into the State (Ropar Headworks in district Ropar) to its confluence with River Beas at Harike Patan (District Tarn Taran) were selected. The objective was to study impact of Buddha Nallah (carrying dairy shed waste and industrial effluents) confluence into the river at village Wallipur Kalan in District Ludhiana. Database in respect to physico- chemical parameters of water, plankton diversity and heavy metal (Cd, Cr, Cu, Pb, Ni and Zn) concentrations in water, sediment and different species of fish (*C. carpio, L. rohita, Wallago attu* and *Aorichthys seenghala*) was recorded on seasonal basis.

- Buddha Nallah confluence increased NH_3 and BOD in river Sutlej to harmful levels at Site-3 (Sutlej downstream after confluence of Buddha Nallah near village Wallipur Kalan), which was found to be up to 1.92 and 41.18 mg/l (ppm) in the month of June (pre-monsoon period).
- Concentration of Cd, Cr, Cu, Ni and Zn was within permissible limits in water, sediment and fish tissue (muscle, gills and gonads) at all the spots, but Pb was above permissible WHO limits (0.05 mg/l in water and 0.5 µg/g in tissue) in water and gills of carnivorous fish at Site -3 in the month of June viz., 0.76 mg/l in water; 0.59 and 1.09 µg/g in flesh and gills of *W. attu*, respectively; and 0.51 µg/g in gills of *A. seenghala*. However, level of all heavy metals (including Pb) was found below permissible levels in the herbivorous species (*C. carpio* and *L. rohita*).
- The results indicated the deleterious impact of Buddha Nallah on ecological health of river Sutlej is associated with serious biodiversity and food security concerns with special reference to carnivorous species like *W. attu* and *A. seenghala*, which are among the most favorite food fishes of the State. Overall results reveal significant pollution rise in river Sutlej during its course in Punjab from Site-1 to Site-3, posing consequential threat to aquatic life, associated fauna and dependent human population.



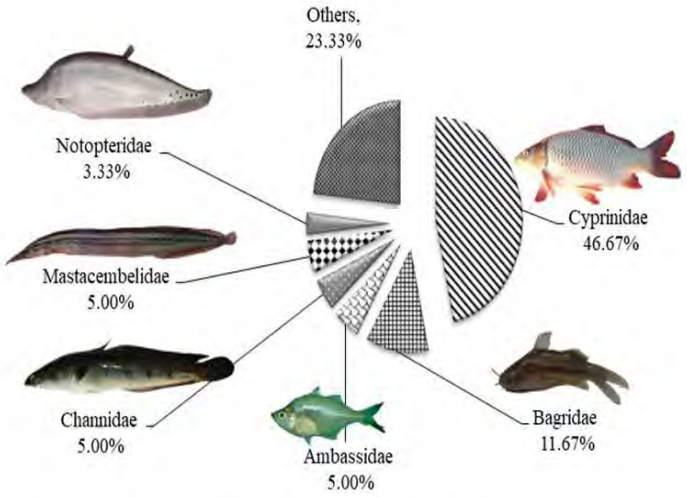
Heavy metal concentrations in flesh and gills of fish



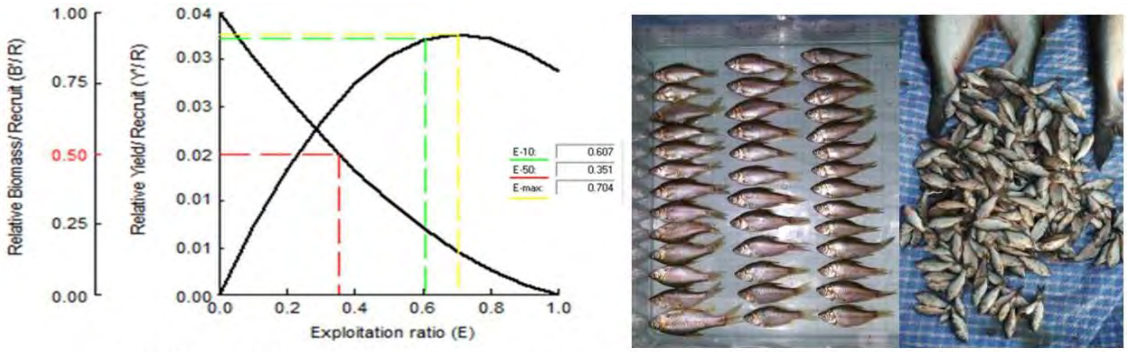
Maximum Pb concentration in water of River Satlej recorded in the month of June

(c) Fish diversity and population dynamics: Icthyofaunal diversity and population dynamics of one of the indigenous minor carp, *Puntius sophore,* in river Sutlej (Ludhiana stretch) was assessed.

- The study revealed that river Sutlej is supporting the existence of indigenous and exotic fishes, despite increasing pollution levels in this region of Punjab. A total of 60 species belonging to 43 genera, 17 families and 7 orders were recorded during the investigation.
- The stock of *P. sophore* was under-exploited and stock may be considered to be exploited optimally, which is one of the favorite species among migrant consumers in the State. As per F and Z values, the estimated exploitation ratio (E) was found to be 0.45 and exploitation rate (U) was found to be 0.40.



Per cent contribution of major fish families with their representative fish species in river Sutlej, district Ludhiana, Punjab



Relative yield and biomass per recruit as a function of exploitation of *P. sophore* (Hamilton, 1822) of river Sutlej in Punjab

RESEARCH PROJECTS

I Projects Submitted 2019-20

Sr No.	Title of the Project
	COVS
	SERB
1.	Novel Electrospun Bioactive Nano-Fibers for the development of functional meat products Under "The empowerment and equity opportunities for excellence in science (EMEQ) scheme.
2.	Exploring Functional Livestock Products as an Innovative Omega-3 Fatty Acid Delivery Vehicle For Enhanced Health Benefits
3.	Standardization of adiposity and inflammatory bio-markers in naturally obese dogs in health and disease and their management through dietary interventions
4.	Large particle size feed: A futuristic low cost novel approach for sustainable poultry production for food security, improved bird welfare and minimum environmental and public health hazards
5.	Bio-fortification strategies for table eggs: A way forward to reduce vitamin D deficiency
6.	Assessment of coarse feed as an alternative of conventional feeding strategy to improve gut health vis-a vis augmenting economic prospects for commercial and rural poultry operations
7.	Studies on environmental pollution due to waste anaesthetic gases and development of mitigation strategies
8.	Evaluation of novel suture materials vis-a-vis commercially available synthetic suture materials/ mesh for hernia repair in bovines
9.	Studies on Comparative evaluation of Adipose Derived Mesenchymal Stem Cells, Hyaluronic acid and TGF β1 for management of osteoarthritis in Guinea Pigs and its clinical application in dogs
10.	Complete orthopedic and orthodontic solutions for veterinary patients by hybridization of 3D bio, metal and ploymer printing
11.	Evaluation of circulating tumor associated biomarkers in canine skin tumor with special reference to its correlation with the outcome of surgical skin reconstruction technique
12.	Swine Specific Mineral Mixture: A key to performance, productivity and profitability
13.	Studies on neglected zoonotic pathogens in ruminant abortion: an immunological and molecular approaches
14.	*In Vivo* application of buffalo placental stem cell therapy to repair wound and tissue injury
15.	Cellular metabolic profile vis-a-vis ovarian status in female buffaloes: Influence of environmental stress
16.	Assessment of the diagnostic strategy for identification of multiple pathogens associated with Bovine Respiratory Disease Complex and its seroepidemiology
17.	To study the effect of cefquinome on teratology and reproductive toxicity in rats
18.	Evaluation of phytochemicals as an alternative to antibiotics in livestock to combat Antimicrobial Resistance
19.	Synergist mediated mitigation of synthetic pyrethroid resistance in cattle tick, *Rhipicephalus microplus*
20.	Development of an effective and improved extender for cryopreservation of rooster semen and its effect on fertility
21.	Equine cardiac diseases – Prevalence, risk factors and diagnosis

Sr No.	Title of the Project
	CCRAS
22.	Evaluation of 'Kutajghana Vati' and 'Sanjivani Vati': The classical Ayurvedic Preparations" as an alternative to modern antimicrobials in feed additives in broiler production
23.	Evaluation of efficacy of Vacha *(Acorus calamus L.)* and Katarina (Cymbopogon citates (DC) stapf For the double layer security for control of fly at poultry farm.
24.	Designing Ayurvedic Herbal products to improve growth and production for sustainable livestock farming
25.	Evaluation of fumigation efficacy and fly repellent potential of a coded Ayurvedic formulation (AYUSH-PPD) in Poultry production practices
26.	Evaluation of antioxidant, immunomodulating and growth promoting potential of Ayurvedic formulation in livestock
27.	Clinical Evaluation and development of polyherbal Ayurveda formulation for early puberty and growth enhancement in goats
28.	Evaluation of the efficacy of Vaishvanara Churna (an herbal formulation) for the enhancement of poultry production
29.	Evaluation of Antimicrobial, Anti-anxiety, Muscle Relaxant and Anticonvulsant Activity of Ayurvedic Herb Kattrina (Cymbopogon itrates DC. Stapfsyn Essential Oil)
30.	Ethno-Veterinary Botanical Survey of Hoshiarpur Districts of Punjab
	DBT
31.	Innovative electrospun nanofibers to fortify and enhance bioavailability & storage stability of micronutrients in livestock products.
32.	Letter of intent in the area of "Genome Engineering Technologies and their applications
33.	Poultry vaccine against major respiratory tract pathogens of chicken to Marie Curie Actions, European Commission under Individual fellowship category through on line portal
34.	Socio-economic upliftment of pig farmers of Punjab by enhanced disease surveillance, management and control
35.	Socio-economic upliftment of Rural Goat Farmers and Enterprnuership Development for non working rural persons through scientific intervention in District Hoshiarpur, Punjab.
36.	Rural employment generation through adoption of improved agricultural practices of pulse production and packaging in kandi region of Punjab for a research grant under R&D and Demonstration projects.
	NABARD
37.	Promotion of corn cob mixture (CCM) quality silage production for dairy farms in Taran Taran District of Punjab
38.	Development of low cost fruit fly traps for Cucurbit Vegetables and its demonstration at farmers' fields in border area of District Tarn Taran of Punjab
	Waltham foundation, UK.
39.	Clinical studies on breed specific morphometry and novel biomarkers of cardio-metabolic risks associated with obesity in dogs
	State Govt.
40.	To Establish dairy development extension centre in Pathankot District, Punjab.
	Australia-India Council
41.	Strategies for training animal disease detectives in India (STADDI)

Sr No.	Title of the Project
	NHB (National Horticulture Board)
42.	Infrastructure development in KVK farm by construction of poly net house for demonstration and training to farmers of District S.A.S Nagar
	CODST
	DST
43.	Engineering intervention for mechanization of mozzarella cheese manufacture at cottage scale
44.	Optimization of emerging technologies, A start up entrepreneural initiative for farmers in producing premium quality milk
45.	Development of novel whey cheeses and its by-product utilization- A holistic approach for dairy entrepreneurs in Punjab.
46.	Characterization of Milk Oligosaccharides and Bioactive Peptides isolated from Indigenous Cow Milk-Potential Novel Therapeutics-Gate Way to Healthy Indigenous Dairy Products
	SERB
47.	Designer fermented milk products for the management of Obesity: Modulating gut microbiota via prebiotics and probiotics
48.	Novel Approach - Intelligent Packaging-2 IN 1 Quality Indicator in Composite Biodegradable Film for Predicting the Characteristics and Shelf-Life Monitoring of Dairy Products
49.	Impact analysis of Interaction of Milk Proteins with Black Tea Polyphenols- A conclusive study to support milk tea concoction
50.	BuMR-Ates' - Buffalo Milk Restructured Proteinates as Functional Food Ingredients
51.	Revisiting pasteurization: Exploring possible link between antimicrobial resistance, heat tolerance and food safety
52.	Impact assessment of economic losses due to clinical and sub-clinical mastitis and its preventive measures in the production of premium quality milk: A study of dairy farms of Punjab
	DBT
53.	Assessment of plant leaf protein as a potential food ingredient for mineral fortification.
54.	Targeting bone health through probiotic generated bioactive peptide fortification
	NABARD
55.	Development of demonstration vehicle for popularization of use of renewable energy sources for value addition to milk at Farm Level under Rural Innovation Fund
	COF
	ICAR
56.	A comprehensive management approach to combat Tilapia lake virus, an emerging pathogen in Indian aquaculture
57.	Fish Health: Evaluation of different drugs used in inland aquaculture and impact on target fishes and their environment under All India Network Project on Fish Health
	DBT
58.	Development of phage repository and bioprospecting of novel antimicrobial molecules from phage genomes for control of pathogens: An approach to prevent the spread of antimicrobial resistance in aquatic environment
59.	"Farmer Friendly Nano-Particle-Conjugated Antibody Based Optical Immunosensors for Detection of Potato virus Y" under Nanotechnology based tools to enhance agricultural productivity

Sr No.	Title of the Project
60.	Development of micronutrient rich cereal based products using fish bone powder.
	SERB
61.	Development of phage protein based novel assays for rapid detection and quantification of *Vibrio parahaemolyticus* in food
62.	Developing microRNA signatures as biomarkers for healthy carp brooders and good quality eggs
63.	Transcriptomics and hormonal characterization of high value striped catfish *Pangasianodon hypophthalmus* for efficient brood stock and breeding technology development
64.	Development of phage repository and characterization of phage encoded recombinant antimicrobial molecules for controlling the bacterial pathogens of fish/human health significance
65.	Exploration of fish faunal diversity and DNA barcoding of prioritized fishes of river Sutlej
66.	Standardization, validation and dissemination of cost-effective novel biofloc technology application in aquaculture
	CCRAS
67.	Development of herbal diets through experimental trials on the selected herbs for growth and immunomodulatory performance in common carp (Cyprinus carpio)
	COABT
	DBT
68.	Development and strengthening of bioinformatics center for research and innovation in animal sciences in Northern India
69.	Genome editing strategy to bring in germ line transformation for improved developmental potential of oocytes
	ICMR-ICRC
70.	A multidisciplinary approach to unravel cancer signaling pathways in non-smoker lung cancer
	CANADA
71.	Permission for International Collaboration with York University Canada in NSERC CREATE program titled "Training in Applied Biotechnology for Environmental Sustainability" (TABES).

II Projects Operational 2019-2020

Sr No.	Title of the Project	Total Budget (2019-20) (Rs.)
	ICAR	
1	Centre for Advanced Faculty Training (CAFT) Gynaecology and Reproduction	18,41,500
2	Network Project on Buffalo Improvement (Main Unit).(C: AGB-1)	1,04,64,333
3	Network Project on Buffalo Improvement (Field Unit). (C:AGB-2)	62,51,665
4	Project Directorate on Cattle Field Progeny Testing Project (ICAR 76/4)	96,92,000
5	All India Coordinated Research Project on Poultry Breeding.(C: AGB-4)	74,60,000
6	All India Coordinated Research Projects (AICRP) on Cattle Sahiwal (Data Recording Unit)	20,68,000

Sr No.	Title of the Project	Total Budget (2019-20) (Rs.)
7	Outreach/Network Programme on "Estimation of Methane Emission under Different Feeding Systems and Development of Mitigation Strategies."	11,20,250
8	Project Directorate on Animal Disease Monitoring & Surveillance	3,25,000
9	Centre for Advanced Faculty Training (CAFT) Surgery /Radiology	11,41,500
10	AICRP on Nutritional and Physiological Approaches for Enhancing Reproductive Performance in Animals (Enhancing Reproductive Performance)	15,86,666
11	All India Network Programme on Diagnostic Imaging and Management of Surgical conditions in animals	23,00,000
12	Outreach Programme On Zoonotic Diseases	7,68,000
13	Outreach Programme on Monitoring of Drug Residues and Environmental Pollutants	7,19,000
14	Integrated approaches for livestock development:Farmers context	18,00,000
15	Centre for Advanced Faculty Training (CAFT) Pathology	18,41,500
16	Network Project on Buffalo Improvement Center at GADVASU (Nili Ravi) 75:25	51,00,000
17	All India Coordinated Research Project (AICRP) on Pig	41,59,844
18	Niche Area of Excellence (NAE) –"Antibiotic Resistance: Animal Human Interface"	2,35,24,000
19	National Surveillance Programme for Aquatic Animal Diseases"	23,80,968
20	Institutional Development plan (IDP) for improved learning outcome, skill and entrepreneurship at GADVASU	1,86,91,000
21	Experimental Learning for the entitled Ornament, Culture, Breeding and Seed Production at GADVASU	32,00,000
Total		**10,64,35,226**
DBT		
1	Molecular characterization of fecundity genes in Assam "Hill Goat"	0
2	Understanding in-situ dynamics of provincial innate immune response during reproductive salmonellosis in chicken for considering future practice of anal (cloacal) mucosal vaccination	50,008
3	DBT– GADVASU CRC PMU Unit	25,69,776
4	Development and evaluation of therapeutic xenogenic DNA vaccines based on canine homologous marker sequences against mammary tumors in mice models	10,89,884
5	Molecular characterization of canine distemper virus field isolates for selection of suitable vaccine candidate (s)	7,05,768
6	Establishment of laboratory for diagnosis of leptospirosis	8,25,612
7	Establishment of Teaching Veterinary Hospital Database Management System	3,75,341
8	Establishment of blood bank and blood grouping unit in dogs	7,73,434
9	Etiology, diagnostic and therapeutic modalities for canine renal diseases	9,21,741
10	Elucidating the etiology of chronic gastroenteropathies in dogs	8,62,591
11	Semen cryopreservation in pet dogs	11,46,196

Sr No.	Title of the Project	Total Budget (2019-20) (Rs.)
12	Nutritional and processing interventions for developing pet foods	11,98,150
13	Parentage Determination and Cytogenetic Profiling in Dogs	11,97,247
14	Development of novel suture materials and implants for canine arthropathies	12,39,253
15	Development and clinical application of biomaterials for root canal treatment and crown therapy in dogs	5,78,130
16	Studies on Patho-Morphological Alterations in Blood Cells to Develop A Foldscope Based Field Test	0
17	Use of Foldscope for diagnosis of parastic disease with emphasis on canine zoonotic parasites under Human Animal Interface	1,76,449
18	Multiplex-polymerase chain reaction based detection of tick borne canine haematozoan diseases	9,49,549
19	To evaluate antigenic relationship among the Canine Parvovirus types and vaccine strains using *in-vitro* cross neutralization test	5,15,350
20	DBT Network programe on bovine Tuberculosis control:mycobacterial diseases in animal network (Mydan) Program	0
Total		**1,51,74,479**
DST		
1	An assessment of the role of mitochondria in bovine mastitis	9,46,000
2	Molecular mapping and octopamine receptor gene polymorphism based detection of amitraz resistance in cattle tick, *Rhipicephalus (Boophilus) microplus*	0
3	Synergistic effect of Modified Atmosphere Packaging (MAP) and antimicrobial edible packaging on shelf life enhancement of composite dairy foods (Doda burfi and Bottle gourd burfi)	4,00,000
4	Isolation and Molecular Characterization of Chicken Infectious Anemia Virus	3,00,000
5	Designer food for management of type 2 Diabetes: Targeting the gut hormone molulatory potential of probioticsalue addition to milk	5,63,582
6	"Nano-particle based oral bio-film recombinant"	6,00,000
7	Solar driven technological interventional in manufacturing of ice bank tank (IBT) for Milk cooling at dairy farms	6,70,407
Total		**34,79,989**
SERB		
1	Value addition of whey and pearl millet in the development of functional gluten free foods	2,99,992
2	Bioactive biodegradable composite films for the extension of shelf life of livestock products	9,00,000
3	Proteomic and genomic insights into the effect of piperine and eugenol….Sakazaki	0
4	Immunopathological and molecular studies on bovine cryptosporidial diarrhoea and associated etiologies	0

Sr No.	Title of the Project	Total Budget (2019-20) (Rs.)
5	Fast clotting clinical grade hemostatic agent for emergency care	4,60,000
6	Designing and evaluation of various configurations of threaded intramedullary pins for canine long fractures	1,25,000
Total		**17,84,992**
RKVY		
1	Enhancing Livestock Production in Punjab through need based Research and Development activities	6,66,983
2	Intensifying research in livestock, dairy and fishery sector on production, disease diagnosis, health care, food safety and value addition for improving rural economy and inclusive growth	51,354
3	Sustainable Livestock, Dairy and Fishery Farming for Food Security and Economic Prosperity through Need based and Problem-Oriented Research	1,63,756
4	Addressing the challenge of increasing production from livestock, dairy and fishery farming through thematic research	13,063
5	Inclusive Growth in Livestock, Dairy and Fishery Farming Through Technological interventions in Punjab	96,66,840
6	Enhancement of Production and Productivity Potential of Livestock, Poultry and Fisheries sector for Socio-economic upliftment of the farmers of Punjab	4,44,81,606
Total		**5,50,43,602**
Miscellaneous		
1	Addressing bovine Tuberculosis at the human animal interface and Veterinary Antibiotic use in smaal holder peri-urban dairy farms in india to ensure safe and sustainable milk production	15,27,123
2	Molecular Epidemiology of Listeria Spp. in Releation to its Ecology and Trace Back using Genome based typing methods.	5,57,435
3	Molecular epidemiology of porcine Trichinellosis and Toxoplamosis in India: addressing negelected zoonotic diseases in a one health context.	7,17,022
4	Genome wide association studies for the improvement of productivity in dairy buffalo in cattle in india	20,62,177
5	Development of medicine & plant garden for veterinary ayurveda resaerch at GADVASU ldh	16,34,450
6	Efficacy of long acting ceftiofur (Wouter-CF for treatment of respiratory infections in cattle and buffaloes	3,69,400
7	Processing and nutritional evaluation of paddy straw and other feed ingredient pellets as livestock feed	2,16,508
8	Development of Good Quality and Healthy Ready to Drink Concoction of Milk Tea	13,88,750
9	Evaluation of pilled hydrogeneted Palm fatty acids in lactating crossbred cows	6,07,905
10	Clinical evaluation of efficiacy of AYUSH V-24 (a coded Ayurvedic Formulation) in the management of selected gastro intestinal illness in ruminants	15,95,200

Sr No.	Title of the Project	Total Budget (2019-20) (Rs.)
11	Clinical evaluation of efficiacy of Ayurvedic Formulation for the augmentation of milk production in ruminants	12,15,200
12	Ultrasonography evaluation of Ovarian and genetial status for evaluation of fertility status in diary animals	3,13,300
13	Modelling exposure to biological hazards in the dairy chain of Andhra pardesh to inform food safety policy	5,76,986
14	Modelling exposure to biological hazards in the dairy chain of Andhra pardesh to inform food safety policy (SPHZ)	5,40,311
15	Creation of State of Art Institute for Sahiwal Breeding Farm at RRTC, Kaljharani, Bathinda	69,59,006
16	Towards Climate Resilient Livestock Production System in Punjab	80,00,514
17	Implementation of Embryo transfer & *in vitro* fertilisation technology for bovine breeding	3,94,76,428
Total		**6,77,57,715**

III New Projects Allocated 2019-20

Sr. No.	Scheme Name	Scheme Code	Funds Received 2019-20
1	Institutional Development Plan (IDP) for improved Learning Outcome, Skill and Entrepreneurship at GADVASU	ICAR-89	1,86,91,000
2	Experimental Learning for the entitled Ornament, Culture, Breeding and Seed Production at GADVASU	ICAR-99	32,00,000
3	Clinical evaluation of efficacy of AYUSH V-24 (a coded Ayurvedic formulation) in the management of selected gastro intestinal illness in ruminants	Misc-91	15,95,200
4	Clinical evaluation of efficacy of Ayurvedic formulation for augmentation of milk production in ruminants	Misc-92	12,15,200
5	Modelling exposure to biological hazards in the dairy chains of Andhra Pradesh to inform food safety policy	Misc-97	5,76,986
6	Modelling exposure to biological hazards in the dairy chains of Andhra Pradesh to inform food safety policy (SPHZ)	MISC-98	5,40,311
7	Fast clotting clinical grade hemostatic agent for emergency care	SERB-21	4,60,000
8	Designing and evaluation of various configurations of threaded intramedullary pins for canine long fractures	SERB-24	12,50,000
Total			**2,75,28,697**

IV Projects Completed 2019-20

Sr. No.	Scheme Name	Scheme Code
1	Development of subviral particle of Japanese encephalitis virus (JEV) as a candidate vaccine against JEV	MISC-19
2	To study effect of herbal formulation during transition period on oxidative status in dairy animals	Misc-51
3	Potential of new varieties of maize crop as silage	Misc 64
4	Aflatoxin M1 in milk samples from smallholders dairy farms in Peri-urban areas of India	Misc. 77
5	A study of factors affecting the chemical parameters of milk fat/ghee in Punjab with special reference to Reichert Meissl (RM) and Polenske (PV) value	PSCMP-01
6	Open Nucleus Breeding System to improve Sahiwal Cattle & Nili Ravi Buffalo in the State of Punjab	ONBS
7	Development of sub-viral particles of IBD as a potential vaccine and diagnostic candidate	DBT-11
8	Evaluation of diagnostic assays for quicker diagnosis of Mycobacterial infections in cattle and buffaloes	DBT-12
9	Isolation and Characterization of Novel Lactic acid bacteria for possible management of kidney stone	DST-06
10	Combating the needs of Vitamin A via fortification strategies using dairy products as vehicle for malnourished tribal community	DST-11
11	FIST- Programme in the department of veterinary surgery & radiology	DST -16
12	Isolation and characterization of dairy flora of Punjab region as probiotic culture	SERB 05
13	Survelliance of anti-microbial resistance in microflora of milk and dairy cattle for organised and unorganised dairy sector of Punjab region	SERB 06
14	Studies on epithelial-mesenchymal transition (EMT) in acute and chronic lung injury	SERB-08
15	Study of microbial diversity and potential human pathogens in freshwater aquaculture environment	SERB-09
16	Rapid and confirmatory detection of important animal meat based food borne pathogens and its associated toxicants and natural toxicants by using immuno-histopathological and molecular techniques- A step towards one health Concept	SERB 10
17	Comprehending the role of mucosal-associated immunity during host-pathogen interaction following *Avibacterium paragallinarum* infection in poultry (chicken and Japanese quail) for developing futuristic mucosal vaccine	SERB-11
18	Development of farmer level monoclonal antibody based flow through immunoassay for detection of *Vibrio parahaemolyticus*- the causative agent of shrimp EMS	SERB-13

EXTENSION

The university has a well-structured program for extension education and transfer of technologies related to animal health, livestock production, fisheries and value addition to the end users

The University has adopted a well designed Extension Model to reach to the livestock, poultry and fish farmers, field functionaries, subject matter specialists, industry people and other related communities. This model includes following activities:

A. Transfer of technologies to the livestock farmers and their feedback for reorienting the ongoing research programmes

The new technologies developed in different areas of Veterinary, Animal Sciences, Poultry and Fisheries are effectively communicated to the livestock farmers who are the ultimate beneficiaries of such technologies. The extension services also help in identifying the researchable problems faced by the livestock farmers and provide new research issues to the scientists. The technologies are effectively transferred through the following activities:

1. Pashu Palan Mela and Regional Kisan Melas

Pashu Palan Mela is one of the best approaches for transferring the technologies generated at the University to the livestock farmers of the State. It is usually a two day affair, however, this year it was of three day duration and was entitled as Regional Agriculture and Pashu Palan Mela (North Zone). This mela was sponsored by Ministry of Agriculture, Government of India. More than 50,000 farmers visited the venue on each day. Various departments of the university exhibited new technologies/ innovations for use in livestock and poultry farming. On the occasion, other Govt. and private agencies involved in animal health, welfare, production etc. also displayed their exhibits of importance to the farmers.

Certain departments of the university also participated in Regional Kisan Melas organized by PAU, Ludhiana at RRS, Ballowal Saunkari; District Shaheed Bhagat Singh Nagar on 10.09.2019; KVK, Rauni, District Patiala on 13.09.2019; RRS Gurdaspur along with KVK Faridkot on 17.09.2019, and RRS Bathinda on 26.09.2019.

Glimpses of Regional Agriculture and Pashu Palan Mela (North Zone)-September, 2019

Regional Kisan Melas were also organized by outstations of GADVASU at following locations:

Sr. No.	Date	Place of Kisan Mela	No. of participants
1.	24.10.2019	Satyam Farm, Barnala	1013
2.	26.02.2020	KVK, Handiaya	812
3.	05.09.2019	Tangori	500
4.	15.10.2019	Derabassi	450

2. Exhibitions

The innovative technologies and research achievements of the University are showcased in exhibitions organized at the time of seminars, conferences, workshops, special occasions, etc. Conservation of natural resources, mitigation measures to counteract ill effects emerging due to climatic changes and location specific integrated farming system models are mostly stressed upon in these exhibitions. Videos of certain specific problems of animals are played on the occasions. Area specific mineral mixture, uromin licks, byepass fat, Mastitis detection kits and other inputs are sold to the needy farmers. New technologies, technical novelties or innovations are also displayed on posters at these occasions.

Above discussed exhibits were displayed on the following occasions.

(i) Sauni Mela, *Haarhi* Mela and Awareness Programme organized by ATMA, Ludhiana on 05.04.2019, 25.09.2019 and 30.09.2019, respectively.

(ii) Kisan Mela on Jal Shakti Abhiyan organized by KVK Tarn Taran on 21.08.2019 and KVK Mohali on 05.09.2019.

(iii) Kisan Mela on *in situ* Crop Residue Management organized on 15.10.2019 by KVKs Mohali and Tarn Taran.

(iv) Inauguration Ceremony of ICAR-IIMR's Maize Institute, Laddowal on 15.11.2019.

(v) Sahiwal Day organized by RRTC, Kaljharani on 05.12.2019.

(vi) Visit of Sh. Giriraj Singh, Cabinet Minister, Fisheries, Animal Husbandry and Dairying, GOI to GADVASU, Ludhiana on 07.12.2019; Visit of MILKFED Officials on 20.12.2019 and Alumni Meet of GADVASU, Ludhiana on 29.12.2019.

3. Animal Health/Welfare Camps

Animal Welfare/Health Camps are being organized by various departments of the University under the aegis of Directorate of Extension Education. These are usually a one day affair. Repeat breeding, anoestrus and mastitis are the major problems encountered in the rural dairy animals. Owing to major chunk of the cases belonging to reproductive disorders, these camps are also known as Infertility Camps. Poor and marginal farmers also get benefitted through participation in these camps. Certain Gram Panchayats, NGOs, Cooperative Societies (Milkfed and Markfed), Government or Semi-Government Agencies like PAU, KVKs, ATMA, etc. and Banking Institutions, sometimes, sponsor these camps.

Department of Veterinary and Animal Husbandry Extension Education organized 22 Animal Welfare Camps// Health Camps mainly in Barnala district under Farmer FIRST programme. A total of 1543 livestock farmers participated in these camps. RRTC, Talwara arranged 81 such camps in various villages of Hoshiarpur district in which 1798 farmers took part. The three KVKs organized 13 camps where 737 farmers benefitted.

4. Awareness Camps, Training Camps, Field Days

The organization of Awareness Camps and Field Days is helpful in disseminating information on a particular subject related to livestock, fishery and agriculture production. Various subject matter specialists deliver their lectures on specific topics in these camps. When the awareness camp is restricted to one theme only, then, it is termed as Field Day. These are organized almost every week by KVKs/ RRTCs of the university. Under Farmer FIRST programme, Department of VAHEE organized 19 Awareness Camps where 1518 farmers were given scientific knowledge on different themes related to livestock farming.

Glimpses of Awareness Camps organized by KVK, Barnala

B. Capacity Building of Livestock Farmers and other Related Personnel

1. Trainings Organized for Farmers

Training is a specialized kind of education, which is mostly skill oriented. It is education for a very specific purpose, where the end product is pre-determined based on performance. The concern here is enhancing the ability of an individual to accomplish a set of tasks by providing an opportunity which results in acquiring the new and upgraded ability in performing the skill.

University organized specialized training courses for dairy, poultry, piggery, and fish farming and value addition of livestock products for the farmers, army personnel to transfer new technologies evolved by the university. Trainings were also organized sponsored by other animal welfare agencies. Following is the list of these trainings.

S. No.	Name of the Training Programme	Month of the Year	Duration (days)	No. of Trainings held	No. of Trainees
College of Veterinary Sciences, Ludhiana					
Veterinary & Animal Husbandry Extension Education					
1	Training on poultry farming	Apr	10	01	41
	Training on poultry farming (ASCI)	Feb	40	01	20
	Training on dairy farming (General)	May	10	01	20
	Training on dairy farming (RKVY)	Jan, Feb, Mar	01	03	115
	Training on dairy farming (ASCI)	Feb	31	01	20
	Training on pig farming	May, Jul, Nov, Dec	05	05	242
	Training on pig farming (RKVY)	Jul, Oct, Nov	05 and 03	03	74
	Training on goat farming	Jul, Nov	05	02	80
Animal Nutrition					
2	Hands on training on nutritional technologies for dairy farmers	Jun	05	01	03
	Buffalo farming for milk and meat production (RKVY)	Jul	03	01	20
	Management of fodder and improvement of low quality roughages	Aug	03	01	20
	Efficient technologies for pig production				
	Nutritional technologies for efficient milk production	Nov	02	01	25
	Preparation of area specific mineral mixture for dairy animals (ICAR:SC-SP)	Dec	02	01	20
	Uromin Lick – an energy, protein and mineral boost (ICAR:SC-SP)	Jan	01	01	24
	Fodder conservation for efficient dairy production (ICAR:SC-SP)	Feb	01	01	30
	Roughage managemental techniques for proficient dairy production	Feb	01	01	13
		Mar	01	01	22
Livestock Production Management					
3	Muharat sikhya course for SC participants from Punjab	Jul	03	01	20
	Rural upliftment through scientific goat farming (RKVY)	Feb	02	01	25
	Training on inculcation of entrepreneurship skills in poultry farming (RKVY)	Mar	01	01	25

S. No.	Name of the Training Programme	Month of the Year	Duration (days)	No. of Trainings held	No. of Trainees
Livestock Products Technology					
4	Clean meat production and by-products utilization (RKVY)	Aug	05	01	23
	Hygienic pork production and value addition for entrepreneurship development	Sept	05	01	36
	Entrepreneurship development programme on processing and packaging of meat into value added Products (ICAR:SC-SP)	Jan	02	01	20
	Entrepreneurship development programme on processing and packaging of eggs into value added products (ICAR:SC-SP)	Feb	02	01	18
	Training on hygienic meat production and processing for value added meat products (RKVY)	Feb	03	01	17
	Training on development of emulsion based meat products (ICAR:SC-SP)	Feb	01	01	09
	Training on development of extruded snack based meat products (ICAR:SC-SP)	Feb	01	01	12
	Training on hygienic poultry processing (ICAR:SC-SP)	Feb	01	01	14
	Clean meat production and by-products utilization (RKVY)	Feb	03	01	21
	Training on hygienic meat production, processing and byproducts utilization (ICAR:SC-SP)	Mar	01	01	18
	Training on development of shelf stable meat products (ICAR:SC-SP)	Mar	01	01	18
Veterinary Surgery and Radiology					
5	Small animal anesthesia for Vets of SACA (Small Animal Clinicians Association, Chd)	Jul	02	01	8
	Systematic interpretation of radiographs for veterinary patients (ICAR: AINP-DIMSCA)	Jan	03	01	15
	Small animal soft tissue surgery (ICAR: AINP-DIMSCA)	Jan	03	01	15
	Hands-on-practice on small animal anaesthesia (ICAR: AINP-DIMSCA)	Jan	03	01	15

S. No.	Name of the Training Programme	Month of the Year	Duration (days)	No. of Trainings held	No. of Trainees
Veterinary Gynaecology & Obstetrics					
6	Optimal reproductive management of dairy animals (RKVY)	Sept	01	01	50
	Optimal reproductive management of dairy animals (RKVY)	Dec	01	01	50
	Nutritional and physiological approaches for enhancing reproductive performance in animals (ICAR)	Mar	01	01	30
	Hands-on-training on AI and large animal obstetrics	Mar	01	01	30
Veterinary Medicine					
7	Training on Health management of dairy animals (RKVY)	Dec, Jan, Feb, Mar	01	04	100
	Training on clinical examination of animals (RKVY)	Mar	01	02	20
Teaching Veterinary Clinical Complex					
8	Scientific approach to dairy farming (RKVY)	Mar	01	01	45
	Scientific approach to dairy farming (RKVY)	Mar	01	01	55
	Optimal production, reproduction & disease management of dairy animals (RKVY)	Mar	01	01	90

Glimpses of certain training programmes organized by different departments of COVS

S. No.	Name of the Training Programme	Month of the Year	Duration (days)	No. of Trainings held	No. of Trainees
College of Dairy Science and Technology					
1	Value addition of milk for Dairy Farmers/ Entrepreneurs	Feb	05	01	17
	Specialized training on "Technology of manufacture of *doda* burfi"	Feb	01	01	01
	Value addition of milk	Mar and May	03	02	06
	Specialized training on "Technology of manufacture of ice-cream"	April	01	01	01
	Specialized training on "Technology of Mozzarella cheese manufacture"	April	01	01	01
	Technology of paneer, flavoured milk, dahi and whey drink	May	03	01	03
	Training on "Value addition of milk" for farmers	Jul	05	01	16
College of Fisheries					
1	Skill training of rural youth (STRY) on "Fish Rearing and Management"	Jul	06	01	14
	Training programme on "Fish Farming"	Aug and Dec	05	02	68
	Best management practices for shrimp farming	Aug	02	01	38
	Ornamental fish farming and aquarium fabrication	Oct	03	01	13




Glimpses of training programmes organized by COF

KVK, Tarn Taran organized 80 trainings for 3262 farmers on various subjects and different durations. The major subjects included Onion Seed Production, Cultivation of Summer Pulses, Termite Control in Horticultural Crops, Scientific Pig Farming, Soil Sampling and Testing, Silage Making, Feed and Fodder Management in Dairy Animals etc.

Glimpses of training programmes organized by KVK, Tarn Taran

KVK, Barnala organized 91 trainings for 1997 farmers on various subjects including Bee Keeping, Fish Farming, Horticulture, Milk Products, Mushroom Production, Integrated Farming System etc.

Glimpses of vocational training programmes organized by KVK, Barnala

Similarly, KVK, Mohali organized 36 trainings for 614 farmers while RRTC, Talwara organized five trainings under RPL (Recognition of Prior Learning) Programme for 117 farmers and seven trainings for 196 farmers under RKVY Scheme.






Glimpses of trainings organized by KVK, Mohali

Glimpses of trainings organized by RRTC, Talwara



Glimpses of trainings organized by Veterinary Polyclinics, Kaljharani

2. Lectures delivered at off-campus trainings

Subject Matter Specialists of the University also delivered expert lectures in trainings organized by outstations of GADVASU or various other agencies.

S No	Date	Topic	Organized by
1.	05.04.2019	Management practices of dairy animal at Sauni Mela	ATMA at Ramgarhia Bhawan, Khanna
2.	30.09.2019	Dairy pashuan vich prajnan bimariyan the ilaj	
3.	02.05.2019	1. Pashu prajnan kiriya ate hehe sambandhi jankari 2. Masnuyi garabhdan di mahattah	KVK Tarantaran
4.	04.09.2019	Reproductive management practices for the successful dairy famers	KVK Barnala
5.	16.10.2019	Dairy pashuan da suchajha prajnan prabandh	
6.	23.10.2019	Sooran di prajnan sambh-sambhal	KVK, Booh
7.	05.08.2019	Important breeds and strains of poultry	PAMETI
8.	09.08.2019	Economics of poultry farming	
9.	10.08.2019	Backyard poultry	
10.	04.11.2019	1. Importance of dairy farming and new prospects 2. Important breeds of cattle and buffaloes breeding strategies	
11.	07.11.2019	Anoestrus, repeat breeding and abortion in dairy animals	
12.	20.11.2019	Identification of different pig breeds and haracteristics	
13.	22.11.2019	Management of pregnant sows	
14.	23.11.2019	Facilities available for the farmers in GADVASU	PAMETI
15.	25.11.2019	Identification of different goat breeds and charateristics	
16.	28.11.2019	Reproductive management of bucks	
17.	09.01.2020	Importance of breeds and its importance	
18.	10.02.2020	Breeding strategies for improvement of cattle breeds	
19.	13.02.2020	Record keeping for efficient management	
20.	14.02.2020	Biosecurity measures at dairy farm	
21.	27.09.2019	Gabhan dairy pashuan di sambh-sambhal	Village Jarg under RKVY
22.	04.12.2019	Dairy pashuan da prajnan prabandh	Sahiwal Day, Kaljharani
23.	19.12.2019	Expert lecture on importance of breeds and its Management Practices in Dairy Animal	District level Animal Welfare Camp
24.	04.03.2020	Milch breeds and their characteristics	RKVY training at village Sarabha

C. EXTENSION PUBLICATIONS

1. Books published

(i) Honparkhe M, Ghuman S P S and Brar P S. 2019. Effect of climate change on animal reproduction (A trilingual book). pp 1-118, 1st Edn, ISBN 978-81-9338-109-0.

(ii) Ansal M D and Kaur V I. 2019. *Machhi Palan*. Guru Angad Dev Veterinary and Animal Sciences University, Ludhiana, India. ISBN- 978-93-87403-27-7**.** Pp. 1-102.

2. Pamphlets published

(i) Singh A K, Sharma A, Chahal U S, Mahajan V, **Sodhi S S,** Bansal B K and Singh P. Suriaan vich prajanan sambandhi samsiawaan.

(ii) Singh A K, Sharma A, Chahal U S, Mahajan V, **Sodhi S S,** Bansal B K and Singh P. Suriaan vich masnui garabhdaan, nasal sudharan da ik lahaevand vardaan.

3. Bulletins published

(i) Brar N S, Kumar A, Kumar B, Dhillon P K and Verma H K.2019. Scientific cultivation of Canola Gobhi Sarson. Directorate of Extension Education, GADVASU, Ludhiana

4. Leaflets (2019)

(i) Tanwar P S and Singh S. Fasalan di katai karan lai heth likhi galan da dhiayan rakho.

(ii) Tanwar P S and Matharu K S. Jhune de beej nu sodhan da tarika.

(iii) Tanwar P S and Sharma A. Gharelu mask upyog vich savdhaniyan.

(iv) Tanwar P S. 2019. COVID-19 doran pashuan da prabadh.

(v) Tanwar P S and Verma H K. Kisan lai fasal katai sambandhi sujhav.

(vi) Tanwar P S. Lu wale dina doran sur palkan lai dhiyan rakhan yog galan.

(vii) Tanwar P S and Verma H K. Garmi de dina vich pashuan di shbh sanbhal.

(viii) Tanwar P S, Singh S and Singh J. Kisana lai loo vale dina doran bachav lai jaruri nukta.

(ix) Tanwar P S, Singh K and Verma H K. Vishav Fisheries Diwas.

(x) Tanwar P S and Sharma A. Bhojan vich aurtan layi poshthik tatavan di mahatata.

(xi) Tanwar P S and Sharma A. Maa da dudh bache layi vardan.

(xii) Tanwar P S and Singh S. Jal Bachao Jeevan bachao.

(xiii) Kaur H, Phulia V, Singh Y, Verma H K. Kuj sikian di khatir putra, luhe dharti man di kukh, na tan faslan hongian, na hi ugan ge rukh.

(xiv) Kaur H, Suryavanshi P, Singh Y. Dalan nu fasli chakkar vich kar ke shamil, tandrusat sehat da khajana karo hansil.

(xv) Kaur H, Suryavanshi P, Singh Y. Gajar Booti di roktham.

5. Folders/Pamphlets published (2019)

(i) Gupta P, Kaur H, Singh Y, Verma H K. Mungi di daal da mul vadha munafe da vadiya upaa.

(ii) Gupta P and Singh Y. Shaker rog de lachhan te upchar.

(iii) Gupta P, Suryavanshi P, Sharma M, Pal S and Singh Y. Water conservation at domestic level.

(iv) Gupta P, Suryavanshi P, Sharma M, Pal S, Singh Y and Verma H K. Ghrelu padhar te pani di sujaji varton.

(v) Kaur H, Suryavanshi P and Singh Y. Mitti di sehat nu barkrar rakhan layi sauni rute mungi di kashat.

(vi) Pal S, Singh Y, Sharma M, Gupta P and Suryavanshi P. Pashu faram te pani di suchajji varton.

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7. TV/Radio Talks

University has liaison with electronic media for flashing various livestock related interventions and precautions for disease control and seasonal correct management practices. University experts deliver TV talks regularly on Doordarshan/ Cable networks/ private channels on current & seasonal topics related to livestock and fish farming. On an average two to three talks are delivered/broadcasted in a week. The comprehensive list of TV talks has been given below.

S. No.	Name of the Faculty Member	Date of the Talk	Topic
College of Veterinary Science			
Department of Animal Nutrition			
1	Dr. J.S. Hundal		Pashuan layi santulit khurak at AIR Jalandhar on 09.08.2019
2			New techniques developed by Veterinary University for dairy animals at AIR Patiala on 16.04.2019
3			Feeding of dairy animals in winter at DD Punjabi Jalanshar on 11.12.2019
4	Dr. R. S. Grewal		'Nutrition and dairy animals on You tube Apni Kheti channel on 02.08.2019
5			TV talk on 'Urea treatment' on 08.05.2019
6			'Transition cow Nutrition on You tube channel on 06.09.2019
7			Radio talk on 'Use of Paddy straw in Animal feed on 01.11.2019
8	Dr. J.S. Lamba		Balance feeding of dairy Animals on AIR Patiala
Directorate of Livestock Farms			
1	Dr. B.K. Bansal		Radio talk on Machine naal chuai samein savdhania on 20.12.2019
2	Dr. S Kaur		Change pashu dee chon on AIR Jalandhar on 14.11.2019
3	Dr. Puneet Malhotra		Modernization of Dairy Farm on AIR Jalandhar on 16.03.2020
4			Dairy dey kitte nu vigiyanik ate lahevand bnaunan on AIR Jalandhar on 31.10.2019
Department of Livestock Production Management			
1	Mandeep Singla		Selection of Animals for competitions at AIR, Jalandhar on 26.09.2019
2	Daljeet Kaur		Murgi Khanian di raihnd khund di vartoan at AIR, Jalandhar on 16.01.2020
3	Amit Sharma		Soor palan on DD Punjabi, Jalandhar on 22.05.2019
4	Sandeep Kaswan		Radio Talk on Bakrian palan ek laheband dhandha on 29.11.2019
Department of Veterinary & Animal Husbandry Extension			
1	H. K. Verma	06-02-2019	CM award application invite; DD Jalandhar
2		06-02-2019	CM award application invite; AIR, Jalandhar
3		14-03-2019	CM award for livestock farmers; AIR Ludhiana
4		02-05-2019	Pashu Gyan de Khetar vich sikhya de mauke; DD Jalandhar
5		02-05-2019	Pashu Gyan de Khetar vich sikhya de mauke; AIR Ludhiana
6		06-05-2019	Pashudhan vigyan ke shetar me shiksha aur rozgar ke avsar; AIR Shimla

S. No.	Name of the Faculty Member	Date of the Talk	Topic
7		06-05-2019	Pashudhan vigyan ke shetar me shiksha aur rozgar ke avsar; DD Shimla
8		08-05-2019	Pashu Gyan de khetar vich sikhya de mauke; AIR, Jalandhar
9		09-05-2019	GADVASU Admission Process; AIR Bathinda
10		17.05.2019	GADVASU Admission Process ; AIR Patiala
11		24.05.2019	Pashudhan vigyan ke shetar me shiksha aur rozgar ke avsar; AIR Rohtak
12		21.06.2019	KVK Barnala Kisana di seva vich-I; DD Jalandhar
13		21.06.2019	Farmer Scientist interaction-II; DD Jalandhar
14		29.08.2019	Career Guidance; AIRBathinda
15		14.09.2019	Vety University da Pashu Palan Mela; AIR Bathinda
16		17.09.2019	Vety University da Pashu Palan Mela; AIR Jalandhar
17		17.09.2019	Vety University da Pashu Palan Mela; DD Jalandhar
18		18.11.2019	Career and Vocational courses of Veterinary University for students and farmers; DD Jalandhar
19		03.12.2019	Tips regarding dairy farming; PTC channel
20	S. K. Kansal	30.09.2019	Pashupalan Vich Sikhleyi Sahultan; AIR Jalandhar
21	Jaswinder Singh	17.07.2019	University wallo kisan sikhlayie; AIR Jalandhar
22		24.12.2019	Veterinary university de kissana lai sikhlai course; AIR Patiala
23	Parminder Singh	07.05.2019	Summer management of dairy animals; AIR Ludhiana
Department of Teaching Veterinary Hospital Complex			
1	S P S Ghuman	02.02.2020	Veterinary University 'ch pashu hasptaal sevavan; AIR, Jalandhar
2	Randhir Singh	28.01.2020	Main Diseases of Domestic Animals and their Remedies; AIR, Patiala
Department of Veterinary Microbiology			
1	Deepti Narang	20.06.2019	Radio Talk on Pashoan dian lagan walian bimarian karan prajanan samasyavan
2	Paviter Kaur	24.10.2019	Radio Talk on Pashuan vich Gal Ghotu bimari ate bachao
Department of Veterinary Parasitology			
1	Harkirat Singh	17.12.2019	Radio Talk on Parjivian da pashu sehat ate aarthikta te asar
Department of Veterinary Pathology			
1	C.K.Singh	06.02.2020	Halka Bimari to Bacha Ate Ilaze; DD Jalandhar
2	B S Sandhu	14.08.2019	Pashu postmortem rahin bimarian di pehchan; AIR Jalandhar

S. No.	Name of the Faculty Member	Date of the Talk	Topic
3		09.03.2020	Farma te Bio security kini Jruri; AIR Jalandhar
4		06.12.2019	Pashuan vich Halkaw (Rabies) Di Bimari Te Bachav; AIR Patiala
5	Kuldip Gupta	20.12-2019	Importance of test for domestic animals; AIR, Patiala
6	Nittin Dev Singh	06.09.2019	Pahuan vich bimari jhanchan layi zaroori laboratory tests; AIR, Patiala
Department of Veterinary Pharmacology and Toxicology			
1	V K Dumka	08.08.2019	Pashu day ilaaj lai kudrati jaddi butian; AIR, Jalandhar
2	Saloni Singla	01.08.2019	Keetnakshaa de suchaaji varto; AIR, Jalandhar
3	S.P.S. Saini	17.12.2019	Pashuan vich vakh vakh zeharbaad ton bachao; AIR, Jalandhar
Department of Veterinary Gynecology			
1	A K Singh	17.05.2019	Sooriyan vich masnui garb dhan; (AIR, Patiala
2		22.01.2020	Behtar nasal laye nar pashuan de yogdaan; AIR, Jalandhar
3	S S Dhindsa	16.02.2020	Pashuan ch hehe di sahi pehchan; AIR, Jalandhar
Department of Veterinary Surgery and Radiology			
1	Ashwani Kumar	28.11.2019	Pashu Ilaz layee Unnat Surgical Techniquan; AIR, Jalandhar
2	J Mohindroo	Jan, 2020	Surgical facilities available at GADVASU; DD Jalandhar
3	Arun Anand	26.07.2019	Ghoreyn dian bimarian te elaaz; AIR Jalandhar
4	Arun Anand	02.08.2019	Wound management in animals; DD Jalandhar
5	Arun Anand	18.02.2020	Pahuan de vikaran da surgery naal ilaz; DD Jalandhar
6	Arun Anand	29.03.2020	Animal care during lockdown; AIR Bathinda
7	Tarunbir Singh	28.02.2020	Surgery rahin pashuan dey jamandru vikaran da ilaj; AIR Jallandhar
Department of Veterinary Medicine			
1	D K Gupta	28.06.2019	Live phone in programme; AIR, Patiala
2	D K Gupta	June 2019	KVK Handyaya; DD Jalandhar
3	Shukriti	26.07.2019	Pachuan ch tapdik (TB) rog to bachau; AIR, Jalandhar
4	Swaran Singh	Nov., 2019	Pashuan ch khuran di samsiyavan; AIR, Jalandhar
Animal Disease Research Centre			
1	V. Mahajan	21.06.2019	Vaccination in animals; AIR Jalandhar
2	G. Filia	17.10.2019	Vaccination in animals; AIR Jalandhar
3	M. S. Bal	30.01.2020	Disease diagnostic facilities by university in case of animal disease outbreaks; AIR Jalandhar

S. No.	Name of the Faculty Member	Date of the Talk	Topic
Department of Livestock Products Technology			
1	M K Chatli	24.12.2019	Quality and value addition of Meat and Eggs; DD Jalandhar
2		17.03.2020	Corona virus and poultry products; AIR, Patiala
3		16.03.2020	Corona Virus and poultry products; TV talk, Fastway, Ludhiana
4		19.02.2020	Value added poultry products; TV talk, Fastway, Ludhiana
School of Public Health and Zoonoses			
1	J S Bedi	18.03.2020	COVID-19 pandemic; DD Jalandhar
2	Rajnish Sharma	31.05.2019	Brucellosis in animals; AIR Patiala
College of Dairy Science and Technology			
1	Nitika Goel	03.06.2019	Garmiyan vich dudh ate dudh utpada di sambhal
2	Pranav K. Singh	06.03.2020	Vadhere munafe layee pashu palak banan udmi; AIR Patiala
3	V P Singh	24.11.2019	Majhan pallana munafe Wwala kitta; AIR Jalandhar
4	Inderpreet Kaur	26.03.2020	Pashuan di jatti anusar dud da mandi karan
5	Gopika Talwar	02.08.2019	Value addition and training given by CODST ; TV Talk
6	Gursharn Singh	07.11.2019	Dudh processing da sahi machinikaran
7	Gursharn Singh	25.11.2019	Dudh processing layi machinikaran
8	Amandeep Sharma	18.03.2020	TV talk- Garmia wich dudh de sambh sabhal
9	Amandeep Sharma	03.04.2019	TV talk: Garmia wich dudh de sambhal layi yog pranalia
10	Narender Kumar	10.05.2019	Radio talk: Garmiyan bich Dudh Sambha lante thandai karan layi machinikarn
KVK and RRTCs			
1	H S Sohi	30.06.2019	Aamne Samne; DD Punjabi
2			Dragon Fruit Cultivation; BBC Punjabi Channel
3	Y Singh	15.10.2019	In-situ Crop Residue Management; DD Jalandhar
4	R K Sharma	23.07.2019	Kandi Ilake Ch Pashudhan Lai Upraley; AIR Jalandhar
5	S D Jindal	24.08.2019	Awareness about Admission procedure for Diploma in Veterinary Sciences and Animal Health Technology; AIR Bathinda
6	Balwinder Kumar	24.08.2019	Crop Residue Management; AIR Jalandhar
7	Balwinder Kumar	23.01.2019	Majha kheter vich KVK da role; AIR Jalandhar
8	P S Tanwar	30.06.2019	Role of KVK for farming community; AIR Jalandhar
9	S Singh	30.06.2019	Crop Residue Management; AIR Jalandhar
10	PJindal	30.06.2019	Zoonotic diseases; AIR Jalandhar
11	Khushvir Singh	07.05.2019	Sanyukat machhi palan de dhang; AIR Jalandhar
12	Khushvir Singh	21.06.2019	Farmer scientist Interaction; AIR Jalandhar

S. No.	Name of the Faculty Member	Date of the Talk	Topic
College of Fisheries			
1	Meera D. Ansal	19.06.2019	Inland Saline water Aquaculture –Status and Scope of development in Punjab; DD Jalandhar
2		17.07.2019	Pond Management during rainy season; Ludhiana Live Channel
3		16.09.2019	Pangas Culture- Status and Scope of Development in Punjab; DD Jalandhar
4	Vaneet Inder Kaur	03.04.2019	Care of Fish Pond During Summer Month; DD Jalandhar
5	Ajeet Singh	20.09.2019	Macchi De Utpad Ate Kissani AIR, Patiala
6		06.08.2019	Fish Processing and Value Addition; DD Jalandhar
7	Grishma Tewari	10.06.2019	Machhi vadhey vikas laye dukwan garmi Mausam; AIR Jalandhar
8	Prabjeet Singh	16.07.2019	Care of fish farms during Monsoon; AIR Jalandhar
9		09.10.2019	Shrimp Farming; DD Jalandhar
College of Animal Biotechnology			
1	S S Sodhi	15.03.2019	Importance of Animal Biotechnology in the field of disease diagnosis in Livestock; TV Talk on Apni Kheti channel
2		21.08.2019	Nassal Sudhar Naal Suran Ton Vadere Utpadan; AIR, Jalandhar

8. Expert visits

University scientists have undertaken expert visits to various parts of ths state on different occasions. These visits have been enumerated below:

(i) For Judging on the occasion of XI National Livestock Championship and Agri Expo-2020, Barnala on 27.02.2020.

(ii) To MC Zoological Park, Chhat Bir, Mohali to examine/ treat sick wild animals on 02.04.2019 and 07.10.2019.

(iii) Nitrate toxicity at Rajpura Goushala on 12.09.2019.

(iv) HS outbreak at NDRI, Karnal on 25.09.2019

9. Utility Services provided by university

Various departments and outstations of GADVASU provide following utility services to different categories of livestock, poultry and fish farmers and other stakeholders.

(i) Sale of area specific mineral mixture, urea molasses multi-nutrient blocks (UMMB), Bypass Fat, eggs, semen straws live germ plasm

(ii) Sale of university literature

(iii) Sale of mastitis detection kits, rumenal magnets, milk adulteration testing kits

(iv) Sale of vegetable kits, vermicompost, mushroom, vegetables, fruits, eed of different crops, honey, fruit fly traps

(v) Testing of faecal, blood, semen samples

(vi) Soil and water testing

10. Guided visits to University and Outstations

Students and farmer-trainees of various institutes were provided guided visits to university as well as its outstations.

Sr. No.	Name of School/ Institute/ Farmer Organization etc.	Date
1	Educational visit of Dairy Farm and Pig Farm for 50 M.Sc. students from Dept. of Zoology, DAV College, Jalandhar.	11.03.2019
2	Exposure visit of beneficiaries of Operational area of Mahalkalan Block under Farmer FIRST Project to Pashu Palan Mela.	16.03.2019
3	Exposure visit and Farmer Scientist Interface of beneficiaries of Operational area of Mahalkalan Block under Farmer FIRST Project.	27.03.2019
4	Exposure visit of beneficiaries of Operational area of Mahalkalan Block under Farmer FIRST Project to Pashu Palan Mela.	22.09.2019
5	Farmers Visit to GADVASU for Indian Army Personnel of Akhnoor (Jammu).	12.10.2019
6	Exposure visit of GADVASU for students of Govt. Girls Senior Secondary School Mansuran, Ludhiana.	23.11.2019
7	Exposure visit of GADVASU for students of Govt. Senior Secondary School Ramsara, Fazilka.	23.11.2019
8	Exposure visit of GADVASU for students of Govt. Senior Secondary School Sayyadwala, Fazilka.	24.11.2019
9	Exposure visit of GADVASU for students of Senior Secondary School, Fazilka	26.11.2019
10	Exposure visit of the students and farmers from Maharashtra	27.11.2019
11	Exposure visit of GADVASU for students of Govt. Senior Secondary School Bhag Singh Pura, Jalandhar.	17.12.2019
12	Visit by farmers of IFTC, Abul Khurana, Shri Muktsar Sahib, VP & RRTC Kaljharani	17.10.2019
13	Visit by Students of Govt. Sen. Sec. School, Dangar Khera, Fazilka, VP & RRTC Kaljharani	31.01.2020
14	Visit by Students of Govt. Sen. Sec. School, Badal, Shri Muktsar Sahib, VP & RRTC Kaljharani	08.01.2020

11. Any other event

Veterinary Polytechnic and Regional research and Training Centre, Kaljharani organized **Sahiwal Day** on 04.12.2019 to promote rearing of Sahiwal Cattle in the state. On this occasion, farmers were made aware of good qualities of Sahiwal Cattle like tick resistance, lower incidence of mastitis and better adoption to adverse climatic conditions.

LIBRARY AND NETWORKING

University Library

The University Library is pivotal to the academic and research activities of the University. The various operations and services of Library are fully automated using Koha (Open-Source Library Management Software).

The Library provides single window access to its various e-resources, services and other important information through its' website i. e. Cyberary. The website of library is continuously updated to facilitate current information to users. The library is a member of Consortium for e-Resources in Agriculture (CeRA) providing access to about 3000 journals in the broad spectrum of Agricultural Sciences including Veterinary Sciences, Animal Husbandry, Livestock Management & Poultry Sciences, Fisheries and Aquaculture, Dairy Technology, Biotechnology, Animal Nutrition and allied subjects.

The Online Public Access Catalogue (OPAC) of the library is also accessible from any device connected to the Internet. The other Information Technology based services of library includes automated Circulation, Creation of ID Cards, Database management for the books, Journals, Thesis etc. along with regular update on the latest arrivals. The University Library publishes e-Newsletter of University Library quarterly to make the students, researchers and facility aware about the recently acquired information resources by the Library.

During the year 2019-20, the University Library strengthened its e-book collection with addition of 87 titles (not available under CeRA) worth Rs. 10,00,000/- and print book collection on veterinary science, dairy science and technology, fisheries and animal biotechnology with addition of 1356 books worth Rs. 16,00,000/-. The Library also strengthened its physical facilities for providing congenial reading environment to the readers and enhanced the seating and books storage capacity by spending Rs.2,99,94/-.

The University Library publishes e-Newsletter of University Library quarterly to make the students, researchers and faculty aware about the recently acquired information resources by the Library. Another e-Newsletter of the University published by the University Library reflects the trinity of teaching, research and extension activities of the University, and its transmission to the end users. The University Library has also developed videos for making viewers aware about usage of KrishiKosh and Consortium for e-Resources in Agriculture. The video has been uploaded on the YouTube so that academicians may view it and get benefitted.

Networking

The University Library has established campus wide network in the University connecting more than 500 nodes throughout the campus. The Library provides various services like Internet, E-mail, and Access of Library through intranet. The Library provides Network Server Management under which the internet services are provided throughout the University via Campus Wide Area Network on Fiber Optic Cable. The internet services are provided through User base authentication. The Library hosts Intranet Web Server to provide Library Services throughout the Campus from its website, i. e. Cyberary. The networking facility of GADVASU has also been extended to cover hostels and Library premises and surroundings using Wi-Fi Technology. The Wi-Fi network is centrally controlled by using the control-based technology from centralized Library server room.

The Library provides the Email Services to the staff on domain @gadvasu.in which can be accessed worldwide. The Information Technology personnel of library manage and control the server for Apache Web-server, Mail Services, Network Management System and Server for Antivirus Software. The Library monitors the traffic and security of Local Area Network through the monitoring software. The facility for managing network switches for continuous smooth functioning of internet services is also rendered by library.

During COVID-19 crises, the University Library has come up with an e-Learning portal "e-Harnirdesh" developed on Moodle platform for interactive teaching-learning processes with archiving feature. The "e-Harnirdesh" can be used not only for distance education, but also for blended learning, flipped classroom and other e-learning ventures. The "e-Harnirdesh" take into its

ambit all the features required to impart veterinary and animal sciences education both at UG and PG level as per VCI and BSMA guidelines, respectively. The Library has also developed an institutional repository of articles published by the faculty. The repository has been customized to retrieve articles by NAAS Rating and Impact Factor. The digital contents available on the repository are accessible to fraternity of the University including faculty, students and researchers for better comprehension of the teaching and research activities.

DIRECTORATE OF STUDENTS WELFARE AND ESTATE OFFICE

(A) Directorate of Student Welfare

(a) Sports Wing

University has created facilities to promote the sports activities among the students. Large number of students (both boys and girls) from constituent colleges have shown keen interest in sports activities. Thirteenth Annual Athletic meet of the university was held on February 13, 2019.

During the year under report, our students participated in various North Zone Inter-varsity Tournaments as given below:

Sr No	Events/ Games	Organizing University	Date of Competition
1.	Badminton (M	LPU Phagwara, Punjab	06.10.2019 to 10.10.2019
2.	Badminton (W)	LPU Phagwara, Punjab	19.11.2019 to 23.11.2019
3.	Chess (M&W)	Chandigarh University, Mohali, Punjab	05.11.2019 to 09.11.2019
4.	Swimming (M&W)	LPU Phagwara	06.11.2019 to 08.11.2019
5.	Volleyball (M)	Amity University, Gurugram, Haryana	07.11.2019 to 12.11.2019
6.	Shooting (M&W)	MRIIS&S, Faridabad, Haryana	12.11.2019 to 15.11.2019
7.	Cricket (M)	Aligarh Muslim University, Aligarh (UP)	21.11.2019 to 4.12.2019
8.	Football (M)	Sant Baba Bhag Singh University, Jalandhar, Punjab	03.12.2019 to 12.12.2019
9.	Weightlifting and Best physique (M)	Chandigarh University, Mohali, Punjab	15.12.2019 to 19.12.2019
10.	Table Tennis (M)	Chitkara, University, HP	17.12.2019 to 19.12.2019
11.	Table Tennis (W)	Chitkara, University, HP	21.12.2019 to 23.12.2019

The students of the university won several positions in sports as mentioned below:

Sr No	Organizing University	Events	Medal
1.	19th All India Inter Agricultural University Sports & Games Meet 2018-19 held at Punjab Agricultural University, Ludhiana from January 2-5, 2019	Basketball (M) Handball (M) Athletics (M) Table Tennis (M)	Silver Silver Silver Bronze

13th University Athletic Meet

- Guneet Pal Kaur was declared Best Athlete and Amninder Kaur declared 2nd Best Athlete in Women section.
- Alamjit Singh was declared Best Athlete and Mankirat Singh declared 2nd Best Athlete in Men section.

(b) Cultural Activities Wing

Cultural Activities Wing of the Directorate has been entrusted with the responsibility of promoting the cultural and co-curricular activities among the students, sharpening of their skills in the fields of fine arts, theatre, drama, etc. and to provide them a platform to articulate their creativity. To achieve this objective, the wing organizes regular camps, seminars, meetings and interaction with eminent artists/personalities from the field of art and culture and facilitates the participation of the students in cultural programmes in and out of the University. Tenth Youth Festival of GADVASU was organized in November, 2019. During the period under report the students actively

participated in cultural activities and won various prizes as given below:

Sr No	Organizing University	Events	Position
1.	35th North Zone Inter Varsity Youth Fest held at Guru Nanak Dev University, Amritsar from December 25-29, 2019	Clay modeling, Poster & painting	3rd 4th
2.	20th All India Inter-Agricultural Universities Youth Festival held at Indira Gandhi Krishi Vishwavidyalaya, Raipur, Chhattisgarh from February 03-07, 2020.	Poster Making	2nd
3	Punjab State Youth Festival held at Chandigarh University Gharuan from January 30-31, 2020	Mono Acting Rangloi Making	3rd 4th

- The students participated in 35th AIU National Youth Festival held at Amity University, Noida from 03-07, February 2020
- The Cultural Activities Wing of the University also organized functions to celebrate Independence Day, Republic Day. Students showed their talents by presenting patriotic song and skits during the celebrations.

(c) NSS Unit

The NSS Unit of the university organized two 7 days Special Winter Camps from January 14-20, 2020 with the theme 'Youth for Environment and Cleanliness' '*Paryavaran Aur Swatchhta Ko Samarpit Yuva*'. Another 7-day NSS Special Camp was organized from November 21-27, 2019 at Khalsa College of Veterinary and Animal Sciences, Amritsar on the theme 'Role of Youth for Clean and Healthy India'. Two NSS Volunteers Krishiv Vasudeva from College of Veterinary Science and Saumya Mehta from College of Fisheries attended a 7-day National Integration Camp (NIC) held at M.C.M DAV College, Kangra, Himachal Pradesh from 24-02-2020 to 01-03-2020. Krishiv Vasudeva won third prize in Debate competition during the camp.

In order to promote series of Government of India's flagship programs, the Swachh Bharat Summer Internship Project was implemented wherein NSS volunteers adopted village Barewal Awana near Ludhiana. Six NSS volunteers devoted 100 hours from July 10th to 31st, 2019 and undertook activities like waste collection, door to door campaign on cleanliness drive, tree plantation, awareness rally on Swatchh Bharat and cleanliness, tree planting, etc. The NSS unit also organized a Blood donation camp in association with Model Blood Bank, Guru Nanak Dev Hospital, Amritsar and NSS volunteers donated over 30 units of blood. A lecture by Dr. Anil Mahajan (Department of Transfusion Medicine, Govt. Medical College & Hospital, Amritsar) on the topic "Values and Need of Blood Donation" was organised on November 22, 2019.

NSS volunteers participated in various social activities such as Self defense classes for girls, Cleanliness drive, Cycle rally, Rose plantation at Scientist Home, International Yoga day, Visit to *Pingalwara*, Jan Seva for the farmers visiting Pashu Palan Mela and collecting donations in the form of beddings, clothes, soft toys, shoes, etc. for an NGO, Eknoor, for further distribution to the flood affected needy people. Three Awareness Rallies on 'Stubble Burning' were performed by NSS volunteers who visited different Villages, viz; Jhamat, Malakpur, Ayali Khurd, Barewal, Birmi, Barsem, Khandoor, Mohi (Near Mullanpur), Pamal and Pamali (near Baddowal) to make farmers aware of the ill-effects of Stubble Burning on Health and environment.

During Covid-19 pandemic, NSS Volunteers took part in various activities of social welfare and got associated in distributing of face mask and food for the welfare of the society in the City/State. Pawandeep Singh, from college Khalsa College of Veterinary and Animal Sciences joined hands with Udham NGO at Abohar for door-to-door distribution of ration and essential grocery items to the needy.

Activities of R&V Sqn NCC Unit /NCC/NSS

a) NCC Training Activities

Various NCC Training activities performed by the NCC cadets of 1 Punjab R&V Sqn NCC, GADVASU- Ludhiana during 2019-20 are as under:

(i) One hundred fourteen Cadets of this unit attended Annual Training Camp w. e. f. 21-12-2019 to 30-12-2019 at Guru Nanak Engineering College, Ludhiana. During the camp the

cadets were imparted rigorous training in Drill, physical training, lectures on basic army training, equitation and firing, etc.

(ii) The NCC cadets also took part in various activities like Swachchta Abhiyaan, Water Conservation, Run for fun, etc. in which various activities like awareness rallies pertaining to the social causes were conducted.

(iii) Cadets were imparted rigorous training in Horse man ship.

(iv) The Cadets of 1 Pb R&V SQN NCC also participated in two horse shows, one at Punjab Public School Nabha, where cadets won 6 medals and second at Sultanpur Lodhi, where they won 13 medals competing with top teams like ITBP, Punjab Police etc.

(v) Three cadets of the unit participated in various equestrian activities during Republic Day Camp which was held from 31-12-2019 to 31-1-2020. The cadets won one Gold Medal, three Bronze and one Runner up trophy in tent Pegging event apart from participating in Prime Minister's Rally.

(vi) Ninety-eight cadets appeared for NCC "B" certificate exam held on 07-2-2020 at SCD Govt. College, Ludhiana.

(vii) Twenty-four cadets appeared for NCC "C" certificate exam held on 15-2-2020 at CG Complex, Ludhiana.

Girl NCC Cadet Performing Trick Jumping

NCC Cadets after a rich haul of medals at Sultanpur Lodhi Horse Show

b) Co-curricular activities for NRI Students

The college of Veterinary Science has started co-curricular activities for NRI Students. It is compulsory for every NRI student to visit playground for at least one hour on every Wednesday.This year, 12, 10 and 15 NRI students from first, second and third year B.V.Sc & A.H, respectively visited playground for general exercise and different games.

National Service Scheme (NSS):

NSS unit of College of Fisheries performed following activities during 2019-20.

- Participation in Special Winter Training Camp on the theme "Youth for Environment and Cleanliness", 14- 20th January 2020, Ludhiana
- Participated in Cyclathon-2020 Rally and NSS Awareness Campaign on 18th January 2020.
- Participation in National Workshop on Awareness for Environment Protection with the theme "Better Environment, Better Tomorrow" organized by Punjab Pollution Control Board, Patiala (Punjab) at Dr. Manmohan Singh Auditorium, Punjab Agricultural University, Ludhiana on 7th Feb. 2020
- Saumya Mehta, B.F.Sc. 2nd year student participated in 7 days NSS National Integration Camp-2020, at MCM, DAV College, Kangra, Himachal Pradesh from 24th February to 1st March, 2020.
- NSS volunteers participated in many social events, including traffic awareness campaign, environmental conservation awareness campaign, yoga sessions, blood donation camp, plantation drive, cleanliness drive, feeding of animals and birds, river health campaign, donation of essential commodities to the poor etc.




NSS Activities undertaken by NSS unit of College of Fisheries - 2019-20

(d) NCC Unit

Three NCC cadets of the 1 PB R&V Sqn participated in various equestrian activities during Republic Day Camp and Prime Minister Rally which was held from 31.12.2019 to 31.01.2020. The cadets won one Gold Medal, three Bronze and one runner up trophy in tent Pegging event. NCC Cadets also participated in two horse shows, one at Punjab Public School Nabha where cadets won 6 medals and at Sultanpur Lodhi where they won 13 medals. Further, 114 Cadets of this unit attended Annual Training Camp w.e.f. 21.12.2019 to 30.12.2019 at Guru Nanak Engineering College, Ludhiana. During the camp the cadets were imparted rigorous training in Drill, Physical training, lectures on basic army training, equitation, firing, etc. NCC cadets actively participated in Swachhta abhiyaan campaign, Water Conservation, Run for fun, etc. along with awareness rallies pertaining to the social causes. While 98 and 24 cadets appeared for NCC "B" and "C" certificate exam, respectively.

(B) Estate Office

During the period under report, the Estate Unit continued to look after its lands, buildings and maintenance services. The construction wing continued its efforts for the construction of new buildings and renovation of existing ones. On the front of Students' Welfare activities, efforts have been made to provide maximum facilities and amenities in the hostels so that the students could feel at home. Efforts have also been made to provide security, good landscaping, proper cleanliness and good atmosphere in the campus. The Engineering Unit has awarded/started 11 Tender works and 18 Quotations works worth Rs. 7.64 Crores in the year 2019-2020. Out of these works, 12 works have been completed satisfactorily and handed over to the user departments.

Engineering unit has started Energy saving drive and green initiative in University campus. Under green campus initiative grid connected solar roof top power plant of 1.1 MW has been installed in GADVASU campus under PPP mode with zero initial investments. The plant will produce 4500 units of electricity (approx) per day from solar energy for 25 years, which will be beneficial for both University as well as for the environment.

(a) Construction Wing

1. The New Girls Hostel building is the first project which is designed, developed and executed by engineering unit and is ready for hand over. This will increase resident student's intake to 150.
2. Boys hostels including International boys hostel have been renovated and In-house sports facilities like Badminton, Basket ball courts, etc. have been constructed in hostels.

3. Streetlights of University Campus have been replaced from conventional sodium vapor lamps to energy efficient LED street lights. A new street light line has been erected from veterinary hospital to girls hostel GADVASU, Ludhiana for safety of girls at night.
4. Repair and Renovation of 11 KV uninterrupted electrical supply to Girls hostel and Boys hostel GADVASU, Ludhiana has been completed.
5. The construction work of other buildings such as Centralized Examination Hall at GADVASU and Regional Research and Training centre (RRTC) Booh, Taran Taran is undergoing in full swing.
6. The estate organization has under taken various renovation works in different departments of the university to facelift the infrastructure.

(b) Security Wing

To give a sense of security to faculty, staff and students, the security wing of the directorate continued to provide round the clock security in the Campus and manned at its entry gates.

(c) Landscape Section

Landscaping wing of GADVASU is looking after planning and implementation of custom landscape plans and maintenance of existing/developed landscape area. In the current year, landscaping wing carried out plantation work in and around the College of Veterinary Science, College of Biotechnology, School of Public Health, Dairy Farm, Silver Jubilee block and Pashu Palan mela ground. Beside ornamental plants, fruit trees were also planted in the university campus. *Van Mahotsav* (Tree Plantation Drive) was organized in campus and approximately 1200 plants were planted including trees (Silver Oak, Kusum, Pilkhan/*Ficus virens*, Sukhchain, Amaltas, Gulmohar, Popular, etc.), Fruit trees (Mango, Jamun, etc.) and shrub plants/small trees (Hamelia, Chandani, Jatropha, *Putran Jeevam*, Har shingar, *Plumeria rubra, Plumeria* alba, etc.).

Awards/Honors/Fellowships by Faculty

a. Awards/Honors/Recognitions

Sr. No.	Name of the Faculty	Detail of the Awards/Honours/Other Recognitions	Date of the Award
		College of Veterinary Science	
1.	Dr. J.S. Hundal	*Best Extension Worker Award 2018-19* of COVS by GADVASU, Ludhiana	29.05.2019
		Distinguish Alumni Award-2019 at Alumni meet	29.12.2019
		Appreciation Award-2019-20 by Indian Society for Advancement of Canine Practice (ISCAP), NDVSU, Jabalpur.	21-23.01. 2020.
		Certificate of Appreciation by GADVASU, Ludhiana for developing and commercialization of ration formulation for 5000L and 8000L milk producing dairy animals for Markfed, Punjab	29.05.2019
		Certificate of Appreciation by GADVASU, Ludhiana for developing technology for processing of paddy straw and its utilization as livestock feed	
		Best Oral Paper Award to Aparna, Kansal SK, Verma HK, Hundal JS and Singh J. for Information seeking behavior of veterinary undergraduate students about animal feed technologies at 3rd National Conferences Society for Veterinary and Animal Husbandry Extension on "Livestock development for Societal Need: Extension and Allied Sectors Initiative" held at Pantnagar.	3-5.04. 2019
		Best Oral Paper Award to Singh A, Bons MS, Singh J and Hundal JS. for Evaluation of teaching priorities of skill development training through farmer's feedback at above mentioned conference.	
		Best Oral Paper Award to A Singla, JS Hundal, M Wadhwa, J Dhanoa and P Malhotra. for Effect of *Emblica officinalis* pomace supplementation on nutrient utilization, enteric methane emission and productive performance of lactating buffaloes at International Conference on Nutritional Strategies for Improving Farm Profitability and Clean Animal Production held at WBUAFS, Kolkata	17-19.12. 2019
2	Dr. MPS Bakshi, Ex. Professor	*Life Time Achievement Award* at International Conference on Nutritional Strategies for Improving Farm Profitability and Clean Animal Production held at above mentioned conference.	
3	Dr. Amit Sharma	*Best Poster Award* at above mentioned conference.	
4	Dr. Simarjeet Kaur	*Award of Honour* during the celebrations of Sahiwal Day at RRTC, Kaljharani	04.12.2019

Sr. No.	Name of the Faculty	Detail of the Awards/Honours/Other Recognitions	Date of the Award
5	Dr. P.P Dubey	*Research Peace Award*-International under the title Best Researcher in Animal Genetics and Breeding by World Research Council and United Medical Council (RULA: Research Under Literal Access Award)	2019
6	Dr. S.K. Dash	*First Best Oral Paper Presentation Award* at 3rd National Conference of Society for Veterinary & Animal Husbandry Extension held at College of Veterinary & Animal Sciences, G.B. Pant University of Agriculture & Technology, Pantnagar	3-5.04. 2019
7	Drs. Sumit Singhal, Narinder Singh, VS Malik and BK Bansal	*Best Oral Presentation Award* for Production of elite Sahiwal calf from cross-bred cattle through embryo transfer technology at farmers' doorstep: A success story first time in India at above conference	
8	Dr. Narinder Singh, Sumit Singal, VS Malik, PS Brar, BK Bansal	*Letter of Appreciation* from GoI to ETT team for participation in Mass Embryo Transfer Programme organized for Indigenous breeds under the scheme National Mission on Bovine Productivity (Rashtriya Gokul Mission, GoI).	2-10.10. 2019
9	Dr. D.S. Malik	*Nominated as Member CEC* by Indian Society of Animal Production and Management (ISAPM)	2019
		Excellence Reviewer Award by ARCC, Karnal	20.05.2019
10	Dr. Amit Sharma	*Member Reviewer Panel* for International Journal of Livestock Research	05.08.2019
		Appreciation Certificate by International Journal of Livestock Research (NAAS score-2020: 5.36)	31.03.2020
11	Dr Nitin Mehta	*1st Prize for Best Oral Presentation* at 9th IMSACON & International Symposium On "Advances in Production, Processing and Quality Assurance of Muscle Foods for Improved Health and Nutritional Security" Palampur (HP)	08.11.2019
12	Dr. Rajesh V. Wagh	*1st Prize for Best Oral Presentation* at above conference	
13	Dr. Neelam Bansal	*Distinguished Alumnus Award* by Alumni Association, College of Veterinary Science, GADVASU, Ludhiana on the Eve of Alumni Meet-2019 during Golden Jubilee Celebrations.	29.12.2019
14	Dr. Devendra Pathak	*Distinguished Alumnus Award* by above conference	
		International Travel Grants from SERB, DST, New Delhi for attending International Conference at University of Calgary, Canada.	11.06.2019

Sr. No.	Name of the Faculty	Detail of the Awards/Honours/Other Recognitions	Date of the Award
15	Dr. Gurjot Kaur Mavi	*Young Women in Veterinary and Animal Sciences* for the contribution in Animal Genetics and Breeding by CARD 	07.03.2020
16	Dr Jaswinder Singh	*Best Teacher Award (Animal Science)* at Second Annual Day of GADVASU	2019
		Innovative Extension Educationist Award at 3rd National Conference of Society for Veterinary & Animal Husbandry Extension (SVAHE) held at GB Pant University of Agriculture and Technology, Pantnagar	3-5.04. 2019
17	Dr Ravdeep Singh	*Best Oral Presentation Award at* 3rd National conference of Society for Veterinary and Animal Husbandry Extension (SVAHE), Pantnagar	
18	Dr Bilawal Singh	*Best Poster Presentation Award* at above conference	
19	Dr. YS Jadoun	*Young Achiever Award* for the year 2018 from Society for the Advancement of Human and Nature (SADHNA) during National Seminar on 'Doubling Income through Sustainable and Holistic Agriculture' dated; at Dr YS Parmar University of Horticulture & Forestry Nauni, Solan HP, India. 	5-7.06. 2019

Sr. No.	Name of the Faculty	Detail of the Awards/Honours/Other Recognitions	Date of the Award
		Young Scientist Award given by 'Indian Society of Extension Education' during the National Seminar on "Socio Digital Approaches for Transforming Indian Agriculture" held at CCS, HAU, Hisar, Haryana. 	20-22.11. 2019.
20	Dr. Bharti Deshmukh	*Best Paper Presentation Award* at 3rd National Conference of Society for Veterinary & Animal Husbandry Extension (SVAHE) on "Livestock Development for Societal Needs: Extension and Allied Sectors. Initiatives" organized by GBPUA&T, Pantnagar, Uttarakhand.	03-05.04. 2019
21	Dr. Raj Sukhbir Singh	*Best Poster Award* at National Symposium on Holistic Approach in Veterinary Medicine for Better Animal Health to Meet Challenges of One Health Mission & 38th Annual Convention of ISVM held at Department of Clinical Veterinary Medicine, Ethics and Jurisprudence, Veterinary College, Hebbal, KVAFSU, Bengaluru.	07.02.2020
22	Dr N K Singh	*Best Teacher Award (ICAR)* in Agricultural Higher Education for the year 2018-19	29.05.2019
23	Dr. L.D. Singla	*Certified Leader in Education* by Association of Leader in Education on World Book Day.	23.04.2019
		International Travel Grant by DST to attend 27th International Conference of World Association for the Advancement of Veterinary Parasitology (WAAVP 19) at Madison, USA.	07-11.07. 2019
		Adjudged at Position Three from among the delegates at the above conference	
		Regional Editor: Asian Journal of Animal and Veterinary Advances	2019
		Distinguished Alumnus Award at Alumni Association, College of Veterinary Science, GADVASU, Ludhiana	29.12.2019

Sr. No.	Name of the Faculty	Detail of the Awards/Honours/Other Recognitions	Date of the Award
24	Dr. Nittin Dev Singh	*Diplomate ICVP Award of Indian College of Veterinary Pathology* under the aegis of Indian Association of Veterinary Pathology 	07.11.2019
25	Dr. V.K. Dumka	*Distinguished Alumnus Award* for providing excellent services to farming community, by Alumni Association, COVS, GADVASU	25.12.2019
26	Dr. M.S. Bal	*Distinguished Alumnus Award* by GADVASU, Ludhiana	29.12.2019
27	Dr M Honparkhe	*International Travel Support Award (ITS)* by SERB, DST, New Delhi to attend 12th World Buffalo Congress 2019 held at Turkey, Istanbul.	18-20.09-2019
28	Dr A K Singh	*Certificate of Excellence* by Current Journal of Applied Science and Technology for reviewing research article	02.05.2019
		Reviewer Certificate by Andrologia as appreciation by the Editors and Editorial Board of the Journal in recognition of outstanding contribution to the quality of the Journal of Andrologia for reviewing research papers	21.02.2020
		Award of Honour for judging Cattle breeds (HF and Jersey cross in milk) and Swine breeds (Large White Yorkshire male and female) at XI National Livestock Championship and Agri Expo-2020, organized by Animal Husbandry Department, Punjab and Punjab Livestock Development Board (PLDB) at Batala, Gurdaspur, Punjab.	01.03.2020
29	Dr S S Dhindsa	*Best Oral Presentation Award* to S S Dhindsa, Puneet Malhotra, R.S.Grewal, M.Honparkhe, Navdeep Singh, S.P.S.Ghuman, B.K.Bansal and P.S.Brar for "Effect of flaxseed supplementation on fertility of dairy buffalo *(Bubalus bubalis)*" at National Conference of Society for Veterinary and Animal Husbandry Extension on "Livestock Development for Societal Needs: Extension and Allied Sectors Initiatives" at Department of Veterinary & Animal Husbandry Extension Education, College of Veterinary and Animal Sciences, G.B. Pant University of Agriculture & Technology, Pantnagar, Uttrakhand.	03-05.04. 2019

Sr. No.	Name of the Faculty	Detail of the Awards/Honours/Other Recognitions	Date of the Award
		Best Oral Presentation Award at above conference 	
30	Dr S S Dhindsa	*Appreciation Letter* by Director Student's Welfare, PAU, Ludhiana	23.10.2019
31	Drs. Anand A, Singh SS, Pathak D, Khosa J, Udehiya R, Mahajan SK and Sangwan V	Gold Medal for Best Paper entitled 'Diagnosis and Surgical removal of granulose theca cell tumour in mares" at 43rd Annual Congress of Indian Society for Veterinary Surgery and National Symposium on 'Recent Advances on Amelioration of Anesthetic and surgical Stress in Farm and Companion Animals', LUVAS, Hisar, Haryana.	16.11.2019
32	Drs. J. Mohindroo, Ashwani Kumar, V. Sangwan, SK Mahajan	*Dr. A.K. Bhargava Memorial Gold Medal Award* for *Best Research Paper* published in the Indian Journal of Veterinary Surgery, entitled "Reliability of the ultrasonography for the diagnosis of diaphragmatic hernia in bovine"	14.11.2019
33	Dr. Ashwani Kumar	*Certificate of Appreciation* for valuable contribution to the service of scientific community as 'Member of Scientific Advisory Board' of International Journal of Livestock Research for the year 2018-19 by Executive Editor, International Journal of Livestock Research (NAAS Rating 5.36)	24.04.2019
		Best Teacher (Clinical Sciences) 2018-19 by GADVASU, Ludhiana	29.05.2019
34	Dr.Vandana Sangwan	*Best Clinician Award* 2018-19 by GADVASU, Ludhiana	
		Certificate of Appreciation for valuable contribution to the service of scientific community as 'Member of Scientific Advisory Board' of International Journal of Livestock Research for the year 2019	16.11.2019
35	Dr. Sujata Turkar	Best Oral Presentation Award entitled "Homeopathy- A successful treatment of transitional cell carcinoma" by Saini N., Khan I.S., and Turkar S., at 38th Annual Convention of Indian Society for Veterinary Medicine and National Symposium, KVAFSU, Hebbal, Bengaluru	05-07.02. 2020

Sr. No.	Name of the Faculty	Detail of the Awards/Honours/Other Recognitions	Date of the Award
36	Dr. M.S. Bal	*Distinguished Alumnus Award* by GADVASU, Ludhiana	29.12.2019
37	Dr. J S Bedi	*M.Sc. degree* in Veterinary Epidemiology and Public Health by Royal Veterinary College, London	February 2020
38	Dr. Randhir Singh	*Most Promising Public Health Scientist* by Vets Club, Ludhiana.	27.04.2019
39	Dr Rajnish Sharma	*Member, International Commission on Trichinellosis*	August 2019
		ICT Student Research Award	August 2019
40	Dr. Pankaj Dhaka	*MSc degree* in Veterinary Epidemiology and Public Health by Royal Veterinary College, London	February 2020
		Certified Professional in 'Biorisk Management' by International Federation of Biosafety Associations	November, 2020
		Awarded Travel Bursary by 'Défense Threat Reduction Agency, USA' International Conference for Global Health Security Sydney, Australia	18-20.06. 2019
College of Dairy Science & Technology			
41	Dr. Sunil Kumar	*Best Researcher Award*-2019 of CODST by GADVASU, Ludhiana	20.05.2019
42	Dr. Harsh Panwar	*Best Teacher Award*-2019 of CODST by GADVASU, Ludhiana	
		AMI Young Scientist Award (Dairy and Food Microbiology) by Association of Microbiologists of India	16.11.2019
		RS Rana Memorial Best Poster Award by Association of Microbiologists of India	18.11.2019
43	Dr Gopika Talwar	*Best Extension Award*-2019 of CODST by GADVASU, Ludhiana	20.05.2019
College of Fisheries			
44	Dr. Jitendra Kumar	*Young Scientist Award* at National Seminar on "River Development, Water Resource, Conservation And Management" organized by Mahatma Gandhi Chitrakoot Gramodaya Vishwavidyalaya Chitrakoot, Satna (MP)	06-07.12. 2019
45	Dr. Prabjeet Singh	*Research Excellence Award* by Institute of Scholars, Bengaluru	18.03.2020

Sr. No.	Name of the Faculty	Detail of the Awards/Honours/Other Recognitions	Date of the Award
46	Dr. Surjya Narayan Datta	*Best Oral Presentation Award* at International Conference on Ecosystem Health and Fisheries of Indian Inland Waters: Multiple Stressors, Management and Conservation organized by Inland Fisheries Society of India (IFSC), Aquatic Ecosystem Health & Management Society, Canada; College of Fisheries, G.B.Pant University of Agriculture & Technology, Pantnagar; ICAR- Central Inland Fisheries Research Institute and Professional Fisheries Graduates Forum, Mumbai at Pantnagar. 	19.02.2020
47	Dr. Surjya Narayan Datta	*Best Researcher Award*- 2019 by GADVASU, Ludhiana	29.05.2019
48	Dr. Abhed Pandey	*Best Teacher Award*- 2019 by GADVASU, Ludhiana. 	
49	Dr. Sachin O. Khairnar	*Research Excellence Award*- 2020 from Institute of Scholars (InSc), Bengaluru	18.03.2020
50	Dr. Amit Mandal	*Young Achiever Award*- 2020 by Institute of Scholars-Bangalore	18.03.2019
51	Dr. Rajinder Kaur	*Best Poster Presentation Award* at conference on Ecosystem Health and Fisheries of Indian Inland waters: Multiple Stressors, Management & Conservation at College of Fisheries, GBPUA&T, Pantnagar, Uttarakhand for "Effect of vitamin C supplementation on hematological changes in sodium fluoride exposed Amur carp (*Cyprinus carpio haematopterus*).	19.02.2020

Sr. No.	Name of the Faculty	Detail of the Awards/Honours/Other Recognitions	Date of the Award
52	Dr. Anuj Tyagi	*Best Young Scientist Award* at 3rd International Symposium on Genomics In Aquaculture (ISGA III) organized by ICAR – Central Institute of Freshwater Aquaculture (ICAR-CIFA), Bhubaneswar. 	23.01.2020
College of Animal Biotechnology			
53	Dr. RS Sethi	*Best Teacher Award by* GADVASU, Ludhiana	20.05.2019
		Travel grant from University of Calgary to attend an International conference of American Association of Veterinary Anatomists at Banff, Canada	26-29.07. 2019
		Best Poster Presentation Award at above conference	
54	Dr Simrinder Singh Sodhi	*Best Administrative Support Award* by GADVASU, Ludhiana.	20.05.2019
		Best Oral Presentation Award at 3rd National Conference of Society for Veterinary and Animal Husbandry Extension held at College of Veterinary & Animal Science, Pantnagar, Uttarakhand	03-05.04. 2019
55	Dr. JS Arora	*Excellence in Teaching Award* by the Society for Bioinformatics and Biological Sciences	05.04.2019
56	Dr. CS Mukhopadhyay	Best Researcher Award for the year of 2018-19 by GADVASU, Ludhiana	29.05.2019
		Congress of Zoology Medal-2020 at 32nd All India Congress of Zoology and International Conference on "Life Security on Earth" organized by Zoological Society of India and Devi Ahilya University, held at Chaturbhuj Shri Ram Mandir Parisar, Mandu, Dhamnod, Distt. Dhar, MP.	22-24.02. 2020
57	Dr. Ajeet Singh	*Best Extension Worker Award-* 2019 by GADVASU, Ludhiana	29.05.2019
University Library			
58	Dr. Nirmal Singh	*IFLA-WLIC Participation Grant* for participation in the IFLA-WLIC held at Athens, Greece	24-30.08. 2019
		Dr. Gurdev Singh Khush Foundation Travel Grant for attending IFLA-WLIC held at Athens, Greece	18.03.2020
59	Sonia Bansal	Best Paper Award for the paper presented at 6th CLA National Conference, Chandigarh	22.08.2019

b. Fellowships by Faculty

Sr. No.	Name of the Faculty	Detail of the Fellowships	Date of the Award
College of Veterinary Science			
1.	Dr. J.S. Hundal	*Associate Fellow of Animal Nutrition Society of India.*	17-19.12. 2019
2.	Dr. A.P.S. Sethi	*Fellow of Animal Nutrition Society of India*.	
3.	Dr. D.S. Malik	*Nominated as Member CEC* by Indian Society of Animal Production and Management (ISAPM)	2019
4.	Dr Manish Kumar Chatli	*Fellow National Academy of Veterinary Science* 	26-27.12. 2019
5.	Dr Pavan Kumar	*Netaji-Subhas ICAR International Fellowship* 2019-20	01.01.2020
6.	Dr Harkirat Singh	*Associate Member,* National Academy of Veterinary Sciences (India)	26.12.2019
7.	Dr. V.K. Dumka	*Fellow of Society of Toxicology (STOX)*, India.	27.12.2019
8.	Dr. Rajdeep Kaur	*Fellow of Society of Toxicology (STOX)*, India.	
9.	Dr Simranpreet Kaur	*Associate Membership* of National Academy of Veterinary Sciences (India)	26.12.2019
10.	Dr. Shukriti Sharma	*Post Doctoral Fellowship Endeavour Australia Cheung Kong Research Leadership Award 2019* by The University of Melbourne, Australia.	Dec, 2019 to March, 2020
11.	Dr. B B Singh	*Adjunct Professor*, University of Saskatchewan, Canada	June, 2019 to March, 2020
		Honorary Lecturer, The University of Sydney, Australia	May, 2019 to March, 2020

Participation by Faculty in Conferences/ Symposia/Workshop/Trainings, etc.

Sr. No.	Name of the Conferences/ Symposia/ Workshop/ Trainings	Organizing agency, place and date	Name of the Faculty Member who attended the meeting
INTERNATIONAL			
College of Veterinary Science			
Overseas			
1.	International Conference of American Association of Veterinary Anatomists (AAVA)	American Association of Veterinary Anatomists, at Banff and University of Calgary (Canada) 26-29.07. 2019	Drs Neelam Bansal, Devendra Pathak
2.	International Wet Lab Workshop	American Association of Veterinary Anatomists, University of Calgary, Canada, 26.07.2019	Dr. Devendra Pathak
3.	Workshop – MSCA-IF Workshop	Aarhus University, Denmark, 13-16.05.2019	Dr. Sidhartha Deshmukh
4.	12th World Buffalo Congress on "Efficient Production for the World"	International buffalo federation and Namık Kemal University, Faculty of Agriculture at Turkey, Istanbul September 18-20, 2019	Dr.M Honparkhe
5.	27th International Conference of the World Association for the Advancement of Veterinary Parasitology (WAAVP)	World Association for the Advancement of Veterinary Parasitology (WAAVP). Madison, WI, U.S.A. 07-11.07.2019.	Dr. M. S. Bal
6.	15th International Conference on Trichinellosis (ICT-15)	University of Agricultural Sciences and Veterinary Medicine (USAMV), University of Medicine and Pharmacy "Iuliu Haţieganu" Cluj-Napoca (UMF), ICT Cluj-Napoca, Romania 26-30.08.2019	Dr Rajnish Sharma
7.	Global Health Security 2019: Progress to date, opportunities for the future	Global Health Security, Sydney, Australia 18-20.06.2019	Dr. Pankaj Dhaka
International Conferences/Workshops held in India			
8.	International Conference on Nutritional Strategies for Improving Farm Profitability and Clean Animal Production	WBUAFS, Kolkata, 17-19.12.2019.	Drs. A.P.S. Sethi, Udeybir Singh, J.S. Hundal, Amit Sharma

Sr. No.	Name of the Conferences/ Symposia/ Workshop/ Trainings	Organizing agency, place and date	Name of the Faculty Member who attended the meeting
9.	International Teaching Workshop	COVS, GADVASU, Ludhiana & University of Calgary, Canada 19-21.02.2020	Drs. Sandeep Kaswan, Rajesh Kasrija, Gurpreet Kaur, Paramjit Kaur, M.K Lonare, Rajdeep Kaur, Ashwani Kumar, V. Mahajan, Simranpreet Kaur
10.	Invest Punjab Business First 2019	Govt. of Punjab, 06.12.2019.	Dr OP Malav
11.	9th IMSACON & International Symposium On "Advances in Production, Processing and Quality Assurance of Muscle Foods for Improved Health and Nutritional Security"	Department of Livestock Products Technology DGCN College of Veterinary & Animal Sciences, CSK HPKV, Palampur 6-8.11.2019	Drs M K Chatli, Nitin Mehta, Rajesh V Wagh
12.	International Conference of Animal Nutrition	Animal Nutrition Society of India at Kolkata, 17-19.12.2019	Dr Parminder Singh
13.	International Conference on "Emerging Challenges to Veterinary Profession"	Indian Veterinary Association and Co-Organized by Indian Immunologicals Limited Commonwealth Veterinary Association and supported by Pashu Chikitsak Mahasangh (PCM) at NASC Complex, New Delhi 26-27.07.2019	Dr. Tejinder Singh Rai
14.	International Conference on Breakthroughs in Toxicology and Human Health and 39th Annual Meeting of Society of Toxicology	Jiwaji University, Gwalior, India 27-29.12.2019	Drs M.K Lonare, Rajdeep Kaur
15.	Seminar on Teaching and Learning	Nobel Prize Series, PAU, Ludhiana, 12.09.2019	Dr. N Umeshwori Devi
16.	International "Teaching Workshop"	GADVASU in collaboration with the University of Calgary, Canada 19-21.02.2020	Dr. Sujata
17.	Nobel Prize Series-2019 Theme: Teaching and Learning	The PAU and National Agri-Food Biotechnology Institute (NABI), Mohali along with Dr. GS Khush Foundation in partnership with the DBT, GoI and the Nobel Foundation, 12.09.2019	Dr. Pankaj Dhaka

Sr. No.	Name of the Conferences/ Symposia/ Workshop/ Trainings	Organizing agency, place and date	Name of the Faculty Member who attended the meeting
College of Dairy Science & Technology			
Overseas			
18.	Annual Meeting of American Dairy Science Association	Cincinnati, Ohio, USA 23-26.06.2019	Dr P. K. Singh
International Conferences/Workshops held in India			
19.	Nobel Prize Series India 2019	PAU (in collaboration with GS Khush Foundation) and National Agri-Food and Biotechnology Institute, Mohali with the support of DBT and Punjab Government at PAU, Ludhiana 12.09.2019	Dr Venus Bansal
20.	13th Indo-Japanese Dialogue on Indian Economy Development	PAU, Ludhiana on 06.09.2019	Dr. Inderpreet Kaur
21.	Nobel Prize Series 2019 (Theme: Teaching and Learning)	DBT, Govt. of India in partnership with The Nobel Foundation at PAU on 12.09.2019	Dr. Varinder Pal Singh
22.	Teaching Workshop	College of Veterinary Science in collaboration with University of Calgary, Canada at Guru Angad Dev Veterinary and Animal Sciences University, Ludhiana, 19-21.02.2020	Dr. Gopika Talwar
23.	60th Annual Conference of Association of Microbiologist of India (AMI-2019) and International Symposium on Microbial Technologies in Sustainable Development of Energy, Environment, Agriculture and Health	Central Haryana University, Mahendragarh, Haryana.	Dr. Harsh Panwar
College of Fisheries			
International Conferences/Workshops held in India			
24.	Teaching Workshop Organized by College of Veterinary Science in collaboration with University of Calgary, Canada	College of Veterinary Science in collaboration with University of Calgary, Canada at GADVASU, Ludhiana, 19-21.02.2020	Drs. Abhed Pandey, Shanthanugouda AH
25.	'Ecosystem Health and Fisheries of Indian Inland Waters: Multiple Stressors, Management and Conservation"	Organized by ICAR-CIFRI, Barackpore; AEHMS, Canada; PFGF, Mumbai & COF, Pantnagar at COF, G B Pant Univ. of Agri. & Tech, Pantnagar. 17-19.02.2020	Drs. S.N. Datta, Grishma Tewari, Rajinder Kaur

Sr. No.	Name of the Conferences/ Symposia/ Workshop/ Trainings	Organizing agency, place and date	Name of the Faculty Member who attended the meeting
26.	3rd International Symposium on Genomics in Aquaculture (ISGA III)	ICAR – Central Institute of Freshwater Aquaculture (CIFA), Bhubaneswar 21-23.01.2020.	Dr. Anuj Tyagi
College of Animal Biotechnology			
Overseas			
27.	International Conference of American Association of Veterinary Anatomists	American Association of Veterinary Anatomists, Banff, Canada, 26-29.07. 2019	Dr. R S Sethi
28.	International Web Lab Workshop	American Association of Veterinary Anatomists, University of Calgary, Canada 26.07.2019	
29.	American Dairy Science Association Annual Meeting	Ohio, USA 23-26.06.2019	Dr. Ratan K Choudahry
30.	Workshop on "Agilent Cell Analysis" organized by the Department of Biomedical and Health Science"	University of Vermont, USA, 13.11.2019	
31.	Dry Ice Shipping Training	University of Vermont, USA, 08.10.2019	
32.	Keeping Your Lab Safe- Classroom training	University of Vermont, USA, 10.04.2019	
33.	Lab Safety partner meeting-Classroom training	University of Vermont, USA, 18.04.2019	
34.	2020 Annual Refresher Training	University of Vermont, USA, 13.01.2020	
International Conferences/Workshops held in India			
35.	International Conference on Advances and Innovations in Biotechnology for Sustainable Development	AKS University, Satna (MP)	Dr. JS Arora
36.	International Seminar on "Animal Agriculture for Doubling Farmer's Income: Technology, policy and strategy options"	College of Veterinary Science, Assam Agricultural University, Khanapara, Guwahati, 27-28.02.2019.	Dr. Dipak Deka
37.	Teaching Workshop	GADVASU in collaboration with University of Calgary, Canada, 19-21.02.2020	
NATIONAL			
College of Veterinary Science			
38.	National Congress on Canine Practice and National symposium on 'Maximizing, Therapy and Welfare in Canine Practice in current scenario	NDVSU, Jabalpur, 21-23.01.2020	Dr. J.S. Hundal
39.	Seminar on "Fodder Chain Management"	College of Agricultural Engineering and Technology, PAU, Ludhiana, 24-28.02.2020.	Dr. Amit Sharma

Sr. No.	Name of the Conferences/ Symposia/ Workshop/ Trainings	Organizing agency, place and date	Name of the Faculty Member who attended the meeting
40.	XVII National Symposium of SOCDAB	COVSc & AH, Mhow (MP) 10-11.02.2020	Drs. SK Sahoo, . Simarjeet Kaur
41.	34th Annual Convention of ISSAR	VCRI, Namakkal, Tamilnadu December 18-20, 2019,	Dr. Navdeep Singh
42.	ICAR-Centre of Advanced Faculty Training	Deptt. Of Vety Gynaecology & Obstetrics, GADVASU, Ludhiana 03- 23.10. 2019	
43.	Winter School on "ICT and Social media in Agricultural Extension"	Directorate of Extension Education, PAU, Ludhiana, 30.01-19.02.2020.	
44.	Alumni Meet- 2019 cum technical Seminar	COVS, GADVASU, Ludhiana	Many faculty members
45.	ICAR CAFT Training	Deptt. of Vety Gynaecology & Obstetrics , GADVASU, Ludhiana 03- 23.10. 2019	Dr. Narinder Singh
46.	National conference on "Paradigm shift in Livestock Management to obtain high quality animal products for enhancing farm economy and entrepreneurship" and 27th Convention of the ISAPM	Department of Livestock Production Management, PGIVER, RAJUVAS, Jaipur, 4-6.02.2020	Drs. M. Singla, Amit Sharma, S. Kaswan
47.	National Conference and 26th Annual Convention of ISAPM on "Innovations in Animal Production for Sustainability and Doubling Farmers Income"	ISAPM, COVAS, Kerala Veterinary & Animal Sciences University, Mannuthy, Thrissur, Kerala 23-25.01.2019	Dr. Daljeet Kaur
48.	Workshop on Nobel Prize Series 2019	PAU, Ludhiana, 12.09. 2019	
49.	Massive Open Online Course (MOOC) on Teaching Excellence	ICAR, NAARM, Hyderabad, 01-30.11.2019	Dr. Ravi Kant Gupta
50.	Training- Recent and Emerging Applications of Membrane Processes in Dairy Industry	CAFT in Dairy Processing, NDRI, Karnal, 04-25.11. 2019	Dr Pavan Kumar
51.	ICAR-CAFT Training on "Technological Advances in Functional Food Ingredients and Validation of Their Claims"	NDRI, Karnal, 06-26.12. 2019	Dr R. V. Wagh
52.	CAFT Training on "ICT and Social Media Use In Agricultural Extension"	PAU, Ludhiana, 30.01- 19.02. 2020	
53.	Workshop on Extrusion Technology: A Way forward to processing and nutritional interventions	Deptt of LPT, COVS, GADVASU, 28.11. 2019	Drs. Pavan Kumar, Nitin Mehta, O P Malav, Simranjeet Kaur, R.V.Wagh

Sr. No.	Name of the Conferences/ Symposia/ Workshop/ Trainings	Organizing agency, place and date	Name of the Faculty Member who attended the meeting
54.	Vet Alumni Meet- cum- Technical seminar	Pal Auditorium, PAU 29.12.2019	Drs Pavan Kumar, Nitin Mehta and R.V Wagh
55.	Seminar-Nobel Prize India Series 2019	PAU, 12.09. 2019	Dr M K Chatli
56.	18th Annual Convocation -cum- Scientific Convention On Futuristic Technologies in Animal Health and Production	National Academy of Veterinary Science, Kamdhenu University Gandhinagar 26-27.12.2019	
57.	Regional Workshop on "Motivating and Attracting Youth in Agriculture (MAYA) in North India"	PAU, Ludhiana, 28-29.02. 2020.	
58.	9th IMSACON & International Symposium On "Advances in Production, Processing and Quality Assurance of Muscle Foods for Improved Health and Nutritional Security"	Department of Livestock Products Technology DGCN College of Veterinary & Animal Sciences, CSK HPKV, Palampur 6-8.11. 2019	Drs M K Chatli, Nitin Mehta, Rajesh V Wagh
59.	International Wet Lab Workshop	American Association of Veterinary Anatomists, University of Calgary, Canada, 26.07.2019	Dr. Devendra Pathak
60.	National Level Brainstorming Workshop on NAHEP Results Framework	NAHEP, ICAR, at IARI New Delhi, 11.09. 2019	Dr Opinder Singh
61.	XXXIV Annual Convention and National Symposium of IAVA	Department of Veterinary Anatomy, College of Veterinary Science, Bengaluru, 28-30.11.2019.	Drs Varinder Uppal, Neelam Bansal
62.	XIV Biennial National Conference of Association of Public Health Veterinarians	DUVAS, Mathura, 24-25.01. 2020	Dr. Anuradha Gupta
63.	3rd National Conference of Society for Veterinary & Animal Husbandry Extension (SVAHE)	GB Pant University of Agriculture and Technology, Pantnangar, 03-05.04.2019	Drs S K Kansal, Parminder Singh, Jaswinder Singh, Rajesh Kasrija, Ravdeep Singh, Bilawal Singh, Khushpreet Singh

Sr. No.	Name of the Conferences/ Symposia/ Workshop/ Trainings	Organizing agency, place and date	Name of the Faculty Member who attended the meeting
64.	Training on "Extension Strategies for Mainstreaming Women in Agriculture and Allied Sector"	Punjab Agricultural Management and Extension Training Institute (PAMETI), Ludhiana in collaboration with EEI Nilokheri, Haryana, 25- 27.06.2019	Dr. Bharti Deshmukh
65.	Workshop-cum-Training program on latest advances in livestock, poultry and fisheries for KVKs of Punjab and University Scientists	GADVASU, Ludhiana, 21.01.2020	
66.	Workshop-cum- Training program on latest advances in Livestock, Poultry and fisheries for KVKs of Punjab and University Scientists	Directorate of Extension Education, 28.01.2020	Dr Gurjot Kaur Mavi
67.	LAB FORUM INDIA 2019	Department of Animal Nutrition, GADVASU, Ludhiana, 03-04.07.2019	
68.	One day Seminar on "Animal Husbandry and Animal Health Practices"	Directorate of Extension Education, 20.12.2019.	
69.	National Congress on Canine Practice & 17 th Annual Convention of ISACP and the Symposium on "Maximizing Diagnosis, Therapy and Welfare in Canine Practice in Current Scenario" scheduled	College of Veterinary Science & Animal Husbandry, NDVSU, Jabalpur, 21– 23.01. 2020	
70.	National Seminar on "Doubling Income Through Sustainable and Holistic Agriculture"	Dr. YS Parmar University of Horticulture & Forestry, Solan, HP, 05-07.06.2019	Dr. YS Jadoun
71.	National Seminar on "Socio Digital Approaches for Transforming Indian Agriculture"	Indian Society of Extension Education" at CCS HAU, Hisar, Haryana, 20-22.11.2019.	
72.	ICAR-CAFT training programme on: Current Knowledge and Future Challenges in Domestic Animal Theriogenology	Department of Veterinary Gynaecology and Obstetrics, GADVASU, Ludhiana, 03-23.10.2019	Dr Khushpreet Singh
73.	Teaching Workshop	College of Veterinary Science, GADVASU, Ludhiana in collaboration with University of Calgary, Canada, 19-21.02.2020.	Dr Rajesh Kasrija
74.	National Seminar on 'Biotechnological Advances for Improving Animal Health and Productivity'	College of Veterinary and Animal Husbandry, NAU, Navsari 5-6.11.2019.	Dr. SPS Ghuman

Sr. No.	Name of the Conferences/ Symposia/ Workshop/ Trainings	Organizing agency, place and date	Name of the Faculty Member who attended the meeting
75.	38th Annual Convention of Indian Society for Veterinary Medicine	Department of Clinical Veterinary Medicine, Ethics and Jurisprudence, Veterinary College, Hebbal, KVAFSU, Bengaluru, 5-7.02.2020	Dr. Raj Sukhbir Singh
76.	Teaching Workshop	COVSc, GADVASU, Ludhiana in collaboration with the University of Calgary, Canada, 19-21.02.2020	Dr Gurpreet Kaur
77.	Advances in Molecular Epidemiology in Veterinary Research	ICAR, at GADVASU Ludhiana. 10-19.12.2019	Dr Paviter Kaur
78.	30th National Congress of Parasitology & Global Summit on Malaria Elimination	Indian Society for Parasitology Convention Centre, Jawaharlal Nehru University, New Delhi, 26-28.09.2019.	Dr. L.D. Singla
79.	29th National Conference of Veterinary Parasitology	Indian Association For the Advancement of Veterinary Parasitology, Nanaji Deshmukh Veterinary Science University, Jabalpur, 05-07.02.2020.	
80.	Regional Workshop on Motivating and Attracting Youth in Agriculture in North India	PAU, Ludhiana & ICAR-ATARI, Ludhiana; 28-29.02 2020	Drs. Paramjit Kaur, Jyoti
81.	Annual Conference of Indian Association of Veterinary Pathologists	COVS, Central Agricultural University, Aizawl, Mizoram, 06-08.11.2019	Drs. C.K.Singh , Amarjit Singh, APS Brar, Nittin Dev Singh
82.	Regional Workshop on Motivating and Attracting Youth for Agricultural in North India.	PAU, Ludhiana, 28-29.02.2020	Dr. L. Geeta Devi
83.	ICAR-CAFT training held in the Department of Veterinary Pathology	Department of Veterinary Pathology, GADVASU, Ludhiana 17.11-07.12.2019.	
84.	Regional Workshop on Motivating and Attracting Youth for Agricultural in North India.	PAU, Ludhiana, 28-29.02. 2020	Dr. Omer Khalil Baba
85.	Teaching Workshop	GADVASU Ludhiana in collaboration with University of Calgary, Canada. 19-21.02.2020	Drs M.K Lonare, Rajdeep Kaur

Sr. No.	Name of the Conferences/ Symposia/ Workshop/ Trainings	Organizing agency, place and date	Name of the Faculty Member who attended the meeting
86.	XIX Annual Conference of Indian Society of Veterinary Pharmacology and Toxicology	COVS, Mannuthy 18-20.12.2019	Drs SK Sharm, SPS Saini, Rajdeep Kaur
87.	23rd Punjab Science Congress	Sant Longwal Institute of Engineering and Technology, Longowal, 7-9.02.2020	Dr Saloni Singla
88.	XXVIII Annual Conference & National Symposium on "Physiological Approaches to address environmental challenges for increasing animal productivity and farmer's income"	ICAR-Central Sheep and Wool Research Institute, Avikangar, 18-20.02.2020	Dr. Digvijay Singh
89.	Fourth Annual Convention and National Symposium on Current Research in Veterinary Biochemistry and Biotechnology in the Improvement of Animal Health and Production	SVVU, Tirupati 04-05.02.2020	Dr. Chanchal Singh
90.	Understanding host-gut microbiome crosstalk for augmenting feed efficiency and economizing livestock production	Animal Nutrition Division, IVRI, Izatnagar, 07-27.02.2020	Dr. Gurpreet Singh
91.	National Level Brainstorming Workshop on NAHEP Results Framework	NAHEP, ICAR, 11.09.2019 at IARI New Delhi	Dr. M Honparkhe
92.	National Congress on Canine Practice & 17th Annual Convention of ISACP and the Symposium on "Maximizing Diagnosis, Therapy and Welfare in Canine Practice in Current Scenario"	College of Veterinary Science & Animal Husbandry, NDVSU, Jabalpur, 21-23.01. 2020	Dr. M Honparkhe Dr. Ajeet Kumar
93.	Advanced training programme on diagnosis and management of chronic gasteroenteropathies and renal disease in dogs	Department of Veterinary Medicine, , GADVASU, Ludhiana 02-03.03.2020	Dr Ankit K Ahuja
94.	"Livestock Development for Societal Needs: Extension and Allied Sectors Initiatives"	Society for Veterinary and Animal Husbandry Extension at Department ofVAHEE, G.B. Pant University of Agriculture & Technology, Pantnagar, Uttrakhand, 03-05.04. 2019	Dr. S S Dhindsa
95.	43rd Annual Congress of ISVS and National Symposium "Recent Advances on Amelioration of Aneasthetic and Surgical Stress in Farm and Companion Animals"	Indian Society for Veterinary Surgery, LUVAS, Hisar, Haryana, 14-16.11.2019	Drs. SS Singh, Arun Anand, Ashwani Kumar, Rahul K. Udehiya

Sr. No.	Name of the Conferences/ Symposia/ Workshop/ Trainings	Organizing agency, place and date	Name of the Faculty Member who attended the meeting
96..	17th Convention of ISACP and National Symposium "Maximizing Diagnosis, Therapy and Welfare of Canine Practice in Current Scenario"	Indian Society for Advancement of Canine Practice, NDVSU, Jabalpur, 21-23.01.2020	Dr. Ashwani Kumar
97.	Diagnosis and management of chronic gastroenteropathies and renal diseases in dogs	Department of Veterinary Medicine, GADVASU, 02-03.03.2020	Drs. N Umeshwori Devi, Jasmeet S Khosa
98.	Workshop on Exotic Animals in Small Animal Practice	Small Animal Clinician Association, Chandigarh, 01.03.2020	Dr. N Umeshwori Devi
99.	ICAR-Centre for Advanced Faculty Training	Deptt. of Veterinary Surgery & Radiology, GADVASU, Ludhiana, 11.09- 01.10. 2019	Drs Rahul Udehiya Jasmeet S Khosa
100.	Seminar on Teaching and Learning	Nobel Prize Series, PAU, Ludhiana, 12.09.2019	Dr. N Umeshwori Devi
101.	One day CE Programme on Exotic Animals	Small Animal Clinicians Association (SACA) Chandigarh 01.03.2020	Dr. Asmita Narang
102.	Workshop on Problem Oriented Approach to Neurological Diseases	Small Animal Clinicians Association (SACA) Chandigarh, 30.06.2019	
103.	3-day DST- INSPIRE Fellowship Review Meet	Sri Mata Vaishno Devi Gurukul, Katra, J & K 11- 13.10.2019	
104.	ICAR sponsored National Training Programme (21 days) on "Imaging, clinical diagnostic techniques and therapeutic interventions in companion and farm animals	CAFT in Veterinary Clinical Medicine and Therapeutics, Madras Veterinary College, Chennai from 27.11-17.12.2019	
105.	38th Annual Convention of Indian Society for Vety Medicine and National Symposium	KVAFSU, College of Veterinary Science, Hebbal, Bengaluru, 05-07.02.2020	Drs Swaran Singh, D K Gupta, Sujata, A Narang
106.	Advanced Training course on "Diagnosis and management of chronic gastroenteropathies and renal diseases in dogs	Department of Veterinary Medicine, GADVASU, Ludhiana, in collaboration with DBT, 02-03.03.2020	Drs. Sujata, Asmita Narang
107.	Advanced refresher training course on "Diagnostic, Anaesthetic and Surgical Interventions in Emergency and Trauma Patients"	Department of Veterinary Surgery & Radiology, College of Veterinary Sciences GADVASU, Ludhiana 11.09-01.10.2019	Dr. Sujata Turkar

Sr. No.	Name of the Conferences/ Symposia/ Workshop/ Trainings	Organizing agency, place and date	Name of the Faculty Member who attended the meeting
108.	Model Training Course on Empowering farm Women with Dairy Preneurship	Ministry of Agriculture & Farmers Welfare, GOI sponsored from Directorate of Extension Education, GADVASU, Ludhiana 03-10.01.2019	Dr S. Sharma
109.	17th National Congress on Canine Practice & National Symposium	CVSc&AH, NDVSU, Jabalpur (M.P.) 21-23.01.2020	Drs. CS Randhawa, Swaran Singh
110.	Annual Review Meeting of ICAR NIVEDI	NIVEDI, Bengaluru 01-02.12.2019	Dr. G. Filia
111.	National multisectoral One Health Workshop for prevention of Zoonotic Diseases	Directorate of Medical & Health Services, Government of Rajasthan Jaipur 12.02. 2020	Dr. BB Singh
112.	18th Annual Convocation of National Academy of Veterinary Sciences (India) –cum-Scientific Convention on "Futuristic Technologies in Animal Health and Production "	Kamdhenu Veterinary University, Gandhinagar, Gujarat 26 -27.12.2019	Dr Simranpreet Kaur
113.	ICAR Short Course on Advances in Molecular Epidemiology in Veterinary Research	School of Public Health and Zoonoses, Ludhiana, 10-19.12.2019	
114.	Workshop on "Motivating and Attracting Youth in Agriculture (MAYA) in North India"	PAU, Ludhian 28-29.02.2020	
College of Dairy Science & Technology			
115.	Regional Workshop on Motivating and Attracting Youth in Agriculture in North India	PAU in collaboration with Trust for Advancement in Agriculture Sciences, 28-29.02.2020	Dr Venus Bansal
116.	CAFT on Emerging Trends of Bio-Process Technologies in Dairy and Food Processing	National Dairy Research Institute, Karnal 15.01-04.02.2020	Dr Venus Bansal
117.	National Conference on Ïnnovative Packaging Techniques for Food Products and Its Safety Aspects"	Indian Institute of Packaging, New Delhi on 10-5-2019.	Dr Sivakumar S,
118.	One Day Workshop on Contemporary Social Issues	PAU, Ludhiana on October 22, 2019	Dr. Inderpreet Kaur
119.	Progressive Punjab Investors' Summit	Punjab Bureau of Investment Promotion, Chandigarh at Indian School of Business, Mohali on 06.12.2019	Drs Inderpreet Kaur, Varinder Pal Singh
120.	27th Annual Conference on Changing Landscape of Rural India by Agricultural Economics Research Association (AERA)	PAU, Ludhiana, from 17 - 19.12.2019	Dr Varinder Pal Singh

Sr. No.	Name of the Conferences/ Symposia/ Workshop/ Trainings	Organizing agency, place and date	Name of the Faculty Member who attended the meeting
121.	Winter School on ICT and Social Media use in Agricultural Extension	Skill Development Centre, PAU, Ludhiana from 30.01-19.02.2020.	
122.	Workshop on Commodity Derivatives-An Introduction	Punjab State Farmers Commission (PSFC) at Mohali on 11.02.2020	Dr Nitin S. Wakchaure
123.	Regional Workshop on Motivating and Attracting Youth in Agriculture (MAYA) in North India	Trust for Advancement of Agricultural Sciences (TAAS) in collaboration with PAU from 28-29.02.2020	
124.	Human Resource Development Training Program on Advancements in Food Packaging Technologies and its Future Research Prospects	ICAR-CIPHET, Ludhiana 06-19.12.2019	
125.	Recent and emerging applications of membrane processing in dairy industry	NDRI, Karnal 04-24.11.2019	Er. Gursharn Singh
126.	Cutting edge epitome of processing value addition and waste utilization of horticultural crops for augmenting farmers income	ICAR-CIPHET, 01-21.10.2019	Er. Narender Kumar
College of Fisheries			
127.	"Innovative Packaging Techniques for Food Products and Its Safety Aspects" Conference	Indian Institute of Packaging, New Delhi, 10.05.2019	Dr. Ajeet Singh
128.	CAFT Training on "Immunological and Molecular Diagnostics for Rapid Disease Diagnosis"	ICAR-CIFE, Mumbai, 07-27.02. 2020	
129.	'Massive Open Online Course (MOOC) on ''Teaching Excellence''	ICAR-National Academy of Agricultural Research Management, Rajendranagar, Hyderabad (Telangana) 01-30.11.2019	
130.	National Conference on "Big-Geospatial Data: Analytics, Modelling and Applications"	Punjab Remote Sensing Centre (PRSC) in collaboration with Indian Society of Remote Sensing-Ludhiana chapter, 25-26.09.2019	
131.	ICAR sponsored 10 days short training programme on "Innovations in Functional foods and Nutraceuticals for Management of Chronic Diseases",	Centre of Food Science & Technology, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi 21-30.01.2020	
132.	Workshop-cum-Training Programme on "Latest Advances in Livestock, Poultry and Fisheries	Directorate of Extension, GADVASU, Ludhiana, 28.01.2020	Drs. Meera D. Ansal, Abhishak Srivastava, Grishma Tewari

Sr. No.	Name of the Conferences/ Symposia/ Workshop/ Trainings	Organizing agency, place and date	Name of the Faculty Member who attended the meeting
133.	21 days training Program on "Precision Fish Farming: Automation Principles and Technological Solutions for Sustainable Aquaculture Production and Productivity."	Central Institute of Fisheries Education- ICAR (Mumbai) 26.11-16.12. 2019	Dr. Abhishek Srivastava
134.	Workshop on "Awareness for Environment Protection - Better Environment Better Tomorrow"	Punjab Pollution Control Board at PAU Ludhiana, 07.02.2020	Drs. S.S. Hassan, S.N. Datta, Grishma Tewari, Jitendra Kumar
135.	Launch Workshop of NAHEP Institutional Development Plan	GADVASU, Ludhiana, 28.11.2019	Dr. S.N. Datta
136.	ICAR sponsored 21 days winter school on "Recent advances in fish processing, value addition and fish waste management"	College of Fisheries, Central Agricultural University, Lembuchhera, Agartala, Tripura, 07-27.01.2020	Dr. Vijay Kumar Reddy
137.	Managing and Attracting Youth Towards Agriculture	PAU, Ludhiana in Collaboration with Trust for advancement of Agricultural Sciences (TAAS), New Delhi, 28-29.02.2020	Dr. Prabjeet Singh
138.	Fisheries and Climate Change: Strategies, Challenges and Sustainable Management"	SKUAST-K, Shalimar, UT of J&K 18-19.07.2019	
139.	CAFT-Enhancement of Aquaculture and Water Productivity through Engineering Interventions in Biofloc Technology, Aquaponics and RAS (21 Days Training)	Central Institute of Fisheries Education- ICAR (Mumbai) 16.01-05.02.2020	Drs. Sachin O. Khairnar, Amit Mandal
140.	Advances in Virological Techniques in Aquatic Animal Disease Diagnosis	College of Fisheries, Mangalore, Karnataka 10.06-10.07.2019	Dr. Naveen Kumar B.T.
141.	Sustainable Environment through Biological Sciences and Technology	Department of Microbiology, Davangere University, Davangere, Karnataka 07-08.02.2019	
142.	Two Day National Seminar On "Spatial Dimensions of Enviornmental Problems and Natural Resource Law"	Universtiy of Delhi, New Delhi, 03-04.09.2019	Dr. Jitendra Kumar
College of Animal Biotechnology			
143.	3rd National Conference of Society for Veterinary & Animal Husbandry Extension (SVAHE) on "Livestock Development for Social Needs: Extension and Allied Sector Initiatives"	College of Veterinary and Animal Science, G. B. Pant University of Agriculture & Technology, Pantnagar, 03-05.04. 2019	Dr. Simrinder Singh Sodhi

Sr. No.	Name of the Conferences/ Symposia/ Workshop/ Trainings	Organizing agency, place and date	Name of the Faculty Member who attended the meeting
144.	3rd Progressive Investors Summit 2019.	Indian School of Business, Mohali Punjab Govt 06.12.2019	Dr. R S Sethi
145.	National Symposiumon "Enhancement of Farmers' Income through Management of Animal Genetic Resources" and XVII Annual Convention of Society for Conservation of Domestic Animal Biodiversity (SOCDAB)	College of Veterinary Science and Animal Husbandry, Mhow, Madhya Pradesh 10-11.02. 2020	Dr. JS Arora
146.	CAFT Training program on "Phenomics and Genomic Evaluation of Dairy Animals for Sustainable Production"	Department of Animal Genetics and Breeding, ICAR-NDRI, Karnal (02-22.01.2020)	Dr. CS Mukhopadhyay
147.	"Massive Open Online Courses (MOOCS) Training on Teaching Excellence.	NAARM-ICAR, organized online (https://elearning.naarm.org.in) 01.11-30.12.2019	
148.	XVI Annual Convention of Indian Society for Advancement of Canine Practice & National Symposium on 'Exploring new horizons in canine practice and welfare'	Khalsa College of Veterinary and Animal Sciences, Amritsar, 26-28.02.2019	Dr. B.V. Sunil Kumar
149.	Short Course Training	National Research Centre, Equine (NRCE), ICAR, Hisar, 28.02-06.01.2020	Dr Dipak Deka
Library			
150.	NDLI Club Punjab State Workshop	Govt. State College of Education, Patiala, 13.12.2019	Sonia Bansal
151.	Workshop on MOOCs. E-content Development and Open Educational Resources	HRDC, Punjabi University, Patiala 15-22.01.2020	
152.	Regional Training Programme on CeRA	DKMA, ICAR NASC Complex, New Delhi, 23.10.2019	Dr Nirmal Singh
153.	Northern Regional Training Programme for PDS (URKUND) University Administrators	Chandigarh University, Gharuan, 19.08.2019	

Invited Lectures Delivered by Faculty

Sr. No.	Details of the Lecture Delivered
1.	A.P.S. Sethi, Amardeep Kaur and Udeybir Singh. Prospects and research priorities in canine nutrition. In compendium of Prospects and Research priorities in Canine Nutrition at 18th International Conference on Animal Nutrition (INCAN-2019), West Bengal University of Animal and Fishery Sciences, Kolkata from December 17-19, 2019.
2.	R. S. Grewal. Nutrition and reproduction in dairy animals. In compendium of Center for Advance Faculty Training Deptt. of Veterinary Gynecology and Obstetrics, GADVASU, Ludhiana on Oct 19, 2019.
3.	J.S. Hundal. Role of omega 3 fatty acids in canine health. In compendium of National congress on canine practice and National symposium on 'Maximizing, therapy and welfare in canine practice in current scenario, Indian Society for advancement of Canine Practice (ISCAP), COVS, NDVSU, Jabalpur on January 23, 2020.
4.	J.S. Hundal. Nutritional strategies for dairy animals. In compendium of Alumni meet cum technical seminar, COVS, GADVASU, Ludhiana on December 29, 2019.
5.	Neeraj Kashyap. Types of Variables and Selection of Appropriate Statistical Test. In compendium of National training on Applications of Artificial Intelligence for Data Analysis in Animal Sciences, sponsored under IDP (ICAR) Deptt. of AGB, JAU, Junagadh on August 05, 2019.
6.	Neeraj Kashyap. Tips and Tricks in Using MS Excel for Efficient Data Management. In compendium ofNational training on Applications of Artificial Intelligence for Data Analysis in Animal Sciences sponsored under IDP (ICAR) Deptt. of AGB on August 06, 2019.
7.	Neeraj Kashyap. Epidemiological Statistical Software: Introduction and Application. In compendium of 10 days short training inAdvances in Molecular Epidemiology in Veterinary Research sponsored by ICAR-CBP, SPHZ, Ludhiana on Dec 16, 2019.
8.	Neeraj Kashyap. Progeny Testing Program for Trustworthy Selection of Bulls. In compendium of Six days training on Rearing of Improved Breed & Rearing of Cattle and Their Management under STRY, PAMETI, Ludhiana on February 11, 2020.
9.	Neeraj Kashyap. A Roadmap for Utilization and Upgradation of Non-descript Breeds of Cattle. In compendium of Six days training on Rearing of Improved Breed & Rearing of Cattle and Their Management under STRY, PAMETI on February 13, 2020.
10.	Simarjeet Kaur. Points for consideration during selection, examining & purchase of dairy animals. PAMETI in Collaboration with GADVASU, Ludhiana on November 05, 2019.
11.	Simarjeet Kaur. Status of Sahiwal Cattle in Punjab. DEE, GADVASU, RRTC, Kaljharani, Bathinda on December 04, 2019.
12.	Navdeep Singh. Management tools for uterine torsion in bovine and post recovery evaluation. In compendium of Centre of Advanced Faculty Training on Current Knowledge and Future Challenges in Domestic Animal Theriogenology, Dept. of Vety Gynaecology and Obstetrics, GADVASU from October 03-23, 2019.
13.	Navdeep Singh. Use of colour doppler for diagnosing female infertility in farm animals. In compendium of Centre of Advanced Faculty Training on Current Knowledge and Future Challenges in Domestic Animal Theriogenology, Dept. of Vety Gynaecology and Obstetrics, GADVASU from October 03-23, 2019.
14.	Navdeep Singh. Color Doppler ultrasonography in animal reproduction. In compendium of Model Training Course Sponsored by Ministry of Agriculture & Farmers Welfare from November 01-08, 2019.
15.	Navdeep Singh. Common Gynaecological conditions in dairy animals. In compendium ofFarmer training programme TVCC, GADVASU, Jaladiwal, Ludhiana on March 03, 2020.

Sr. No.	Details of the Lecture Delivered
16.	Narinder Singh. Embryo production and *in vitro* fertilization – updates. Deptt. of Veterinary Gynaecology and Obstetrics, GADVASU, Ludhiana on October 16, 2019.
17.	Narinder Singh. Grading and selection of embryos for IVF. Deptt. of Veterinary Gynaecology and Obstetrics on October 18, 2019.
18.	Mandeep Singla. Beetal Nasal Naal Adunik Bakri Farm Di Shuruat. Directorate of Extension Education, Pashu Mela Ground, GADVASU, Ludhiana.
19.	Mandeep Singla. Badl De Mausam Dauran Majha Gawa Da Prabandh. Directorate of Extension Education, GADVASU, Ludhiana on May 31, 2019.
20.	Mandeep Singla. University De Bakri Farm Da Daura, Pashua Nu Kaboo Karna, Bukhar Check Karna Adi. Directorate of Extension Education, Goat Farm, Ludhiana on July 11, 2019.
21.	Mandeep Singla. Soora Lai Kifaiti ate Araamdaek Sheda di Usaari. Dept. of Livestock Production Management, GADVASU, Ludhiana on July 15, 2019.
22.	Daljeet Kaur. 1. Murgiyaan Lai Vakh Vakh Kisama De Shed 2. Murgiaantae broiler farm te roshni da parbandh 3. Brooding of Chicks, 4. Digestive system of poultry Murgiyaan Da Muharat Sikheya Course by Directorate of Extension Education, GADVASU, Ludhiana from April 22, 24-25, 2019.
23.	Daljeet Kaur. Suur Diyaan Vakh Vakh Naslaan Te Una Di Choan. Punjab De SC Umeedvaaran Lai Suur Palan Da Muharat Sikheya Course (Spl. Component), Deptt. Of Livestock Production Management, GADVASU, Ludhiana on July 15, 2019.
24.	Daljeet Kaur. 1. Panchhiyaan Layi Awaas Sambandhi Loadaan 2. Vakh Vakh Taraan De Shedaan Lai Lodihda Samaan Ate Usdi Choan 3. Vadhiyaan Ande Utpadan Lai Vigiyanak Leehaan 4. Murgi Di Pachhaan Pranali 5. Chuchae paun toan pehlaan farm di tyari Expert lectures at, Skill development programme on Small Poultry FarmerDirectorate of Extension Education, GADVASU, Ludhiana from December 04-08, 2019.
25.	Daljeet Kaur. Backyard poultry farming- An coming supplementing venture. In compendium of Expert Lecture at Workshop-cum-training program on Latest Advances in Livestock, Poultry and Fishers for KVKs of Punjab as well as University Scientists.Directorate of Extension Education, GADVASU, Ludhiana on January 28, 2020.
26.	Daljeet Kaur. 1. Information on housing requiements for birds at different stage 2. Raw material selection for different types of sheds 3. Different type of sheds used for poultry and their modifications according to weather conditions 4. Preparation of shed before arrival of chicks 5. Equipments, brooders and cage system and their specification 6. Light management in broiler and poultry farming 7. Grading of live poultry birds In compendium of Expert Lecture in Training on Skill development programme of Small Poultry Farmer organized. Directorate of Extension Education, GADVASU, Ludhiana from February 07-March 04, 2020.
27.	Daljeet Kaur. Strategies to minimize neonatal kid morality. In compendium of Expert lecture in training on Rural upliftment through scientific goat farming organized by Deptt. of LPM, GADVASU, Bhundri, Ludhiana on February 13, 2020.

Sr. No.	Details of the Lecture Delivered
28.	Daljeet Kaur. 1. Preparation Procedure for brooding of day -old chicks 2. General Management practices and tips to enhance the overall profit in Poultry Farming In compendium of Expert Lecture at Poultry Farmers training on Inculcation of Entrepreneurship skills in poultry farming among SC farmers. Deptt. Of Livestock Production Management, GADVASU, Ludhiana on March 15, 2020
29.	Daljeet Kaur. Hands-on training for general prophylactic measures to be adopted at Poultry Farm. In compendium of Expert lecture on Hands-on training for UG/PG students (SC/ST) on prophylactic practices followed at Poultry Farm, Deptt. of LPM, GADVASU, Ludhiana on March 15, 2020.
30.	Amit Sharma. Role of pig farming to address the agrarian and environmental crises of transgangetic plains in India. Indian Society of Animal Production Management, Jaipur on February 05, 2020.
31.	Amit Sharma. Housing management – demonstration. PAMETI, Ludhiana on November 25, 2019.
32.	Dr. Sandeep Kaswan. Status of goat farming. Golden Jubilee Celebrations, Alumni Association, COVS, Pal Auditorium, PAU, Ludhiana on December 29, 2019.
33.	Dr. Sandeep Kaswan. Way forward in goat farming. 11th National Livestock Championship and Agri Expo-2020, Animal Husbandry Dept., Punjab, Batala, Gurdaspur on February 27, 2020.
34.	Manish Kumar Chatli. Quality and functional properties of Eggs. Punjab Layer Farmer's Association, Chandigarh, Rajpura on April 27, 2019
35.	Manish Kumar Chatli. Guidelines for the disposal of birds. Progressive Poultry Farmers Association, Ludhiana on May 15, 2019
36.	Manish Kumar Chatli. 1. Production of Egg & Meat Products 2. Options for value addition in dairy 3. Livestock Production and value addition: Potential and prospects 4. Livestock Production: Recent trends, future prospects 5. Technologies for value addition in meat & egg products 6. Value Addition in dairy products FSSAI registration process 7. Goat meat processing and Value Addition PAMETI, Ludhiana from August 08, 2019 - February 28, 2020.
37.	Manish Kumar Chatli. Quality Assurance and Value Addition of Egg. World Egg Day, Central Poultry Development organization, Chandigarh on October 11, 2019
38.	Manish Kumar Chatli. 1. Bioactive Peptides: A New Vista for Neutraceuticals 2. Employment opportunities in Meat Industry IMSA & Department of Livestock Products Technology DGCN College of Veterinary & Animal Sciences, CSK HPKV, Palampur from November 06-08, 2019.
39.	Manish Kumar Chatli. Scope and opportunities of Processing and value addition in small ruminant sector. Institutional Development Plan cell, GADVASU, Ludhiana from November 20-21, 2019.
40.	Manish Kumar Chatli. 1. Entrepreneurship through value addition in meat and eggs 2. Functional Meat and Egg Products: market and regulations Bihar Animal Science University, Patna from March 06-07, 2020

Sr. No.	Details of the Lecture Delivered
41.	Manish Kumar Chatli. Ante-Mortem and Post Mortem Examination Of Meat Animals with A Special Reference To Poultry. CAFT, Department of Veterinary Pathology, GADVASU, Ludhiana on December 05, 2019
42.	Manish Kumar Chatli. Species-specific identification of adulteration of meat using traditional and novel approaches. ICAR Short Course by School of Public Health and Zoonoses, GADVASU, Ludhiana on December 16, 2019
43.	Dr Nitin Mehta. 1. Meat Taun Banan Wale Padarthan Da practical (Practical demonstration of value added meat products) 2. Vigyanik Dhang Naal Sooran Da Slaughter Karna, Sooran Daa Uttam Quality Da Meat Paida Karna Ate Sooran De Maas Taun Product Bannaune(Practical demonstration of scientific slaughter, hygienic production of pork and value addition) 3. Vigyanik Dhang Naal Sooran Da Slaughter Karna, Sooran Daa Uttam Quality Da Meat Paida Karna Ate Sooran De Maas Taun Product Bannaune(Practical demonstration of scientific slaughter, hygienic production of pork and value addition) 4. Bakri De Meat Taun Padarath Bannaune; Likhti Ate Prayogi(Practical demonstration and lecture on value addition of goat meat) 5. Sooran Da Jhatkaun Da Sahi Tareeka Ate Saaf Suthra Maas Utpadan (Scientific slaughter of pigs and hygienic production of pork) 6. Vigyanik Dhang Naal Sooran Da Slaughter Karna, Sooran Daa Uttam Quality Da Meat Paida Karna Ate Sooran De Maas Taun Product Bannaune (Practical demonstration of scientific slaughter, hygienic production of pork and value addition) 7. Vigyanik Dhang Naal Sooran Da Slaughter Karna, Sooran Daa Uttam Quality Da Meat Paida Karna Ate Sooran De Maas Taun Product Bannaune (Practical demonstration of scientific slaughter, hygienic production of pork and value addition) 8. Hygienic slaughtering and dressing of poultry birds Department of Veterinary and Animal Husbandry Extension Education, GADVASU, Ludhiana from April 29, 2019- March 04, 2020.
44.	Nitin Mehta. Scientific slaughtering of pigs - Value addition of pork through various products. PAMETI, GADVASU, Ludhiana on November 18, 2019.
45.	Pavan Kumar. Nutritive value of poultry meat. In Skill Development Programme on Small Poultry farmer, GADVASU, Ludhiana on March 07, 2020.
46.	Pavan Kumar. 1. Lecture-cum-Practical Preparation of mutton pickle 2. Preparation of chicken snack 3. Preparation of pork products RKVY training program entitled Insight on different techniques in value addition of livestock products for self-employment, Village Sabhra on February 27, 2020
47.	Pavan Kumar. Status and scope of snack foods for human and pet nutrition. One day workshop on extrusion on Extrusion Technology: A Way forward to processing and nutritional interventions on November 28, 2019
48.	Pavan Kumar and Rajesh V Wagh. Development of Value added meat and meat products. KVK, Handiya, Barnala on October 16, 2019
49.	Pavan Kumar and Rajesh V Wagh. Development of meat pickle and practical demonstration. KVK, Tarn Taran on January 23, 2020
50.	Varinder Uppal. Topographic Anatomy of Canine Thorax in relation to Thoracic trauma. ICAR sponsored CAFT programme. Deptt. of Veterinary Surgery and Radiology, GADVASU, Ludhiana on September 30, 2019

Sr. No.	Details of the Lecture Delivered
51.	Neelam Bansal. Application of Enzyme Histochemistry in Diagnostic Pathology. ICAR sponsored CAFT programme. Dept. of Veterinary Pathology, GADVASU, Ludhiana from November 17- December 07, 2019
52.	Varinder Uppal. Practical Histochemistry and Histoenzymology. ICAR sponsored CAFT programme. Dept. of Veterinary Pathology, GADVASU, Ludhiana from November 17- December 07, 2019
53.	Neelam Bansal. Cytodifferentiation of gonads in mammals. XXXIV Annual Convention and National Symposium of IAVA, Department of Veterinary Anatomy, Bengaluru from November 28-30, 2019.
54.	Anuradha Gupta. Thyroid gland overview: Hormonal and Metabolic Disorders. XIV Biennial National Conference of Association of Public Health Veterinarians, DUVAS, Mathura, from January 24-25, 2020
55.	Parminder Singh. Farmer friendly extension approach of Veterinary University. 3rd National Conference of Society for Veterinary & Animal Husbandry Extension (SVAHE). G B Pant University of Agriculture and Technology, Pantnagar, Uttarakhand, from April 03-05, 2019.
56.	Parminder Singh. National Dairy Plan: Implementation & Challenges. 3rd National Conference of Society for Veterinary & Animal Husbandry Extension (SVAHE). G B Pant University of Agriculture and Technology, Pantnagar, Uttarakhand from April 03-05, 2019.
57.	Jaswinder Singh. Focusing experienced based livestock extension reforms. G B Pant University of Agriculture and Technology, Pantnagar, Uttarakhand from April 03-05, 2019.
58.	Bilawal Singh. Melatonin Implants and Seasonal Breeding in Buffaloes. G B Pant University of Agriculture and Technology, Pantnagar, Uttarakhand from April 03-05, 2019.
59.	YS Jadoun. Gender Mainstreaming through Livestock Preneurship. Indian Society of Extension Education, New Delhi, HAU, HISAR from November 20-22, 2019.
60.	Bilawal Singh. Role of melatonin in augmenting reproduction in dairy animals CAFT Veterinary Gynaecology and Obstetrics, GADVASU, Ludhiana on October 16, 2019
61.	Khushpreet Singh. Breeding soundness and evaluation of bulls. CAFT training programme on: Current Knowledge and Future Challenges in Domestic Animal Theriogenology, GADVASU, Ludhiana on October 07, 2019
62.	Khushpreet Singh. Ultrasonography of testicles and evaluation of male genital glands. Model Training Course (MTC) on Ultrasonography evaluation of ovarian and genital status for evaluation of fertility status in dairy animals. Veterinary Gynaecology and Obstetrics, GADVASU, Ludhiana on November 05, 2019
63.	Khushpreet Singh. Pig farming a boon for unemployed youth. Speculating knowledge to young entrepreneurs on pig farming one day training (ICDP), Directorate of Extension Education, GADVASU on February 09, 2020
64.	SPS Ghuman. Fertility enhancement in farm animals using endocrine approaches and imaging technologies. In compendium of National Seminar on 'Biotechnological Advances for Improving Animal Health and Productivity', College of Veterinary and Animal Husbandry, NAU, Navsari from December 05-06, 2019.
65.	Navdeep Singh. Echocardiography for detection of cardiac disorders in large animals. ICAR CAFT, Deptt. of Vety. Surgery & Radiology. GADVASU, Ludhiana from September 11- October 01, 2019
66.	Navdeep Singh. Considerations for imparting general anesthesia in surgical emergencies of canine patients. ICAR CAFT, Deptt. of Vety. Surgery & Radiology GADVASU, Ludhiana from September 11- October 01, 2019

Sr. No.	Details of the Lecture Delivered
67.	Navdeep Singh and Arun Anand. Inhalation anesthesia – Agents for maintenance of GA and Boyle's anesthesia. ICAR CAFT, Deptt. of Vety. Surgery & Radiology. GADVASU, Ludhiana from January 08- 10, 2020
68.	Tarunbir Singh and Navdeep Singh. Radiographic interpretation of bones and joints. ICAR CAFT, Deptt. of Vety. Surgery & Radiology. GADVASU, Ludhiana from January 14-16, 2020
69.	Pallavi Verma and Navdeep Singh. Endoscopy for evaluation of Gastrointestinal tract in dogs. ICAR CAFT, Deptt. of Vety. Surgery & Radiology.GADVASU, Ludhiana from January 21-23, 2020
70.	Raj Sukhbir Singh. Services provided by Veterinary clinics (in Punjabi). Dairy training course, Department of VAHE, GADVASU, Ludhiana on May 24, November 29, 2019.
71.	Raj Sukhbir Singh. Metabolic diseases, mastitis, vaccination and deworming schedule and visit to veterinary clinics. In compendium of Training programme on Goat rearing and management Department of VAHE, GADVASU, Ludhiana on May 24, November 29, 2019
72.	Raj Sukhbir Singh. Introduction to hospital database management system for disease surveillance. In compendium of Training course on Advances in Molecular Epidemiology in Veterinary Research. School of Public Health and Zoonoses, GADVASU, Ludhiana on December 15, 2019.
73.	Raj Sukhbir Singh. Important breeds of dogs and their restraint. Skill Development Training Program on Animal Health Workers. Department of VAHE, GADVASU, Ludhiana on February 18, March 24, 2020
74.	Raj Sukhbir Singh. Udder formation of milch animals, its diseases and remedies. Skill Development Training Program on Dairy Farmer Entrepreneur. Department of VAHE, GADVASU, Ludhiana on February 18, March 24, 2020
75.	Tejinder Singh Rai. Challenges Faced by Scientists in Vaccine Development and Vaccination in Combating Animal Diseases. World Veterinary Day celebration Blue Cross Society. Blue Cross Society BRS Nagar Ludhiana on April 27, 2019
76.	Tejinder Singh Rai. Scourge of Antimicrobial Resistance: Time to Act Now. Indian Veterinary Association, Indian Immunologicals Limited, Commonwealth Veterinary Association, Pashu Chikitsak Mahasangh (PCM). NASC Complex, New Delhi from July 26-27, 2019
77.	P. N. Dwivedi, Gurpreet Kaur and Sreekala S. Mohandas. Applications of molecular epidemiology for detection of viral diseases. ICAR short course "Advances in Molecular Epidemiology in Veterinary Practice" School of Public Health and Zoonoses. GADVASU, Ludhiana from December 10-19, 2019
78.	P. N. Dwivedi, Gurpreet Kaur and Sreekala S. Mohandas. An overview on Chicken infectious anaemia virus. IPSACON-2019 (Indian Poultry Science Association). Chhattisgarh Kamdhenu Vishwavidyalaya, Durg from December 11-13, 2019
79.	P. N. Dwivedi, Gurpreet Kaur and Sreekala S. Mohandas. Virus like particles: A new generation tool for diagnosis and prophylaxis of canine viral disease. ISACPCON-2020, College of Veterinary Science & Animal Husbandry, NDVSU, Jabalpur (M.P.) from January 21-23, 2020.
80.	Deepti Narang. Bovine Tuberculosis: Epidemiology and Diagnosis in India. Short term training course on "Advances in Molecular Epidemiology in Veterinary Research" by School of Public Health and Zoonosis, GADVASU, Ludhiana from December 10-19, 2019.
81.	Deepti Narang and Pallvi Slathia. Infectious infertility in domestic animals with special reference to Brucellosis. CAFT 21- day Training course on "Current knowledge and future challenges in domestic Animal Theriogenology" Department of Veterinary Gynaecology. GADVASU, Ludhiana from October 02-23, 2019

Sr. No.	Details of the Lecture Delivered
82.	Deepti Narang. Recent Advances in diagnosis of mycobacterial diseases in animals. ICAR-Sponsored CAFT Training course on Diagnosis of animal and poultry diseases with emphasis on morphological characterization of gross and histological lesions, Department of Veterinary Pathology. GADVASU, Ludhiana from November 17-December 07, 2019.
83.	L.D. Singla. Trypanosomosis: The Current Status in India. Indian Society for Parasitology during 30th National Congress of Parasitology & Global Summit on Malaria Elimination. Jawaharlal Nehru University, New Delhi Sept 26-28, 2019.
84.	L.D. Singla. Transmission Potential of Parasitic Diseases by Rodents to Animals and Humans. ICAR Model Training Course on Management of Vertebrate Pests in Drylands for Enhancing Farmers Income. ICAR-Central Arid Zone Research Institute, Jodhpur on October 19, 2019.
85.	N K Singh. 1. Importance of ticks and possible strategy for the sustainable control of ticks on domestic animals in Indian situation 2. Acaricide resistance, mechanism and methods of investigation IDP (ICAR) sponsored vocational training, Junagadh Agricultural University, Junagadh from November 18-22, 2019.
86.	L.D. Singla. Diagnosis of haemoprotozoan infections of animals. ICAR sponsored CAFT on Diagnosis of animal and poultry diseases with emphasis on morphological characterization of gross and histological lesions. Department of Veterinary Pathology, GADVASU on November 20, 2019
87.	Paramjit Kaur. Analysis of clinical parasitic samples. ICAR sponsored CAFT on Diagnosis of animal and poultry diseases with emphasis on morphological characterization of gross and histological lesions. Department of Veterinary Pathology, GADVASU on November 28, 2019.
88.	L.D. Singla. Zoonotic importance and molecular diagnostic tools for identification of *Cryptosporidium* species. ICAR Short Course on Advances in Molecular Epidemiology in Veterinary Research. School of Public Health and Zoonosis, GADVASU on December 11, 2019
89.	L.D. Singla. Approaches and issues on drug resistance management in trypanosomosis and provided inputs. ICAR-National Research Center on Camel, Bikaner on January 06, 2020.
90.	L.D. Singla. Status of Cryptosporidiosis and its public health significance. 29th National Conference of Veterinary Parasitology, Indian Association for the advancement of Veterinary Parasitology. Nanaji Deshmukh Veterinary Science University, Jabalpur from February 05-07, 2020.
91.	Harkirat Singh. Important endo and ectoparasites in cattle and buffaloes. Skill Development Programme on Animal Health Worker under PMKVY, Directorate of Extension Education GADVASU, Ludhiana on February 21, 2020.
92.	Paramjit Kaur. Ectoparasites, their prevention and control in dairy animals at farms. Skill Development Programme on Animal Health Worker under PMKVY, Directorate of Extension Education. GADVASU, Ludhiana on February 26, 2020
93.	Jyoti. Important endo and ectoparasites in pig. Skill Development Programme on Animal Health Worker under PMKVY, Directorate of Extension Education GADVASU, Ludhiana on March 04, 2020
94.	C K Singh. Prevention of Rabies and stray Dog Management. Municipal Corporation, Chandigarh on September 28, 2019
95.	C K Singh. Ante-mortem diagnosis of Rabies in animals. In compendium of CAFT Training on "Current knowledge and future challenges in domestic animal theriogenology" by the Department of Veterinary Gynaecology and Obstetrics. GADVASU, Ludhiana on October 20, 2019

Sr. No.	Details of the Lecture Delivered
96.	C K Singh. Rabies in India. Annual Conference of Indian Association of Veterinary Pathologists. COVS, CAU, Aizawl on November 8, 2019
97.	B S Sandhu. 1. Vaccination of broilers and layers 2. Important viral diseases of poultry and their management 3. Practical of poultry birds postmortem for bacterial and viral diseases diagnosis-1 4. Bird flu in poultry 5. Practical of poultry birds postmortem for bacterial and viral diseases diagnosis-II Skill development programme on Small poultry Farmer Director Extension GADVASU, Ludhiana from February 13 – March 03, 2020.
98.	B S Sandhu. Humane culling methods and scientific disposal of animals/birds. Skill Development Programme on Animal Health workers under Pradhan Mantri Kaushal Vikas Yojana, Director Extension GADVASU, Ludhiana on March 03, 2020.
99.	B S Sandhu. Important bacterial diseases of poultry birds and their control practices – practical. Skill Development Programme on Animal Health workers under Pradhan Mantri Kaushal Vikas Yojana, Director Extension GADVASU, Ludhiana on March 07, 2020
100.	B S Sandhu. Pashuan Vich Halkaw Dee Bimari. Director Extension GADVASU, Ludhiana Pashu Palan Mela from September 21-23, 2019.
101.	B S Sandhu. Pashuan Vich Halkaw Da Tikakaran. Deputy Director Animal Husbandry, Ludhiana Polyclinic Gill, Ludhiana on September 28, 2019.
102.	APS Brar. Single & multiple antigen labeling for diagnosis of important etiological agents in the field outbreaks of bovine calf diarrhea. Annual Conference of Indian Association of Veterinary Pathologists. COVS, CAU, Aizawl on November 08, 2019.
103.	APS Brar. Bovine calf diarrhea: Importance of microscopic examination of faecal smears. Annual Conference of Indian Association of Veterinary Pathologists. COVS, CAU, Aizawl on November 08, 2019.
104.	Kuldip Gupta. Patho-diagnosis of tumours in reproductive organs of farm and pet animals. CAFT Training on Current knowledge and future challenges in domestic animal theriogenology by Department of Veterinary Gynaecology and Obstetrics. GADVASU, Ludhiana on October 20, 2019.
105.	Nittin Dev Singh. Epithelial to Mesenchymal Transition (EMT) in Pulmonary Fibrosis. Annual Conference of Indian Association of Veterinary Pathologists. COVS, CAU, Aizawl on November 08, 2019
106.	Sidhartha Deshmukh. Introduction to *in-situ* hybridization techniques for disease diagnosis during ICAR short course on Advances in Molecular Epidemiology in Veterinary Research. School of Public Health and Zoonoses GADVASU, Ludhiana on December 16, 2019.
107.	V. K. Dumka. Assessment and Management of Pain in Trauma Patients. ICAR Advanced Faculty Training Course on Diagnostic, Anaesthetic and Surgical Interventions in Emergency and Trauma Patients. Dept. of Veterinary Surgery and Radiology GADVASU, Ludhiana from September 11- 01 October, 2019.
108.	Digvijay Singh. UMMB licks and Yea Sac 1026 as feed supplementation alternatives in ruminants. XXVIII Annual Conference & National Symposium on Physiological approaches to address environmental challenges for increasing animal productivity and farmer's income at ICAR-Central Sheep and Wool Research Institute, Avikangar from February 18-20, 2020.
109.	M Honparkhe. 1. Ultrasonographic interventions and application in animal reproduction 2. Diagnosis and treatment of uterine diseases in large animals 3. Use of Alphavision for the diagnosis of female reproductive problems

Sr. No.	Details of the Lecture Delivered
	4. Fetotomy operations 5. Cytobrush technique in evaluating uterine health in bovine ICAR Sponsored CAFT center Dept of Veterinary Gynaecology and Obstetrics, GADVASU, Ludhiana from October 04-22, 2019.
110.	M Honparkhe. 1. Basics of ultrasonography procedures 2. Machine setups, Buttonology, care and maintenance of ultrasound machines 3. Special techniques related to ultrasonography 4. Transvaginal ultrasound guided follicle/cyst ablation in dairy animals Directorate of Extension (DOE), Ministry of Agriculture & Farmers Welfare, Veterinary Gynaecology and Obstetrics GADVASU, Ludhiana from Nov 1-8, 2019.
111.	M Honparkhe. Fetal malformations and their handling. MANAGE, Hyderabad under Off campus collaborative Training program, Veterinary Gynaecology and Obstetrics GADVASU, Ludhiana on December 10, 2019
112.	A K Ahuja. 1. Management of incomplete cervical dilation in large animal dystocia 2. Antisperm antibody: A major cause of repeat breeding syndrome in dairy animals ICAR CAFT center Dept of Veterinary Gynaecology and Obstetrics. GADVASU, Ludhiana from October 05, 09, 2019
113.	A K Ahuja. Reproductive ultrasonography in small ruminants. Directorate of Extension (DOE), Ministry of Agriculture & Farmers Welfare, Veterinary Gynaecology and Obstetrics GADVASU, Ludhiana on November 07, 2019
114.	A K Ahuja. 1. Fetotomy operations in large animal 2. Management of incomplete cervical dilation in large animals MANAGE, Hyderabad under Off campus collaborative Training program, Veterinary Gynaecology and Obstetrics, GADVASU, Ludhiana on December 11, 13, 2019
115.	A K Singh. 1. Reproductive and breeding management practices in swine and future prospects. 2. Semen additives used for optimization of male fertility: An update. 3. Semen cryopreservation and artificial insemination in swine. ICAR CAFT, Dept of Veterinary Gynaecology and Obstetrics, GADVASU, Ludhiana on October 10, 19, 2019
116.	A K Singh. Ultrasonographic characteristics of normal and abnormal tubular genital tract of bovines. Directorate of Extension (DOE), Ministry of Agriculture & Farmers Welfare, Veterinary Gynaecology and Obstetrics, GADVASU, Ludhiana on November 02, 2019
117.	A K Singh. Ultrasound aided pregnancy diagnosis in dairy animals. Directorate of Extension (DOE), Ministry of Agriculture & Farmers Welfare, Veterinary Gynaecology and Obstetrics. GADVASU, Ludhiana on November 04, 2019
118.	A K Singh. Obstetrical lubricants in large animal practice. MANAGE, Hyderabad under Off campus collaborative Training program. Veterinary Gynaecology and Obstetrics GADVASU, Ludhiana on December 10, 2019
119.	Prahlad Singh. 1. Criteria for selection of animals for embryo transfer technology 2. Mechanisms Involved in Retention of Fetal Membranes in Dairy Animals ICAR Sponsored CAFT center Dept of Veterinary Gynaecology and Obstetrics. GADVASU, Ludhiana on October 16, 17, 2019
120.	Prahlad Singh. Estimation of fetal age and sex by ultrasonography. Directorate of Extension (DOE), Ministry of Agriculture & Farmers Welfare, Veterinary Gynaecology and Obstetrics. GADVASU, Ludhiana on November 07, 2019

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121.	Prahlad Singh. Advance in retention of fetal membranes in dairy animals. MANAGE, Hyderabad under Off campus collaborative Training program, Veterinary Gynaecology and Obstetrics. GADVASU, Ludhiana on December 12, 2019
122.	Ajeet Kumar. 1. Current scenario of bull fertility and semen technology in India 2. Cryopreservation induced changes in sperm: structural and molecular aspects 3. Ultrasonography and Infrared thermography : Robust tools for diagnosis of male infertility ICAR CAFT Dept of Veterinary Gynaecology and Obstetrics, GADVASU, Ludhiana from October 03-16, 2019.
123.	Ajeet Kumar. Use of ultrasonography in male reproduction. Directorate of Extension (DOE), Ministry of Agriculture & Farmers Welfare, Veterinary Gynaecology and Obstetrics. GADVASU, Ludhiana on November 04, 2019.
124.	Ajeet Kumar. Genital prolapse and its management in large animals. MANAGE, Hyderabad under Off campus collaborative Training program, Veterinary Gynaecology and Obstetrics, GADVASU, Ludhiana on December 09, 2019.
125.	Shahbaz S Dhindsa. Ultrasonographic characteristics of normal and abnormal ovarian structures of bovines. Directorate of Extension (DOE), Ministry of Agriculture & Farmers Welfare, Veterinary Gynaecology and Obstetrics. GADVASU, Ludhiana on November 02, 2019.
126.	Shahbaz S Dhindsa. Obstetrical anaesthesia in farm animals with special reference to epidural anaesthesia in buffalo. MANAGE, Hyderabad under Off campus collaborative Training program, Veterinary Gynaecology and Obstetrics GADVASU, Ludhiana on December 09, 2019
127.	Shahbaz S Dhindsa. Caesarean section in dairy animals: Preparations and approaches. MANAGE, Hyderabad under Off campus collaborative Training program, Veterinary Gynaecology and Obstetrics. GADVASU, Ludhiana on December 12, 2019.
128.	J Mohindroo. Radiographic interpretation of heart, lungs and abdomen in canines. Small Animal Clinicians Association (SACA) Chandigarh on April 21, 2019.
129.	J Mohindroo. Induction and maintenance of inhalant anesthesia in canine. GADVASU+SACA, GADVASU, Ludhiana from July 16-18, 2019.
130.	J Mohindroo. Radiographic assessment of small animal surgical patients suffering from thoracic emergencies. ICAR CAFT at Deptt of Veterinary Surgery & Radiology, GADVASU, Ludhiana from September 11- 01 October, 2019.
131.	J Mohindroo. Application of Ultrasonography for the diagnosis of abdominal emergencies in dogs. ICAR CAFT at Deptt of Veterinary Surgery & Radiology from September 11- 01 October, 2019.
132.	J Mohindroo. Various pre-anesthetic drugs combinations for elective and critical patients. Hands on practice on small animal anesthesia, DIMSCA, ICAR, GADVASU, Ludhiana from January 08-10, 2020.
133.	J Mohindroo. Radiographic interpretation of lungs and mediastinum. Systematic interpretation of radiographs for veterinary practitioners DIMSCA, ICAR GADVASU, Ludhiana from January 14-16, 2020.
134.	J Mohindroo. Perineal hernia and other body wall hernia. Soft tissue Surgery DIMSCA, ICAR GADVASU, Ludhiana from January 21-23, 2020.
135.	Navdeep Singh. Anesthesia of cats and exotic animals. GADVASU+SACA, GADVASU, Ludhiana from July 16-18, 2019.
136.	Navdeep Singh. Echocardiography for detection of cardiac disorders in bovine. ICAR CAFT at Deptt. of Vety. Surgery & Radiology GADVASU, Ludhiana from September 11- 01 October, 2019.

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137.	Navdeep Singh. Considerations for imparting general anesthesia in surgical emergencies of canine patients. ICAR CAFT at Deptt. of Vety. Surgery & Radiology, GADVASU, Ludhiana from September 11- 01 October, 2019.
138.	Navdeep Singh. Inhalation anesthetic agents for maintenance of GA and Boyle's anesthesia machine. Hands on practice on small animal anesthesia, DIMSCA, ICAR. GADVASU, Ludhiana from January 08-10, 2020.
139.	Navdeep Singh. Radiographic interpretation of bones and Joints. Systematic interpretation of radiographs for veterinary practitioners DIMSCA, ICAR from January 14-16, 2020.
140.	Navdeep Singh. Endoscopy for evaluation of upper GIT. Soft tissue Surgery DIMSCA, ICAR from January 21-23, 2020.
141.	SK Mahajan. Recent advances in cataract surgery in dogs- diagnosis and surgical techniques. ICAR, CAFT Dept. of Veterinary Surgery & Radiology. GADVASU, Ludhiana from September 11- 01 October, 2019.
142.	SK Mahajan. Recent advances in corneal surgeries in dogs. ICAR, CAFT Dept. of Veterinary Surgery & Radiology from September 11-01 October 2019.
143.	SK Mahajan. Monitoring of general anesthesia and management of anesthetic emergencies. Hands on practice on small animal anesthesia, DIMSCA, ICAR. GADVASU, Ludhiana from January 08-10, 2020.
144.	SK Mahajan. Radiographic interpretation of contrast radiography. Systematic interpretation of radiographs for veterinary practitioners DIMSCA, ICAR GADVASU, Ludhiana from January 14-16, 2020.
145.	SK Mahajan. Thoracic surgery in small animals and use of IPPV. Soft tissue Surgery DIMSCA, ICAR from January 21-23, 2020.
146.	Arun Anand. Patient monitoring during general anesthesia. GADVASU+SACA, GADVASU, Ludhiana from July 16-18, 2019.
147.	Arun Anand. Clinical assessment of surgical patients suffering from trauma and emergencies. ICAR, CAFT Deptt. of Veterinary Surgery & Radiology. GADVASU, Ludhiana from September 11- 01 October 2019.
148.	Arun Anand. Diagnostic and surgical interventions for dental and mandibular emergencies in dogs. ICAR, CAFT Deptt. of Veterinary Surgery & Radiology GADVASU, Ludhiana from September 11- 01 October 2019.
149.	Arun Anand. Inhalation anesthetic agents for maintenance of GA and Boyle's anesthesia machine. Hands on practice on small animal anesthesia, DIMSCA, ICAR GADVASU, Ludhiana from 08-10.01.2020.
150.	Arun Anand. Radiographic interpretation of Heart. Systematic interpretation of radiographs for veterinary practitioners DIMSCA, ICAR GADVASU, Ludhiana from 14-16.01.2020.
151.	Arun Anand. Genital tract surgery (OH, Castration, Scrotal Ablation, Prostatic abscess). Soft tissue Surgery DIMSCA, ICAR from January 21-23 2020
152.	Ashwani Kumar. Anesthetic emergencies and their management. GADVASU+SACA GADVASU, Ludhiana from July 16-18, 2019
153.	Ashwani Kumar. Advanced local infiltration techniques, diagnostic nerve blocks, therapeutic neurectomy and tenectomies in large animals. ICAR, CAFT Dept. of Veterinary Surgery & Radiology, GADVASU, Ludhiana from Sept 11- 01 Oct 2019
154.	Ashwani Kumar. Diagnosis and treatment of bovine patients suffering from intestinal obstruction. ICAR, CAFT Dept. of Veterinary Surgery & Radiology GADVASU, Ludhiana from September 11- 01 October 2019
155.	Ashwani Kumar. Discussion on pre-anesthetic evaluation and patient preparation for anesthesia. Hands on practice on small animal anesthesia, DIMSCA, ICAR, GADVASU, Ludhiana from January 08-10, 2020

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156.	Ashwani Kumar. Radiographic interpretation of Abdomen. Systematic interpretation of radiographs for veterinary practitioners DIMSCA, ICAR GADVASU, Ludhiana from January 14-16, 2020
157.	Ashwani Kumar. Genital tract surgery (OH, Castration, Scrotal Ablation, Prostatic abscess). Soft tissue Surgery DIMSCA, ICAR GADVASU, Ludhiana from January 21-23, 2020.
158.	Tarunbir Singh. Preanaesthetic evaluation, premedication and anesthetic protocol for small animals. GADVASU+SACA, GADVASU, Ludhiana from July 16-18, 2019.
159.	Tarunbir Singh. Internal skeletal fixation techniques in orthopedic instruments. ICAR, CAFT, Dept. of Veterinary Surgery & Radiology, GADVASU, Ludhiana from September 11- 01 October, 2019.
160.	Tarunbir Singh. Clinical applications of arthroscopic procedures for diagnosis and treatment of skeletal disorders. ICAR, CAFT, Dept. of Veterinary Surgery & Radiology, GADVASU, Ludhiana from September 11- 01 October 2019.
161.	Tarunbir Singh. Pain management in surgical patients. Hands on practice on small animal anesthesia, DIMSCA, ICAR. GADVASU, Ludhiana from January 08-10, 2020.
162.	Tarunbir Singh. Radiographic interpretation of bones and Joints. Systematic interpretation of radiographs for veterinary practitioners DIMSCA, GADVASU , Ludhiana ICAR from January 14-16, 2020.
163.	Tarunbir Singh. Urinary Tract surgery (Cystotomy, Urethrotomy, Scrotal Urethrostomy). Soft tissue Surgery DIMSCA, ICAR GADVASU, Ludhiana from January 21-23, 2020.
164.	Pallavi Verma. Induction and maintenance of inhalant anesthesia in canine. GADVASU+SACA. GADVASU, Ludhiana from July 16-18, 2019.
165.	Pallavi Verma. Basic principles of ultrasonography. ICAR, CAFT, Dept. of Veterinary Surgery & Radiology, GADVASU, Ludhiana from September 11- 01 October 2019.
166.	Pallavi Verma. Roll of Doppler ultrasonography for critically ill small animal patients. ICAR, CAFT, Dept. of Veterinary Surgery & Radiology GADVASU, Ludhiana from September 11- 01 October 2019.
167.	Pallavi Verma. Radiographic interpretation of Abdomen. Systematic interpretation of radiographs for veterinary practitioners DIMSCA, ICAR, GADVASU, Ludhiana January 14-16, 2020.
168.	Pallavi Verma. Monitoring of general anesthesia and management of anesthetic emergencies. Hands on practice on small animal anesthesia, DIMSCA, ICAR GADVASU, Ludhiana from January 08-10, 2020.
169.	Pallavi Verma. Endoscopy for evaluation of upper GIT. Soft tissue Surgery, DIMSCA, ICAR, GADVASU, Ludhiana from January 21-23, 2020.
170.	Vandana Sangwan. Preanaesthetic evaluation, premedication and anesthetic protocol for small animals. GADVASU+SACA, GADVASU, Ludhiana from July 16-18, 2019.
171.	Vandana Sangwan. Thoraco-reticular radiography in Bovines. ICAR, CAFT, Dept. of Veterinary Surgery & Radiology, GADVASU, Ludhiana from September 11- 01 October 2019.
172.	Vandana Sangwan. Injectable anaesthetics. Hands on practice on small animal anesthesia, DIMSCA, ICAR, GADVASU, Ludhiana from January 08-10, 2020
173.	Vandana Sangwan. Radiographic interpretation of Skull and Vertebral coloumn. Systematic interpretation of radiographs for veterinary practitioners DIMSCA, ICAR, GADVASU, Ludhiana from January 14-16, 2020.
174.	Vandana Sangwan. Use of transposition flaps for large skin defects and treatment of canine mammary tumors. Soft tissue Surgery DIMSCA, ICAR, GADVASU, Ludhiana from January 21-23, 2020

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175.	Rahul Udehiya. Anesthesia of cats and exotic animals. GADVASU+SACA, GADVASU, Ludhiana from July 16-18, 2019
176.	Rahul Udehiya. Systemic radiographic evaluation in small animal surgical patients suffering from abdominal emergencies. CAFT, ICAR, Dept. of Veterinary Surgery & Radiology GADVASU, Ludhiana from September 11- 01 October 2019.
177.	Rahul Udehiya. Application of LASER for the treatment of tumors in small animals. CAFT, ICAR, Dept. of Veterinary Surgery & Radiology, GADVASU, Ludhiana from September 11- 01 October 2019.
178.	Rahul Udehiya. Discussion on pre-anesthetic evaluation and patient preparation for anesthesia. Hands on practice on small animal anesthesia, DIMSCA, ICAR, GADVASU, Ludhiana from January 08-10, 2020.
179.	Rahul Udehiya. Radiographic interpretation of Heart. Systematic interpretation of radiographs for veterinary practitioners DIMSCA, ICAR GADVASU, Ludhiana from January 14-16, 2020.
180.	N Umeshwori Devi. Anesthetic emergencies and their management. GADVASU+SACA, GADVASU, Ludhiana from July 16-18, 2019.
181.	N Umeshwori Devi. Application of theloscopy and endoscopy for diagnosis and treatment in veterinary patients. ICAR, CAFT, Dept. of Veterinary Surgery & Radiology, GADVASU, Ludhiana from September 11- 01 October 2019.
182.	N Umeshwori Devi. Skin reconstruction and local flaps for traumatic wound in dogs. ICAR, CAFT, Dept. of Veterinary Surgery & Radiology. GADVASU, Ludhiana from September 11- 01 October 2019.
183.	N Umeshwori Devi. Injectable anaesthetics. Hands on practice on small animal anesthesia, DIMSCA, ICAR. GADVASU, Ludhiana from January 08-10, 2020.
184.	N Umeshwori Devi. Radiographic interpretation of Skull and Vertebral coloumn. Systematic interpretation of radiographs for veterinary practitioners DIMSCA, ICAR GADVASU, Ludhiana from January 14-16, 2020.
185.	N Umeshwori Devi. Use of transposition flaps for large skin defects and treatment of canine mammary tumors. Soft tissue Surgery DIMSCA, ICAR GADVASU, Ludhiana from January 21-23, 2020.
186.	Jasmeet S Khosa. Patient monitoring during general anesthesia. GADVASU+SACA, GADVASU, Ludhiana from July 16-18, 2019.
187.	Jasmeet S Khosa. General Anesthesia induction and monitoring in critical large animal patients. ICAR, CAFT, Dept. of Veterinary Surgery & Radiology, GADVASU, Ludhiana from September 11- 01 October 2019
188.	Jasmeet S Khosa. Assessment of equine patients for acute abdomen-colic surgery. ICAR, CAFT, Dept. of Veterinary Surgery & Radiology GADVASU, Ludhiana from September 11- 01 October 2019.
189.	Jasmeet S Khosa. Handling of superficial wounds and trauma. Skill development program for animal health worker, GADVASU, Ludhiana on February 28, 2020.
190.	Jasmeet S Khosa. Various pre-anesthetic drugs combinations for elective and critical patients. Hands on practice on small animal anesthesia, DIMSCA, ICAR GADVASU, Ludhiana from January 08-10, 2020.
191.	Jasmeet S Khosa. Radiographic interpretation of contrast radiography. Systematic interpretation of radiographs for veterinary practitioners DIMSCA, ICAR GADVASU, Ludhiana from January 14-16, 2020.
192.	Jasmeet S Khosa. Thoracic surgery in small animals and use of IPPV. Soft tissue Surgery DIMSCA, ICAR from January 21-23, 2020.
193.	Kirti Dua. Wildlife human conflict- issues and solution/ Challenges to livestock health during natural disasters. Workshop Learning Paradigm and Aid of Animal Sciences, FVAS, RGSC, BHU from October 18 -19, 2019

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194.	Kirti Dua. Challenges to livestock health during natural disasters. Bihar Veterinary College, Patna on December, 2019
195.	Swaran Singh, Diagnostic Ultrasonography in Bovine Medicine. ICAR, CAFT, MVC, TANUVAS, Chennai on December 13, 2019.
196.	C.S. Randhawa. An update on canine respiratory diseases in Indian perspective. 17th National Congress on canine practice & National Symposium, CVSc & AH, NDVSU, Jabalpur from January 21-23, 2020.
197.	Swaran Singh. Chronic gatroenteropathies in dogs: a wakeup call for small animal practitioners in developing countries. 17th National Congress on canine practice & National Symposium, CVSc & AH, NDVSU, Jabalpur from January 21-23, 2020.
198.	Neetu Saini. Fluid therapy and blood transfusion in critically ill trauma patients. ICAR CAFT on Diagnostic, anaesthetic and surgical interventions in emergency and trauma patients, Deptt. of Surgery and Radiology, GADVASU, Ludhiana on September 23, 2019.
199.	C.S. Randhawa. Common diseases of dairy animals. One day seminar on Animal Husbandry by Milk fed and Directorate of Extension Education, GADVASU, Ludhiana on December 20, 2019.
200.	D.K. Gupta. Clean milk production. Ministry of Animal Health Department and Directorate of Extension Education on December 20, 2019.
201.	S. Sharma, AK Sharma and CS Randhawa. Role of classical and recombinant vaccines in Animal Disease Prevention and Control Programs. ICAR sponsored short course on Advances in Molecular Epidemiology in Veterinary Research, School of Public Health and Zoonoses, GADVASU, Ludhiana from December 10-19, 2019.
202.	S K Uppal. Recent approaches on diagnosis and management of renal diseases in dogs. DBT-GADVASU CRC sponsored Advanced training course on Diagnosis and management of chronic gastroenteropathies and renal diseases in dogs, Department of Veterinary Medicine, GADVASU, Ludhiana from March 2-3, 2020.
203.	Swaran Singh. Diagnosis and therapeutic approach to chronic gastroenteropathies in dogs. DBT-GADVASU CRC sponsored Advanced training course on Diagnosis and management of chronic gastroenteropathies and renal diseases in dogs, Department of Veterinary Medicine, GADVASU, Ludhiana from March 2-3, 2020.
204.	Neetu Saini. Echocardiography and its application in canines. DBT-GADVASU CRC sponsored Advanced training course on Diagnosis and management of chronic gastroenteropathies and renal diseases in dogs, Department of Veterinary Medicine, GADVASU, Ludhiana from March 2-3, 2020.
205.	V. Mahajan. Diagnosis of animal Diseases on basis of clinical signs and gross lesions. ICAR, CAFT on Diagnosis of animal and poultry diseases with emphasis on morphological characterization of goss and histological lesion, Department of Veterinary Pathology, GADVASU, Ludhiana from November 17 – December 7, 2019.
206.	M.S. Bal. Diagnosis of Helminthic infection in animals with emphasis on molecular diagnosis. ICAR, CAFT on Diagnosis of animal and poultry diseases with emphasis on morphological characterization of goss and histological lesion, Department of Veterinary Pathology, GADVASU, Ludhiana from November 17 – December 7, 2019.
207.	G. Filia. Investigation and control of animal disease outbreaks. ICAR, New Delhi, School of Public Health and Zoonosis, GADVASU, Ludhiana from December 10-19, 2019.
208.	JS Bedi. Sampling plan and study design. ICAR sponsored 10 days Short Training Course on Advances in Molecular Epidemiology in Veterinary Research, 10th-19th December, 2019, GADVASU, Ludhiana on December 10, 2019.

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209.	Rajnish Sharma. Molecular epidemiology and diagnostics of pig transmitted parasitic zoonoses. ICAR sponsored 10 days Short Training Course on Advances in Molecular Epidemiology in Veterinary Research. GADVASU, Ludhiana from December 10-19, 2019.
210.	Rajnish Sharma. 1. Research question: Fuel for your research project. 2. Tools for data analysis 3. Ethics in scientific research Workshop on "Elements of research: Defining, designing and structuring a research problem" Oct 16-18, 2020, GADVASU, Ludhiana from October 16-22, 2019
211.	Rajnish Sharma. Lab Safety: Why is it important and what do you know about it? Workshop on Ethics in Research and lab safety Oct 22-24, 2020, GADVASU, Ludhiana on October 22, 2019.
212.	Rajnish Sharma. 1. Making an effective poster- Do and Don'ts 2. Power point presentation – Few simple steps and you are an expert Workshop on "Presenting your research to a scientific audience", GADVASU from January 24, 25, 2020.
213.	BB Singh. How to prepare a poster: organization and design- Hands on. Workshop on Presenting your research to a scientific audience" from Jan 24-25, 2020, GADVASU, Ludhiana on January 24, 2020.
214.	BB Singh. Planning epidemiological research: design principles. Workshop on "Elements of research: Defining, designing and structuring a research problem" from Oct 16-18, 2020, GADVASU, Ludhiana on October 17, 2019.
215.	Simranpreet Kaur. Epidemiology of listeriosis in India and molecular characterization of *Listeria monocytogenes* from food of animal origins. ICAR Short Course at School of Public Health and Zoonoses. GADVASU, Ludhiana from December 10-19, 2019.
216.	Simranpreet Kaur. Personal protective measures for the workers on poultry farm. Skill Development Programme for small poultry farmer, GADVASU, Ludhiana
217.	Randhir Singh. 1. Systematic review and meta- analysis: an introduction. 2. Pulse field gel electrophoresis (PFGE) in molecular epidemiology. ICAR sponsored 10 days Short Training Course on Advances in Molecular Epidemiology in Veterinary Research, by School of Public Health & Zoonoses. GADVASU, Ludhiana from December 10-19, 2019.
218.	Randhir Singh. Lab safety General guidelines (Basics). School Public Health & Zoonoses, GADVASU, Ludhiana from October 21-23, 2019.
219.	Randhir Singh. Handling questions during a conference presentation. School Public Health & Zoonoses, GADVASU, Ludhiana from January 24-25, 2020.
220.	Pankaj Dhaka. Introduction to Epidemiological Study Designs in Veterinary Research. ICAR sponsored Short Training Course on Advances in Molecular Epidemiology in Veterinary Research, 10th-19th December, 2019, GADVASU, Ludhiana on December 10, 2019.
221.	Pankaj Dhaka. Water Conservation under Jal Shakti Abhiyan. Kisan Mela, Krishi Vigyan Kendra, Taran Taran. GADVASU, Ludhiana on August 21, 2019.
222.	Pankaj Dhaka. Emerging Zoonoses: A One-Health Challenge. One-Health lecture series, School Public Health & Zoonoses, GADVASU, Ludhiana on March 04, 2020.
223.	Pankaj Dhaka. Finding conferences and getting maximum out of them. In compendium of International workshop on 'Presenting your research to a scientific audience' School Public Health & Zoonoses, GADVASU, Ludhiana on January 25, 2020.

Sr. No.	Details of the Lecture Delivered
224.	Pankaj Dhaka. Fundamentals of Biosafety in Laboratory Research International Workshop on 'Ethics in Research and Lab Safety', GADVASU, Ldh Oct 24, 2019.
225.	R S Sethi. Immunohistochemistry as a diagnostic tool in molecular pathology. ICAR - CAFT on "Diagnosis of animal and poultry diseases with emphasis on morphological characterization of gross and histological lesions" Department of Veterinary Pathology, GADVASU, Ludhiana from November 17 to December 7, 2019.
226.	R S Sethi. An experimental study (randomized controlled) to assess the long-term dietary exposure to pesticides and pulmonary health. ICAR- Short course on Advances in molecular epidemiology in Veterinary research School of Public Health and Zoonoses, GADVASU, Ludhiana from December 10-19, 2019.
227.	R S Sethi. Dietary exposures to pesticides and pulmonary health. Khalsa College for Women, Ludhiana on Feb 15, 2019.
228.	C S Mukhopadhyay. BLR and rrBLUP: two handy and useful packages for genomic selection. ICAR-IASRI. New Delhi on February 21, 2020.
229.	C S Mukhopadhyay. Weighted gene co-expression network analysis: identifying the hub-genes in genome-wide expression study through R-package WGCNA. ICAR-IASRI on February 21, 2020.
230.	C S Mukhopadhyay. Bioinformatics: Concept, Dimensions & Applications. Punjab College of Technical Education (PCTE), Ludhiana on February 17, 2020.
231.	C S Mukhopadhyay. Analyzing genomic selection data using R packages: Hands-on. ICAR-NDRI, Karnal on January 10, 2020.
232.	C S Mukhopadhyay. Bioinformatics Approaches to Analyze Molecular Epidemiological Data. GADVASU, Ludhiana on November 12, 2019
233.	Simrinder Singh Sodhi. Stem Cells and their role in genomics. Department of Biotechnology, PCTE Group of Institutes. Ludhiana on November 11, 2019.
234.	Simrinder Singh Sodhi. Selection and identification of pigs for a healthy herd. Training on Piggery Rearing and Management from 18-23 November 2019 organized by PAMETI. PAU, Ludhiana on November 23, 2019.
235.	Ratan K Choudhary. Introduction and Applications of Mammary Stem Cells in Dairy Animals. Department of Animal and Veterinary Sciences, University of Vermont. Burlington VT USA on February 28, 2020.
236.	Ratan K Choudhary. Mammary Stem Cells of Dairy Animals: Introduction and Applications. Animal Science Research Center, University of Missouri, Ohio, MO USA on October 24, 2018.
237.	Niraj Kumar Singh. Application of ELISA assay in serological diagnosis of infectious viral diseases. School of Public Health and Zoonoses, GADVASU, Ludhiana on December 15, 2020
238.	Dipak Deka. Cloning and expression of recombinant proteins and their use in disease diagnosis. Advances in diagnosis and control of endemic and emerging infectious diseases of livestock and poultry in North Eastern Region of India, Department of Microbiology, AAU, Guwahati from December 03-23, 2019.
239.	Meera D. Ansal. Scope and Employment Opportunities for Rural Youth Through Fisheries in Punjab. DEE, GADVASU, Ludhiana on January 28, 2020.
240.	Meera D. Ansal. Fish Farming Practices for Punjab- Status and Scope in "Skill Training of Rural Youth (STRY)- Fish Rearing & Management, PAMETI and DEE, GADVASU, PAU Campus Ludhiana on July 22, 2019.
241.	Meera D. Ansal. *Azolla* Culture in Skill Training of Rural Youth (STRY)- Fish Rearing & Management. PAMETI and DEE, GADVASU. Fish farm, College of Fisheries, GADVASU, Ludhiana on July 25, 2020.
242.	Meera D. Ansal. Shrimp farming in Skill Training of Rural Youth (STRY)- Fish Rearing & Management. PAMETI and DEE, GADVASU, PAMETI, PAU, Ludhiana on July 26, 2020.

Sr. No.	Details of the Lecture Delivered
243.	Meera D. Ansal. Scope and Employment Opportunities for Rural Youth Through Aquaculture in Punjab. DEE, GADVASU, Ludhiana on February 20, 2020.
244.	Ajeet Singh. (i) Fish Processing and Value Addition (ii) Breeding and seed production of carps KVK, S.A.S. Nagar, Ludhiana on June 27, 2019.
245.	Ajeet Singh. Important techniques in hygienic fish production. Off Campus farmer's training programme under RKVY scheme organized by KVK, Booh, Tarn Taran on February 14, 2019.
246.	Ajeet Singh. Practical demonstration on preparation of fish pickle. Off Campus farmer's training programme under RKVY scheme organized by KVK, Booh. Tarn Taran on February 14, 2019.
247.	Ajeet Singh. Fish Processing and Value Addition. During Skill Training of Rural Youth on Fish Rearing and Management PAMETI, GADVASU and MANAGE, PAMETI, Ludhiana on July 27, 2019.
248.	Ajeet Singh. Fish Processing and Value addition in Fish & Fish Products. Lecture during training programme on Post-harvest Management, Value Addition and Marketing of Agriculture, Horticulture and Livestock Produce. PAMETI, Ludhiana on September 13, 2019.
249.	Ajeet Singh. Fish Processing and Value addition for better economic returns. Training programme on Value Addition in Livestock Products for Better Marketing Opportunities. PAMETI, Ludhiana on November 25, 2019.
250.	Abhed Pandey. Feed and feeding management in aquaculture. NFDB sponsored training program at Govt. Fish Seed Farm, Malwal, FFDA, Ferozepur on November 29, 2019.
251.	Abhed Pandey. Design and construction of fish pond/ Integrated Fish-cum-Pig Farming. KVK, Booh, Tarn Taran on July 9, 2019.
252.	Abhed Pandey. Freshwater Pearl Culture. Department of Zoology. MCM D.A.V. College for Woman, Chandigarh on August 2, 2020.
253.	Abhed Pandey. Integrated Fish Farming. Punjab State Fisheries Department 11th Livestock Championship and Agri Expo-2020, Gurdaspur, Batala on February 29, 2020.
254.	Abhishek Srivastava. Marketing and Economics of fish farming. Skill Training of Rural Youth (STRY), Organized by PAMETI, MANAGE and Directorate of Extension, GADVASU, Ludhiana. PAMETI, Ludhiana on July 27, 2019
255.	Abhishek Srivastava. Integrated fish farming. Skill Development Programme on Small Poultry Farmers By Agriculture Skill Council of India, Directorate of Extension Education, GADVASU, Ludhiana on March 03, 2020.
256.	Anuj Tyagi. Metagenomics based approach for survey of antimicrobial resistance in the environment. ICAR Short Course Advances in Molecular Epidemiology in Veterinary Research School of Public Health and Zoonoses, GADVASU, Ludhiana on December 19, 2019.
257.	Prabjeet Singh. Intensive technologies for sustainable aquaculture development. NFDB sponsored training program. Govt. Fish Seed Farm, Malwal, FFDA, Ferozepur on November 29, 2019.
258.	Prabjeet Singh. BMP's in Shrimp Culture. FFDA, Fish Seed Farm Raike Kalan, Bathinda on February 13, 2020.
259.	Prabjeet Singh. Entrepreneurship Development in Fisheries: Opportunities in Shrimp Farming. IDP-Cell, NAHEP, GADVASU, Ludhiana February 19, 2020.
260.	Prabjeet Singh. Aquatic Biodiversity and its role in Agrobiodiversity. PAMETI, PAU, Ludhiana on February 07, 2020.

Sr. No.	Details of the Lecture Delivered
261.	Sachin O. Khairnar. 1. Ornamental fish breeding and farming. 2. Design and economics of ornamental fish farm KVK, S.A.S. Nagar on June 27, 2019.
262.	Pranav K Singh. Effect of Encapsulation on Processing and Storage Stability of Vitamin D_2 in Milk. American Dairy Science Association (ADSA), USA Cincinnati, Ohio, USA on June 25, 2019.
263.	S. Sivakumar. Packaging of Dairy Products. CIPHET, Ludhiana on September 04, December 18, 2019.
264.	S. Sivakumar. Setting up of establishing small scale dairy processing unit. MANAGE, Hyderabad & ATIC, NDRI, Karnal on January 06, 2020.
265.	S. Sivakumar. Recent concepts in value addition of milk products -Entrepreneurship through dairy processing. Dept. of Food Technology. PAU, Ludhiana on March 19, 2020.
266.	Rekha Chawla. Practical demonstration on edible packaging.CIPHET, Ludhiana, Dairy Technology lab, CODST on December 13, 2019.
267.	Venus Bansal. Value Addition in Dairy. Punjab Agriculture Management and Extension Training Institute (PAMETI). PAU, Ludhiana on September 09, 2019.
268.	Venus Bansal. FSSAI-Guidelines to apply for registration and license for dairy entrepreneur. Punjab Agriculture Management and Extension Training Institute (PAMETI) PAU, Ludhiana on September 11, 2019
269.	Sunil Kumar. Application of Membrane Processing in Dairy Industry. In Training-cum-Workshop on Recent Advances in Dairy Processing, SGIDT, BASU, Patna on September 04, 2019.
270.	Sunil Kumar. The Wonders of Buffalo Milk/ Dairy Industry in India. Dept. of Food Technology. PAU, Ludhiana on March 18, 2020.
271.	Nitika Goel. Value addition of milk and milk products. PAMETI, PAU, Ludhiana from July 22-26, 2019.
272.	Nitika Goel. Value Addition to milk. Punjab Dairy Development Board in collaboration with IDA Punjab Chapter, MILKFED Punjab and Baani Milk Producer Company, Ltd. NITTR Institute, Chandigarh on June 01, 2019.
273.	Varinder Pal Singh. Economics of Goat rearing and establishment of farms for entrepreneurship development. IDP Sponsored Workshop on Improving small ruminant health and management for increasing learning outcome amongst young vets GADVSU, Ludhiana on November 21, 2019.
274.	Varinder Pal Singh. Project Evaluation Techniques for Dairy Entrepreneurs to strengthen existing Academic Interface for B.Tech (Dairy Technology) students. IDP Cell, College of Dairy Science and Technology, GADVASU, Ludhiana on March 12, 2020.
275.	Nitin S Wakchaure. Methods of milk pricing and FSSAI standards. Skill Development programme on Dairy Farmer/Entrepreneur by Ministry of Skill Development and Entrepreneurship, Agriculture Skill Council of India (ASCI), College of Dairy Science and Technology, GADVASU, Ludhiana on February 24, 2020
276.	Nitin S Wakchaure. Clean Milk Production. Refresher Course for Field Functionaries of Dairy Development, PAMETI, PAU, Ludhiana on July 23, 2019.
277.	Inderpreet Kaur. Strengthening of Dairy Sector - Scope and threats. National Milk day celebrations, GADVASU, Ludhiana on November 25, 2019.
278.	Gopika Talwar. Packaging aspects of dairy products. PAMETI, Ludhiana on November 20, 2019.
279.	Amandeep Sharma. Dairy science education: Opportunity and scope. PDDB and IDA (Punjab Chapter), Chandigarh on June 01, 2019

Sr. No.	Details of the Lecture Delivered
280.	Gursharn Singh. Cow milk and milk product on Sahiwal day. RRTC, Kaljharani on December 04, 2019.
281.	Nirmal Singh. Reference Management and Research Writings. GGDSD College, Chandigarh on March 03, 2020.

Conferences/ Symposia/ Workshop/ Trainings, etc. organised

Sr. No.	Name of the Conferences/ Symposia/ Workshop/ Trainings	Organizing agency	Date
1.	Celebrations of Sahiwal Day at RRTC, Kaljharani	Directorate of Livestock Farm	04.12.2019
2.	ICAR-Centre of Advanced Faculty Training	Deptt. of Vety Gynaecology& Obstetrics	03- 23.10. 2019
3.	Alumni Meet- 2019 cum technical Seminar	COVS, GADVASU, Ludhiana	
4.	International Teaching Workshop	COVS in collaboration with University of Calgary, Canada at GADVASU, Ludhiana	19-21.02.2020
5.	Workshop on Extrusion Technology: A Way forward to processing and nutritional interventions	Deptt of LPT	28.11. 2019
6.	Workshop-cum-Training program on latest advances in livestock, poultry and fisheries for KVKs of Punjab and University Scientists	GADVASU, Ludhiana	21.01.2020
7.	Workshop-cum-Training program on latest advances in Livestock, Poultry and fisheries for KVKs of Punjab and University Scientists	Directorate of Extension Education	28.01.2020
8.	LAB FORUM INDIA 2019	Department of Animal Nutrition	03-04.07.2019
9.	One day Seminar on “Animal Husbandry and Animal Health Practices”	Directorate of Extension Education	20.12.2019 .
10	ICAR-CAFT training	Department of Veterinary Pathology	17.11-07.12.2019
11	Advanced training programme on diagnosis and management of chronic gasteroenteropathies and renal disease in dogs	DBT and Department of Veterinary Medicine	02-03.03.2020
12	ICAR-Centre for Advanced Faculty Training	Deptt. of Veterinary Surgery &Radiology	11.09-01.10.2019
13	Advanced refresher training course on “Diagnostic, Anaesthetic and Surgical Interventions in Emergency and Trauma Patients”	Department of Veterinary Surgery & Radiology	11.09-01.10.2019
14	ICAR Short Course on Advances in Molecular Epidemiology in Veterinary Research	School of Public Health and Zoonoses, Ludhiana	10-19.12.2019
15	Model Training Course (MTC) on “Ultrasonography evaluation of ovarian and genital status for evaluation of fertility status in dairy animals”	Veterinary Gynaecology and Obstetrics	05.11.2019

Distinguished Visitors at GADVASU, Ludhiana

S. No.	Name and other details about the visitor	Date (s) of the Visit
1.	Dr. Nigel Caulkett, Department of Veterinary Clinical and Diagnostic Science, University of Calgary Faculty of Veterinary Medicine (UCVM), Canada	13.5.2019
2.	Dr. S.S. Dahiya (Director) and Dr. K.P. Singh (Principal Scientist), CIRB, Hisar	22.05.2019
3.	Mr. Yehuda Sprecher, Dairy Expert from Israel	23.05.2019 15.06.2019
4.	Dr. Alexander Jagar, Manoj Yadav, Oliver Milosch, Martina Wiedmaier – Delegates from GIZ	23.07.2019
5.	Expert committee from Department of Biotechnology (DBT), Government of India – Dr. S R Rao, Dr. A K Rawat (Advisors to DBT) and eminent scientists Dr. H V Batra, DRDE Gwalior, Dr. Gaya Prasad, Vice Chancellor, Meerut Agriculture University, Dr. R K Singh, Director, IVRI and Brig. Devendar Kumar, RVC, Indian Army	24.07.2019
6.	Mr. Yehuda Sprecher Dairy Expert from Israel, Dr. Inderjeet Singh, Director Animal Husbandry, Dr. Inderjeet Singh, Director Dairy and Veterinary Officers.	25.07.2019 28.08.2019
7.	Delegation from South Africa	19.08.2019
8.	Dr. S.S. Dahiya (Director), CIRB, Hisar	20.08.2019
9.	Sh. B. Srinivasan, IAS (Deputy Commissioner), Bathinda	09.10.2019
10.	VCI Team – Dr. A. K. Panda (Professor), Deptt. of Public Health, CSKHPKVV, Palampur; Dr. S. K. Gupta (Professor), Deptt. of Veterinary Medicine, SKUAST, Jammu and Dr. D. Nagalakshmi, Deptt. of Animal Nutrition, PVNRTVU, Rajendranagar, Hyderabad	22.10.2019 - 24.10.2019
11.	Prof. Paula Menzies (Prof. Emeritus), Dept. of Population Medicine, Ontario Veterinary College, University of Guelph	19.11.2019
12.	Sh. Raj Kamal Choudhary, Secretary, Animal Husbandry, Punjab	22.11. 2019
13.	Dr. R.C. Aggarwal, DDG Education ICAR & National Director of National Agriculture Higher Educational Project	28.11.2019
14.	Shri Giriraj Singh, Cabinet Minister, Fisheries, Animal husbandry and Dairying, Government of India	07.12.2019
15.	Dr. Ashok Kumar, ADG (Animal Health), ICAR	16.12.2019
16.	Dr. Jatinder Bhandal and Dr. Sukh Kalon, DVM ACVS	27.12.2020
17.	Professor Harjinder Singh (Director), Riddet Institute, Massey University, New Zealand	23.01.2020

Visit of Shri Giriraj Singh, Cabinet Minister, Fisheries, Animal husbandry& Dairying, GOI

Visit of Dr R.C Agrawal, ICAR-Deputy Director General (Education) and National Director of NAHEP

Visit of Dr. Ashok Kumar, ADG (Animal Health) ICAR

Visit of Mr. Yehuda Sprecher, Dairy Expert from Israel

Professor Harjinder Singh, Director, Riddet Institute Massey University, New Zealand

Visit of high Level Expert Committee DBT

Dr. S.S. Dahiya, Director, CIRB, Hisar

Distinguished Visitors at Krishi Vigyan Kendras

S. No.	Name and other details about the visitor	Date (s) of the Visit
1	S. Harminder Singh Gill, MLA, Patti	21.08.2019
2	Dr. Ismail Cakmak, Professor, Sabanci University, Istanbul, Turkey	30.01.2019
3	Dr. Katja Hora, Professor, World Iodine Association, Belgium	30.01.2019
4	Dr. Soumitra Das, Director, South Asia - Zinc Nutrition Initiative, International Zinc Association	30.01.2019
5	Sh. Umesh Kumar, Director Infrastructure, Ministry of Development of North Eastern Region	19.07.2019 21.08.2019
6	Sh. Rajat Sachar, Senior Economic Advisor & Central Nodal Officer	21.08.2019
7	Sh Pardeep Kumar Sabharwal, Deputy Commissioner, Tarn Taran	21.08.2019
8	Sh. Prabhas Kumar, Director, Ministry of Chemicals and Fertilizers, GOI	21.08.2019
9	Sh. Sarveshwar Kumar, Technical officer, Department of Water Resources, River Development and Ganga Rejuvenation, Ministry of Jal Shakti, GOI	21.08.2019
10	Sh. NK Singh, Technical officer, Department of Water Resources, River Development and Ganga Rejuvenation, Ministry of Jal Shakti	21.08.2019
11	Sh. Sandeep Rishi, ADC (D), Tarn Taran	03.09.2019
12	Sh. Amardeep Singh Cheema, Chairman, Punjab Health Systems Corporation, Government of Punjab	11.09.2019
13	Sh. Tej Partaap Singh Phoolka, IAS, Deputy commissioner, Barnala	17.09.2019
14	Dr. S.L. Mehta, Chairman QRT Dr. S. Prabhu Kumar, Member QRT Dr. S. K. Rawat, Member QRT Dr. Rajbir Singh, Director ICAR ATARI,Zone1 Ludhiana Dr. H. K. Verma, DEE, GADVASU, Ludhiana	11.10.2019
15	Sh. Vikas Verma, Assistant Commissioner, GST, Custom and Narcotics, Ministry of Finance, Govt. of India	24.10.2019
16	Sh. Tej Partaap Singh Phoolka, IAS, Deputy commissioner, Barnala Dr. H. K. Verma, DEE, GADVASU, Ludhiana Dr. Gurpal Singh Walia, Deputy Director, Animal Husbandry, Barnala Dr. Vivek Kumar, District Extension Specialist (Agronomy), FASC, Mr. Manavpreet Singh, DDM, NABARD, Sangrur	16.10.2019

Kisan Mela under Jal Shakti Abhiyan KVK, Booh, Tarn Taran

Inaugration of F F S on Pig-cum-Fish Farming at Village Chapri Sahib, Tarn Taran

Visit of Sh. A S Cheema, Chairman, Punjab Health Systems Corporation, Govt. of Punjab

D C, Barnala, Plantation of forest and fruit trees, at KVK Barnala

Visit of the Faculty Abroad

S. No.	Name of the Faculty	Place of Visit	Dates (s) of the Visit	Purpose of the Visit
1	Dr. Ratan K Choudhary	University of Vermont, USA	Aug 15, 2018-Aug 9, 2020	Post-Doctoral Associate
2	Dr. Pranav K. Singh	Massey University, New Zealand	Sept 14, 2018-Aug 31, 2019	Post-Doctoral Fellowship
3	Dr. Harsh Panwar	University of South Australia, Adilaide	Feb 01-July 31, 2019	Indo-Australian Gold Fellowship by DBT
4	Dr. Sidhartha Deshmukh	Aarhus University, Denmark	May 13-15, 2019	Attended MSCA-IF workshop
5	Dr. Pankaj Dhaka	University of Sydney, Australia	June 18-20, 2019	Participated in Global Health Security 2019: Progress to Date, Opportunities for the Future
6	Dr. Pranav K Singh	Cincinnati, Ohio, USA	June 22-28, 2019	Attended 2019 Annual Meeting of American Dairy Science Association (ADSA)
7	Dr. L.D. Singla	Convention Centre, Madison, USA	July 7-11, 2019	Attended 27th International Conference of the World Association for the Advancements of Veterinary Parasitology, WAAVP 2019
8	Dr. R S Sethi	University of Calgary, Canada	July 24-Aug 7, 2019	Attended Conference at Banff & visited Taylor Institute for Teaching & Learning and Research Institutes at Cumming School of Medicine, University of Calgary
9	Dr Devendra Pathak	University of Calgary, Canada	July 30- Aug 5, 2019	Visited Taylor Institute for Teaching and Learning
10	Dr. Nirmal Singh	Athens, Greece	Aug 23- 31, 2019	Participated in 85th IFLA-WLIC
11	Dr M Honparkhe	Harbiye Military Museum & Cultural Centre, Istanbul, Turkey	Sept 18-20, 2019	Attended 12th World Buffalo Congress on "Efficient Production for the World"
12	Dr. Shukriti Sharma	The University of Melbourne, Australia	Dec, 2019-March, 2020	Post-Doctoral Fellowship

National and International Linkages

a) National Partners

(i) ICAR

- ICAR-NRC on Pig, Guwahati, Assam - under the AICRP research project on pig
- ICAR-CIRG, Makhdoom, Mathura - under the AICRP research project on goats
- ICAR- National Dairy Development Research Institute (NDRI) Karnal, Haryana
- ICAR- Indian Veterinary Research Institute, Bareilly, UP
- ICAR-CIPHET, Ludhiana - Member of Scientific Advisory Committee of KVK and resource person in training programmes; Research & Training

(ii) Punjab Government Departments/Agencies

- Regional Disease Diagnostic Laboratory, Jalandhar
- Punjab Dairy Development Board – KVK Scientists as resource persons
- Department of Fisheries, Punjab – Collaborative Extension Activities
- Department of Horticulture, Punjab - Collaborative Extension Activities
- Zonal Project Director (ZPD), Agricultural Technology Application Research Institute (ATARI), Zone-1, Ludhiana - Financial, Technical back stopping
- Department of Animal Husbandry, Barnala – for Conducting training programme
- Punjab Agricultural Management & Extension Training Institute (PAMETI), Ludhiana - Collaborative Training Programs for Farmers and Students
- State Department of Agriculture – Collaborative Extension Activities (Trainings, Camps, Melas)
- Department of Soil and Water conservation - Member of Scientific Advisory Committee of KVK
- PAU, Ludhiana - Member of Scientific Advisory Committee of KVK, Frontline Demonstrations, Resource Persons for Trainings; PG Research & Teaching
- Integrated Child Development Scheme (CDPO), Tarn Taran (Different blocks) – Training of Anganwadi workers
- Farm Advisory Service Scheme (FASS) - KVK Scientists as resource persons for various extension activities in coordination with State Department of Agriculture & ATMA
- ATMA/NMSA - KVK Scientists as resource persons for extension activities organized by State Department of Agriculture & ATMA

(iii) Leading National Institutes

- National Institute of Technology Rourkela - MoU for Research Collaboration under Impacting Research Innovation and Technology (IMPRINT), Scheme of the Ministry of Human, Resource Development, Government of India
- IVRI, Izatnagar; RAJUVAS Bikaner; DUVASU Mathura and TANUVAS Chennai - All India Network Program on Diagnostic Imaging and Management of Surgical Conditions in Animals
- Fisheries ICAR Institutes (CIFRI, CIFA, CIBA, DCFR, CIFT, CMFRI) - Educational Tour of UG (B.F.Sc.) students and PG, PhD and Faculty Research
- National Institute of Technology (NIT), Rourkela
- Indian Veterinary Research Institute (IVRI), Izatnagar
- NIVEDI, Bengaluru, Karnataka - under the project On Animal Disease Monitoring & Surveillance
- Sri Venkateswara Veterinary University, Andhra Pradesh
- Agriculture Skill Council of India - Skill Development Trainings to farmers and rural youth

- NABARD, Hyderabad - Member of Scientific Advisory Committee of KVK and resource person in training programmes; Collaborative Research Project and Training Programs
- National Bureau of Fish genetic Resources (NBFGR), Lucknow - Collaborative Research Projects
- Rajiv Gandhi Center for Aquaculture (RGCA), Chennai, Tamil Nadu - Procurement of certified fish/shrimp seed
- Assam Agricultural University and IIT Guwahati, Assam
- University of Calcutta, Kolkata, West Bengal - collaboration for writing a book chapter
- Sher-e-Kashmir University of Agricultural Sciences & Technology, R.S. Pura, Jammu TANUVAS, Tamil Nadu
- Muralidhar Girls' College, Kolkata, West Bengal - collaboration for writing a book chapter

(iv) Private business houses/ Corporate Houses

- Small Animal Clinician's Association - for organizing anesthesia training for Veterinary Officers/Private Vets
- Neway Renewable Energy Pvt. Ltd. - to develop paddy straw-based feed pellets for livestock
- Cargill India Pvt Ltd. - for evaluation of prilled palm fatty acids as livestock feed in lactating crossbred cows

b) International Partners

- University of Calgary, Canada - for imparting spay and neuter surgery training to their 10 internship students at Department of Veterinary Surgery and Radiology, GADVASU
- Polar Genetics Inc, Leduc, Alberta, Canada
- University of McGill, Canada
- University of Saskatchewan, Canada
- The University of Sydney and University of Tasmania, Australia - Collaborative project development under Australian Alumni Grant Scheme
- Charles Sturt University, Wagga Wagga, Australia
- Royal Veterinary College, University of London, London, UK
- Department of Animal Nutrition & Management, Faculty of Veterinary Medicine & Animal Science, Swedish University of Agricultural Sciences (Slu), Sweden – Collaboration for Ph.D. Research
- Brazilian Agricultural Research Corporation (Embrapa), Brazil
- Jeju National University, Jeju- Si, Jeju- Do, South Korea
- Kangwon National University, Chuncheon-si, Kangwon-do, South Korea

Research Publications (International and National) and Review Articles

1. Ahuja A, Singhal S, Singh R and Deshmukh S. 2019. Ultrasonographic and pathological findings of grade III cervico-vaginal prolapse in a pregnant buffalo. *Indian Journal of Animal Research* doi.10.18805/ijar.B-3802. (6.44)
2. Alka, Singh R, Kaur S and Bedi J S. 2019. Listeria contamination in chevon and mutton from retail meat shops and slaughter house environment of Punjab, India. *FEMS Microbiology Letters* 366(9) https://doi.org/10.1093/femsle/fnz111. (7.99)
3. Amandeep, Singh R, Kaur S and Gill J P S. 2019. Panton-Valentine leukocidin (PVL) positive methicillin resistant *Staphylococcus aureus* (MRSA) in raw milk in Punjab. *Indian Journal of Animal Sciences* 89(1): 9-14. (6.23)
4. Aslam B, Bansal N, Uppal V and Gupta A. 2019. Morphological variation in cellular and fibrous components in buffalo testis during different seasons. *Haryana Veterinarian* 58 (2): 201-04. (5.36)
5. Bal M S, Sagar R, Kaur P, Mahajan V, Singla L D and Singh C K. 2019. Foldscope as a diagnostic tool for identification of parasites of domesticated animals. *Indian Journal of Animal Sciences* 89(10):1082-85. (6.23)
6. Balouria A, Deshmukh S, Banga H S, Ahmad A, Brar R S and Sodhi S. 2019. Early migration pattern of *Avibacterium paragallinarum* in the nasal passage of experimentally infected chicken and Japanese quail by immunohistochemistry. *Avian Pathology* 48(2): 168-77. (7.96)
7. Bansal B K, Gupta D K, Sharma S, Shafi T A and Filia G. 2019. Phenotypic antibiotic resistance pattern and presence of *MecA* in *Staphylococcus aureus* isolated from bovine mastitis. *International Journal of Livestock Research* 9(9): 65-79. (5.36)
8. Bansal S. 2019. A bibliometric assessment of global publication output on buruli ulcer during 2000-2017. *COLLNET Journal of Scientometrics and Information Management* 13(1): 65-77.
9. Bansal S. 2019. A bibliometric study of research output of BRICS on eye neoplasm. *International Journal of Library Information Network* 4(2): 159-64.
10. Bansal S. 2019. A bibliometric study of world research publications on scabies. *Library Waves* 5(1): 29-34.
11. Bansal V, Kanawjia S K, Chawla R, Khetra Y, Debnath A, and Nigam R. 2019. Qualitative effects of milk proteins, stabilizers and variable spice ratio on organoleptic properties of cheese dip. *International Journal of Agriculture Sciences* 11(9): 8354-57. (4.20)
12. Basu S, Singh Y, Gupta R K, Sharma A, Bera S, Kumar A and Chatli M. 2019. Effects of feed restriction on morphometric and biochemical parameters in cattle. *Indian Journal of Animal Health* 58(2):213-20. doi.10.36062/ijah.58.2.2019. (4.08)
13. Behera D P, Sethi A P S, Singh C, Singh U and Wadhwa M. 2019. Effect of citrus waste on blood parameters of broiler birds with and without cocktail of enzymes. *Veterinary World* 12(4): 483-88. (5.71)
14. Bhangu S S, Saini N S, Mohindroo J, Singh T and Mahajan S K. 2019. Ultrasonography as a decision-making tool for surgery of obstructive urolithiasis in bovine. *Indian Journal of Veterinary Surgery* 40(2):116-18. (5.25)
15. Bhutia P S, Bansal B K, Gupta D K, Singh R S and Uppal S K. 2019. Bacterial isolation of milk samples submitted from clinical mastitis buffaloes during 2007 to 2016. *Tropical Animal Health and Production* 51: 1551-57. (7.09)
16. Birdi R, Sunil Kumar B V, Gupta K, Kashyap N and Kumar A. 2019. Circulating level of heat shock protein 27 is elevated in dogs with mammary tumors. *3Biotech* 9 (6):229. doi:10.1007/s13205-019-1765-x. (7.79)
17. Birla R, Malav O P, Wagh R V, Mehta N, Chatli M K and Kumar P. 2019. Storage stability of pork emulsion incorporated with Arjuna (*Terminalia arjuna)* tree bark extract. *International Journal of Livestock Research* 9 (02): 95-109. (5.36)
18. Brahma D, Narang D, Chandra M, Filia G, Singh A and Singh S T. 2019. Diagnosis of Bovine Tuberculosis by comparative intradermal tuberculin test, interferon gamma assay and

esxB (CFP-10) PCR in blood and lymph node aspirates. *Open Journal of Veterinary Medicine* 9: 55-65.

19. Brar N S, Kumar B, Kaur J, Kumar A, Verma H K, Singh R and Singh P. 2019. Qualitative study of corn silage of cattle farms in subtropical conditions of Indo- Gangetic plains. *Range Management and Agroforestry* 40(2): 306-12. (6.10)
20. Brookes V J, Gill G S, Singh B B, Sandhu B S, Dhand N K, Aulakh R S and Ward M P. 2019. Challenges to human rabies elimination highlighted following a rabies outbreak in bovines and a human in Punjab, India. *Zoonoses and Public Health* 66(3): 325-36. doi: 10.1111/zph.12568. (8.16)
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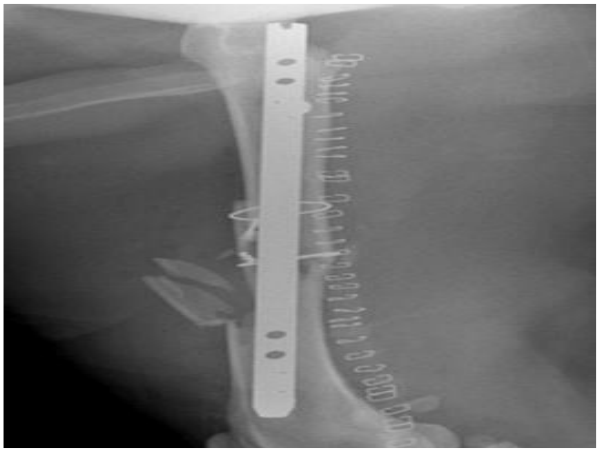


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