

# Annual Report

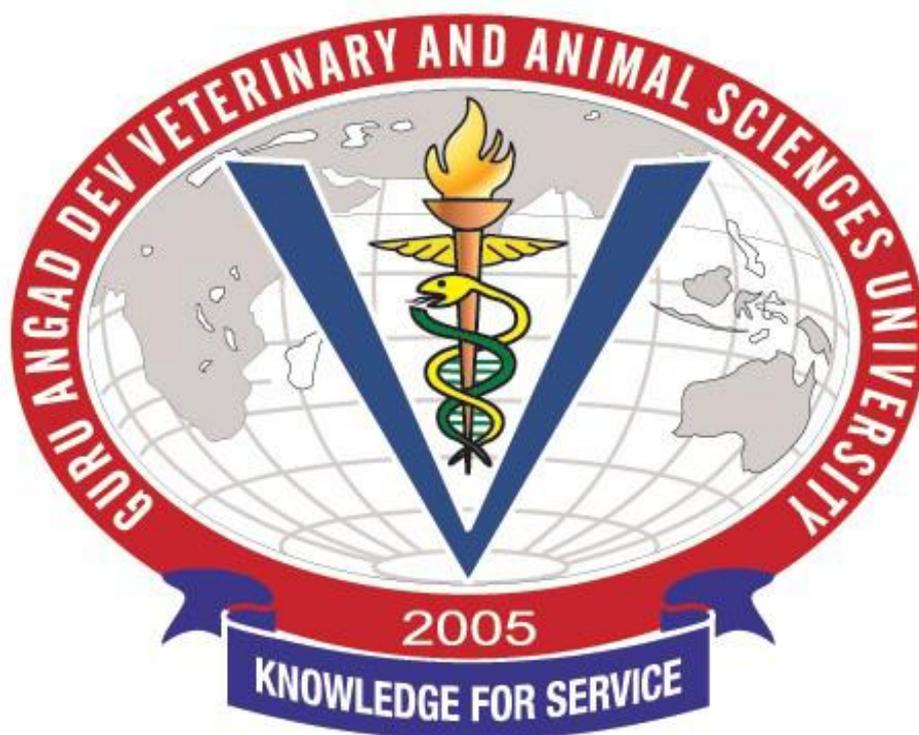
2014-15



**Guru Angad Dev Veterinary and Animal Sciences University**

# Annual Report

2014-15



GURU ANGAD DEV VETERINARY AND ANIMAL  
SCIENCES UNIVERSITY, LUDHIANA – 141 004  
(PUNJAB) INDIA

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## EXECUTIVE SUMMARY

Guru Angad Dev Veterinary and Animal Sciences University (GADVASU) started functioning at Ludhiana from 21<sup>st</sup> April, 2006 with one college i.e. College of Veterinary Science with the motto to act as a centre of excellence for teaching, Research, extension and learning in animal health and production. To produce highly efficient and skilled human resource for giving boost to activities of livestock and fishery sectors in Punjab, the GADVASU has created College of Fisheries, College of Dairy Science and Technology, School of Public Health and Zoonosis, School of Animal Biotechnology and Veterinary Polytechnic. One private veterinary college, Khalsa College of Veterinary and Animal Sciences at Amritsar (Punjab) has been affiliated with the university. Three Regional Livestock Research and Training centres at Kaljharani (Bathinda), Talwara (Hoshiarpur) and Booh (Taran Taran) have been established for catering to the specific needs of the area. Three Krishi Vigyan Kendras have been established each at Taran Taran, Barnala and Mohali districts of Punjab for technology assessment, refinement and demonstration. The University got recognition from the University Grants Commission (UGC) in order 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 Association of Indian Universities (AOIU).

### Financial Report

Total budget allocation for the year 2014-15 was ₹ 8378.74 lacs under various schemes/projects which included ₹ 6981.79 lacs from State Agencies, ₹ 907.34 lacs from ICAR and ₹ 489.61 lacs from other agencies. A sum of ₹ 635.34 lacs were generated under various Non-Plan schemes. The total budget available for the year 2014-15 was ₹ 9014.08 lacs. The total expenditure for the year 2014-15 was ₹ 8743.37 lacs which included ₹ 6296.27 lacs for State NPV Schemes, ₹ 22.29 lacs for State Plan Schemes, ₹ 911.25 lacs for ICAR Schemes/Projects and ₹ 1513.55 lacs for other schemes.

### Faculty profile

Total present faculty strength in the constituent colleges of the university is 195, out of which 51 are professors or equivalent, 31 associate professors or equivalent and 112 assistant professors or equivalent. About 112 faculty members are in the teaching schemes, 55 in the

research schemes and 27 in the extension schemes. On university basis, 20% of the faculty are female, 87% faculty holds doctoral degree, 25% faculty are trained in foreign institutes and 34% faculty are from outside Punjab.

### **Student profile**

The present strength of student in various programs of the constituent colleges is 1055, out of which 56% are in undergraduate courses, 20% are in postgraduate courses, 11% are in doctoral program and 13% are in diploma course. The percentage of male and female students in the university is 70% and 30%, respectively.

### **Teaching**

Admission in various undergraduate programs and diploma course was strictly on the basis of entrance examination conducted by Controller of Examination. The total number of students admitted for the session 2014-15 was 362 which included 83 in B.V.Sc. & A.H., 15 in B.F.Sc., 29 in B. Tech. (Dairy Technology), 104 in M.V.Sc./M. Sc., 8 in M.F.Sc., 6 in M.Tech/M.Sc. (Dairy Engineering), 32 in Ph.D program, 5 in PG Diploma in Fisheries and 80 in Diploma in Veterinary Science. A total of 185 students successfully completed their degrees/diploma in different disciplines (58 - B.V.Sc. & A.H., 12 B.F.Sc., 24 B.Tech, 77 - M.V.Sc./M.Sc., 3 - M.F.Sc. and 11 – Ph.D.).

All India Study Tour of 13 days for final year B.V.Sc. and A.H. students was organized during Jan. 2015. Students of 2010 batch visited various veterinary colleges, national institutes, laboratories and wild life sanctuaries at Mumbai, Goa, Bengaluru and Hyderabad. All India Compulsory Educational Tour of 15 days was conducted for 14 B.F.Sc. final year and five PGDIF students from Jan 8-22, 2015

Three cadets of the unit participated in various equestrian activities during Republic Day Camp and Prime Minister Rally 2015. The cadets won two Gold Medals in the Republic day camp. The Cadets of GADVASU participated in various activities during 2014-15 like Combined Annual Training Camp at NCC Academy, Malout, Army Attachment Camp at Ferozepur Cantt., painting competition, declamation, awareness rallies against social evils and run for fun and good health during NCC week and appeared in Certificate 'B' and 'C' examinations.

Two training course were conducted for the scientists by the Centers of Advanced Studies, on “Current trends in Veterinary Surgery and Imaging Techniques” by Department of veterinary Surgery and Radiology and “Adoption of newer reproductive techniques in education, diagnostics and research” by Department of Veterinary Gynaecology and Obstetrics in collaboration with Centre of Advanced Faculty Training, ICAR, New Delhi. A training course on ‘Management of Gynaecological Complications in Large Animals’ for the Veterinary Officers of Andhra Pradesh, Telangana, West Bengal, Gujarat, Maharashtra and Rajasthan was also conducted by the Department of Veterinary Gynaecology and Obstetrics in collaboration with Indian Immunologicals Limited. Department of Veterinary Medicine organized four training programmes on “Canine Diseases: diagnosis, prevention and treatment”, “Diagnosis of Animal Diseases”, “Canine Diseases: diagnosis, prevention and treatment” and “Equine Diseases: diagnosis, prevention and treatment” in collaboration with Department of Animal Husbandry, Chandigarh, Punjab. Department of Livestock Production Technology organized an Entrepreneurship Development Programme (EDP) on “Hygienic processing and Value Addition of Meat and Meat products for Employment Generation and Women Empowerment” sponsored by Ministry of Food Processing Industries, Govt. of India and a hands-on-training on “Value Added Pork Products”. Department of Veterinary Microbiology organized one month practical training course in ‘Techniques in Veterinary Microbiology and Molecular Biology’ for B.Sc./B.Tech. and M.Sc. Biotechnology/ Microbiology students.

International Symposium on “One Health: An Integrated View on Infectious Diseases, Food Safety and Zoonoses” and International Workshop on “Dynamic Modeling in Support of Infectious Disease Issues” were conducted by School of Public Health in collaboration with University of Saskatchewan, Canada. Department of Veterinary Pathology and Department of Animal Husbandry, Punjab jointly organized a training for field Veterinary Officers on “Pathology and Pathological techniques for diagnosis”. World Vet Day function and Oath taking ceremony of Veterinary interns were organized by the Department of Teaching Veterinary Clinical Complex with the involvement of Pharmaceutical companies. Five training courses were conducted by Veterinary Polytechnique College, Kaljharani on Goat Farming and Dairy Farming. College of Fisheries organized three training programmes on “Ornamental Fish Culture”, “Carp Fish Farming” and “Value Addition of Fish and Shellfish”.

Faculty participated in international and national conferences, symposia and workshops and presented research papers. The faculty has won several awards and honours and published 188 research papers, 28 books/compendium/ proceedings/training manuals/bulletins/practical manuals and contributed chapters in 21 books.

Teaching and diagnostic laboratories in various departments of constitute colleges have been strengthened and made fully operational. New Molecular lab in Department of Veterinary Medicine, Meat proteomics and biotechnology lab in Department of Livestock Products Technology and Bioinformatics Lab in School of Animal Biotechnology have been established. Several new facilities like Veterinary Video Endoscope, Plus maze with video-treacking software, ChemiDoc XRS+ELISA Reader, Colour Doppler ultrasound system (Z 5 vet Mindray), Gene Pulser, Class2 B2 Biosafety Cabinet, Computer assisted semen analyzer, Ultra sound Probe holder with aspiration assembly, Semi dry western Blotter, Pulse Field Gel Electrophoresis, Real Time PCR, Atomic Absorption Spectrometer and Honey bee extractor have been created in various laboratories of the University. Feed Mill for making pellet fish feed has been procured in College of Fisheries. Two new modern dairy sheds of capacity to accommodate 300 animals are nearing completion at GADVASU Dairy Farm. Embryo Transfer Tech Lab, Reproductive Biology Lab, Heavy Metal Analysis Lab, and Livestock and Poultry Production Management Lab were renovated. Several other existing infrastructure have been renovated and modern equipments were procured.

### **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 2014-15, a total of 131 research schemes were operational in the university, which included 46 state schemes, 16 ICAR schemes, 4 revolving fund schemes, 4 RKVY schemes and 61 miscellaneous schemes.

### **Improvement and conservation of cattle and buffalo germplasm**

University has played an immense role in denetic improvement of crossbred cattle and Murrah buffalo in terms of milk production traits. In elite herd of crossbred cattle, the complete lactation yield was 7,891 kg and 34.6 kg was peak yield, whereas, elite herd of Murrah buffalo had complete lactation yield as 4,082 kg with 17.2 kg peak yield. Under Nili Ravi buffalo

conservation project, university has increased herd strength to 108 with 73 breedable buffaloes. In this herd, one of the performers has produced 3,180 kg milk in complete lactation with 15.5 kg peak yield. Genetic improvement of crossbred cattle and Murrah buffalo was continued in Punjab state by supplying 30 breeding bulls/bull calves, 58,958 doses of frozen semen and 4,274 doses of chilled semen to farmers and other state dairy development agencies.

### **Poultry production**

In commercial broiler (IBL 80) diet, supplementation of sun dried whole leaf aloe vera powder for 5 weeks improved the overall acceptability of meat. Furthermore, inclusion of black pepper powder @ 0.5% for 5 weeks can be a good phytogetic alternative to the antibiotic growth promoters in commercial broilers.

Iron supplementation in white leghorn layers through feed can enrich egg iron to the extent of 40-60% without any adverse impact on bird's welfare.

### **Goat rearing**

Dam's serum may be a good alternative in terms of IgG absorption if natural colostrums is not available for Beetal kids under stall-fed conditions. Early weaning of Beetal kids under stall-fed conditions at 60-days of age can maintain growth rate without negative effects on morbidity and mortality rate of kids parallel to conventional weaning at 90 days of age.

### **Feeding strategies for dairy animals**

For buffalo calves, zinc bioavailability studies in calf starters and total mixed ration (TMR) indicated that out of inorganic and organic zinc, organic zinc is beneficial for body weight gain due to higher digestibility of dry matter and other nutrients. Guar @ 7-8% can be used as replacement of soya bean meal in concentrate without any adverse effect on the feed intake, nutrient utilization and health of the animals. Furthermore, Niacin supplementation @ 600 ppm in slow release urea (NPN source) replacing upto 30% of total CP of ration in buffalo calves fed on TMR had no impact on daily feed intake, digestibility, nitrogen retention.

In high producing crossbred dairy cows, the supplementation of bypass fat (200 g/d) along with 12 g niacin could be a cost effective measure to improve production and health. In addition, the feeding of rumen protected choline (750 mg per 100 g) along with both low and

high energy rations during transition period starting from -21 d to +10 d improved average milk yield, peak milk yield and metabolic health status.

Natural fermentation of straws with urea not only depressed *in vitro* methane production but also improved the quality and nutritional worth of straws. Agro-industrial wastes like spent sugar syrup, waste bread and tomato pomace could be incorporated into urea molasses multi-nutrient blocks (UMMBs) without any adverse effect on palatability, nutrient utilization or health of animals.

### **Meat processing and value addition**

The processing technology for chitosan-based edible films for extending shelf life of meat-based products was standardized and these films are completely degraded within 21-27 days after shrinkage. The antimicrobial efficacy of chitosan based edible film matrix material was enhanced with the incorporation of 1.0% v/v eugenol and 50 mg/g potassium sorbate against food pathogenic and spoilage bacteria. Moreover, lemon grass oil @ 1.5% is appropriate to inhibit the growth of most pathogenic and spoilage organisms in bioactive films. The shelf life of pork nuggets, chicken thigh and breast muscles, fiber enriched chicken meat bullets, chicken lollipops and chevon chunks was successfully extended after storage in the biodegradable films incorporated with lemon grass oil, nisin and/or cinnamaldehyde.

### **Pesticide toxicity mechanism and acaricide multi-resistance in ticks**

Pesticide-induced adverse effects were evaluated in buffalo calves viz. quinalphos @ 1 mg/kg, oral subacute exposure to fenvalerate (1 mg/kg/day) and/or sodium nitrate (20 mg/kg/day) for 21 days. The major alterations were recorded in haematological, biochemical, and endocrine parameters along with an increase in oxidative stress. Exposure of new generation insecticides can impact the disposition of antimicrobial agents. Plasma levels of cloxacillin in insecticide-exposed animals were lesser compared to healthy buffalo calves.

Larval packet test used for evaluating *fenvalerate* resistance levels in *Rhipicephalus (Boophilus) microplus* revealed level I, II and IV resistance with resistance factors in range of 1.56–54.34 were determined in tick isolates collected from central plain zone of Punjab. Among field isolates of *Hyalomma anatolicum*, susceptible status was recorded against cypermethrin in all the isolates, whereas level I–III resistance status was recorded against deltamethrin. Esterase

and glutathione S-transferase levels associated with synthetic pyrethroid resistance in *H. anatolicum* and *R. (B.) microplus* were correlated.

Ivermectin, malathion and amitraz resistance (level I and II) was recorded in *R. (B.) microplus* in Punjab. Malathion resistance also existed in *H. anatolicum*.

Aqueous and/or ethanolic extracts of leaves and roots of some indigenous plants of Punjab are toxic to *R. (B.) microplus* adults, *H. anatolicum* larvae and highly effective in controlling hatching of eggs laid by treated ticks. Adult immersion test was used to assess the *in vitro* acaricidal activity of aqueous, ethanol, chloroform, acetone and hexane extracts of leaves of *Murraya koenigii* against synthetic pyrethroid-resistant *R. (B.) microplus*. The mortality caused by various extracts at concentrations ranging from 0.625 to 10% varied from 0 to 100%.

### **Surveillance of toxicities and diseases**

Pesticide residues may be linked to adverse impact on the reproductive tract of neonatal calves and adult female buffalo as the concomitant presence of specific pesticide residues was observed in blood, reproductive tract and follicular fluid of buffaloes as well as their calves that could be associated with histopathological alterations in the reproductive tract of calves. High prevalence of heavy metals in plasma of dairy animals of Buddha Nallah is an alarming situation and can result in detrimental health effects and release of heavy metals in milk can be of public health significance.

About 25-30% fodder samples contained nitrate >2,000 ppm and higher nitrate in fodder was found in Ludhiana, Kapurthala and Bathinda districts. Healthy bovine and goat blood had nitrate as 9-44 ppm and 7.5-18 ppm, respectively.

The prevalence of sub-clinical mastitis in goats was 20.89% at animal level and 14.95% at quarter level. The major organism isolated from specific subclinical and clinical mastitis in goats was coagulase negative staphylococci.

Out of cattle tested for brucellosis, 3.30% were positive by Rose Bengal Plate Test (RBPT) and 0.82% were positive by competitive ELISA. In another study, an overall seroprevalence of brucellosis in cattle and buffaloes by RBPT was 31.45%. Out of cattle tested for tuberculosis, 14.87% were positive by comparative intradermal test, 0.82% by Gamma

Interferon assay, 14.87% by PCR for mycobacterium complex and 3.30% by PCR for *Mycobacterium bovis*.

Haemoprotozoan infections (*Trypanosoma evansi*, *Theileria annulata*, *Babesia bigemina* and *Anaplasma marginale*) were present in the dairy animals either in patent or latent form. The latent form of infection detected by immunomolecular means may act as nidus for spread of disease to other susceptible animals. The overall prevalence of *Theileria equi* in Punjab state by PCR was recorded as 11.64%. Overall PCR based prevalence for *Theileria* spp. and *T. annulata* was 30.2 and 29.3%, respectively in bovines. Higher prevalence of *T. annulata* was observed in western zone (40.4%) and least in submountain zone (18.9%).

The pathological conditions prevailed in the poultry farm in Punjab were oophoritis and egg peritonitis mainly in adult and omphalitis in young chicks as well as air sacculitis, coccidiosis, *E. coli* infections, CRD, Marek's disease (MD), Newcastle disease (NCD), Infectious bursal disease (IBD), rickets/soft bones and visceral gout.

### **Molecular and serological diagnosis of diseases**

Isolation, amplification of *Brucella abortus* was carried out in cattle and buffalo. Cloning, sequencing and expression of immunodominant outer membrane protein Omp25 from *Brucella* species could be a first step in providing rapid diagnosis of *Brucella* species as well as in development of recombinant antigen based indigenous ELISA. Molecular heterogeneity among the isolates of *Brucella* species was shown using RAPD, REP, ERIC and SSCP analysis.

To avoid false negative diagnosis of brucellosis, a novel Superagglutination test was developed to minimize the false negative results in brucellosis diagnosis and this test is more sensitive than the current agglutination tests and agglutination based diagnostic kits. Bruce Ladder Multiplex PCR can be used for the differentiation of *Brucella* species. Moreover, Hinc Real time PCR was easy method for the detection of *Brucella* species.

Multiplex real time PCR assay using hydrolysis probe chemistry can be used for detection and confirmation of *P. multocida* type B from tissue sample. A new marker vaccine and a new DIVA assay developed for Hemorrhagic Septicemia.

Mycotoxin studies in respiratory disease of poultry revealed occurrence of aflatoxin B2 to be the highest followed by aflatoxin B1, ochratoxins and citrinin. Isolates of bacteria associated

with various respiratory tract infections in chicken showed an increasing trend of resistance to various antimicrobial drugs and emergence of multi-drug resistant bacteria.

Isolation and molecular characterization of *Mycobacterium avium subsp. Paratuberculosis* (MAP) (Johne's disease) was carried out using techniques such as IS900 PCR, qRT-PCR and PCR-RFLP.

Immunohistochemistry, ELISA and PCR were effective and precise diagnostic techniques of poultry diseases like MD, CRD, IBD, and NCD. Poultry disease diagnostic laboratory using molecular or immunological techniques can be made available to the farmers in near future.

Molecular approaches viz. Heminested RT-PCR and/or TaqMan real time PCR and Immuno-pathological approach can be used to detect rabies in urine, saliva and skin samples. In comparison of detection of rabies from urine and saliva, saliva renders more sensitive and accurate secretion for attempting diagnosis of rabies.

Multiplex PCR has 100% sensitivity and 95.32% specificity to detect *T. evansi* and *T. equi* irrespective of whether the amplification was against single or dual haemoparasites and with low level of infections, thus it can be suitable for their epidemiological study in equines. Duplex PCR for simultaneous diagnosis of *Anaplasma marginale* and *Theileria* spp. revealed higher sensitivity in detection (17.7%) of covert or subclinical multiple infections in animal under field. Realtime PCR for detection of *B. bigemina* had remarkably higher sensitivity as compared to conventional SSU rRNA PCR assay.

### **Clinical interventions**

Current culture sensitivity pattern of clinical mastitis in bovines revealed Ceftriaxone-salbactam as the most effective and Penicillin, Ampicillin and amoxicillin as the least effective drugs. The cows with dirty udders were likely to have quarters infected with minor pathogens compared with cows with clean udders. The application of good pre-milking udder preparation could lower the occurrence of specific mastitis by 50.44%.

In crossbred cows, feeding of high grain diet increased heel erosions, white line haemorrhage, white line fissures and overgrown soles, whereas, these can be prevented with the supplementation of high grain diet with sodium bicarbonate, magnesium oxide, zinc sulphate,

sodium bicarbonate and/or magnesium oxide. The convex probe of ultrasound machine was standardized for measurement of sole thickness in dairy cattle.

Feeding of rumen protected choline @ 50 g/day for 20 days or intravenous injection of parenteral choline @ 10 ml/animal for 6 consecutive days was effective in prevention of Hepatic Lipidosis. Herbal Vitamin E and Se powder @ 6 g/day for 20 days was effective in reducing oxidative stress during periparturient period. Nutritional values of feed samples were low in crude protein (<20%) at majority of farms.

In colic horses, heart rate, pulse rate and respiration rate as well as serum ALKP, lactate, blood glucose, activated partial thromboplastin time and platelet count can be used for prognosticating survival. Treatment with low molecular weight heparin (LMWH) improved the coagulation parameters in colic patients but not the survivability. Blood pressure monitoring, electrocardiography, echocardiography and endoscope is being used for diagnostic and critical care facilities for domestic animals.

Following comparison of different techniques of internal and external fixation, interlocking nailing was adjudged best for healing of long bone fractures. Xylazine-Ketamine–Midazolam-isoflurane was standardized for the induction of general anesthesia in bovine. Advanced pregnancy had no effect on the Doppler values of major arteries and veins in cattle and buffalo. Extracapsular lens extraction is being performed successfully for the treatment of cataract in small animals.

Ultrasonography was standardized for pre- and post-operative evaluation of colic and other abdominal affections in equine. In equine colic, ventral midline celiotomy provided proper visualization of intestinal lesion and helped in removal and drainage of the obstruction.

*B. abortus* was most sensitive to oxytetracyclin and resistant to penicillin, erythromycin, cephalothin, cotrimoxazole. *Pasteurella multocida* isolates were sensitive to ceftriaxone, gentamycin, enrofloxacin and chloramphenicol. Pharmacodynamic characteristics of commonly used antibacterials against *E. coli* isolates from diarrheic buffalo calves revealed full susceptibility to fluoroquinolones and cephalosporins.

### **Enhancing reproductive efficiency**

In the ovary of buffalo, localization of various enzymes was carried out during different reproductive stages that indicated variable reactions during luteal and follicular phase as well as in pre-pubertal, pubertal and pregnant stage. The frequency and intensity of estrogen receptor

alpha and progesterone receptor immunoreactivity in the cervix of buffalo varied according to the cervical cell types and the phases of the sexual cycle.

An estradiol/progesterone-based fixed-time AI (FTAI) protocol has potential for better conception rate in buffalo during hot-humid conditions. Melatonin pre-exposure for 35 days in anestrus buffalo subjected to FTAI suggested that better luteal profile during pre- and post-AI period might be related to better conception rate. Polymorphism of melatonin receptor MT1 gene in buffalo could be responsible for variation in cyclicity pattern of buffalo population. Supplementation of amla powder @ 200 mg/Kg body wt. /day may ameliorate the adverse effects of oxidative stress and improve the reproductive performance of summer stressed buffaloes.

Delayed fertility in 14.3% cattle might be due to the presence of significant level of antisperm antibodies (ASA) in blood serum or cervical mucus. For subclinical endometritis, the uterine cytobrush technique can be considered as a cow side test at field level. Proteolytic enzymes, *E coli* LPS and levamisole enhanced uterine immunity and pregnancy rates in subclinical endometritic repeat breeding cattle. Progesterone radioimmunoassay using indigenously raised polyclonal progesterone antiserum is being employed for the reproductive status evaluation of dairy cattle and buffalo.

Identification of the metabolites associated with libido in serum, seminal plasma and urine could demarcate good and poor libido breeding buffalo bulls. Low dose FSH (400 IU) was enough to superovulate buffalo with an average embryo recovery of 4.57 per donor, and transferable rate of 2.0 embryos per buffalo. *In vitro* embryo development has reached upto 4-cell stage from ovum pick-up derived oocytes.

### **Animal biotechnology**

Canine distemper virus (CDV) infects with the help of signaling lymphocyte activation molecule (SLAM) or CD150 present on the surface of susceptible cells, therefore, Vero-dSLAM and MDCK-dSLAM cell lines developed which will serve as permissive cell lines for isolation and culture of CDV. Expression of Tumor necrosis factor-alpha (TNF $\alpha$ ) mRNA was increased following single and multiple exposures to poultry barn air.

Cloning, phylogenetic analysis and expression of recombinant LipL41, Loa22 and LipL21 Proteins from *Leptospira interrogans* carried out which can be used for various

downstream applications like as vaccine candidates and for development of ELISA for sero-diagnosis of leptospirosis. Cloning, expression and characterization of recombinant outer membrane protein 16 from *Brucella spp* can be evaluated as vaccine candidate. Sequence analysis of e2 glycoprotein from Indian isolates of classical swine fever virus (CSFV) revealed a reliable differentiation of strains into specific genetic groups and subgroups.

Role of fibronectin binding outer membrane proteins of *Pasteurella multocida* in extracellular matrix (ECM) adhesion and pathogenesis in *Bubalus bubalis* is under investigation. Investigations on canine mammary tumour revealed that the peri-tumoral lymphatics played a role in tumour spread and prognosis mainly versus intra-tumoral lymphatics.

### **Food safety and zoonoses**

A community awareness project for prevention and control of zoonoses for different target groups (school children, dairy farmers, poultry handlers, pet owners, animal husbandry workers and consumers) has been started.

The high prevalence of *S. suis* in Indian pork is worrisome and warrants intervention policies to stop the practice of rearing pigs under unhygienic conditions. The validation of a new ELISA for the detection of *Toxoplasma gondii* infection is underway. The seroprevalance of brucellosis, echinococcosis, hydatidosis, *T. canis*, *T. spiralis* and *T. solium* detected in humans.

Epidemiological studies on foodborne pathogens revealed that majority *S. aureus* isolates were resistant to penicillin, followed by ciprofloxacin and tetracycline. Overall mean residue levels indicated that p,p'-DDE contributed 48% of the total POPs residues detected in fish followed by p,p'-DDD, chlordane, lindane, methoxychlor, PCB-28, PCB-138, PCB-180 and endosulfan, however, mean POP levels detected were below the MRLs. Mapping of Punjab for the presence of pesticide residues in milk and meat revealed cancer and non-cancer risks were within prescribed range values. Antibiotic residues were estimated in chicken samples and human health hazard risks were calculated based on the residue levels in chicken.

### **Dairy science and technology**

Technology for low fat yoghurt ice cream, sugar free milk cake was developed and a prototype for hygienic 'pinni' has been designed and fabricated. A nanoemulsion-based herbal formulation developed. An emulsion-based delivery system developed for the delivery of

bioactive ingredients into food matrix and their targeted delivery into human gut. Technology for particle coating and encapsulation using food grade materials has been standardized and would be useful for the encapsulation of bioactive ingredients/minerals. These technologies are significant step forward in development of specialized functional foods for a specific group of people. Compliance with requirements of food safety measures involves cost and may be unbearable for farmers.

### **Enhancement of fish productivity**

Productivity of fresh water carps (catla, rohu with common carp) enhanced from 3.5 to 4.75 t/ha/yr through stocking density enhancement from 15,000 to 20,000 fingerlings/ha and integration with duck (layer variety –Khaki Campbell @ 300/ha), with an anticipated annual net profit of 2.27 lakhs. First commercial trial of ‘Vannamei’ shrimp culture was conducted successfully in inland saline water at stocking density of 50PL/m<sup>2</sup>, with an average productivity of 3.12 t/ha in single crop of 96 day and a net profit of 2.43 lakhs. Ecological mapping revealed that *Tilapia mossambicus* is the major species breeding and surviving well, at wide range of salinity (5 to 30 ppt), in all the saline water drains and salt affected water logged waste lands in district Fazilka throughout the year.

First Commercial trial of ‘Pangas’ culture revealed productivity of 17.5 t/ha (average fish weight 500g) and net profit of 1.25 lakhs in 6 months of culture period. ‘Pangas’ catfish was overwintered with 100% survival under polyhouse conditions. Farmers have come with an interest to take up small scale processing units to develop value added Pangas products for their profitability. Vitamin C @ 100 mg/kg diet or Vitamin-E @ 200 mg/kg supplemented brood stock diets developed for *H. fossilis* for improved breeding performance. Larval diets, fry diets and fingerlings diets were also improved for better performance. Successful overwintering of fingerlings (6.2 g) and brood stock (95 g) was achieved in outdoor earthen ponds. Brood stock of Murrel, *Channa striatus* (Saul) reared successfully in outdoor earthen pond under simulate natural habitat conditions. Addition of sucrose as carbon source for biofloc production resulted in better growth, survival and innate immunity in freshwater prawns. An indigenous bio-filtration system has been developed to maintain water quality during larval rearing of freshwater prawn.

Research on non-conventional resources in aquaculture nutrition is underway. Manuring doses (cow dung @ 0.5-2.0 kg/m<sup>2</sup>/week and DAP @ 1-4 gm/m<sup>2</sup>/week) and harvesting rates

(125-250 gm/m<sup>2</sup> daily) for producing protein rich *Azolla* biomass with higher productivity during different months of the year were manipulated. Duckweed (*L. minor* and *L. gibba*) culture technology was standardized under local climatic conditions with cow dung and poultry droppings as organic manures and urea and TSP as inorganic fertilizers. Fish biomass production and profitability can be enhanced through rearing selected species with pressmud-based diets. In periphyton based aquaculture technology, best results in terms of fish growth and flesh quality were observed with bamboo substrate as compared to sugarcane bagasse and rice straw, but in view of high cost of bamboo involved, both sugarcane bagasse and rice straw is expected to have more relevance.

Probiotic, *Paenibacillus polymyxa* inoculation ( $10^3$ - $10^4$  cfu ml<sup>-1</sup>) can be used as water additive in aquaculture, to improve survival, growth performance and innate immune responses in freshwater carps. Value added Koi carp, *Cyprinus carpio*, with enhanced colour pattern/intensity was developed. Round and designer pearl nuclei implanted in freshwater pearl mussel and true pearls produced successfully.

Fish wafers, fish papad, fish samosa, fish Muruku, fish fingers and fish sausages developed with good acceptability. Steaks, fillets, whole marinated fish, cutlets and pickle developed from Pangas catfish. Breaded/battered products and pickle developed from brackish water shrimp.

### **Extension**

In order to transfer the new technologies evolved by the university, training courses/programs were organized for the farmers, field veterinarians and scientists from other universities. Faculty published about 160 extension publications in various magazines, journals, News papers etc. in order to disseminate information important to farmers. The faculty members of different departments delivered 51 TV talks and 50 radio talks on the topics assigned by the Directorate of Extension Education. It constitutes a very good medium to educate farmers and is very popular among farmers.

Animal welfare camps were organized in the rural areas of Punjab for treatment of animals. Farmers and field functionaries were advised/made aware of the recommended animal health practices. The faculty members delivered extension lectures to the farmers in collaboration with the other animal welfare agencies of the state like Department of *Animal*

Husbandry, Fisheries and Dairy Development, Govt. of Punjab, Fish Farmer's Development Agencies, Punjab, Nestle, Smith Klime Beecham, Punjab & Sind Bank and in the trainings organized by the Krishi Vigyan Kendras and Department of Extension Education, PAU, Ludhiana. On these occasions, demonstrations regarding the collection, dispatch and transport of clinical material like blood, mucous discharge and faeces from the animals, correct method of milking, teat dip, computation of ration, silage making, acaricide drug application and heat detection were carried out in the field for livestock farmers.

Two Pashu Palan Mela were organized, each in the months of March and September in the university campus. Various departments of the university exhibited new technologies /innovations for use in livestock and poultry farming. On this occasion, other government and private agencies involved in animal welfare work also displayed their exhibits of importance to the farmers. University faculty also participated in the Kisan Melas at Regional Research Stations of PAU for the benefit of the Livestock farmers. To give a push to the livestock farming, GADVASU regularly confers Chief Minister Award to progressive farmers of the state.

Training courses and awareness camps were organized by Regional Research and Training Centre, Kaljharani, Bathinda, Regional Research and Training Centre Bhatoli, Talwara, Regional research and Training Centre Booh, Tarn Taran and Krishi Vigyan Kendras, Barnala and Booh at different places in the adjoining areas.

University provided information services through preparation as well as sale and distribution of the university publications like Package of Practices for Livestock Health Management, Vigyanak Pashu Palan (Monthly Punjabi Magazine), Hand book on Infectious Animal Diseases, Veterinary Punjabi Shabad Kosh, Dairy Farming, Goat Farming in Punjab (English & Punjabi), Fish Farming and GADVASU hand-book. Services for fisheries included Free pond water testing for fish farmers, on-campus and off-campus consultancy for Carp culture, Carp breeding and seed production, post-harvest processing and value addition, ornamental fish breeding and seed production and farm visits to address farmers problems related to water quality management, feeding, breeding and disease outbreak.



## **Library and Networking**

The University Library is central to the academic, research and extension activities of GADVASU. It has state-of-the-art infrastructure and ultra-modern facilities supporting the goals of the University through collection, organization and dissemination of information and knowledge. The Library has upgraded Libsys Software which is used for automation of library's operations.

The library provides a single platform to access various e-resources through its website i. e. Cybrary through out the campus. The library provides access to about 3500 journals through the Consortium for electronic Resources in Agriculture (CeRA). Access has been provided to KrishiPrabha, a database of doctoral dissertations and theses submitted to Agricultural Universities in India. In addition links have been given to various open access electronic information resources. The Library provides the facility of Online Public Access Catalogue (OPAC) not only inside the library but throughout the campus vide intranet.

Library has established a Campus wide Network connecting all buildings and offices of the University with more than 600 access nodes. Library provides SPSS Statistics 22.0 software on network based version for statistical analysis

## **Sports and Co-curricular activities**

During the period under report, university has created enough facilities to promote the sports activities among the students. Large numbers of students (both boys and girls) from our various constituent colleges have shown keen interest in sports activities. 9<sup>th</sup> Annual Athletic Meet of the university was organized successfully on March 11-12, 2015. The students from constituent colleges of GADVASU have participated in various events of North Zone and All India Intervarsity Tournaments.



The 5<sup>th</sup> Inter College Youth Festival – 2014 successfully organized from Nov. 04-09, 2014. The university cultural contingent also participated in 19<sup>th</sup> All India Inter University Youth Festival (REVERIE '14) held at NDRI, Karnal from April 24-26, 2014 and won 22 first prizes and 6 second prizes. The Cultural Activities Wing of the University also organized functions to celebrate Independence Day (15 Aug., 2014), Republic Day (26 Jan., 2015) and *Parkash Utsav* of Shri Guru Angad Dev Ji on April 23-25, 2014.

During the period under report, the NSS Unit organized 7 Days NSS Special Summer Camp in September, 2014 and 7 days NSS Special Winter Camp from January, 2015. The NSS Unit also observed various important days such as National Youth Day, Wetland Day, World Health Day, Anti-Terrorism Day, World No Tobacco Day, World Red Cross Day, World Environment Day, World Population Day, Sadbhawana Divas, Teachers Day, International Literacy Day, International Peace Day, NSS Day, Social Justice Day, National Blood Donation Day, Communal Harmony Day, National Integration Day, World AIDS Day, World Human Rights Day, Road Safety Week, Van Mahotsav Week, International Literacy Week, *Parthenium* Awareness Week and Qaumi Ekta Week. NSS volunteers also took part in various activities of social welfare and get associated in problems related to environment and the society in the city/State.

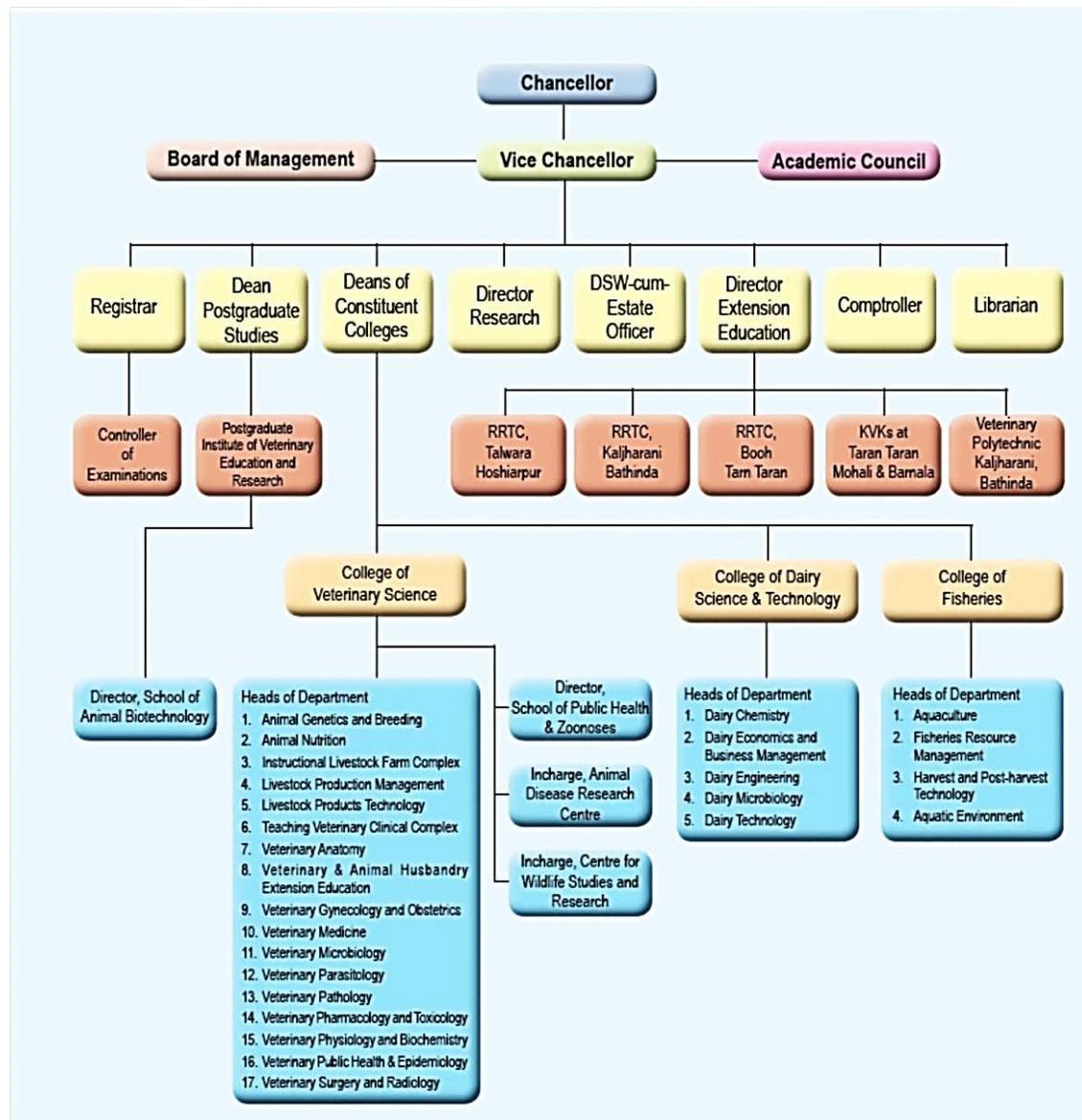


## ABOUT THE UNIVERSITY

Guru Angad Dev Veterinary and Animal Sciences University started functioning on 21st April, 2006 at Ludhiana, as per Punjab Act no. 16 of 2005 to serve the society by promoting the livestock production, health and prevention of the diseases through integrated teaching, research and extension programmes. The University was established with the following goals and objectives:

- To provide adequate supply of trained veterinary professionals including Master's and Doctorate level specialists capable of handling livestock health and production aspects according to the needs of the State Government and allied agencies.
- To undertake research work in selected areas and wherever applicable following multi-disciplinary approach.
- To provide opportunities for continuing professional education in veterinary science.
- To provide consultancy and specialist services to livestock owners, government, semi-government and allied agencies.
- To run "Referral" hospital for specialized treatment of the livestock patients and to provide clinical training to the students.
- To provide technical expert opinion to different government and other agencies.
- To foster faculty development by providing them opportunities to participate in appropriate training programmes, conferences, workshops, seminars, symposia etc. and avail opportunities in exchange programmes.
- To encourage cooperation and collaboration with other departments, colleges, universities and industries both national and international.

## ORGANIZATIONAL SETUP

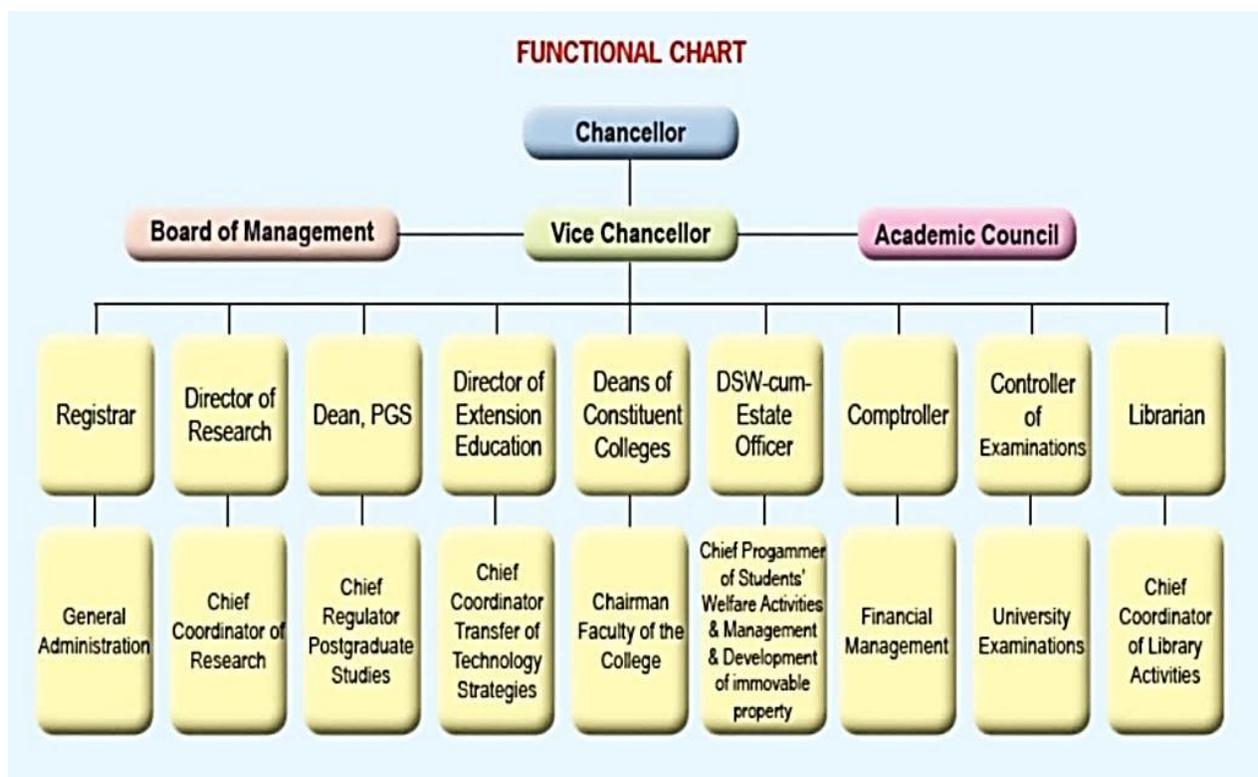


The functioning of the university is governed by following bodies focused at education, research and extension activities:

- Board of Management
- Academic Council
- Committee on Student's 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 center 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. Board also reviews from time to time the standards of teaching and evaluation of students.

## ADMINISTRATION

### BOARD OF MANAGEMENT

<p><b>Honorary Chairman</b></p> <ul style="list-style-type: none"> <li>• His Excellency Prof. Kaptan Singh Solanki, Chancellor and Governor of Punjab, Chandigarh</li> </ul>
<p><b>Working Chairman</b></p> <ul style="list-style-type: none"> <li>• Dr. A.S. Nanda, Vice-Chancellor, Guru Angad Dev Veterinary and Animal Sciences University Ludhiana</li> </ul>
<p><b>Ex-officio Member</b></p> <ul style="list-style-type: none"> <li>• Shri Sarvesh Kaushal, IAS, Chief Secretary to Government of Punjab, Chandigarh</li> <li>• Shri Suresh Kumar, IAS, Financial Commissioner Development, Department of Agriculture, Punjab, Chandigarh</li> <li>• Mrs. Vini Mahajan, IAS Principal Secretary to Govt. Punjab, Department of Finance, Chandigarh</li> <li>• Shri M.S. Sandhu, IAS, Financial Commissioner Department of Animal Husbandry, Dairy Development &amp; Fisheries, Punjab, Chandigarh</li> <li>• Dr. Harjinderjeet Singh Sandha, Director of Animal Husbandry, Punjab, 17-Bays Building, Sector -17, Chandigarh</li> <li>• Shri Inderjit Singh, Director, Dairy Development Punjab, Chandigarh</li> <li>• Shri B.K. Sood, Director &amp; Warden of Fisheries, Chandigarh</li> <li>• Dr. B.N. Tripathi, Director, National Research Centre for Equines, Hisar</li> <li>• Dr. H.S. Sandhu, Dean, College of Veterinary Science, GADVASU, Ludhiana</li> </ul>
<p><b>Non-officio Member</b></p> <ul style="list-style-type: none"> <li>• Dr. Suresh S.Honnappagol, Animal Husbandry Commissioner, DAHDF, Ministry of Agriculture, Delhi</li> <li>• Sh. Sukhharpreet Singh Rode, VPO Rode, Tehsil Bagha Purana (Moga)</li> <li>• Sh. Gur Jatinder Singh Virk, Village Kadhola, Tehsil Chamkaur Sahib, Distt. Roopnagar</li> <li>• Sh. Sanjeev Nagpal, Engineer, Arya Samaj Road, Fazilka</li> <li>• Dr. Baljit Singh, Professor and Associate Dean (Research), Western College of Veterinary Medicine, University of Saskatchewan, Saskatoon, Canada</li> <li>• Dr. Dilbagh Singh Rana, 18038, 64<sup>th</sup> Ave, Survey BC, Canada</li> <li>• Smt. Navpreet Kaur wife of Sh Harsharan Singh, Village Manawalan, District Amritsar</li> </ul>
<p><b>Special Invitee</b></p> <ul style="list-style-type: none"> <li>• Dr. B.S. Dhillon, Vice-Chancellor, PAU, Ludhiana</li> <li>• Dr. V.K. Gandotra, President, GADVASU Teacher's Association</li> </ul>
<p><b>Secretary</b></p> <ul style="list-style-type: none"> <li>• Dr. Asha Dhawan, Registrar, GADVASU, Ludhiana</li> </ul>



## ACADEMIC COUNCIL

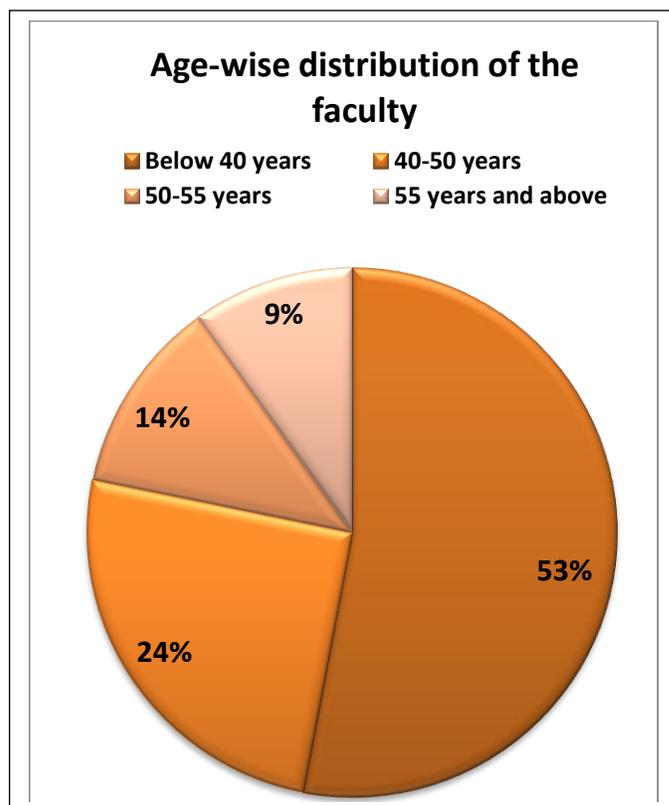
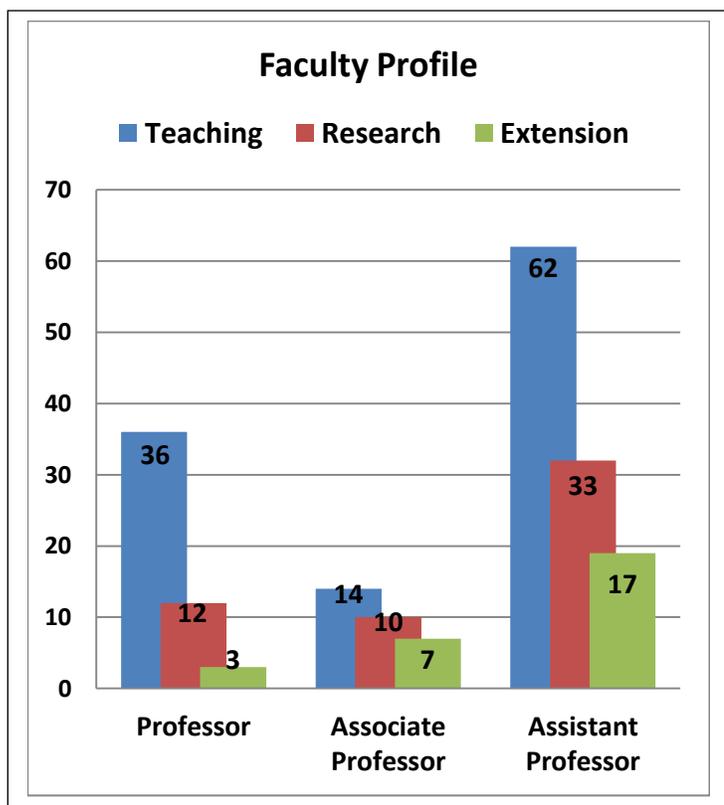
1	Dr. Amarjit Singh Nanda, Vice-Chancellor	Chairman
2	Dr. S.N.S. Randhawa, Director of Research	Member
3	Dr. S.N.S. Randhawa, Dean, Postgraduate Studies (Additional charge)	Member
4	Dr. H.S. Sandhu, Dean, College of Veterinary Science	Member
5	Dr. Asha Dhawan, Dean, College of Fisheries	Member
6	Dr. S.P.S. Sangha, Dean, College of Dairy Science and Technology (Additional charge)	Member
7	Dr. S.N.S. Randhawa, Director of Extension Education (Additional charge)	Member
8	Dr. Digvijay Singh, Professor-cum-Head, Department of Veterinary Physiology and Biochemistry	Member
9	Dr. S.S.Sikka, Professor-cum-Head, Department of Animal Nutrition	Member
10	Dr. N.S.Sharma, Professor-cum-Head, Department of Veterinary Microbiology	Member
11	Dr. Meera D. Ansal, Scientist and Head, Department of Aquatic Environment and Harvest & Post-harvest Technology	Member
12	Dr. L.D. Singla, Professor-cum-Head, Department of Veterinary Parasitology	Member
13	Dr. S.P.S. Sangha, Director of Students' Welfare-cum-EO	Special Invitee
14	Dr. Sushil Prabhakar, Controller of Examinations	Special Invitee
15	Dr. Ramneek, Director, School of Animal Biotechnology	Special Invitee
16	Dr. V.K. Gandotra, President, GADVASU Teacher's Association	Special Invitee

## OFFICERS OF THE UNIVERSITY

Vice-Chancellor	Dr. Amarjit Singh Nanda
Registrar	Dr. Asha Dhawan
Director of Research	Dr. S.N.S. Randhawa
Director of Extension Education	Dr. S.N.S. Randhawa
Dean, Postgraduate Studies	Dr. S.N.S. Randhawa
Dean, College of Veterinary Science	Dr. H.S. Sandhu
Dean, College of Dairy Science and Technology	Dr. S.P.S. Sangha
Dean, College of Fisheries	Dr. Asha Dhawan
Director of Students' Welfare-cum-Estate Officer	Dr. S.P.S. Sangha
Comptroller	Dr. S.P.S. Sangha
Librarian	Dr. S. Prabhakar

## FACULTY PROFILE

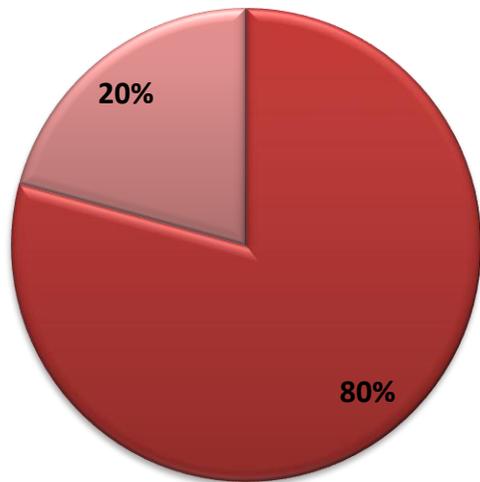
Institution	Professor	Associate Professor	Assistant Professor	TOTAL
College of Veterinary Science	47	26	62	135
College of Dairy Science & Technology	0	0	13	13
College of Fisheries	1	1	13	15
School of Animal Biotechnology	2	1	7	10
Veterinary Polytechnic	1	1	2	4
Krishi Vigyan Kendra's and Others	0	2	15	17
<b>TOTAL</b>	<b>51</b>	<b>31</b>	<b>112</b>	<b>195</b>





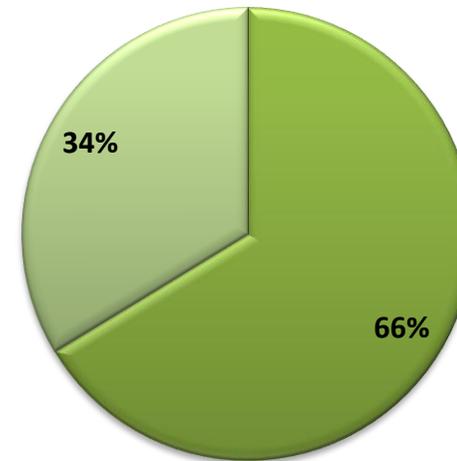
**Gender-wise distribution of the faculty**

■ Male Faculty   ■ Female Faculty



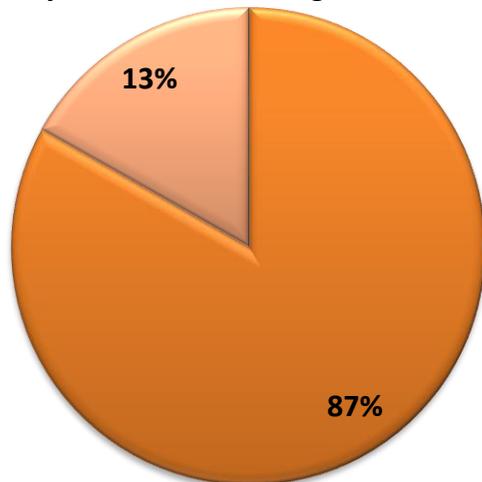
**Domicile based distribution of the faculty**

■ From Punjab State   ■ From Outside States



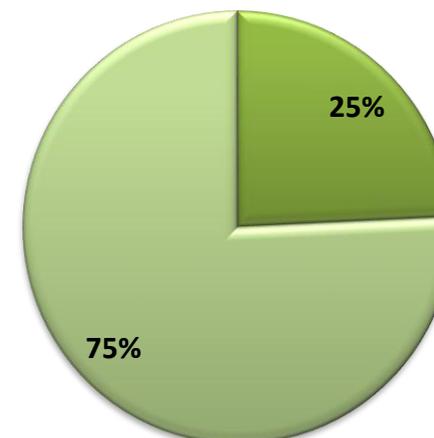
**Faculty with doctorate degree**

■ Faculty with Doctorate Degree   ■ Others



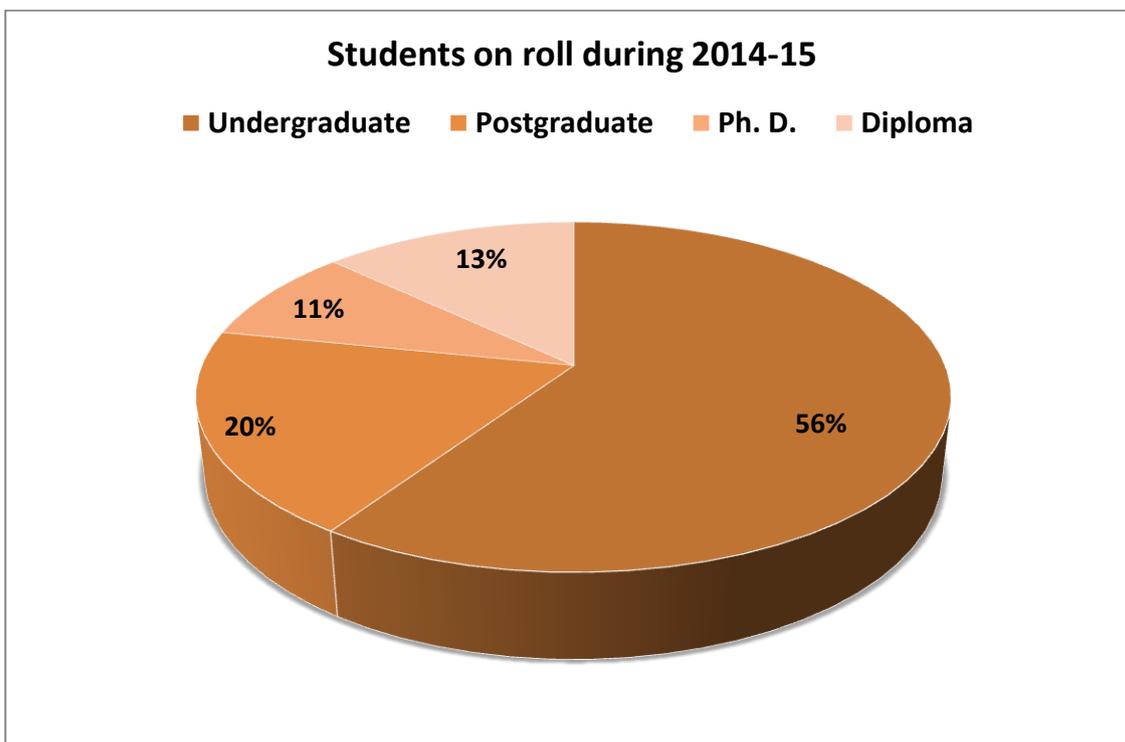
**Training based breakup of the faculty**

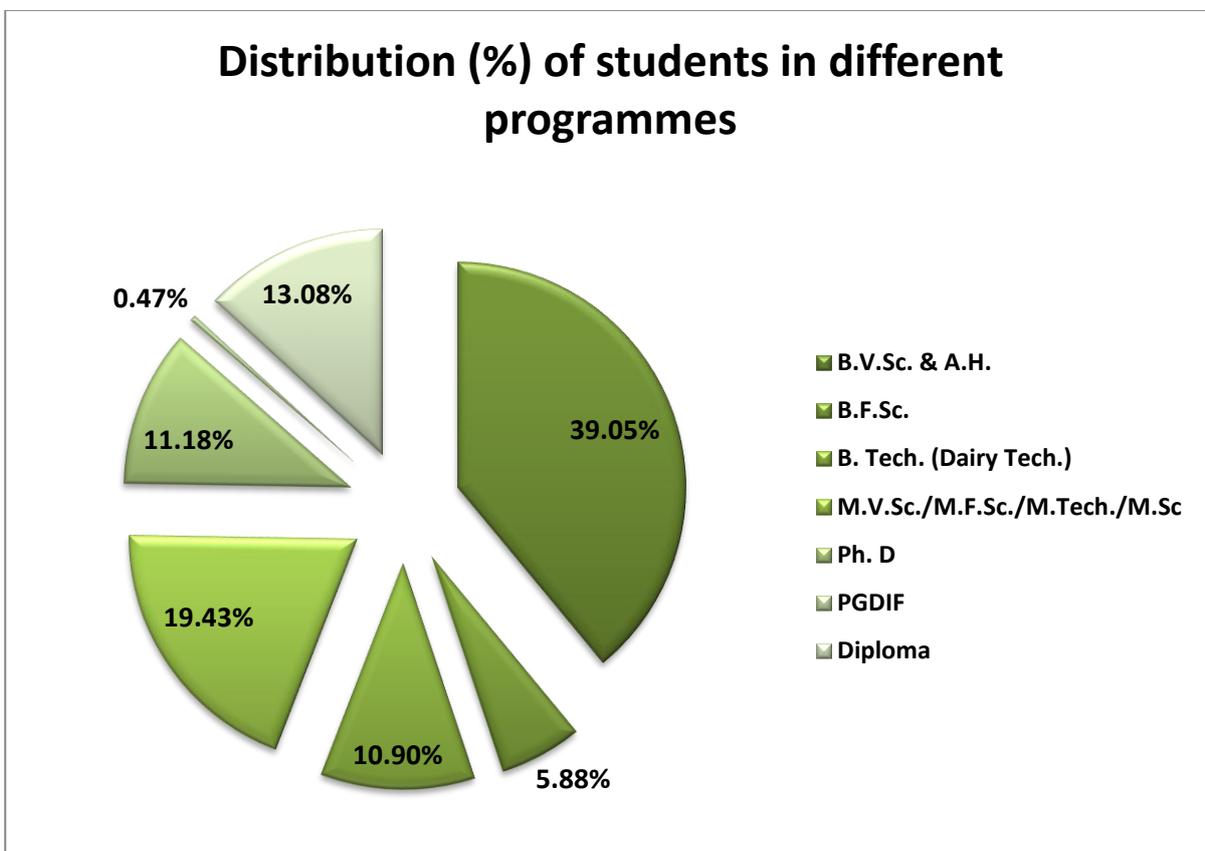
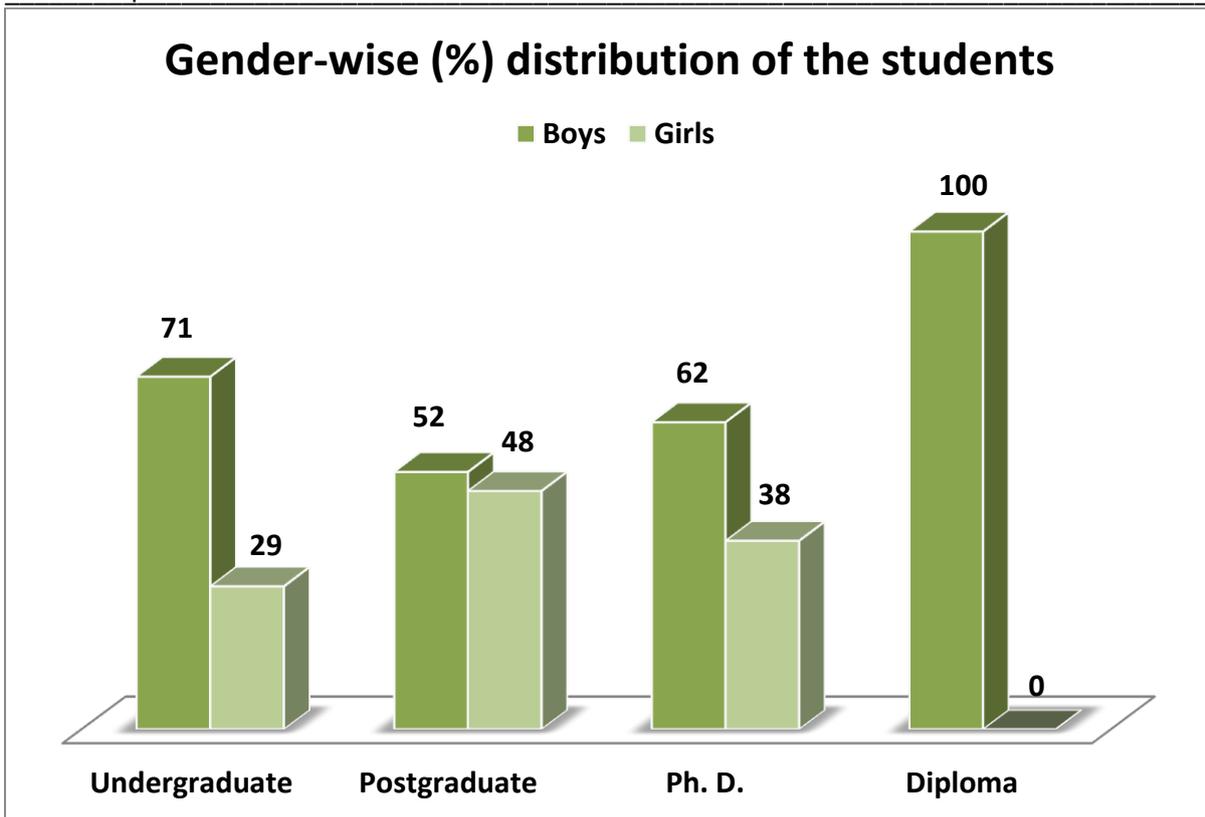
■ Faculty Trained in Foreign Institutes   ■ Others



## STUDENT PROFILE

Programme	Boys	Girls	Total
<b>B.V.Sc. &amp; A.H.</b>	281	131	<b>412</b>
<b>B.F.Sc.</b>	36	26	<b>62</b>
<b>B. Tech. (Dairy Tech.)</b>	101	14	<b>115</b>
<b>M.V.Sc./M.F.Sc./M.Tech./M.Sc</b>	108	97	<b>205</b>
<b>Ph.D.</b>	73	45	<b>118</b>
<b>PG Diploma in Inland Fisheries (PGDIF)</b>	1	4	<b>5</b>
<b>Diploma in Veterinary Science and Animal Health Technology</b>	138	0	<b>138</b>
<b>Total</b>	<b>738</b>	<b>317</b>	<b>1055</b>





## FINANCIAL REPORT

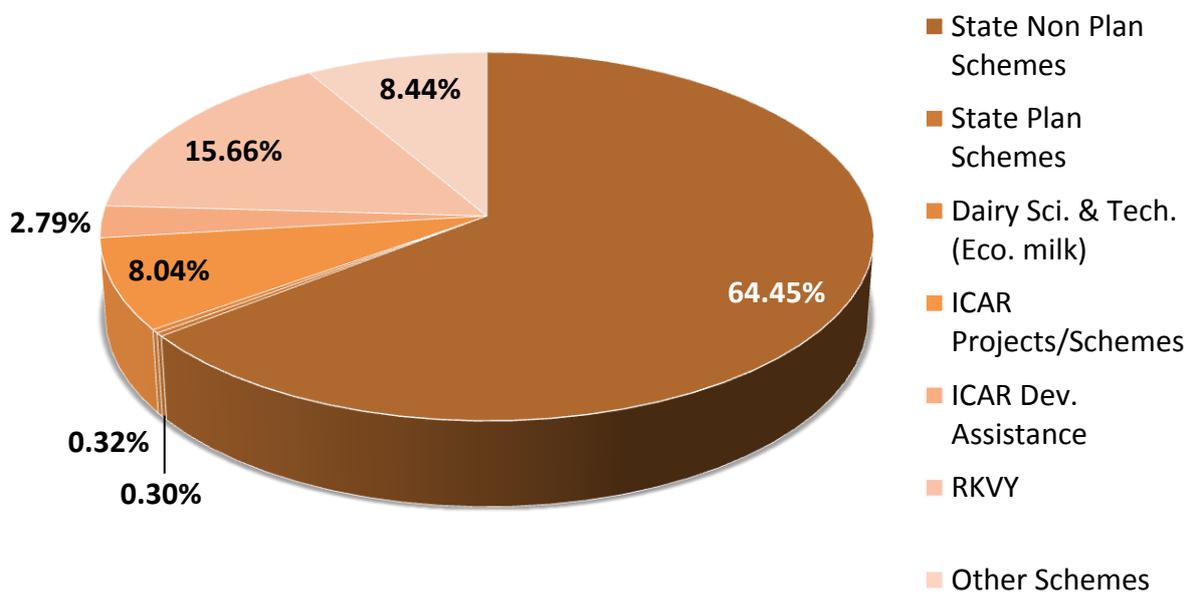
**Financial statement indicating budget allocated and amount spent (Rs. in lakh) under various schemes/projects during financial year 2014-15**

Schemes	Budget Allocated for 2014-15*	Expenditure				
		Salary	Wages	TA	Contingencies & Others	Total
State Non Plan Schemes	5400.00	5573.11	230.94	11.44	480.77	<b>6296.27</b>
State Plan Schemes	25.38	0.00	1.45	0.00	20.84	<b>22.29</b>
Dairy Sci. & Tech. (Eco. milk)	26.42	11.99	2.05	1.38	0.12	<b>15.54</b>
ICAR Projects/Schemes	673.36	232.52	3.14	7.94	394.08	<b>637.69</b>
ICAR Dev. Assistance	233.98	0.03	0.00	5.97	267.56	<b>273.56</b>
RKVY	1312.11	38.90	2.02	0.08	1140.57	<b>1181.57</b>
Other Schemes	707.49	22.48	29.67	9.07	255.22	<b>316.44</b>
<b>Total</b>	<b>8378.74</b>	<b>5879.04</b>	<b>269.27</b>	<b>35.88</b>	<b>2559.18</b>	<b>8743.37</b>

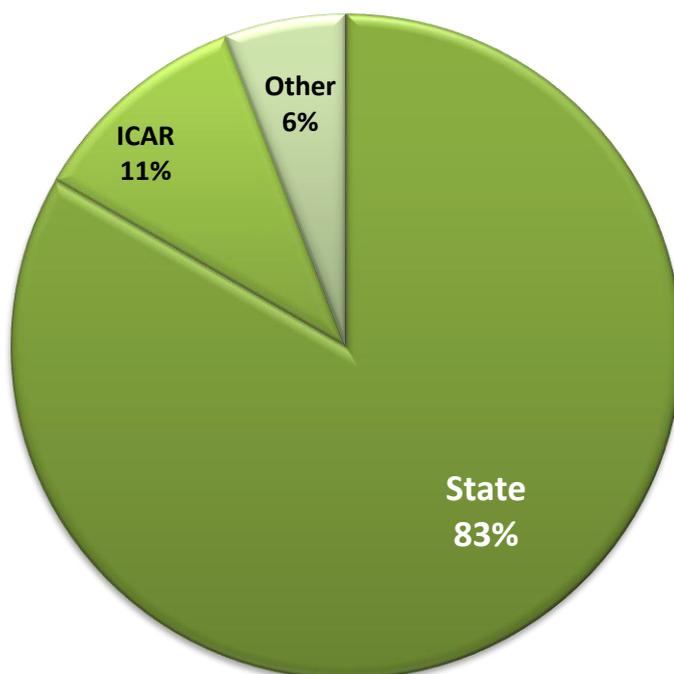
\*including revalidated amount of Rs. 999.39 lakh

A sum of ₹ 635.34 lacs were generated under various Non-Plan schemes. The total budget available for the year 2014-15 was ₹ 9014.08 lacs.

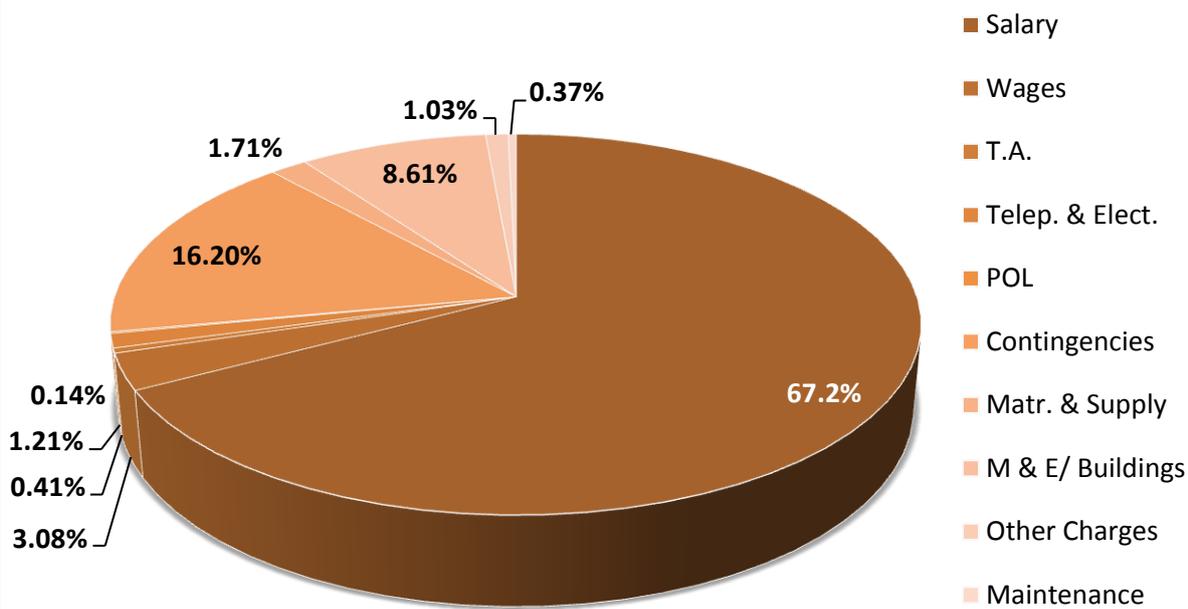
### Per cent budget allocated under various schemes/projects during 2014-15



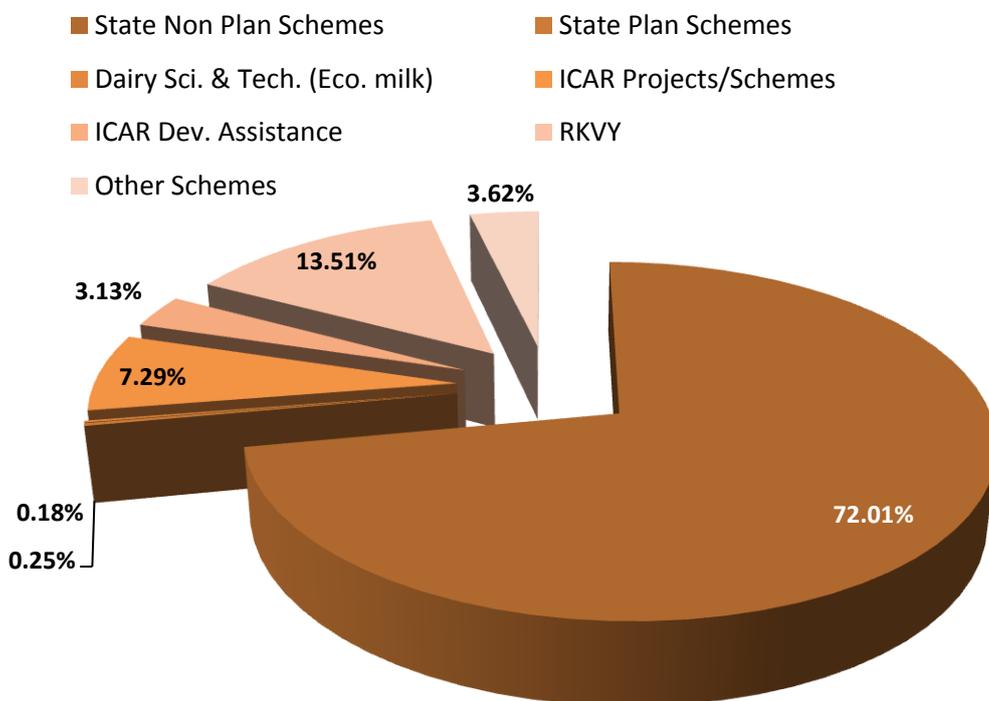
### Contribution (%) from different funding agencies during 2014-15



### Head-wise Expenditure (%) during 2014-15



### Scheme-wise Expenditure (%) during 2014-15





## ACADEMIC UNITS

There are three constituent colleges, viz. College of Veterinary Science, College of Dairy Science & Technology, College of Fisheries, which are imparting undergraduate and postgraduate teaching in various discipline. Besides, the university has established School of Animal Biotechnology and 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.

### College of Veterinary Science

The College of Veterinary Science was set up in 1969 as a constituent college of Punjab Agricultural University, Ludhiana. Now, this college is a part of Guru Angad Dev Veterinary and Animal Sciences University. The college was created to be a centre of regional, national and international excellence in teaching, research and learning in animal health and production. It carries out teaching, research and extension education programmes pertaining to livestock production and health and has been instrumental in ushering in an era of 'White Revolution' in the State.

The college has highly competent and experienced faculty members who have made significant contributions in research on animal health and production and won various national and international awards. The college is recognized by the Veterinary Council of India and has obtained accreditation from the Indian Council of Agricultural Research (ICAR) in the year 2004. The Minimum Standards of Veterinary Education Degree Course (B.V.Sc. & A.H.) Regulations, 1993 of Veterinary Council of India (VCI), subsequently revised in 2008, have been implemented in the college. External examination system for B.V.Sc. & A.H. programme was introduced from the year 1998 onwards. Two ICAR Centres of Advance Faculty Training in the Departments of Veterinary Surgery & Radiology and Veterinary Gynaecology and Obstetrics exist in the college.

The College of Veterinary Science has 17 departments having excellent laboratory facilities and adequate infrastructure for the undergraduate and postgraduate teaching and research, a well-equipped teaching veterinary hospital to cater to the needs of large and small animal health care. In addition, the college also has an elite dairy herd and poultry farm for teaching and research.

School of Public Health and Zoonoses has been established after upgradation of Department of Veterinary Public Health and has the mandate for teaching and research on diagnostic and prevention of zoonotic diseases; food safety and quality control; environmental hygiene and pollutants; and food borne pathogens and their toxins. School of Public Health and Zoonosis thus would be instrumental in developing strategies for control of zoonotic diseases, recommending food safety guidelines through novel research in the area of food safety, food production and processing practices prevalent in the region. The School has well equipped laboratories for Residue Analysis, Zoonoses, Food safety and quality control, Water testing and Brucellosis diagnostics. International collaborative research project with University of Saskatchewan, Canada under International Partnership Fund Programme to study impact of environmental pollutants on human and animal health is also operational in the school. The School of Public Health and Zoonoses has initiated a Collaborative Research and Training Experience on infections disease, food safety and Public Policy funded by Natural Science and Engineering Research Council, Canada in collaboration with University of Saskatchewan, Canada and Free University, Berlin.

The college offers the following programmes of study:

- B.V.Sc. & A.H. (5-year programme)
- M.V.Sc.
- Ph.D.

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 to a veterinary career. 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 and pharmacology. The clinical phase (surgery, medicine and gynaecology) starts in year four and culminates in the fifth year. At the end of course work (9 semesters), the students undergo a compulsory rotational internship programme of six calendar months on the training in diagnostic laboratories, clinical practice and animal production technology. The programme aims to enrich the knowledge of the students to be professionally competent and face the professional challenges.



The successful completion of B.V.Sc.& A.H. programme entitles the graduates to seek mandatory registration with the Punjab State Veterinary Council / Veterinary Council of India as registered veterinary practitioner.

### Students Intake Capacity and Entrance Procedure

Programs	Intake Capacity	Mode of Entrance
<b>B.V.Sc. &amp; A.H.</b>	60 (Open seats for domicile of Punjab State and UT of Chandigarh)	Based on CET merit
	10 (VCI)	Based on entrance test conducted by VCI
	2(Kashmiri Migrant)	Based on CET merit
	12(NRI)	Merit based on qualifying exam
<b>M.V.Sc. in 16 subjects</b>	111	Merit based on qualifying exam
<b>Ph.D. in 15 subjects</b>	35	Merit based on qualifying exam

### College of Dairy Science and Technology

The College of Dairy Science and Technology was established in the year 2008 with the following mandate:

- To produce quality human resource through its undergraduate/postgraduate degree programmes.
- To develop new technologies in the field of milk processing and dairy product development.
- To conduct training programmes and vocational courses for dairy farmers, entrepreneurs & persons from dairy industry.
- To provide consultancy services to dairy farmers, industry, Govt. & non-Govt. agencies involved in dairy development programme.
- To liaise with various dairy development organization(s).

The college offers the following programmes of study:

- B. Tech (Dairy Technology) – 4 year Programme
- M. Tech (Dairy Technology)

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<sup>th</sup> Dean's committee constituted by the Indian Council of Agricultural Research, New Delhi. The programme has been structured into eight semesters. The first six semesters include the courses (Theory & Practicals) on Dairy Technology, Dairy Engineering, Dairy Chemistry, Dairy Microbiology and Dairy Economics & Business Management. Seventh and eighth semesters include in-plant training practica on different aspects of Dairy Technology. M.Tech. (Dairy Technology) was started in the college of Dairy Science and Technology in the academic year 2012-13 to strengthen the research programmes of the college. Under both undergraduate and postgraduate programmes the students are exposed to every aspect of equipment designing, technology of product making and quality assurance.

### Students Intake Capacity and Entrance Procedure

Programs	Intake Capacity	Mode of Entrance
<b>B. Tech. (Dairy Technology)</b>	25 (Open seats for domicile of Punjab State and UT of Chandigarh)	Based on CET merit
	4 (ICAR nomination)	Based on entrance test conducted by ICAR
	2(Kashmiri Migrant)	Based on CET merit
	3 (NRI)	Merit based on qualifying exam
	2 (Nominees from other states which do not have colleges of Dairy Science and Technology (against additional seats)	Nomination by the State Government
<b>M. Tech in Dairy Technology</b>	2	Merit based on qualifying exam
	2 (ICAR nomination)	Based on entrance test conducted by ICAR
<b>M. Tech in Dairy Economics</b>	1	Merit based on qualifying exam
	1 (ICAR nomination)	Based on entrance test conducted by ICAR

## College of Fisheries

College of Fisheries was established in April, 2008 with the following objectives:

- To develop qualified human resource in fisheries.
- To carry out basic, applied and adaptive research for higher fish productivity.
- To disseminate the developed technologies to the farmers and entrepreneurs for commercial adoption.

The college has competent and experienced faculty and is well equipped with both laboratory and farm facilities to carry out teaching, research and extension activities efficiently. The college offers following programmes of study:

- B.F.Sc.
- M.F.Sc. in Aquaculture
- Ph. D. in Aquaculture
- Post-graduate Diploma in Inland Fisheries (PGDIF)

The curriculum of the four year UG degree programme (B.F.Sc.) is based on recommendations of the 4th Dean's Committee of the ICAR 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 for finfish and shell fishes, aquatic ecology, culture and capture fisheries resources and their management, post-harvest technology, marketing and trading, economics and statistical methods and extension education. During the 7<sup>th</sup> semester the students undergo experiential learning programme (credit Hours- 0+25) at the fish farm, College of Fisheries and take up In-plant training (credit hours- 0+20) in the 8<sup>th</sup> semester which includes practical training at aqua-farms, hatcheries, feed industry, fish markets and processing/value addition units. The curriculum of M.F.Sc and Ph.D in Aquaculture is also based on ICAR recommendations covering both theory and research in the field of advanced aquaculture technologies. One year PG diploma in Inland Fisheries is offered to the in-service candidates of the State Fisheries Department.

### Students Intake Capacity and Entrance Procedure

Programs	Intake Capacity	Mode of Entrance
<b>B.F.Sc.</b>	18 (Open seats for domicile of Punjab State and UT of Chandigarh)	Based on CET merit
	3 (ICAR nomination)	Based on entrance test conducted by ICAR
	2(Kashmiri Migrant)	Based on CET merit
<b>M.F.Sc (Aquaculture)</b>	3	Merit based on qualifying exam
	2 (ICAR nomination)	Based on entrance test conducted by ICAR
<b>M.F.Sc (Fisheries Resource Management)</b>	2	Merit based on qualifying exam
	1 (ICAR nomination)	Based on entrance test conducted by ICAR
<b>PG Diploma in Inland Fisheries (PGDIF)</b>	5 (State Govt. nomination)	Nominations by The Director and Warden of Fisheries, Govt. of Punjab
<b>Ph. D. in Aquaculture</b>	2	Merit based on qualifying exam

### Postgraduate Institute of Veterinary Education and Research

Postgraduate institute of Veterinary Education & Research (PGIVER) has been 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.

#### Objectives:

- To develop and strengthen post graduate education, research and training programs.
- To strengthen embryo transfer technology for better productivity.



- To develop molecular techniques for diagnostics, production of genetically defined marker vaccines, and identification of physiological, biochemical, molecular and cytogenetic markers for early selection of animals and poultry birds in order to produce the quality products and increase the productivity.
- To have super specialty teaching/referral hospital for equine, companion and wild animals.
- To establish a centralized laboratory of international standards to deal with emerging diseases of livestock and poultry.

### **School 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 by upgrading the department with the mandate to integrate and strengthen the 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 School of Animal Biotechnology include:

- To generate scientific expertise and human resource in various facets of animal biotechnology
- To develop specialized and state of 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

The thrust areas in Animal Biotechnology are:

- Animal genomics, proteomics vis-a-vis genetic improvement
- Animal disease diagnostics and vaccinology

Presently the School is offering the following programs of study:

- M.V.Sc./ M.Sc. (Animal Biotechnology)
- 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. The first batch of the students of M.V.Sc./M.Sc. has completed their program in July/August, 2010. School of Animal Biotechnology has been granted accreditation to confer M.V.Sc./ M.Sc. and Ph.D degrees under the aegis of Ministry of Science and Technology.



### Students Intake Capacity and Entrance Procedure

Programs	Intake Capacity	Mode of Entrance
<b>M.V.Sc./M.Sc. (Animal Biotechnology)</b>	<b>6</b>	<b>Merit based on qualifying exam</b>
	<b>1 (ICAR nomination)</b>	<b>Based on entrance test conducted by ICAR</b>
	<b>8</b>	<b>JET of JNU, Delhi</b>
<b>Ph.D. (Animal Biotechnology)</b>	<b>6</b>	<b>Merit based on qualifying exam</b>

### Veterinary Polytechnic, Kaljharani (Bathinda)

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

#### Students Intake Capacity and Entrance Procedure

Program	Intake Capacity	Mode of Entrance
<b>Diploma in Veterinary Science &amp; Animal Health Technology</b>	70	Merit based on qualifying exam
	2	For residents of Kaljharani, Bathinda

### Regional Research and Training Centre at Kaljharani, Bathinda

Keeping in view the decline in Sahiwal cow population in the State due to extensive crossbreeding, the GADVASU has established a regional research station at village Kaljharani (Bathinda) in 2008 for Conservation and Genetic improvement of Sahiwal cattle with the following objectives:

- To conserve Sahiwal cattle.
- To improve its genetic potential for production and reproduction traits.

- To supply semen and bulls of Sahiwal breed to the dairy farmers and to different states for up gradation of local cows of that areas.

The Regional Research and Training Centre at Kaljharani has been strengthened with establishment of herds of Sahiwal cattle, crossbred cattle, Beetal goats, fish unit, vermi-compost unit and honey bee unit for area specific studies and demonstration purposes.

### **Regional Livestock and Poultry Research and Training Centre at Bhatoli (Talwara)**

A regional livestock and poultry research training centre has been established at Bhatoli (Talwara) Dist. Hoshiarpur in 2008 with the following objectives:

- To understand the cattle, buffalo, sheep, goat and fish improvement programs suitable for Kandi area
- To introduce small scale and back yard poultry for economic upliftment of the rural people
- To introduce managerial and nutritional strategies
- To provide extension services to the farmers of Kandi area for livestock rearing.

This centre has been established at Bhatoli (Talwara) in Hoshiarpur district for transfer of the technologies developed by the university to the Kandi area of the State. The agricultural farming system of Kandi area is different from the rest of the State because of the rain fed sub-mountainous area, lack of awareness about improved animal production systems and poor financial resources for managing the input systems. The agro-climatic conditions of Kandi area including the type of feed and fodder resources are also different from those prevailing in other parts of the State. This centre is providing extension services to the farmers for improving the livestock enterprises particularly sheep and goat which can be reared effectively in this area. The centre is also providing a strong supporting hand for the proper implementation of the NAIP sub-project on “Sustainable livestock based farming system for livelihood security in Hoshiarpur district of Punjab”.

## **Regional Research and Training Centre, Booh (Tarn Taran)**

GADVASU has been established with the aim to spearhead research, teaching and extension of emerging issues related to livestock development in the State of Punjab. Recognizes the conservation and proliferation of Nili Ravi as one of its priority areas for research and development, GADVASU has established one Regional Research and Training Centre for conservation, improvement and proliferation of Nili Ravi buffaloes at Booh, Dist. Tarn Taran which is the natural habitat of Nili Ravi buffaloes. The specific objectives of the centre are:

1. To preserve Nili Ravi buffloes
2. To improve its genetic production and reproduction potential
3. To proliferate Nili Ravi germplasm through conventional and modern technology
4. To enhance dairy production and improve socio-economic status of the farmers.

## **Counselling and Placement Cell**

The university has a placement cell which is manned by experienced members well-versed with job opportunities in Veterinary Science, Fisheries and Dairy sector. The placement cell is involved in organizing different activities for the personality development and to provide information and guidance for the better placement of the young graduates of the university. The university has a very impressive track record of placement of its graduates in highly competitive organizations both within and outside the country.



## TEACHING

Academic programs of the university are of high standard and attract students and fellows both at national and international level for education and research.

### Educational Programme(s)

Admissions to the various undergraduate programs of the university, and Diploma for Veterinary Pharmacists were strictly on the basis of entrance examinations conducted by the Controller of Examinations.

### Entrance Tests conducted by Controller of Examinations for admission to various programmes of the University

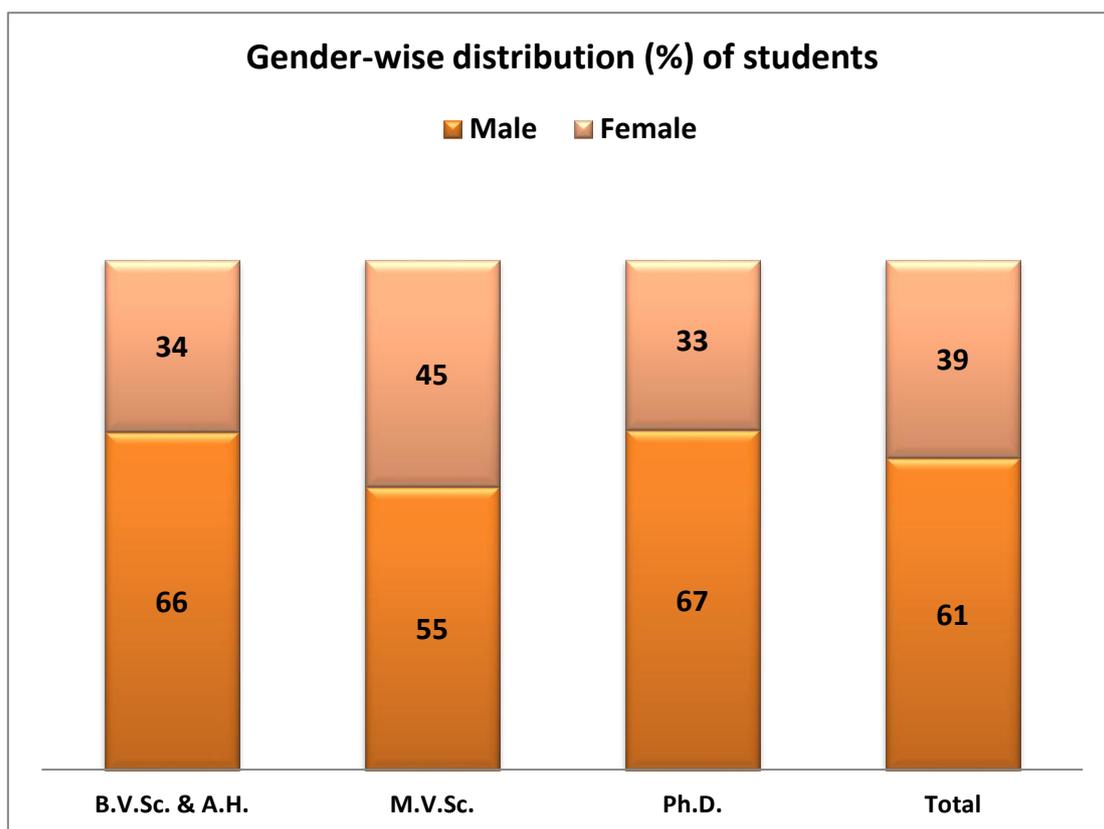
Test	Date of Test	Number of Applications Received	Number of Candidates appeared in the test
<b>Common Entrance Test (CET-2014) for admission to undergraduate programs of the university i.e B.V.Sc. &amp; A.H./ B.F.Sc./ B. Tech (Dairy Technology)</b>	19.06.2014	2711	2456

The detail of admissions made in various undergraduate and postgraduate programmes for the academic session 2014-15 is as below:

Program	General/ Reserve Categories	VCI/ICAR/ JNU/ State Govt. Nominations	NRI Seats/ Foreign Nationals	Total
<b>B.V.Sc. &amp; A.H.</b>	63	08	12	<b>83</b>
<b>B.F.Sc.</b>	15	-	-	<b>15</b>
<b>B. Tech. (Dairy Technology)</b>	27	02	-	<b>29</b>
<b>M.V.Sc./M.Sc. (ABT)/ M.F.Sc. / M. Tech. (Dairy Technology)</b>	79	39	-	<b>118</b>
<b>Ph.D.</b>	32	-	-	<b>32</b>
<b>PG Diploma in Inland Fisheries (PGDIF)</b>	-	5	-	<b>05</b>
<b>Diploma in Veterinary Science Animal Health Technology</b>	80	-	-	<b>80</b>
<b>Grand Total</b>				<b>362</b>

## College of Veterinary Science

The total number of students admitted in the College of Veterinary Science for the session 2014-15 was 211 which included 83 in B.V.Sc. and A.H., 101 in M.V.Sc. and 27 in Ph.D program. Among 211 students admitted, 129 were male and 82 were female. The gender-wise distribution of male and female students admitted in different programmes of College of Veterinary Science is shown as below:



During 2014-15, a total of 133 students' successfully completed their degrees, of which 58, 66 and 9 students completed B.V.Sc. & A.H., M.V.Sc. and Ph. D. programmes in different disciplines, respectively.

### Scholarships/Fellowships

The university awards merit scholarships to students for academic excellence. During 2014-15, University Merit Scholarship was given to 50 undergraduate, 57 M.V.Sc. and 24 Ph.D students. Junior Research Fellowship of ICAR was awarded to 08 M.V.Sc. students and Senior Research Fellowship to two Ph.D students. Inspire Fellowship was awarded by DST to 14 Ph. D. students.

### Courses Taught

The undergraduate students of the college were offered courses as per Veterinary Council of India – Minimum Standards of Veterinary Education Degree Course (B.V.Sc &

A.H.) Regulations, 2008. The students were offered 36 courses in the Semester I and 32 courses in Semester II according to the new guidelines and 11 courses in Semester I and 11 courses in Semester II as per the old guidelines. Postgraduate students were offered courses in their respective major, minor and supporting field as approved by the Dean, Postgraduate Studies.

### Thesis/Dissertations

#### *Master of Veterinary Science*

Sr. No.	Name	Month & Year of completion	Major Subject and Title of Thesis
1.	Priya Gupta	July, 2014	ANIMAL NUTRITION "Bioavailability of zinc from inorganic and organic sources in calves".
2.	Priyanka Rana	July, 2014	LIVESTOCK PRODUCTION MANAGEMENT "Effect of different immunoglobulin sources on performance of beetal kids under stall-fed conditions".
3.	Abhijit Nandi	July, 2014	VETERINARY PARASITOLOGY "Detection of resistance status against synthetic pyrethroids in <i>Hyalomma anatolicum anatolicum</i> from central plain zone of Punjab".
4.	Aleesha Luthra	July, 2014	LIVESTOCK PRODUCTION MANAGEMENT "Studies on some feeding management techniques to design iron enriched egg in white leghorn layers".
5.	Richa Rani	July, 2014	LIVESTOCK PRODUCTS TECHNOLOGY "Development of whey protein concentrate based edible antimicrobial films for shelf life extension of functional chicken meat bullets".
6.	Jyotshna Rani Sarpatia	August, 2014	ANIMAL NUTRITION "Effect of replacement of soybean meal with guar korma on the performance of dairy cows".
7.	Pradeep Kumar M.S.	August, 2014	ANIMAL NUTRITION "Evaluation of some commonly used energy rich feedstuffs for their energy values in dogs".
8.	Divya Gupta	September, 2014	VETERINARY ANATOMY "Histomorphogenesis and histochemical studies on pancreas of buffalo during prenatal life".
9.	Kritima Kapoor	September, 2014	VETERINARY ANATOMY "Histomorphological and histochemical studies on gut associated lymphoid tissue (GALT) in prenatal and neonatal buffalo".



10.	Khushpreet Singh	September, 2014	VETERINARY GYNAECOLOGY & OBSTETRICS “Identification of libido associated metabolites in biofluids of breeding buffalo bulls using nuclear magnetic resonance (NMR)”.
11.	Asima Zehra	September, 2014	VETERINARY PUBLIC HEALTH & EPIDEMIOLOGY “Molecular characterization of antibiotic resistant Staphylococcus aureus of meat origin”.
12.	Krishan Dev	September, 2014	VETERINARY & ANIMAL HUSBANDRY EXTENSION EDUCATION “Study on the feeding practices followed by dairy farmers in different agro-climatic zones of Punjab”.
13.	Simrat Singh Parmar	September, 2014	VETERINARY & ANIMAL HUSBANDRY EXTENSION EDUCATION “Prevalence of common reproductive problems in dairy animals with respect to management practices in different agro climatic zones of Punjab”.
14.	Amritpal Singh	September, 2014	VETERINARY GYNAECOLOGY & OBSTETRICS “Efficacy of melengestrol acetate based synchronization protocols on fertility in postpartum buffaloes”.
15.	Tejbeer Singh	September, 2014	ANIMAL NUTRITION “Effect of niacin supplementation on nitrogen utilization from different NPN sources in buffalo calves”.
16.	Vikram Narula	September, 2014	VETERINARY ANATOMY “Prenatal development of superficial lymph nodes in buffalo (Bubalus bubalis)”.
17.	Karanpreet Kaur	September, 2014	VETERINARY GYNAECOLOGY & OBSTETRICS “Effects of pesticide residues on the reproductive tract of buffaloes”.
18.	Tufail Hussain	September, 2014	VETERINARY MEDICINE “Application of magnet for diagnosis, treatment and prevention of foreign body syndrome in cattle and buffalo”.
19.	Jagpreet Singh	September, 2014	VETERINARY PATHOLOGY “Diagnosis of some important diseases of poultry using immunopathological approaches”.
20.	Manpreet Singh Buttar	September, 2014	VETERINARY SURGERY & RADIOLOGY “Effect of dobutamine and epinephrine for maintenance of cardiovascular parameters in bovine subjected to general anaesthesia.



21.	Gurlal Singh	September, 2014	VETERINARY PUBLIC HEALTH & EPIDEMIOLOGY “Prevalence and molecular characterization of group a rotavirus among neonatal calves and children and its public health significance”.
22.	Mitali Mehta	September, 2014	VETERINARY MEDICINE “Diagnosis and management of common endocrinopathies in dogs”.
23.	Patil Nilesh Ramesh	September, 2014	VETERINARY MEDICINE “Use of endoscopy in respiratory diseases of dogs”.
24.	Suresh Gonde	September, 2014	VETERINARY MEDICINE “Studies on clinico-haemato-biochemical changes and therapeutic management of babesiosis in dogs”.
25.	Priyanka Biswas	September, 2014	VETERINARY PHARMACOLOGY & TOXICOLOGY “Influence of ketoprofen administration on the disposition of cephalosporins in buffalo calves”.
26.	Mandeep Kaur Sran	September, 2014	VETERINARY PUBLIC HEALTH & EPIDEMIOLOGY “Molecular characterization of Listeria spp. Prevalent in Fish, Pork and Chicken Meat”.
27.	Ravneet Kaur	September, 2014	VETERINARY SURGERY AND RADIOLOGY “Diagnostic approaches to gastrointestinal hepatic and splenic affections in dogs, with special reference to doppler studies”.
28.	Jasveer Singh	September, 2014	VETERINARY GYNAECOLOGY & OBSTETRICS “Immunomodulation therapy as an alternative approach to antibiotic therapy in endometritic dairy cattle”.
29.	Langnyei L. Phom	September, 2014	VETERINARY PATHOLOGY “Studies on immunopathological and molecular approaches for the diagnosis of bovine tuberculosis”.
30.	Anil Kumar	September, 2014	VETERINARY SURGERY & RADIOLOGY “Studies on ultrasonographic diagnosis and prognosis of intestinal obstruction in bovine”.
31.	Kose Megha Shriram	September, 2014	VETERINARY GYNAECOLOGY & OBSTETRICS “Effect of progesterone levels during dominant follicle development on fertility in buffalos”.
32.	V. Zodinsanga	September, 2014	VETERINARY GYNAECOLOGY & OBSTETRICS “Antisperm antibodies in blood serum and seminal plasma of cross-bred cow bulls in relation to semen characteristics”.

33.	Sumiyah Rasool	September, 2014	VETERINARY MICROBIOLOGY “Studies on diagnosis of mycobacterium avium subsp. paratuberculosis in cattle and buffaloes and its differentiation from non-tuberculous mycobacteria (NTM)”.
34.	Navjot Kaur	September, 2014	VETERINARY PUBLIC HEALTH & EPIDEMIOLOGY “study on occurrence of organochlorine pesticides and polychlorinated biphenyl residues levels in market fish and their public health significance”.
35.	Chaudhari Mehulkumar Ramabhai	October, 2014	VETERINARY MICROBIOLOGY “Studies on molecular diagnosis and vaccination against Pasteurella multocida infection”.
36.	Manoj Kumar	October, 2014	VETERINARY PATHOLOGY “Determination of important markers of drug resistance in canine mammary tumour(s) ”.
37.	Mohsina Mushtaq	October, 2014	VETERINARY MEDICINE “Mineral imbalances and efficacy of area specific mineral mixture in dairy animals of sub-mountainous zone of Punjab”.
38.	Dibyajyoti Hazarika	October, 2014	VETERINARY MICROBIOLOGY “Studies on prevalence of brucellosis in dairy animals and dogs using conventional and molecular techniques with special emphasis on canine brucellosis”.
39.	Monteiro Raisa Bebiana Theresa	October, 2014	VETERINARY PHARMACOLOGY & TOXICOLOGY “Amelorative effect of $\alpha$ – tocopherol on enrofloxacin induced testicular toxicity in rats”.
40.	Moon Shilpa Laxmanrao	October, 2014	VETERINARY PUBLIC HEALTH & EPIDEMIOLOGY “Studies on antibiotic residues in chicken and its public health significance”.
41.	Amarinder Jit Singh Brar	October, 2014	LIVESTOCK PRODUCTION MANAGEMENT “Effect of weaning age on performance of beetal kids under stall-fed conditions”.
42.	Vikas Kumar	October, 2014	LIVESTOCK PRODUCTS TECHNOLOGY “Studies on the synergism of various bioactive phyto-extracts as an antioxidant in functional pork patties”.
43.	Manoj Kumar	October, 2014	VETERINARY PATHOLOGY “Comparison of molecular and immunopathological approaches for diagnosis of rabies from saliva and urine”.
44.	Devendra Kumar Gupta	October, 2014	ANIMAL NUTRITION “Effect of choline and rumen protected choline with varying energy levels on the performance of crossbred cows during transition period”.



45.	Inderpreet Singh	October, 2014	VETERINARY ANATOMY “Prenatal development of gonads in buffalo during early foetal life”.
46.	Devinder Singh	October, 2014	VETERINARY GYNAECOLOGY & OBSTETRICS “Assessment of vascularization to the female genitalia during estrous cycle in dairy buffaloes”.
47.	Sadanand Khandekar	October, 2014	VETERINARY GYNAECOLOGY & OBSTETRICS “Studies on histo-morphological and hormonal alternations in buffaloes having incomplete cervical dilatation”.
48.	Khalid Omer	October, 2014	VETERINARY SURGERY & RADIOLOGY “Doppler sonography of major abdominal vessels vis-à-vis renal affections in dogs”.
49.	Karandeep Kaur Mann	October, 2014	VETERINARY SURGERY & RADIOLOGY “Ultrasonographic evaluation of renal blood flow and associated changes in canine renal affections”.
50.	Gauravdeep Singh	November, 2014	VETERINARY PHARMACOLOGY & TOXICOLOGY “Influence of nimesulide administration on rational selection of ceftiofur for its use as antimicrobial agent against Pasteurella multocida in goats”.
51.	Virendra Singh	November, 2014	VETERINARY PUBLIC HEALTH & EPIDEMIOLOGY “Monitoring of persistent organic pollutants (POPs) in farm fish, sediments and water from different agroclimatic zones of Punjab”.
52.	Prabhjot Kaur	November, 2014	VETERINARY MEDICINE “Monitoring effectiveness of defluoridated drinking water in fluorotic dairy animals of Punjab”.
53.	Pompi Deuri	November, 2014	VETERINARY BIOCHEMISTRY “In vitro methane mitigation potential of tree leaves”.
54.	Yanglem Pushpa	November, 2014	VETERINARY MICROBIOLOGY “Immunological evaluation of a new phage lysate vaccine for haemorrhagic septicemia”.
55.	Daptardar Monal Ajit	November, 2014	VETERINARY PUBLIC HEALTH & EPIDEMIOLOGY “Prevalence and molecular studies on Sarcocystis Species in cattle and water buffaloes”.
56.	Khushwinder Singh	November, 2014	VETERINARY & ANIMAL HUSBANDRY EXTENSION EDUCATION “Reactions of the trainees about dairy entrepreneurship training course organised by Punjab Dairy Development Board at Bija, Ludhiana”.



57.	Jayaveer Singh Tomar	November, 2014	VETERINARY PUBLIC HEALTH & EPIDEMIOLOGY “Isolation and molecular characterization of antibiotic resistant staphylococcus aureus from community setting”.
58.	Satinderpal Singh	November, 2014	VETERINARY SURGERY & RADIOLOGY “Studies on diagnosis and surgical management of ophthalmic affections in dogs”.
59.	Vikrant Jarora	December, 2014	VETERINARY GYNAECOLOGY & OBSTETRICS “Antisperm-antibodies: Cause of repeat breeding in cross bred cows”.
60.	Mandeep Kaur	December, 2014	VETERINARY PUBLIC HEALTH & EPIDEMIOLOGY “Molecular studies on zoonotic coccidian parasites in pigs and its public health significance”.
61.	Mandeep Singh	December, 2014	VETERINARY & ANIMAL HUSBANDRY EXTENSION EDUCATION “Studies on pig management practices vis a vis production and reproductive efficiency in different zones of Punjab”.
62.	Arvind Bagga	February, 2015	VETERINARY MEDICINE “Biochemical and ultrasonographic studies on foot lameness in dairy cattle”.
63.	Varinder Singh Raina	February, 2015	ANIMAL GENETICS & BREEDING "Studies on genetic and non-genetic factors affecting breeding efficiency in dairy cattle and buffaloes"
64.	Tejinder Singh	February, 2015	LIVESTOCK PRODUCTS TECHNOLOGY “Processing quality and storage stability of functional chicken meat cutlets”.
65.	Jaspreet Kaur	February, 2015	VETERINARY MEDICINE “Status of heavy metals and pesticide residues and their effect on dairy animal health in South-west Punjab”.
66.	Karamdeep Singh	February, 2015	VETERINARY MEDICINE "Cow hygiene scores and pre milking teat preparation as indicators of udder health and milk quality at dairy farms"
67.	Ravneek Singh	March, 2015	VETERINARY MEDICINE "Surveillance and clinic-haematological studies on heavy metal status in dairy animals inhabiting Budha Nallah area of Ludhiana district of Punjab".
68.	Gagandeep Singh	March, 2015	VETERINARY PARASITOLOGY “Prevalence of equine gastrointestinal parasitism with special reference to strongylosis in central plain zone of Punjab”.

**Ph. D. Program**

Sr. No.	Name	Month & Year of completion	Major Subject and Title of Thesis
1.	Gagandeep Singh	May, 2014	VETERINARY MEDICINE “Metabolic profiling, therapeutic and prophylactic studies on metabolic diseases in crossbred cows from Punjab”.
2.	Neetu Saini	May, 2014	VETERINARY MEDICINE “Diagnosis and therapeutic management of myocardial and valvular diseases in dogs”.
3.	Paramjit Kaur	June, 2014	VETERINARY PARASITOLOGY “Studies on molecular based diagnostic assay and clinico-pathobiochemical findings in <i>Babesia bigemina</i> infection in dairy animals”.
4.	Gadhawe Prashant Dattatray	June, 2014	VETERINARY PATHOLOGY “Clinicopathological studies on $\lambda$ -cyhalothrin and lead toxicities in fish.”
5.	Sabia Qureshi	August, 2014	VETERINARY MICROBIOLOGY “Studies on the development of a DIVA assay for Haemorrhagic septicaemia”.
6.	Anita Tewari	September, 2014	VETERINARY PUBLIC HEALTH “Studies on immunotoxicity induced by lindane and deltamethrin in Mice Model and its public health significance”.
7.	Ashuma Tuli	October, 2014	VETERINARY PARASITOLOGY “Studies on molecular diagnosis of theileria annulata in dairy animals of Punjab”.
8.	Jaswinder Singh	February, 2015	ANIMAL NUTRITION “Herbal feed additives as alternatives to antibiotic growth promoters in broilers”.
9.	Wagh Rajesh Vishwanath	February, 2015	LIVESTOCK PRODUCTS TECHNOLOGY “Development and storage stability of functional pork frankfurters with the incorporation of various bioactive phyto-ingredients”.
10.	Nameirakpam Umeshwori Devi	March, 2015	VETERINARY SURGERY AND RADIOLOGY “Studies on biological osteosynthesis of canine diaphysial fractures using C-arm image intensifier and intramedullary fixation devices”.
11.	Devendra Pathak	March, 2015	VETERINARY ANATOMY “Histomorphochemical and ultrastructural characterization of hypothalamo-hypophyseal – ovarian axis in Indian buffalo ( <i>Bubalus bubalis</i> )”.
12.	Ashwani Kumar Singh	March, 2015	VETERINARY GYNAECOLOGY & OBSTETRICS “Purification and characterization of heparin binding proteins and their correlation with sperm function vis-à-vis fertility in buffalo bull semen”.



13.	Randhir Singh	March, 2015	VETERINARY MEDICINE “Prediction and management of metabolic diseases in dairy cows and buffaloes”.
14.	Amandeep Singh	March, 2015	VETERINARY ANATOMY “Histomorphological, histochemical and ultrastructural studies on prenatal development of major salivary glands in buffalo ( <i>Bubalus bubalis</i> )”.

### **Internship Programme**

After completion of course work in nine semesters, 53 B.V.Sc. and A.H students of 2009 batch were registered to the internship programme. The students underwent training program in 6 departments (Veterinary Medicine, Epidemiology and Preventive Medicine, Veterinary Surgery and Radiology, Veterinary Gynaecology and Obstetrics, Livestock Production Management and Teaching Veterinary Clinical Complex) for a period of 6 months. The oath taking ceremony was organized on 31-1-15.

### **All India Study Tour**

Seventy six students of B.V.Sc.&A.H. participated in all India Study Tour from January 2-14, 2015. The students visited various Veterinary Colleges, National Institutes, Laboratories and places of academic interest at Mumbai, Goa, Bengaluru and Hyderabad.

### **Teaching Veterinary Clinical Complex (TVCC)**

The location of different units of Veterinary Clinics and various clinical departments at one place has provided a well integrated and coordinated approach to the diagnosis and treatment of diseases in small and large animals. The department also provides physical facilities for training of undergraduate and postgraduate students; organizes internship programme, provides regular ambulatory service to rural areas; organizes training courses for the field Veterinarians and animal owners; organizes exhibitions at Kisan Melas, Kisan Diwas etc., and provides mass communication through radio, television and printed literature. In addition to specialized services for disease diagnosis and treatment of animals, TVCC provides 24 hrs emergency services to the farmers and pet owners.

### Clinical cases registered in Teaching Veterinary hospital from Jan to Dec, 2014

Deptt	Small animals	Large animals
Medicine	14092	4212
Surgery	4728	2328
Gynecology & Obstetrics	596	946
<b>Total</b>	<b>19416</b>	<b>7486</b>
<b>Grand Total</b>	<b>26902</b>	

### Total number of clinical laboratory samples processed from Jan to Dec, 2014

Pathology	Parasitology	Biochemistry	Total
7364	3822	2467	13653

### R&V Sqn NCC Unit

1<sup>st</sup> Punjab R&V Sqn NCC is an integral part of College of Veterinary Sciences, GADVASU, is entrusted with the task of imparting infantry as well as equestrian training to NCC cadets enrolled with this unit. Various NCC Trg activities performed by the NCC cadets of 1 Punjab R&V Sqn NCC, GADVASU- Ludhiana during the year 2014-15, are as under:-

- 53 Cadets (SD 30+ SW 23) of this unit attended Annual Training Camp w.e.f. 12.10.2014 to 21.10.2014 at NCC Academy, Malout. During the camp the cadets were imparted rigorous training in Drill, Physical training, lectures on basic army training, equitation and firing etc.
- These cadets won a total of 124 medals for the Unit in various events like, Drill, Shooting and other cultural activities. The Camp Commandant also wrote a commendation letter to Worthy Vice-Chancellor praising the discipline and performance of the cadets.
- 10 SD cadets of this unit attended Army Attachment Camp w.e.f. 20/01/2014 to 02/02/2014 held at Ferozpur Cantt.



- NCC week was celebrated from 18/11/2014-24/11/2014 in which cadets of College of Vety. Science performed in various activities like Painting competition, Declamation, awareness rallies against social evils and Run for fun and good health.
- Three cadets of the unit participated in various equestrian activities during Republic Day Camp and Prime Minister Rally which was held from 1/1/2015 to 31/1/2015. The cadets won two Gold Medals in the Republic day camp.
- 61 cadets appeared for NCC “B” certificate exam held on 15/2/2015 at CG Complex, Ludhiana.

### **College of Dairy Science and Technology**

During the session 2014-15, the total admissions made in undergraduate programme in B. Tech. (Dairy Technology) were 29. Among these 26 were male students and 3 were female students. In postgraduate program 6 students were admitted in M.Tech/M.Sc. out of which 4 were male and 2 were female students.

#### **Courses Taught**

The undergraduate students were offered courses as per the recommendations of 4<sup>th</sup> Dean’s committee constituted by ICAR, New Delhi. The B. Tech. students were offered 22 courses in 1<sup>st</sup> Semester and 22 courses in 2<sup>nd</sup> semester. M.Tech/M.Sc. students were offered 16 courses in 1<sup>st</sup> Semester and 8 courses in 2<sup>nd</sup> semester.

### **College of Fisheries**

Total number of students admitted during 2014-15 in various programs of College of Fisheries were 28, which included 15 in B.F.Sc. 8 in M.F.Sc. and 5 in PGDIF. Out of these, 14 were male and 14 female students. The percentage of girl students in B.F.Sc. was 50 per cent.

#### **Scholarships/Fellowships**

University Merit Scholarship/Fellowship was given to 14 undergraduate, one postgraduate and one doctoral student. ICAR Scholarship (NTS) was given to four undergraduate students.

#### **Courses Taught**

The undergraduate students of the college were offered courses as per recommendations of the 4<sup>th</sup> Dean’s Committee of the ICAR. The students were offered 23 courses in the Semester I and 25 courses in Semester II. Postgraduate students were offered courses in their respective major, minor and supporting field as approved by the Dean, Postgraduate Studies.

## Thesis/Dissertations

### M.F.Sc. in Aquaculture

Sr. No.	Name	Month & Year of completion	Major Subject and Title of Thesis
1.	Harsimranjit Kaur	November, 2014	AQUACULTURE “Efficacy of manuring and harvesting schedule on quality and quantity of <i>Azolla</i> production”.
2.	Neha Sharma	November, 2014	AQUACULTURE “Effect of sugarcane by-product-pressmud incorporated diets in semi-intensive carp polyculture system”.
3.	Rajni Bala	November, 2014	AQUACULTURE “Productivity of Indian major carps in a periphyton based semi-intensive polyculture system”.

### All India Study Tour

All India Compulsory Educational Tour of 15 days was conducted for 14 B.F.Sc. final year and five PGDIF students from Jan 8-22, 2015 under the supervision of Dr Akhil Gupta (Tour In-charge) and Dr V. I. Kaur (Tour Supervisor). The students visited different national institutes like Indian Agricultural Research Institute (IARI), New Delhi; Central Inland Fisheries Research Institute (CIFRI), Barrackpore, West Bengal; Central Institute of Fisheries Education (CIFE) Regional Centre, Kolkata, West Bengal; Central Institute of Freshwater Aquaculture (CIFA), Kausalyaganga, Bhubaneshwar, Odisha; Central Institute of Fisheries Technology (CIFT), Kochi, Kerala; Central Marine Fisheries Research Institute (CMFRI), Kochi, Kerala; Marine Products Export Development Authority (MPEDA), Kochi, Kerala. Exposure lectures on current issues in Fish and Fisheries and visits were arranged to make students aware of various ongoing teaching, research, extension and developmental activities in these institutes. Students also visited fish landing sites, fishing vessels and fish processing unit along with fish museums and aquarium houses.

### School of Animal Biotechnology

Total number of students admitted for the session 2014-15 was 8 which included 3 in M.V.Sc./M.Sc. and 5 in Ph.D. Among these 5 students were girls.

### Courses Taught

A total of 21 courses were offered during the year which included one for UG, 14 for Masters and 6 for PhD.

**Thesis/Dissertations***M.V.Sc./M.Sc. Animal Biotechnology*

<b>Sr. No.</b>	<b>Name</b>	<b>Month &amp; Year of completion</b>	<b>Major Subject and Title of Thesis</b>
1	Rulee Basumatary	May, 2014	ANIMAL BIOTECHNOLOGY “Establishment of canine cells constitutively expressing canine signaling lymphocyte activation molecule (SLAM)”.
2	Upkardeep Singh Pandher	August, 2014	ANIMAL BIOTECHNOLOGY “Effect of endotoxins on the viability and apoptotic potential of buffalo neutrophils”.
3	Neeraj Chaudhary	September, 2014	ANIMAL BIOTECHNOLOGY “Expression profiling, cloning and characterization of the cDNA encoding erythroblastic leukemia viral oncogene homolog2 (ERBB2) from canine tumor”.
4.	Rajinder Kaur	October, 2014	ANIMAL BIOTECHNOLOGY “Cloning and sequence analysis of glycoprotein E gene of field isolated Marek's disease virus”.
5.	Kamaljeet Kaur	October, 2014	ANIMAL BIOTECHNOLOGY “Cloning and sequencing and bio-computational characterization of cathelicidin coding region in sheep ( <i>Ovis aries</i> )”.
6.	Amrit Preet Singh	October, 2014	ANIMAL BIOTECHNOLOGY “Seroprevalence of Hepatitis E virus in swine population of Punjab”.
7.	Mehak	November, 2014	ANIMAL BIOTECHNOLOGY “Cloning, expression and characterization of classical swine fever (CSF) E2 recombinant protein as a potential diagnostic antigen”.
8.	Arif Ahmad Pandit	July, 2014	ANIMAL BIOTECHNOLOGY “Expression of TLR-4 and TNF- $\alpha$ in lungs of mice after exposure to imidacloprid.”
9.	Shahid Hussain	July, 2014	ANIMAL BIOTECHNOLOGY “Cloning, sequence analysis and expression of cathelicidin coding sequence in Indian water Buffalo ( <i>Bubalus bubalis</i> )”.
10	Irfan Ahmad Mir	August, 2014	ANIMAL BIOTECHNOLOGY “ <i>In Vitro</i> differentiation and characterization of canine adipose derived stem cells (cASCs)”
11	Ayesha Sultana	September, 2014	ANIMAL BIOTECHNOLOGY “Development and characterization of induced pluripotent stem cells from canine adult somatic cells”.
12	Neeraj Chaudhary	September,	ANIMAL BIOTECHNOLOGY “Expression profiling, cloning and



		2014	characterization of the cDNA encoding erythroblastic leukemia viral oncogene homolog2 (ERBB2) from canine tumor”.
13	Rajinder Kaur	October, 2014	ANIMAL BIOTECHNOLOGY “Cloning and sequence analysis of glycoprotein E gene of field isolated Marek's disease virus”.
14	Amrit Preet Singh	October, 2014	ANIMAL BIOTECHNOLOGY “Seroprevalence of Hepatitis E virus in swine population of Punjab”.
15	Mehak	November, 2014	ANIMAL BIOTECHNOLOGY “Cloning, expression and characterization of classical swine fever (CSF) E2 recombinant protein as a potential diagnostic antigen”.

*Ph. D. Program*

Sr. No.	Name	Month & Year of completion	Major Subject and Title of Thesis
1.	Daljit Kaur	September, 2014	ANIMAL BIOTECHNOLOGY “Development and evaluation of recombinant antigen based enzyme linked immunosorbent assay (ELISA) for serodiagnosis of Leptospirosis”.
2.	Gagandeep Kaur	September, 2014	ANIMAL BIOTECHNOLOGY “Development and evaluation of recombinant antigen based enzyme linked immunosorbent assay (ELISA) for serodiagnosis of brucellosis”.

### **Veterinary Polytechnic, Kaljharani**

During the session 2014-15, the total admissions made in undergraduate programme in Diploma in Veterinary Science and Animal Health Technology were 80. All the candidates admitted were male students.

### **Courses Taught**

The diploma students were offered offered 11 courses in 1<sup>st</sup> Semester 11 courses in 2<sup>nd</sup> semester.

## 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 2014-15, a total of 132 research schemes were operational in the university as detailed below:

Schemes/Projects	Number
<b>Non Plan Schemes</b>	46
<b>ICAR Schemes</b>	16
<b>UGC</b>	27
<b>DBT</b>	9
<b>DST</b>	8
<b>Ministry of Food Processing of India</b>	3
<b>ICMR</b>	2
<b>Revolving Fund Schemes</b>	4
<b>Miscellaneous Schemes</b>	12
<b>RKVY Schemes</b>	4
<b>Total</b>	131

### Research Highlights

#### College of Veterinary Science

##### Animal Genetics and Breeding

###### *Cattle Breeding*

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 as 5,222 kg and 25.7 kg, respectively with the wet average of 13.35 kg. The average 305 days milk yield and complete lactation yield of the elite herd being used for the production of future crossbred bulls was 6,595 and 7,891 kg, respectively with the peak yield of 34.6 kg. Maximum 305-day milk yield and peak yield recorded were 7,104 kg and 51.5 kg, respectively in the herd. The average age at first calving in crossbred cattle is achieved to 28.1 months. Twelve breeding bulls/male calves, 24,518 doses of frozen semen and 2,670 doses of chilled semen were supplied to the farmers and other dairy development agencies of the state.



### *Buffalo Breeding*

Average 305-day milk yield of general herd of buffaloes was 2,665 kg with lactation milk yield of 3,081 kg. The 305-day milk yield, lactation milk yield and peak yield in elite herd which is used for production of future young sires were 3,390 kg and 4,082 kg and 17.2 kg, respectively. The maximum 305-day milk yield and peak yield were recorded 4,284 kg and 21.5 kg respectively in the herd.

Bull No. M 2045 of Set no. 10 under Network Project on Buffalo Improvement (Main Unit) is ranked 2<sup>nd</sup> among all the progeny tested bulls of the set in the Network Project. In the 15<sup>th</sup> set, 6 buffalo bulls were selected under the Network Project on Buffalo Improvement. 34,440 doses of frozen semen and 1,604 doses chilled semen were supplied to the farmers and other dairy development agencies for improvement of buffalo population in the state. About 18 buffalo breeding bulls/bull calves were sold to farmers for breeding purposes.



### *Conservation and improvement of Nili Ravi buffalo*

The present herd strength of Nili Ravi Buffaloes is 108 with 73 breedable buffaloes. The average 305-day milk yield and complete lactation yield were 2,285 kg and 2,514 kg, respectively. One of the Nili Ravi buffalo produced 2,697 kg milk in 305 d lactation length and 3,180 kg milk in complete lactation with peak yield of 15.5 kg, which is comparable to the best yield of any of the buffalo breeds. Dissemination of germplasm being one of the foremost priorities, efforts have been initiated right from the inception of the project to pay emphasis to this aspect and one breeding bull/bull calves were supplied to progressive dairy farmers.



### *Layer Breeding*

Rhode Island Red female lay tinted (brown) eggs and are thus popular in rural areas of the state. It lays 260 eggs in a year with an average egg weight of 54 g.

### *Broiler Breeding*

Commercial broiler (IBL-80) attains average 6-week body weight of 1600-1700 g with a feed efficiency of 1.9 and the mortality of <5%. The egg weight remained more or less static but egg production to 52 weeks of age significantly improved.

### *Quail Breeding*

Average 5-week body weight of the commercial crosses is about 240 g. 'Punjab White Quail' has average egg weight of 13 g and their eggs are used for preparation of pickles.

## **Animal Nutrition**

### *Bioavailability of zinc in calf starters and TMR*

*In vitro* studies regarding the bioavailability of organic zinc ( $Zn_o$ ) over inorganic Zn ( $Zn_i$ ) indicated no correlation of source and level of zinc on neutral detergent fibre (NDF) digestibility, organic matter digestibility (OMD), net gas production (NGP) in the  $Zn_o/Zn_i$  based calf starters but microbial mass production (MMP) and its efficiency (EMMP) was lowest in 0.4% Zn containing calf starters irrespective of form of Zn. The NGP was lowest in total mixed ration (TMR) with mineral mixture containing 0.8%  $Zn_i$  and highest in 0.4%  $Zn_o$  and  $Zn_i$  combination. The calf starter and TMR with  $Zn_i$  and another with  $Zn_o$  produced more acetic acid, propionic acid and total volatile fatty acids (VFA). *In vivo* study in buffalo calves indicated numerically higher body weight and body measurements in organic  $Zn_o$  containing TMR with higher digestibility of dry matter and other nutrients.

### *Guar as replacement of soya bean meal in concentrates*

Guar-korma, roasted guar-korma and guar-churi could be added up to 7-8% level in the concentrate mixture in place of soya bean meal without any adverse effect on the feed intake, nutrient utilization and health of the animals.

### *Evaluation of low- and high-energy ration*

Two isonitrogenous TMR's with low (1.26 Mcal/kg  $NE_L$ ) and high (1.50 Mcal/kg  $NE_L$ ) energy levels and supplemented with different levels (0, 50, 75 and 100 ppm of concentrate) of choline chloride were subjected to *in vitro* gas production method. No difference was observed in any *in vitro* parameter (except PF) at any level of supplemented choline chloride with either low- or high-energy ration indicating no significant effect of supplemented choline. Metabolizable energy (ME), NGP, OMD, neutral detergent fiber degradability (NDFD), true digestibility (TD) and short chain fatty acid (SCFA) were high for high energy ration while microbial mass production MMP and EMMP were high for low energy ration.

### *Niacin supplementation in buffalo calves*

Niacin supplementation at varying levels of 0, 200, 400 and 600ppm in total mixed ration (TMR) consisting of 60% roughages and 40% concentrates having different NPN sources (urea, uromol and slow release urea) replacing at 10, 20 and 30% of total CP of ration on nitrogen utilization was investigated. Supplementation of niacin at 600ppm either in slow release urea replacing upto 30% of total CP of ration in buffalo calves fed on TMR did not have any effect on daily feed intake, digestibility, nitrogen retention.

### *Bypass fat with niacin for high yielding crossbred cows*

The supplementation of bypass fat @ 200g/d along with 12g niacin improved the lactation and reproductive performance as well as blood glucose and cholesterol without affecting digestibility of nutrients. Thus, supplementation of bypass fat could be a cost effective measure to improve production and health in high producing dairy cows.

### *Rumen Protected Choline (RPC) supplementation in high yielding crossbred cows*

Feeding of high milk yielding crossbred cows with high NE<sub>L</sub> (8.12 MJ/kg) or low NE<sub>L</sub> (6.81 MJ/kg) with or without RPC @ 750mg per 100g (75 ppm) of concentrate in their ration was started 21 days before expected date of parturition and continued upto 10 days after calving. After 10 days of calving all the cows were given same lactation diet. RPC supplementation before calving increased the blood glucose and lowered plasma triglycerides, thereby improving the metabolic health status during transition period. Feeding of RPC during transition period starting from -21 d to +10 d improved average milk yield, peak milk yield and metabolic health status of the high yielding dairy cows in both low and high energy rations.

### *Impact of fermentation on quality and nutritional worth of straws*

Methane produced by rice straw at  $t^{1/2}$  was high compared to wheat straw (1.55 vs 1.45 ml/mg digestible OM). Availability of ME from fermented wheat straw was higher than fermented rice straw. The NGP, digestibility of nutrients and ME availability were higher in fermented straws as compared unfermented straws. The methane production estimated at  $t^{1/2}$  was low in fermented straws as compared to their unfermented counterparts (1.76 vs 1.24 ml/mg digestible OM). Fermentation increases rapidly soluble fraction, insoluble but potentially degradable fraction and effective degradability as compared to unfermented straws. Wheat straw as compared to rice straw had lower methane production potential. Natural fermentation of straws with urea not only depressed *in vitro* methane production but also improved the quality and nutritional worth of straws.

### *Urea molasses multi-nutrient blocks (UMMB) containing agro-industrial wastes*

Nutritional worth of conventional UMMB with UMMB containing spent sugar syrup (SSP) from aamla (*Phyllanthus emblica*) preserve (*murabba*) industries, sundried waste bread (WB) and/or tomato pomace (TP) was evaluated in male murreh buffaloes. Wheat flour and oil mustard cake in the conventional UMMB was replaced, respectively, with WB and TP on nitrogen basis, while molasses was replaced by SSS on weight-by-weight basis. In addition to the respective UMMBs for 45 days, the animals were offered 1 kg conventional concentrate mixture, 5 kg green fodder and 9 kg wheat straw. The daily intake of block varied from 0.49 kg (SSS-UMMB) to 1.08 kg (conventional-UMMB). It was concluded that agro-industrial wastes like spent sugar syrup, waste bread and tomato pomace could be incorporated into UMMBs without any adverse effect on palatability, nutrient utilization or health of animals. Above all the preparation of UMMB could be economized and conventional ingredients could be spared for more vulnerable species.

### *Impact of sun dried whole leaf aloe vera powder on commercial broilers*

The sun dried whole leaf aloe vera powder was evaluated as phyto-genic alternative to antibiotic growth promoters in broilers. The dietary treatment of one-day-old broiler chicks (IBL 80) comprised of basal diet as control, antibiotic group receiving 0.1g/kg of oxytetracycline, whole leaf aloe vera powder @ 1.0, 1.5 and 2.0% was added to basal diet. At the end of 5<sup>th</sup> week, supplementation of whole leaf aloe vera powder has no effect on the weight gain and final body weight. However, FCR was lower in 1.0 and 1.5% whole leaf aloe vera powder supplemented groups. Dietary treatment does not influence the carcass parameters except the relative heart and gizzard weight. Supplementation of whole leaf aloe vera powder improved the overall acceptability of meat.

### *Graded level of black pepper powder (BPP) as phyto-genic growth promoter in commercial broilers*

The dietary treatments to one-day-old broiler chicks (IBL 80) comprised of basal diet as control, antibiotic group receiving 0.1g/kg of oxytetracycline, and 0.5, 1.0, and 1.5% of BPP added to basal diet. At the end of 5<sup>th</sup> week, the results revealed that inclusion of BPP @ 0.5% level improved weight gain, feed conversion ratio and protein efficiency ratio as compared to other treatment including antibiotic fed group. The dietary regimes failed to affect the carcass parameters studied except the heart weight. Black pepper powder supplementation improved the appearance, colour and over all acceptability score of meat. Blood parameters data revealed improvement in haemoglobin and reduction in triglycerides and cholesterol level in BPP supplemented groups. BPP supplementation affected the fat digestibility and calcium

retention. Perusal of data revealed that BPP @ 0.5% can be a good phyto-genic alternative to the antibiotic growth promoters.

### **Livestock Production Management**

#### *Impact of immunoglobulin sources on performance of Beetal kids under stall-fed conditions*

The efficacy of dam's serum was better than artificial colostrum or goat milk and almost similar to natural colostrum in terms of IgG absorption. Furthermore, Dam's serum may be a good alternative if natural colostrums is not available.

#### *Designing of iron enriched egg in white leghorn layers*

Iron enriched eggs can be produced by supplementation of organic or inorganic iron through feed. Iron supplementation through feed enriches egg iron to the extent of 40-60% and it has no untoward effect on body weight, body temperature, haematology and biochemical profile, therefore, on bird's welfare. Winter season is comparatively more conducive period than hot-humid summer for iron enrichment of egg.

#### *Impact of weaning age on performance of beetal kids under stall-fed conditions*

Early weaning at 60-days of age was able to maintain growth performance in terms of ADG, growth rate without negative effects on morbidity and mortality rate of kids parallel to conventional weaning at 90 days of age. The production advantages of having beetal dams in moderate to high body condition at the next kidding cycle may improve conception rates, decreased reproductive culls and supplementation cost of nursing the kids and weaning weight in the next kidding. While designing early-weaning rations, particularly for kids weaned at 60-75 days of age, consideration of level of concentrate, fodder, protein and palatability and evaluation of the cost associated with supplementation and extra management will be of paramount importance.

### **Livestock Products Technology**

#### *Pure cultures of food spoilage and pathogenic organisms*

Pure cultures of nine different food spoilage and pathogenic organisms are being maintained in the department by regular passaging and made available to other departments of GADVASU. The inoculation dose (cfu/ml) of inoculum was optimized on the basis of cell number in the inoculums.

#### *Chitosan-based edible films for extending shelf life of meat based products*

The processing technology for the chitosan-based edible films was standardized using response surface methodology with 2.0% chitosan, 0.75% glycerol and drying temperature of 40°C was selected. The developed films were completely degraded within 21-27 days after shrinkage.

Minimum Inhibitory concentration (MIC) of Lemon grass oil, coumarin, cinnamaldehyde, seabuckthorn seed extracts, nisin, eugenol, grape seed extract and green tea extract, aloe vera powder was evaluated against *Staphylococcus aureus*, *Bacillus cereus*, *Listeria monocytogenes*, *Escherichia coli*, *Yersinia enterocolitica*, *Salmonella typhimurium*, *Vibrio parahaemolyticus*, *Shigella flexneri* and *Klebsiella pneumonia* using broth dilution method and zone inhibition assays. The antimicrobial efficacy of chitosan based edible film matrix material was enhanced with the incorporation of 1.0% v/v eugenol and 50 mg/g potassium sorbate against food pathogenic and spoilage bacteria namely *Escherichia coli*, *Staphylococcus aureus* and *Listeria monocytogenes*. The antimicrobial efficacy of bioactive films incorporated with different levels of nisin and lemon grass oil (*Cymbopogon citratus*) against food spoilage and pathogenic microorganism was compared and found that 1.5% lemon grass oil level is appropriate to inhibit the growth of most of the pathogenic and spoilage organisms and it does not have any effect on the sensory quality attributes.

Pork nuggets can be successfully stored in the chitosan based films incorporated with 1.5% lemon grass oil for 34 days at refrigeration temperature with acceptable sensory quality attributes as well as microbial and oxidative quality parameters well within the permissible levels. Oxidative and microbial stability of chicken thigh and breast muscles was assessed for 9 days at refrigeration temperature under aerobic packaging conditions supplemented with chitosan films incorporated with 60,000 ppm nisin and 0.5% cinnamaldehyde. The fresh thigh and breast muscles can be stored successfully for 9 days without any deteriorative effect on its color, flavor and microbial quality. Shelf life of chicken lollypops is extended to more than 35 days at refrigeration temperature on wrapping with developed chitosan films in addition to modified atmosphere packaging conditions.

#### *Development of biodegradable films*

Biodegradable films of thickness 180  $\mu\text{m}$ , penetrability 7.4 N, WVTR 0.00187  $\text{g}/\text{m}^2\text{-t}$  were developed from whey protein concentrate (6%) and sodium alginate (0.3%) combination. Storage stability of fiber enriched chicken meat bullets was increased for 35 days at refrigeration temperature by incorporating 0.5% cinnamaldehyde in developed WPC films. Composite Chitosan (1.5%) and starch (4%) based biodegradable films were developed. Their antimicrobial efficacy was increased by incorporating lemon grass oil (1.5%), cinnamaldehyde (0.5%) and nisin (60,000 IU/g). The developed films were used to extend the storage life of chevon chunks at refrigeration temperature for 9 days.

## **Veterinary Anatomy**

### *Enzyme localization in the ovary of buffalo during different reproductive stages*

Distribution of AKPase was strong in the primordial and primary follicles in all the phases of reproduction. A moderate to intense reaction was observed in the theca and granulosa cells, whereas, a weak reaction was in the oocyte and zona pellucida. During prepubertal and pubertal period, the distribution of AKPase was weak and/or moderate in the ovarian medulla. In the corpus luteum, the luteal cells and blood vessels showed moderate reactions, whereas the reaction was strong in pregnant buffalo.

In the prepubertal and pubertal buffaloes, the distribution of G-6-Pase in the ovarian surface epithelium, tunica albuginea and cortical stroma was weak, while it was moderate in the primordial and primary follicles. Granulosa cells showed strong activity while the theca cells exhibited weak activity. The activity of G-6-Pase was weaker in the prepubertal buffaloes compared to follicular, luteal and pregnant animals. The luteal cells exhibited moderate reaction both during luteal phase and in pregnant buffalo.

Activity of SDH and GLD enzyme was weak in the primordial and primary follicles of buffalo ovary. Luteal cells exhibited moderate to strong reaction of SDH and GLD in the luteal phase of estrous cycle, while it was strong in the pregnant animals. The reaction was perinuclear and granular in nature. The activity of LDH was weak in the surface epithelium, tunica albuginea and cortical stroma. The membrana granulosa cells and theca cells exhibited moderate reaction of LDH during follicular, while weak during luteal phase of the estrous cycle. Luteal cells showed microgranular reaction of LDH both during luteal phase and in pregnant buffalo. The membrana granulosa cells and theca cells exhibited weak to moderate reaction of G-6-PD during follicular and luteal phases.

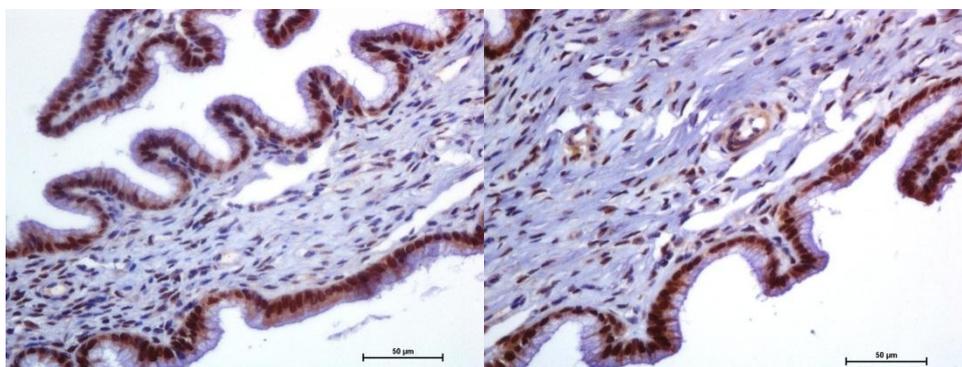
Activity of NADH-diaphorase was weak to moderate in the surface epithelium, tunica albuginea and cortical stroma in prepubertal buffalo whereas reaction was moderate in the pubertal. Moderate reaction was observed in the primordial and primary follicles during the pubertal period while a strong activity was exhibited in the ovary during follicular phase. A strong to intense activity was recorded in the theca cells and membrana granulosa cells of growing and tertiary follicles during follicular phase. The luteal cells exhibited strong to intense reaction of NADH-diaphorase in pregnant animals while moderate to strong reaction was observed in the corpus luteum during luteal phase.

The MAO activity was weak in the primordial and primary follicles in prepubertal and whereas it was weak to moderate in pubertal buffaloes. The granulosa cells and theca cells during follicular and luteal phase of estrous cycle exhibited weak to moderate activity. Strong

MAO activity was observed in the interstitial gland present in the medulla of ovary during follicular phase and in pregnant animals.

#### *Immunolocalization of estrogen receptor alpha in cervix uteri of buffalo*

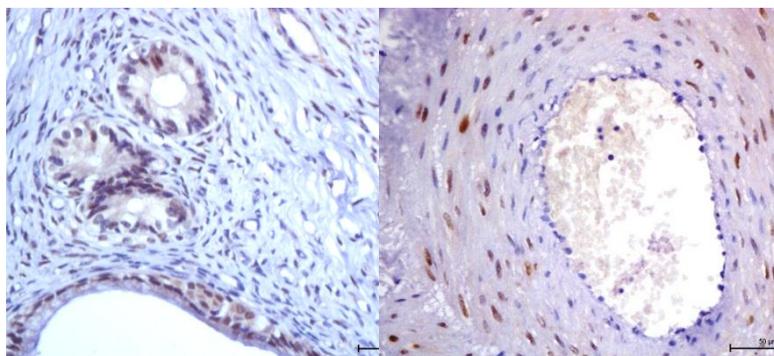
Tissue distribution of ER $\alpha$  was determined by immunohistochemical technique using one-step polymer horseradish peroxidase staining system. Nuclear staining for ER $\alpha$  was observed in the epithelial cells of the surface epithelium, stromal cells and smooth muscle cells. In the cervix, ER $\alpha$  immunoreactivity was more intense in the epithelial, cervical glands and smooth muscle cells during the follicular phase. These results indicated that the frequency and intensity of ER $\alpha$  immunoreactivity in the cervix of buffalo varied according to the cervical cell types and the phases of the sexual cycle.



*Nuclear positive immunostaining of ER $\alpha$  in the glandular epithelial (left) and stromal (right) cells of the stratum compactum region of cervix*

#### *Immunolocalization of progesterone receptor in cervix uteri of buffalo*

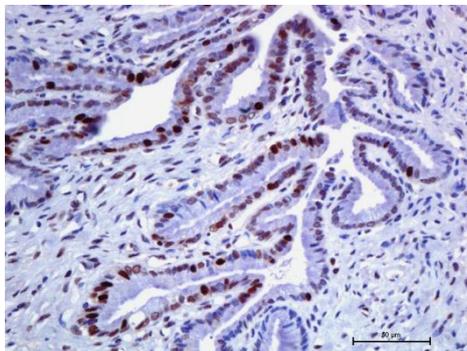
Tissue distribution of PR was determined by immunohistochemical technique using one-step polymer horseradish peroxidase staining system. Nuclear staining for PR was observed in the epithelial cells of the surface epithelium, stromal cells and smooth muscle cells. The lining epithelium of cervical glands showed intense positive nuclear reaction for progesterone receptor. These results indicated that the frequency and intensity of PR immunoreactivity in the cervix of buffaloes varied according to the cervical cell types and the phases of the sexual cycle.



*Nuclear positive immunostaining of PR in the luminal and glandular epithelial cells and stromal cells (left), and muscle cells of muscular arteries (right) of cervix*

### *Immunolocalization of PCNA and Ki 67 in cervix uteri of buffalo*

Immunolocalization of Ki67 and PCNA was used to determine the relation of proliferation potential of estrogen hormone. The results indicated that the status of cervix uteri using expression of proliferation marker PCNA and Ki67 was well correlated to the ER<sub>α</sub> expression in cervix uteri of buffalo.



*Nuclear positive immunostaining of PCNA in the epithelial and stromal cells of cervix*

### **Veterinary Gynaecology and Obstetrics**

#### *Improving conception rate following application of fixed-time AI (FTAI) protocol in buffalo during hot-humid conditions*

The present study aimed at comparison of fertility outcome of two FTAI protocols in buffalo reared by rural smallholder dairy farmers during hot-humid months. Group-I: Buffalo were subjected to ovsynch or estradiol/progesterone-based FTAI protocol. In both groups, pregnancy was confirmed by ultrasound aided diagnosis on d60 post-AI and the buffalo failing to conceive and returning to estrus were re-inseminated at observed spontaneous estrus without any additional hormonal treatment. Overall (1<sup>st</sup> AI and re-insemination) conception rate in group-I and group-II buffalo was 25% and 69.8%, respectively. In summary, an estradiol/progesterone-based FTAI protocol has potential for better conception rate in buffalo during hot-humid conditions.

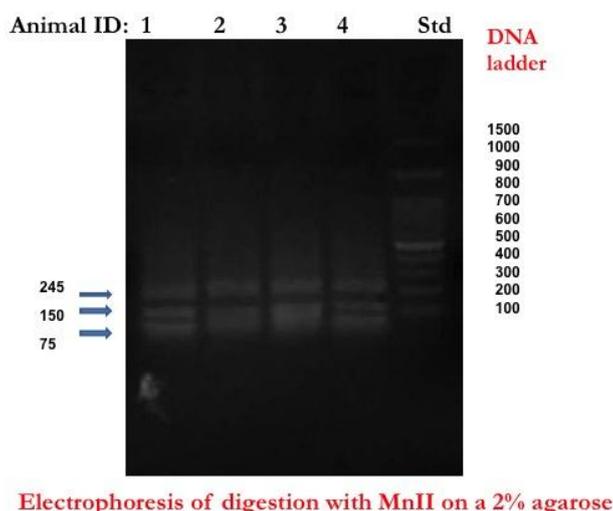
#### *Impact of melatonin pre-exposure on ovarian profile and conception rate in buffalo subjected to FTAI*

Anestrous buffalo subjected to FTAI following melatonin pre-exposure for 35 days exhibited higher conception rate compared to their non-treated counterparts (55.4 vs. 31.6%). The reason for higher conception rate seems unclear from the ovarian profile during the course of FTAI protocol. The dominant follicle diameter or plasma progesterone concentrations on day 7 of protocol and on the day of AI were similar in control and melatonin-implanted buffalo as well as their non-pregnant or pregnant sub-groups. Nevertheless, in pregnant buffalo of melatonin-implanted group, the plasma progesterone during pre-conception (day 7 of

protocol) and post-conception (day 7 post-AI) period was high compared to the day of AI. In addition, corpus luteum diameter on day 7 post-AI tended to be higher in melatonin-implanted buffalo compared to controls. Both these observations suggested that better luteal profile during pre- and post-AI period in melatonin-implanted buffalo might be related to better conception rate.

#### *Polymorphism of melatonin receptor MT1 gene in buffalo*

The PCR of MTNR1A receptor in buffalo was standardized and 824 bp PCR products was amplified and cut with MnlI restriction enzymes to identify an RFLP (Restriction fragment length polymorphism) in buffalo. Cutting of 824 bp PCR product with MnlI indicated variation in base-pairs of MTNR1A receptor of various buffalo. This could be responsible for variation in cyclicity pattern of buffalo population. To further validate the data, studies will be continued on another set of buffalo, and using the same and another restriction enzyme.

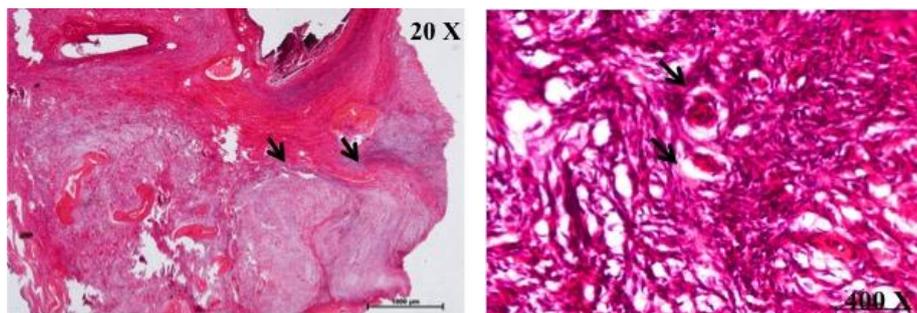


*Amplification of 824 bp MTNR1A fragment showing polymorphism of melatonin receptor MT1 gene in buffalo (n=4)*

#### *Impact of pesticide residues on the reproductive tract of buffalo*

Pesticide residues were detected in 25% blood ( $42.0 \pm 47.4$  ng/ml), 43% reproductive tract ( $107.3 \pm 115.6$  ng/g) and 32% ovarian follicular fluid ( $63.6 \pm 55.5$  ng/ml) samples. The concomitant presence of specific pesticide residues was observed in blood, reproductive tract and follicular fluid. Moreover, in another set, pesticide residues were in 25% blood ( $41.5 \pm 26.5$  ng/ml) samples of buffaloes, and in 15% blood ( $32.1 \pm 22.4$  ng/ml) and 35% reproductive tract ( $119.5 \pm 149.1$  ng/g) samples of their calves. In calves, the histopathological alterations in pesticide-negative and low and highly pesticide-positive reproductive tracts were  $0.28 \pm 0.75$ ,  $1.57 \pm 2.15$  and  $3.53 \pm 2.51$  per sample. The recorded alterations in calves were polycystic ovaries, distortion of uterine mucosa, distinct vacuolations in uterus, deciliation of

oviductal epithelium and seminiferous tubule degeneration. In conclusion, pesticide residues have adverse impact on the reproductive tract of neonatal calves and adult female buffaloes.



*Leiomyosarcoma of ovary showing whorls of connective tissue and cysts in the stroma*

*Haemangiosarcoma showing infiltrations of endothelial cells of ovary*

*Alterations in the pesticide-positive genitalia of buffalo*

*Uterine cytobrush technique for subclinical endometritis*

The uterine cytobrush technique is an efficient method and can be considered as a cow side test for the diagnosis of subclinical endometritis at field level. The proteolytic enzymes (Trypsin, chymotrypsin and papain), *E coli* LPS and levamisol can be used to enhance uterine immunity and pregnancy rates in subclinical endometritic repeat breeding cattle.

*Identification of libido associated metabolites in buffalo bulls*

<sup>1</sup>H NMR spectra of serum analysis indicated that acetate, lactate and alanine were higher in good libido bulls compared to poor libido bulls. In seminal plasma, glycerophosphorylcholine/choline, citrate, lactate, glutamine/glutathione, creatinine and sugar levels were higher in good libido bulls compared to poor libido bulls. Urine analysis indicated higher concentration of hippurate, creatine and creatinine in good libido as compared to poor libido bulls. Identification of the metabolites associated with libido in serum, seminal plasma and urine could demarcate good and poor libido breeding buffalo bulls.

*Role of antisperm antibodies (ASA) in infertility/repeat breeding of cattle*

ASA were present in blood serum and cervical mucus (CM) of tested cross-bred cows irrespective of age, parity and number of inseminations. Percentage of cows with significant level of IgG, IgA and ELISA titre in CM was higher than in serum. A significant increase in total Ig, and ASA in serum/CM was observed with increase in number of inseminations, but no significant difference was observed according to age and parity. About 28%, 3.8% and 15.3% of cows with > 40% IgA and IgG; only IgA or IgG in CM and low values of parameters of CM penetration test (CMPT) revealed equal importance of IgA and IgG in decreasing the penetration ability of spermatozoa. It was further concluded that delayed

fertility in 14.3% of 42 tested cows might be due to the presence of significant level of ASA in blood serum or cervical mucus.

#### *Superovulation and embryo recovery work in buffalo*

Low dose of FSH (400 IU) was enough to superovulate buffalo with superovulatory response of average 8.7 CL's per buffalo and with an average embryo recovery of 4.57 per donor, and transferable rate of 2.0 embryos per buffalo. *In vitro* maturation rate of oocytes collected from slaughter-house ovaries was 65% and 70 % in buffalo and goat, respectively. *In vitro* embryo development has reached upto 4-cell stage from ovum pick-up derived oocytes

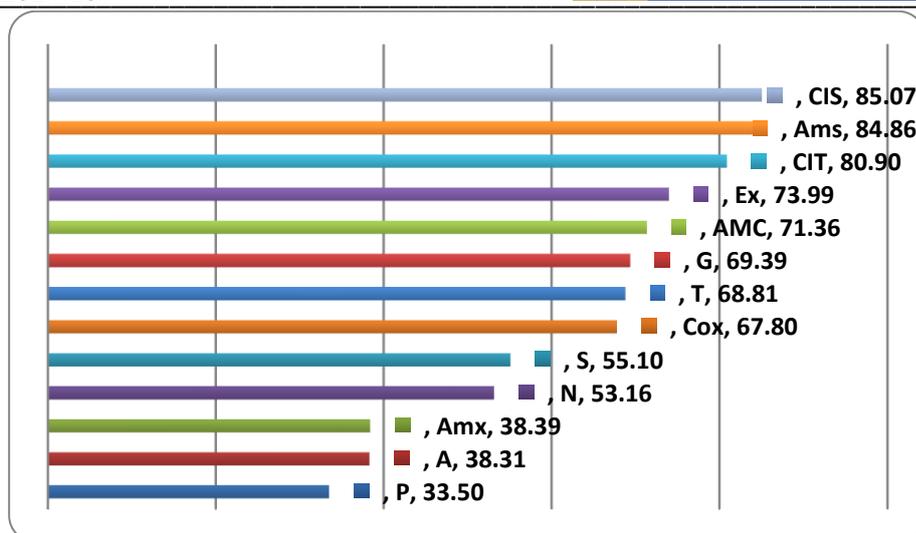
#### *Progesterone measurements for the evaluation of reproductive status of dairy animals*

Progesterone radioimmunoassay using indigenously raised polyclonal progesterone antiserum is being employed for the reproductive status evaluation of dairy cattle and buffalo of Punjab State management of dairy animals. Analysis of 2,192 plasma samples was carried out during 2014-15. Veterinary institutes located at Hisar are also utilizing the services of RIA lab at GADVASU.

### **Veterinary Medicine**

#### *Current culture sensitivity pattern of clinical mastitis*

The organisms isolated from the affected quarters (1570 quarter foremilk samples from 497 dairy animals; 1231 from 397 cows and 339 from 100 buffaloes) comprised, in overall for cows and buffaloes as; coagulase-negative staphylococci 50.91%, *Staphylococcus aureus* 26.36%, *Pseudomonas* and Gram negative spp. 9.39%, *Streptococcus* spp. 5.15%, *Corynebacteria* spp. 0.30%, *Bacillus* spp. 0.91% and others 6.97%. Testing of isolated bacteria for drug sensitivity revealed, in overall, Ceftriaxone-salbactam as the most effective drug followed by amoxicillin-sulbactam, ceftriaxone-tazobactam, enrofloxacin, amoxicillin-clavinate and Gentamicin. On the other hand, least effective drugs were Penicillin, Ampicillin and amoxycillin. In addition to these, 39 milk samples from 28 bitches were also subjected to bacteriological examination. Out of which 14 samples revealed positive for bacteriological examination comprising of 50% each of coagulase-negative staphylococci and *Staphylococcus aureus*.



*Drug sensitivity pattern of clinical mastitis in Punjab State (2014)*

#### *Supply of mastitis diagnostic kits and analysis of milk samples for SCC*

A regular service of preparing and supplying mastitis diagnosis reagent to the farmers/technical persons for early identification of mastitic quarters is being undertaken. During last year, about 200 mastitis diagnostic kits were supplied. Besides milk samples received from dairy industry were analyzed for somatic cell count.

#### *Epidemiological study on goat mastitis in north-western states of India*

About 702 aseptic foremilk samples from both the udder halves of 359 apparently healthy lactating goats from Ludhiana, Faridkot, Barnala, Bathinda and Hoshiarpur, Ferozpur districts of Punjab and Haridwar district of U.K. were collected and subjected to Sodium Lauryl Sulphate (SLS) test and bacteriological examination to observe the prevalence of disease. The average prevalence of sub-clinical mastitis in goats was 20.89% at animal level and 14.95% at quarter level. The quarters affected with specific, non-specific and latent infection were 9.82%, 5.13% and 7.41%, respectively. Left (54) and right (51) sided teats did not show any significant difference in affections with mastitis ( $\chi^2 = 0.025$ , 01df;  $p > 0.05$ ). Among goats with intramammary infection, 81.33% had unilateral infection; the others had both udder halves infected. The prevalence of IMI in left and right half udders were 51.31% and 48.63%, respectively. According to the logistic-regression analysis, the risk of infection was approximately similar for the left and right udder halves ( $\chi^2 = 0.025$ , 01df;  $p > 0.05$ ). Overall, 17.24% udder halves were bacteriologically positive which comprised 57.02% from specific subclinical mastitis and 42.98% from latent infections. The organisms isolated from specific subclinical mastitis constituted Coagulase negative staphylococci (CNS, 81.16%), Coagulase poasitive (CS, 14.49%) and G (-) ve organism (4.35%) However, in case of latent infections,

CNS (84.62%) was chief isolates followed by and CS (15.38%). Nine goats with clinical mastitis were also observed during the study. Out of 18 quarters, 16 quarters were bacteriologically positive. The organisms isolated from clinical cases comprised of CNS (37.5%), CS (37.5%) and *Mycoplasma* sp. (25%).

*Improvement of udder health and milk quality through application of mastitis control programme under field conditions*

About 181 HF × Sahiwal crossbred cows at 10 machine milked dairy herds were involved. The cows were in average parity of 2.1 with lactation days 169. The average prevalence of subclinical mastitis was found 39.2% at udder level and 22.2% at quarter level. The mean UHS, LHS and CHS of cows in herds under study varied from 1.05 to 2.33, 1.40 to 2.83 and 1.29 to 2.58, respectively. The 58.0, 28.7, 11.6 and 1.7%, of cows showed UHS of 1, 2, 3 and 4, respectively. The corresponding values for LHS were 33.7, 36.5, 21.0, and 8.8%, respectively. A positive correlation was found between UHS and LHS ( $r=0.62$ ,  $P<0.01$ ). Results of general linear models showed significant associations of  $\log_{10}$ SCC with UHS. The mean  $\log_{10}$  SCC values with respect to UHS of 1, 2, and 3+4 were found to be 5.44, 5.44, and 5.95, respectively. The cows with LHS of 1, 2, and 3+4 were having mean  $\log_{10}$  SCC values of 5.44, 5.43, and 5.63, respectively. A positive correlation was found between  $\log_{10}$ SCC and UHS ( $r=0.24$ ,  $P<0.01$ ), LHS ( $r=0.15$ ,  $P<0.05$ ) and CHS ( $r=0.21$ ,  $P<0.01$ ). The cows with dirty udders were more likely to have quarters infected with minor pathogens compared with cows with clean udders (OR 2.65;  $P<0.01$ ). Quarters with positive CMT score were also significantly associated with IMI with minor pathogens. The intra-mammary infection with major pathogens was significantly associated with dirty udders (OR 2.0;  $P<0.05$ ) and dirty legs (OR 2.47;  $P<0.01$ ). The occurrence of mastitis between clean vs. dirty udders, and clean vs. dirty hind legs was observed as 32.5% vs. 83.0%, and 32.3% vs. 39.2%, respectively. The parity also contributed significantly to the outcome of mastitis. The results showed significant ( $P<0.05$ ) association of parity and days since parturition with cow hygiene scores. Evaluation of cow hygiene in relation to milk quality showed dirty udders with 2 times higher absolute SCC than cows with clean udders. The application of good pre-milking udder preparation could lower the occurrence of specific mastitis by 50.44% ( $\chi^2 = 4.30$ ;  $p < 0.05$ ). The occurrence of new intramammary infections was prevented by 21.17%.; however, the results were statistically non-significant ( $Z = 1.01$ ;  $p > 0.05$ ). As for effect of good udder preparation on milk quality is concerned, the mean cow composite milk SCC decreased significantly ( $p < 0.05$ ) from 1009 to 501 ( $\times 10^3$  cells/ml), and lactose content increased from 4.73% to 4.89% ( $p < 0.05$ ).

### *Nutritional deficiency diseases of dairy animals*

Buddha Nallah, a narrow unlined canal, is an important drainage line of Ludhiana city. Due to intense industrialization and discharge of sewage water into it, Buddha Nallah has become a host of environmental pollution in area around it. In the present study, prevalence of heavy metals (Pb, Cd, As, Ni) in dairy animals inhabiting Buddha Nallah was assessed. Total 122 plasma samples, out of which 63 and 59 were cows and buffaloes, respectively, were collected from three zones of Buddha Nallah i.e. zone 1 (upstream), zone 2 (in the city) and zone 3 (downstream). Samples were analyzed for heavy metals and overall concentrations of Pb, Cd, As and Ni were  $0.58 \pm 0.06$  ppm,  $0.12 \pm 0.02$  ppm,  $0.39 \pm 0.06$  ppm and  $0.04 \pm 0.006$  ppm, respectively. Highest prevalence rate of heavy metals viz., Pb, Cd, As and Ni was 100%, 88.9%, 77.8% and 94.4%, respectively in dairy animals of zone 3 and minimum prevalence rate was recorded in zone 1. High prevalence of heavy metals in plasma of dairy animals of Buddha Nallah is an alarming situation and can result in detrimental health effects and release of heavy metals in milk can be of public health significance.

### *Clinical and therapeutic studies on foot lameness in dairy cattle*

Feeding of high grain diet to crossbred cows resulted in a significant increase in heel erosions, white line haemorrhage, white line fissures and overgrown soles. The feeding of high grain diet was not associated with any change in locomotion score in dairy animals but a significant increase in rear leg view index. Supplementation of high grain diet with 50 grams of buffer in the form of sodium bicarbonate and magnesium oxide (3:1) showed a significant decline was in heel erosions and overgrown soles. Additional supplementation of zinc sulphate along with sodium bicarbonate and magnesium oxide as above improved the cure rate for heel erosions, white line haemorrhage, white line fissures and overgrown soles. Copper sulphate and zinc sulphate in 1:1 ration was found effective topical application for treatment of sole ulcers. First time the convex probe of ultrasound machine was standardized for measurement of sole thickness in dairy cattle. Sole thickness was significantly less in lame animals as compared to non-lame animals. It increased with respect to parity and decreased from 10-day post calving to 110 day post calving. Acute phase response in terms of serum amyloid, haptoglobin, C-reactive protein and fibrinogen was significantly higher in lame animals as compared to non-lame animal.

### *Epidemiology, diagnosis and management of production diseases in dairy animals*

Metabolic profiling was established in crossbred cows and buffaloes in five districts viz., Nawan Shahar, Jalandhar, Patiala, Ludhiana and Kapurthala. In cows, the prevalence rate of subclinical ketosis (SCK) was 2.02%, SCK followed by Hepatic lipidosis (HL) 5.05%, HL

19.2% and HL followed by SCK 6.06%. In buffaloes, the prevalence rate SCK followed by HL 18.4% and HL 11.7%. Overall prevalence rate of mineral deficiencies was 30.7%, 21.8%, 20.8%, 32.7% and 24.8% for plasma calcium, magnesium, copper, zinc and phosphorus, respectively, in cows. In buffaloes, prevalence rate of mineral deficiencies was 24.5%, 19.8%, 10.1%, 19.1% and 25.7% for plasma calcium, magnesium, copper, zinc and phosphorus, respectively. Hepatic Lipidosis was diagnosed ultrasonographically in 29.7% and 12.6% in cows and buffaloes, respectively. Feeding of rumen protected choline @ 50 g/day for 20 days was effective in prevention of Hepatic Lipidosis. Intravenous injection of parenteral choline @ 10 ml/animal for 6 consecutive days was an effective treatment of Hepatic Lipidosis. Herbal Vit. E & Se powder @ 6g/day for 20 days was effective in reducing oxidative stress during periparturient period. Propylene glycol feeding to SCK cows corrected ketonemia (reduced BHBA, NEFA) and increased TPP, glucose, plasma Ca and improved milk yield and body condition score. Analysis of feed and fodder samples for nutritional values showed that feed samples were low in crude protein (<20%) at 8 of 12 farms.

#### *Diagnosis and therapeutic management of important diseases of equines*

Obstruction/impaction is a leading cause of colic in horses followed by inflammatory and verminous colic. Lack of parasitic control is a major risk factor for causing colic in horses. Heart rate, pulse rate and respiration rate are vital signs, which can be used for prognosticating survival in colic horses. Serum ALKP, lactate and blood glucose are the biochemical parameters of prognostic significance in colic cases. Activated partial thromboplastin time and platelet count are the coagulation parameters, which can contribute significantly to the prognosis in colic horses. Treatment with low molecular weight heparin (LMWH) improves the coagulation parameters like aPTT and D-dimer levels in colic patients but not the survivability.

#### *Strengthening of diagnostic and critical care facilities for domestic animals*

During the period under reporting, the equipments and instruments purchased for running the critical care unit have been successfully installed, standardized and put into practical use for taking care of critically ill patients. Blood pressure monitoring of each case under this critical care unit is being undertaken. Further the cases suffering from conditions pertaining to cardiac origin have been subjected to electrocardiographic and echocardiographic studies and various conditions of arrhythmias and structural cardiac problems have been diagnosed and successfully managed. The Endoscope used for diagnosis of various gastrointestinal affections was put to use and various affections like megaesophagus, intra and extra luminal

tumours of esophagus, esophagitis, ulcerative colitis, ano-rectal problems and foreign body were successfully diagnosed and treated. Further, affections of upper respiratory tract were also addressed in paediatric large animals. Apart from this, common eye ailments like kerato conjunctivitis sicca, corneal ulceration, uveitis, glaucoma and diseases of fundus have been diagnosed and possibly treated.

#### *Serological and molecular studies on infectious diseases of small ruminants in Punjab*

A detailed questionnaire was developed to collect history regarding various risk factors associated with infectious agents. Approximately 400 serum samples of sheep and goats have been collected from different districts of state, which will be screened for various infectious diseases. The fecal samples (n=80) were collected and evaluated for various endoparasitic infections revealing strongyle, moneizia, coccidia, strongyloid and trichuris infections. In some of the samples, even mixed infections of strongyle and coccidia were observed. Milk samples collected from sheep and goats were subjected to culture and various mastitic organisms have been isolated including *Staphylococcus aureus*, coagulase negative staphylococci. Polymerase chain reaction has been standardized for diagnosis of mycoplasma infections from milk.

#### *Diagnosis and management of reticulo-omasal and abomasal disorders in cattle and buffaloes*

During this period, 605 cases of gastrointestinal disorders were presented at the clinic, out of which 491 were of reticulo-omasal and abomasal disorders comprising of foreign body syndrome (160), diaphragmatic hernia (73), peritonitis (137), reticular abscess (12), omasal impaction (29), abomasal impaction/dilation (7), abomasitis (62) and late pregnancy indigestion (11).

### **Veterinary Microbiology**

#### *Screening for Brucellosis*

A total of 1186 sera samples from apparently healthy cattle and buffaloes and 80 serum samples from dogs were collected from different areas in and around Ludhiana. An overall seroprevalence of brucellosis in cattle and buffaloes by RBPT was 31.45% whereas the seroprevalence in cattle and buffaloes was 25.15% and 46.4%, respectively. The seroprevalence in dogs by RBPT and canine *Brucella* Ab test kit was 66.25% and 12.5%, respectively. Out of a total of 40 samples of fetal stomach contents (5), placenta (8), vaginal swabs (16) and uterine fluids (11) processed for isolation of *Brucella* in cattle and buffaloes, three samples were positive by isolation. All the isolates were confirmed by PCR using B4/B5 and F4/R2 primers pairs amplifying 223 bp and 905 bp, respectively. All the three

isolates amplified with a  $C_T$  value between 14 to 16 using Hinc real time PCR. With multiplex PCR (Bruce ladder), all the three isolates were found to be that of *Brucella abortus*. Out of 150 samples of blood, preputial swabs, urine and vaginal swabs from male and female dogs processed for isolation of *Brucella*, none of the samples were found positive for *Brucella*. DNA was extracted from these 150 samples and subjected to PCR using F4/R2 primer pair. *Brucella* was detected in two samples of blood. Antimicrobial sensitivity revealed that *B. abortus* was sensitive to oxytetracyclin, amoxycillin, enrofloxacin, ampicillin, doxycycline, neomycin, cholarmphenicol, norfloxacin, gentamicin, kanamycin and resistant to penicillin, erythromycin, cephalothin, cotrimoxazole.

#### *Cloning, sequencing and expression of immunodominant outer membrane protein Omp25 from Brucella species*

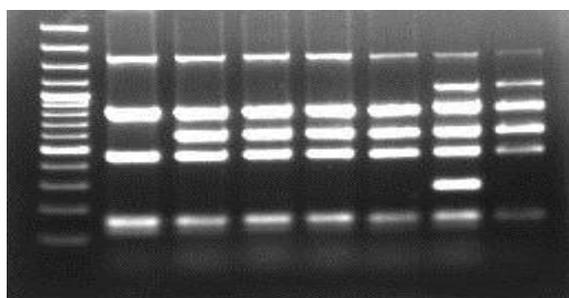
Out of total 84 samples collected from aborted cattle (29) and buffaloes (55), 9 (10.71%) were positive through isolation whereas, 12 (14.28%) were positive by PCR. Out of total 9 isolates, one isolates was typed as biotype 2, one as biotype 3 and seven isolates were typed as biotype 1. Prevalence of *Brucella abortus* in buffaloes and cattle was 14.54% and 13.79% respectively. Foetal stomach content was the best sample for detection of *Brucella* organism. All the brucellosis positive animals were having history of abortion in 6-9<sup>th</sup> month of gestation. The amplicons of 905bp and 223bp were amplified for *B. abortus* 16S rRNA and *bcs31* gene by using published primers of *Brucella* Genus specific F4/R2 and B4/B5 primers respectively. A new set of primers based on *omp25* gene was designed. Subsequently *omp25* gene was amplified from a clinical isolate of *B. abortus* and cloned in to TA cloning vector. The cloned product was sequenced and the sequence data obtained (Accession No. JQ839278.1) was analysed. For expression of *omp25* gene, pPROExHT (b) prokaryotic expression vector (Invitrogen, USA) was used. His-tagged recombinant Omp25 protein was successfully expressed which showed a specific band of ~25kDa in SDS-PAGE analysis. Expressed recombinant Omp25 protein was successfully purified to homogeneity by Ni-NTA affinity chromatography under denaturing conditions and the purified recombinant protein was confirmed by Western blotting. The present study is a first step in providing rapid diagnosis of *Brucella* species as well as in development of recombinant antigen based indigenous ELISA.

#### *Molecular heterogeneity/typing of Brucella species*

Molecular heterogeneity among the isolates was shown using RAPD, REP, ERIC and SSCP analysis. RAPD Analysis with OPG 10 grouped the 18 isolates including S99, 16M, *B. suis* 1330 into seven profiles and has a D-value of 0.82. RAPD analysis with OPG 13 also

grouped the 18 isolates including S99, 16M, *B. suis* 1330 into seven profiles while the D-value obtained was 0.74. ERIC analysis grouped the isolates into six profiles with a D-value of 0.72. The number of bands obtained from the isolates ranges from 4 to 9. REP analysis grouped the isolates into nine profiles with a D-value of 0.80. The number of bands obtained from the isolates ranges from 4 to 24. The SSCP analysis exhibited a D-value of 0.83 which is the highest among the molecular techniques used for profiling. Hence, SSCP revealed highest discriminatory ability among all the typing techniques. SSCP analysis grouped the isolates into ten profiles. All the typing techniques used placed *B. melitensis* 16M separate from other groups.

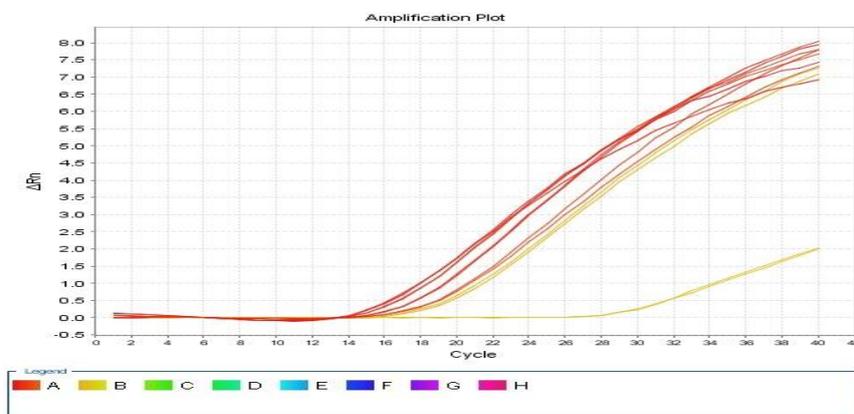
#### *Bruce Ladder Multiplex PCR for differentiation of Brucella species*



*Gel electrophoresis of PCR amplified fragments from Brucella spp. by Bruce Ladder PCR (Lane 1- 100 bp plus DNA ladder (Fermentas); Lane 2- S-19 (standard positive); Lane 3,4,5,6- B.abortus field isolates (LMN1, LMN2, LMN3, LMN4); Lane 7- B.suis (standard positive); Lane 8- B.melitensis (standard positive))*

#### *Hinic Real time PCR for the detection of Brucella species*

PCR and qRT-PCR were found to be a better technique with regards to sensitivity, specificity, safety, rapidity of analysis and ease of automation for detection of *Brucella* species in comparison to the conventional methods.



### *Haemorrhagic Septicemia research progress*

Twelve isolates (Ten from buffalo and two from cattle) of *Pasteurella multocida* were obtained from samples comprising of nasal swabs and peripheral blood from live and tissues (heart blood, tracheal swabs, lung, liver and spleen) from dead animals. The sensitivity pattern revealed that all the isolates were sensitive to ceftriaxone, gentamycin, enrofloxacin and chloramphenicol. The number of isolates sensitive to other antimicrobials (in decreasing order) were: pefloxacin (11), cephalothin (10), cephotaxime, spectinomycin, tetracycline (9 each) ciprofloxacin and co-trimoxazole (8 each); and amoxicillin, erythromycin and streptomycin (six each). The isolates were confirmed as capsular type B (B: 2, B: 2, 5) by multiplex capsular typing and species and type specific PCRs. Multiplex real time PCR assay using hydrolysis probe chemistry can be used for detection and confirmation of *P. multocida* type B from tissue sample. The *PlpE* gene of *P. multocida* type A was cloned and expressed in to prokaryotic expression vector and studied the immunogenicity and protective efficacy in mice. The r-PlpE protein enhanced the level of protection in the mice challenged by using *P. multocida* type B.

### *Development of a DIVA strategy for Haemorrhagic Septicaemia*

Developed a new marker vaccine and a new DIVA assay for Hemorrhagic Septicemia of cattle and buffaloes based on induction of novel immunogenic protein and phage lysis of *Pasteurella multocida*.

### *Innovative solutions to false positive and false negative results in Brucellosis diagnosis*

False negative and false positive results are commonly encountered in the conventional agglutination based tests like RBPT for Brucellosis. Simple, cost effective modifications can help in circumventing these problems. A novel Superagglutination Test was developed in which false negative results due to smaller clumps formed by low titer of antibodies in serum are minimized by the addition of biotinylated antiglobulin followed by Avidin, which forms easily detectable larger clumps. Similarly, prior staining of serum antibodies with a dye helps in differentiating a specific agglutinate formed by both antigen and antibody, from a non-specific aggregate of antigen alone that leads to false positive results. Superagglutination is more sensitive than the current agglutination tests and agglutination based diagnostic kits. Superagglutination test reduced false results, had higher sensitivity (95.88%) and negative predictive value (95.83%) than Rose Bengal Plate Test (RBPT), Standard Tube Agglutination Test (STAT), ELISA, and Complement Fixation Test and specificity (89.32%) and positive predictive value (89.42%) higher than RBPT and STAT. The modification steps are easy to perform and give a more accurate diagnosis without much increase in the cost of the test. The

economic losses to livestock industry caused by the spread of infectious diseases like brucellosis due to false negative diagnosis and culling/slaughtering of productive animals due to false positive diagnosis can be avoided by employing the new test.

#### *Mycotoxins in respiratory disease of poultry*

Fifty two (52) isolates of bacteria associated with various respiratory tract infections in chicken were isolated from twenty two (22) different outbreaks in and around Ludhiana comprising of *Staphylococcus aureus* (46%), avian pathogenic *E. coli* (APEC, 29%), *Proteus* sp. (9%), *Klebsiella pneumoniae* (6%), *Streptococcus equi* subsp. *zooepidemicus* and *Pseudomonas aeruginosa* (each 4%) and *Citrobacter koseri* (2%). Antibiogram showed an increasing trend of resistance to various antimicrobial drugs and emergence of multi-drug resistant bacteria. Phenotyping of APEC showed all the isolates as Congo red binding positive (Crb<sup>+</sup>) suggesting their invasive nature. Virulence typing of APEC showed 7/15 isolates to contain all the five plasmid associated virulent genes. Present study also reported molecular detection of the organism *Avibacterium paragallinarum* (1.29%), although the organism could not be isolated. Occurrence of *Mycoplasma gallisepticum* was 59.15% while that of *Mycoplasma synoviae* was 33.8%. Multiple sequence alignment of partial sequence data revealed 98%-100% sequence homology with respect to *M. gallisepticum* and/or *M. synoviae*. Poultry feed samples (n=50) were analyzed initially for presence of any mycotoxins by screening through pressure mini columns (PMCs) in which the level of aflatoxin was in the range of 25±25 ppb to 600±25 ppb. Results of TLC revealed occurrence of aflatoxin B2 to be the highest (88%) followed by aflatoxin B1 (84%), ochratoxins (74%) and citrinin (10%). The levels of AflatoxinB1 and B2 were in the range of 25-600 ppb with an average of 178.57±23.8 ppb and 202.27±25.43 ppb, respectively while that of ochratoxin and citrinin were in the range of 50-600 ppb with an average of 206.08±20.6 ppb and 50-200 ppb with an average of 150±31.56 ppb, respectively.

#### *Isolation and molecular characterization of Mycobacterium avium subsp. Paratuberculosis (MAP) (Johne's disease) and its differentiation from Non Tuberculous Mycobacterium*

Faecal and milk samples (n=200) from cattle and buffaloes were processed for isolation and molecular characterization. IS900 PCR and qRT-PCR were used for the detection of *Mycobacterium avium* subsp. *paratuberculosis* (MAP). PCR-RFLP was employed for the species level differentiation of genus *Mycobacteria*. Out of all the samples processed only one faecal sample yielded colony of MAP, which was confirmed by IS900 PCR. Seven faecal samples were detected positive for MAP both by conventional and qRT-PCR. Sensitivity of the qRT-PCR was 1000 times more as compared to conventional PCR. Each of 200 faecal

and milk samples were subjected to *hsp65* gene amplification by PCR followed by restriction enzyme digestion using *BstEII* and *HaeIII* enzymes for the species level differentiation of *Mycobacteria*. A total of eleven samples were positive for *hsp65* gene, which gave different restriction patterns after digestion. Four samples were detected as *M. vacca*, one as *M. kansasii* and rests of six samples were having variable restriction patterns.

#### *Molecular characterization of Mycobacterium spp. by PCR*

Lymph node aspirates (n=18) from tuberculosis suspected animals were collected and subjected to DNA extraction as per the standard protocol. Genus specific primers Tb11 and Tb12 targeting the *hsp65* gene were used to amplify a 439 bp size amplicon. Standard culture of *M. phlei* was used as positive control. None of the 17 lymph node aspirates from tuberculosis suspected cattle and buffaloes were positive for the *Mycobacterial* infection by PCR. Ten of the above 18 lymph node aspirates were also tested using GenePack DNA PCR tests kit by GeneOn to check for *Mycobacterium* (tuberculosis + bovis). However, all the ten samples were negative.

#### *Canine parvovirus research progress*

A Multiplex Real-Time PCR for the rapid detection of the different antigenic types of CPV viz. CPV-2a, CPV-2b and CPV-2c was successfully designed and tested. Full length VP2 gene was successfully cloned (Accession number is KP406928 for P12, KP406927 for P15, KP406930 for P32, KP406926 for Megavac-6 and KP406929 for NobivacDHPPi).

### **Veterinary Parasitology**

#### *Mapping of prevalence of major haemoparasites*

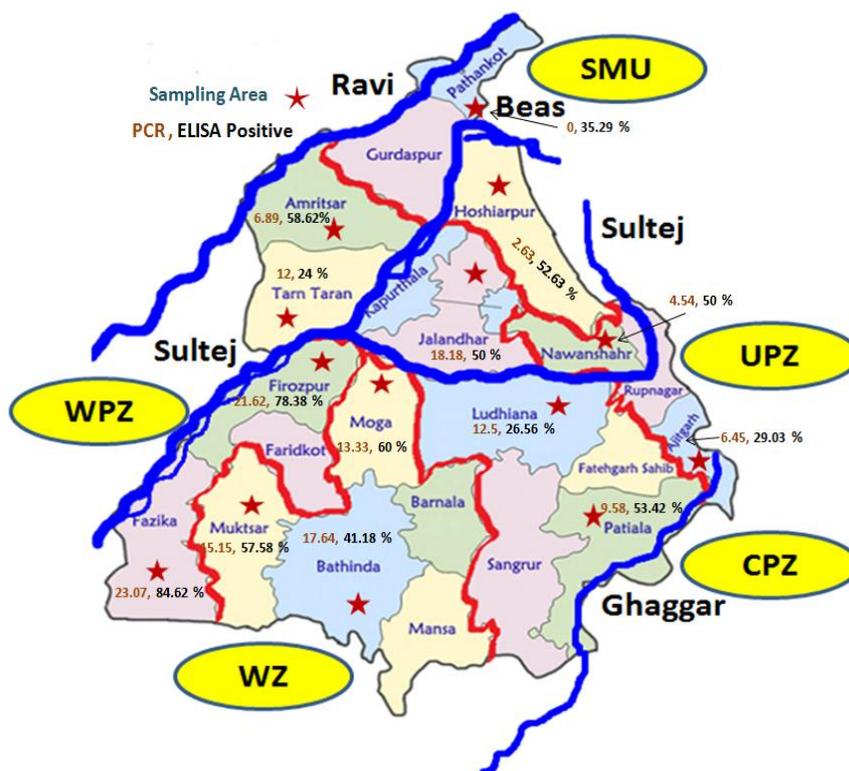
A map was developed for the prevalence of four major haemoparasites (*Trypanosoma evansi*, *Theileria annulata*, *Babesia bigemina* and *Anaplasma marginale*) of immense economic importance on the basis of polymerase chain reaction. The results indicated that haemoprotozoan infections were present in the dairy animals either in patent or latent form. We were able to detect the latent form of infection detected by immunomolecular means may act as nidus for spread of disease to other susceptible animals. Various combinations of duplex PCR were expected to be more time and cost effective molecular diagnostic tools for early diagnosis. The immunological tools like ELISA and CATT were correlated with PCR based assay to know their relative diagnostic efficacy. CATT proved to the test for field utility.

#### *Prevalence of Theileria equi by PCR and Indirect ELISA*

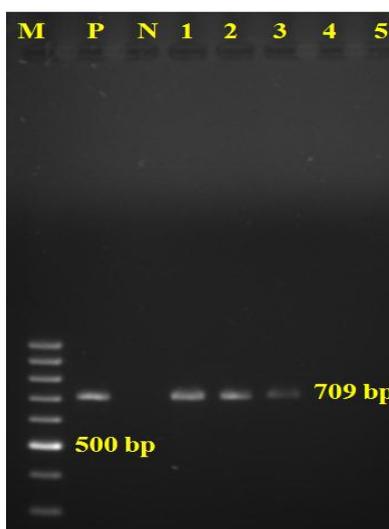
Out of 464 samples screened, the overall prevalence of *T. equi* based on PCR was 11.64%. The zone wise prevalence of babesiosis/theileriosis based on PCR assay was the highest from

the western plain zone (22.22%) and the lowest in the sub mountain zone (1.82%). The district wise positivity by PCR was recorded to be highest in Fazilka (23.07%) and lowest (0%) in Pathankot of sub mountain zone. The zone wise prevalence based on indirect ELISA assay was the highest from the western plain zone (80.95%) and the lowest in the undulating zone (37.74%). The district wise positivity was recorded to be highest in Fazilka (84.62%) and lowest in Tarn Taran (24%) from central plane zone.

Multiplex-PCR for simultaneous detection of *Trypanosoma evansi* and *Theileria equi* in single-step reaction was standardized and employed on 108 equine blood samples collected from two agroclimatic zones of Punjab to evaluate the status of concurrent infection and associated risk factors. The overall prevalence of *T. evansi* and *T. equi* was 3.7 and 1.85%, with Undulating zone at higher risk of *T. equi* infection (Odd Ratio=3.24, 95% CI=0.28-83.65); and Submountain zone (OR= $\infty$ , 95% CI=0.25- $\infty$ ) for *T. evansi*. Multiplex PCR revealed higher risk of subclinical infection of both *T. equi* (OR=6.75, 95% CI=0.58-175.38) and *T. evansi* (OR=2.11, 95% CI=0.05-80.36) in the farms with unorganized management system. The host species had marked effect on the prevalence of *T. evansi* infection (Odds ratio=12.35, 95% CI=0.29-508.37), revealing the donkey/mule population most susceptible to *T. evansi* infection. This group was also at higher risk of infection with Odds ratio (OR) of 4 (95% CI=0.14-53.99). The sequence of *T. equi* (accession number LC008132) in the present study amplified by BeqF1/BeqR1 primers fell in the same node with isolated of *T. equi* from Brazil, Spain and South Africa, while was quite distance from other species of *Theileria*. The sequence of *T. evansi* (accession number LC008133) obtained in PCR by TR3/TR4 Primers showed significant difference from *T. evansi* strain *RoTot1.2* from Palestine (EU931247.1) and *T. evansi* Strain C6 of Camel from Israel (HM209054.1). The sequence showed closest homology with the local isolate obtained from cattle (AB979445). As multiplex PCR has 100% sensitivity and 95.32% specificity, so it was able to detect both parasites irrespective of whether the amplification was against single or dual haemoparasites and with low level of infections, thus it can be suitable for epidemiological study of *T. evansi* and *T. equi* infection in equines.



Distribution of *Theileria equi* in different districts of Punjab

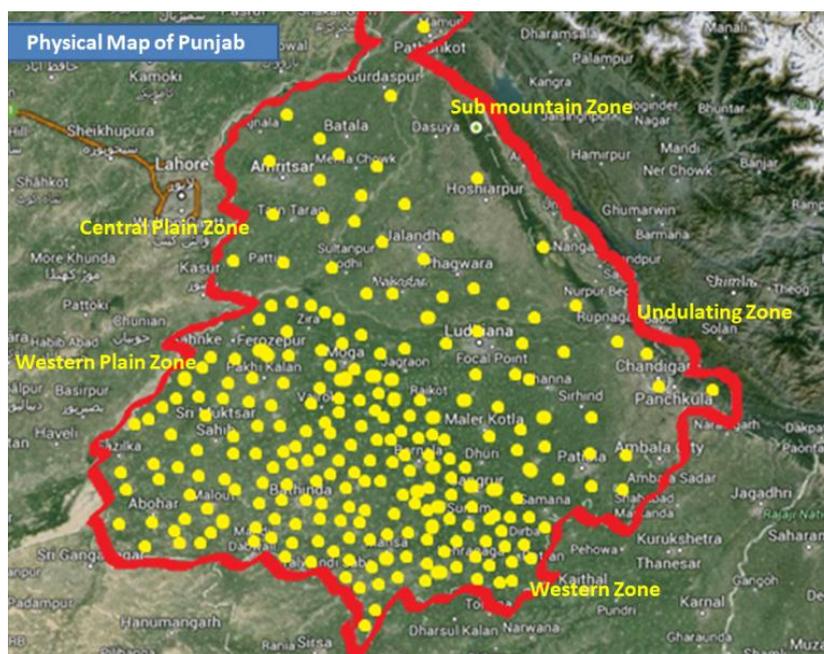


Agarose gel electrophoresis (1.5%) showing amplified DNA of 709 bp PCR for *Theileria equi*. Lane M: 100 bp DNA ladder; Lane P: positive control; Lane N: negative control; Lane 1–5: Tested field samples

*Distribution of prevalence of infection of T. annulata in bovines*

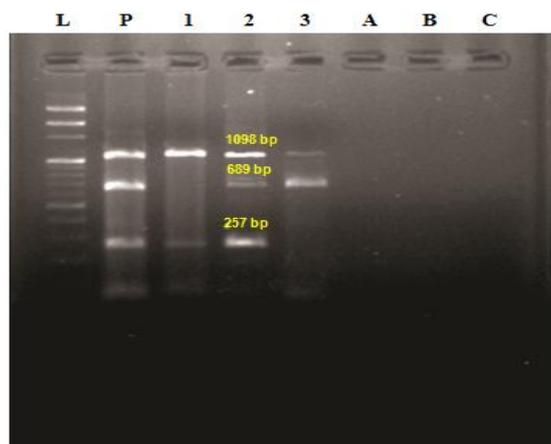
A total 1,278 blood samples of bovines (972 cross-bred cattle, 56 indigenous cattle, 250 buffaloes) collected from 5 different agroclimatic zones of Punjab were analyzed by parasitological and molecular diagnostic techniques. Overall PCR based prevalence for

*Theileria* spp. and *T. annulata* was 30.2 and 29.3%, respectively. Higher prevalence of *T. annulata* was observed in western zone (40.4%) and least in submountain zone (18.9%).



*Prevalence of infection of T. annulata in bovines in Punjab (Intensity of dots is directly proportional to the frequency of incidence of infection)*

District wise maximum prevalence was reported in Mansa district (48.1%) and least in Pathankot district (12.8%). Highly significant difference in prevalence of *T. annulata* was observed among crossbred cattle (32.4%), indigenous cattle (19.6%) and buffaloes (19.2%) in different agro climatic zones. Sex-wise difference in prevalence of *T. annulata* was observed in male (23.1%) and female bovines (30.6%). Highly significant difference was seen in the prevalence of *T. annulata* on the basis of the farm condition. Assuming sensitivity of PCR to be 100%, relative sensitivity of Giemsa stained thin blood smear examination (GSTBS) and acridine orange staining was determined to be 26.8 and 45.8%, respectively. Haematological and blood cellular changes in parasitologically positive cases revealed anemia and leucopenia. Biochemical changes in parasitologically positive cases revealed increase in serum levels of iron, ALT, AST and TBIL and decrease in level of GLU, globulin and TP values, whereas in subclinical cases, there was a decrease in globulin, TP and GLU. Multiplex PCR for simultaneous identification of *Theileria* spp., *B. bigemina* and *T. evansi* was 100% sensitive and 81.8% specific with respect to GSTBS examination.



1.5% Agarose gel electrophoresis showing multiple amplified fragments of 1098bp of *Theileria* spp., 689bp of *B. bigemina*, 257bp of *T. evansi* in field samples by multiplex PCR (L: 100 bp plus DNA ladder, P: *Theileria* spp, *B. bigemina* and *T. evansi* DNA, 1: *Theileria* spp. and *T. evansi* DNA, 2: *Theileria* spp., *B. bigemina* and *T. evansi* DNA, 3: *Theileria* spp. and *B. bigemina* DNA, A, B: Negative field samples, C: Non template controls)

Duplex PCR for simultaneous diagnosis of *Anapalsma marginale* and *Theileria* spp. revealed higher sensitivity in detection (17.7%) of covert or subclinical multiple infections in animal under field as compared to GSTBS (2.2%) with a slight agreement ( $Kappa=0.19$ ) between the two techniques. Nested PCR was employed on 12 samples, which were negative for *T. annulata* but positive for *Theileria* spp., revealed 5 more cases positive for *T. annulata* in secondary PCR reaction. Remaining 7 cases warranted further investigation.

#### *Realtime PCR for detection of B. bigemina*

Real time PCR was standardized and employed on 95 field samples of cattle and buffaloes suspected for babesiosis. The results of realtime PCR were compared with conventional PCR targeting the small subunit ribosomal RNA (SSU rRNA) gene. The samples were quantified based on standard curve generated with the given positive control. Out of 21 samples positive by SSU rRNA PCR assay, 19 samples displayed a Ct value in the range of  $10^4$ - $10^3$  copy/ $\mu$ L. The 18 animals positive for *B. bigemina* infection by realtime PCR alone fell in the range of  $10^2$ -10 copy/ $\mu$ L. Realtime PCR was found to have remarkably higher sensitivity as compared to conventional SSU rRNA PCR assay with a detection limit of 10 copies/ $\mu$ L of 18s rRNA gene.

#### *Sensitivity of the primers for the detection of B. bigemina*

The diagnostic efficacy of PCR assay targeting the *SpeI-AvaI* restriction fragment was compared with that targeting SSU rRNA gene of *B. bigemina* on 783 samples. Out of 783 samples, 31 and 52 samples positive by *SpeI-AvaI* and SSU rRNA gene based PCR assay, respectively. Phylogenetic analysis of the nucleotide sequence of *SpeI-AvaI* PCR amplicon of local isolate (AB922127) showed 83% identity to nucleotide sequence of GenBank

(Accession number S45366), while SSU rRNA amplicon (AB922126) showed 100% identify with data of Genbank (EF458206, X59605 and EF458199).

*Molecular detection of B. bigemina infection in apparently healthy cattle*

Examination of Giemsa-stained peripheral thin blood smears revealed 2.45% animals to be positive for piroplasms of *B. bigemina*. However, genomic DNA isolated from these blood samples when subjected to primary PCR revealed a positivity of 7.35% as detected by the amplification of a 278-bp product in the agarose gel. PCR products obtained from the primary PCR, when employed in nested PCR produced the amplicons of 170 bp in 30.39% of the samples.

*Fenvalerate resistance status in Rhipicephalus (Boophilus) microplus*

Larval packet test was used for evaluating the resistance levels in *R. (B.) microplus* collected from different districts of central plain zone of Punjab against fenvalerate. The slope of mortality (95 % CI) varied from  $0.730 \pm 0.097$  (0.419–1.043) to  $1.455 \pm 0.281$  (0.558–2.352) and the value of  $R^2$  varied from 0.881 to 0.997. From the regression equation the values of  $LC_{50}$  and  $LC_{95}$  were recorded in range of 184.39–1,338.01 and 3,253.33–112,706.26 ppm, respectively. Among the various tick isolates resistance factors in range of 1.56–54.34 were determined and all field isolates studied were found resistant against fenvalerate. Two field isolates (Jalandhar and Ludhiana) showed level I resistance; three (Patiala, Fatehgarh Sahib and Amritsar) showed level II and Kapurthala isolate showed level IV resistance.

*Esterase and glutathione S-transferase levels associated with synthetic pyrethroid resistance in Hyalomma anatolicum and R. (B.) microplus*

Larval packet test was used for assessment of resistance status against cypermethrin and deltamethrin in *H. anatolicum* and *R. (B.) microplus* from various districts of Punjab. Among the various field isolates of *H. anatolicum* susceptible status was recorded against cypermethrin in all isolates, whereas against deltamethrin resistance status (level I–III) was recorded. In *R. (B.) microplus* lower resistance levels (I–II) were recorded against cypermethrin in comparison to deltamethrin (level I–IV). Quantitative analysis of general esterase activity revealed a range of  $4.21 \pm 0.46$  to  $6.05 \pm 0.55$  and  $2.23 \pm 0.23$  to  $2.66 \pm 0.24$   $\mu\text{mol/min/mg protein}$  for  $\square$ - and  $\square$ -esterase activity, respectively, in different field isolates of *H. anatolicum* and the increase in comparison to susceptible was not significant. In contrast to *H. anatolicum*, the  $\square$ - and  $\square$ -esterase activity in all field isolates (except Jalandhar) of *R. (B.) microplus* was higher (range of  $3.89 \pm 0.26$  to  $10.85 \pm 0.47$  and  $1.75 \pm 0.08$  to  $5.87 \pm 0.29$   $\mu\text{mol/min/mg protein}$ , respectively). The GST activity in field isolates of *H. anatolicum* and *R. (B.) microplus* was in the range of  $0.01 \pm 0.001$  to  $0.03 \pm 0.001$  and

0.02±0.0003 to 0.03±0.001 mM/mg/min. The enzyme ratios ( $\square$ - and  $\square$ -esterase and GST) and RR<sub>95</sub> against deltamethrin of *H. anatolicum* isolates were correlated whereas in *R. (B.) microplus* only  $\square$ - and  $\square$ -esterase and RR<sub>50</sub> against deltamethrin were correlated.

*In vitro* acaricidal activity of *Murraya koenigii* extracts against synthetic pyrethroid-resistant *R. (B.) microplus*

Larval packet test was used for detection of resistance status against cypermethrin and deltamethrin in *R. (B.) microplus* collected from Faridkot, Punjab. Results indicated presence of resistance of levels I and II against cypermethrin and deltamethrin, respectively. Adult immersion test was used to assess the acaricidal activity of aqueous (MLAq), ethanol (MLE), chloroform (MLC), acetone (MLA) and hexane (MLH) extracts of leaves of *M. koenigii* against these resistant engorged adult female ticks by determination of per cent adult mortality, reproductive index (RI), per cent inhibition of oviposition (%IO) and hatching rate. The per cent mortality caused by various extracts at concentrations ranging from 0.625 to 10.0 % varied from 0.0 to 100.0 % with maximum per cent mortality of 10.0, 100.0, 70.0, 40.0 and 10.0 recorded against MLAq, MLE, MLC, MLA and MLH, respectively. Among all extracts, the highest acaricidal property against resistant *R. (B.) microplus* was exhibited by the MLE as it showed the minimum LC<sub>50</sub> values of 2.97% (2.82–3.12%), followed by MLC as 10.26% (8.84–11.91%) and MLA as 18.22% (16.18–20.52%). The average egg mass weight recorded in live ticks treated with various concentrations of different extracts was lower than the respective control group ticks and was significantly lower in ticks treated with MLH extract. However, no significant effect on hatchability of eggs of treated groups when compared to control was recorded. A significant decrease in the RI was recorded in MLH extract-treated ticks, and the %IO varied from 0.07 to 34.73% with various extracts and was recorded maximum with highest concentration of MLH.

*Ivermectin resistance status in R. (B.) microplus*

Detection of resistance levels against ivermectin in *R. (B.) microplus* collected from four districts (Bathinda, Gurdaspur, Hoshiarpur and Pathankot) of Punjab was carried out using larval immersion test (LIT). The LIT was conducted in triplicate for various concentrations of technical grade ivermectin and larval mortality was recorded after 24 h of incubation of the larvae in packets at 28±1°C and 85±5% RH. The LC<sub>50</sub> and LC<sub>95</sub> values for the susceptible *R. (B.) microplus* isolate (collected from Kulgam, J&K) were 3.41 and 26.98 ppm, respectively whereas, in field isolates of Punjab were in range of 10.13-30.19 and 65.37-228.69 ppm, respectively. Against ivermectin, RFs ranging from 2.97-8.85 were recorded indicating presence of level I resistance status in one (Pathankot) and level II in three (Gurdaspur,

Bathinda and Hoshiarpur) field isolates. The data generated seems to be pioneer report of ivermectin resistance in *R. (B.) microplus* from Punjab, India.

#### *Malathion resistance status in R. (B.) microplus*

Adult immersion test (AIT) was used for the assessment of malathion resistance status in *R. (B.) microplus* collected from various districts (Barnala, Bathinda, Faridkot and Muktsar) of southern Punjab. The slope of mortality ranged from  $1.02 \pm 0.36$  to  $3.64 \pm 0.52$  and the value of goodness of fit ( $R^2$ ) ranged from 0.72-0.95 for various isolates. The  $LC_{50}$  and  $LC_{95}$  values were in range of 1002.3-3509.4 and 6288.9-41376.0 ppm, respectively with resistance factors of 1.35-8.86 indicating susceptible (Faridkot), level I (Bathinda) and II status (Barnala and Muktsar). The effect of malathion on reproductive parameters of treated ticks viz. egg mass weight, reproductive index (RI) and percentage inhibition of oviposition IO% were studied by AIT. The slope of egg mass wt. ranged from  $-23.91 \pm 5.32$  to  $-33.02 \pm 7.38$  and was negative because with the increasing concentrations of malathion the survived ticks laid significantly fewer eggs. The mean RI of treated ticks showed a decreasing trend with increasing concentrations of malathion whereas, a significant increase was recorded in the mean %IO in treated ticks with increasing drug concentrations.

#### *Malathion resistance status in Hyalomma anatolicum anatolicum*

The engorged adult female ticks when exposed to an increasing concentration of malathion showed an upward trend in the mortality percentage. The regression graph of probit mortality of ticks plotted against log values of malathion concentrations was utilized for the determination of slope of mortality (95% confidence intervals) which was  $2.489 \pm 0.719$ , whereas, the value of goodness of fit ( $R^2$ ) was 0.799. The  $LC_{50}$  and  $LC_{95}$  were 9099.2 (8378.6-9881.7) and 41511.3 (35060.2-49149.4) ppm, respectively and the resistance factor (RF) was 16.60 (Level II). The slope of egg mass wt. was  $-91.79 \pm 25.15$  (-171.8 to -11.76) and was negative because with the increasing concentrations of malathion the survived ticks laid significantly fewer eggs. The mean RI of treated ticks showed a decreasing trend with increasing concentrations of malathion and the slope was  $-0.293 \pm 0.059$  (-0.482 to -0.105). There was a significant increase in the mean %IO in treated ticks with increasing drug concentrations.

#### *Alterations in acetylcholinesterase and glutathione S-transferase associated with malathion resistance in R. (B.) microplus*

Adult immersion test was used for the assessment of malathion resistance status in *R. (B.) microplus* collected from different districts of Punjab. The values of  $RR_{50}$  and  $RR_{95}$  were recorded in range of 0.49-3.33 and 1.03-8.85, respectively and variable resistance levels (I-II)

were detected in eight out of ten field isolates studied. The percent uninhibited activity of acetylcholinesterase (AChE) and enzyme ratios were recorded in range of  $37.24 \pm 0.55$  to  $43.97 \pm 0.81$  and 1.27-1.49, respectively. The elevation in mean AChE levels of various isolates was significantly correlated with their  $RR_{95}$  values for malathion through a correlation coefficient ( $r$ ) of 0.627. A significantly higher glutathione S-transferase levels in the range of 0.02-0.03 mM/mg/min with a non-significant correlation with  $RR_{95}$  values for malathion were also observed.

#### *Amitraz resistance status in R. (B.) microplus*

The resistance status of *R. (B.) microplus* collected from Faridkot and Moga districts of Punjab was evaluated against amitraz by Adult Immersion Test (AIT). Amitraz showed mortality in a concentration dependent manner in both isolates of adult female ticks upon exposure to various concentrations (125, 250, 500, 1000 and 2000 ppm). The regression graph of probit mortality of ticks plotted against log values of amitraz concentrations revealed the slope of mortality (95% CL) as  $3.856 \pm 1.149$  (0.1988 to 7.513) and  $3.837 \pm 0.6684$  (1.710 to 5.964) for Faridkot and Moga isolates, respectively. The  $LC_{95}$  values were calculated as 488.04 (438.09-543.68) and 661.35 (593.67-736.74) ppm whereas, the RF were 3.90 and 5.29 which indicated level I and II resistance status for Faridkot and Moga isolates, respectively. The dose response curves for egg mass weight, reproductive index and percent inhibition of oviposition of both isolates were also validated by AIT.

### **Veterinary Pathology**

#### *Prevalence of poultry diseases*

The pathological conditions prevailed in the farm in Punjab were mainly oophoritis and egg peritonitis mainly in adult, omphalitis in young chicks, airsacculitis, coccidiosis, *E. coli* infections, chronic respiratory disease, viral disease like Marek's disease (MD), Newcastle disease (NCD), Infectious bursal disease (IBD), pigeon pox, cancer, metabolic disease like rickets/soft bones, visceral gout and congenital defect like kidney aplasia etc. Approximately 5000 poultry birds / Emus were necropsied. They were affected with Aspergillosis, Hypercalcemia, Rickets and heat stroke.

#### *Poultry disease diagnosis*

Immunohistochemistry, ELISA and PCR were effective and precise diagnostic techniques for MD, Chronic Respiratory Disease (CRD), IBD, and NCD. Immunohistochemistry using fluorescent-tagged secondary antibody was standardized for IBD. ELISA technique was developed for the detection of MD viral antigen in tissue homogenates. To confirm PCR results, MDV specific positive PCR products were gel purified and sequenced commercially.

97% homology was observed with Gallid Herpesvirus-II isolates. In future, poultry disease diagnostic laboratory using molecular or immunological techniques can be made available to the farmers.

#### *Rabies diagnosis*

Rabies was tested in 62 animals clinically suspected for rabies. These animals comprised of dogs (32), buffaloes (10), cows (15), rabbits (2), mongooses (2) and horse (one). 30 (48.38 %) animals out of the 62 tested were diagnosed to be rabid by FAT on brain tissue. The animals confirmed to be positive comprised of dogs (17), buffaloes (4), cows (8), and mongoose (one). From urine, molecular approaches viz. Heminested RT-PCR and TaqMan real time PCR diagnosed rabies in 65.4% and 73.1% animals. Immuno-pathological approach viz. fluorescent antibody technique failed to detect rabies any of the urine sample. From saliva, Heminested RT-PCR and TaqMan real time PCR diagnosed rabies in 76.92% and 84.62% animals. Fluorescent antibody technique diagnosed rabies in 46.1% saliva samples. Comparison of sensitivity, specificity and accuracy between molecular and immuno-pathological techniques for detection of rabies from urine revealed that molecular approaches are more sensitive and accurate than immuno-pathological approaches for rabies virus detection in skin. Taqman real time PCR is most sensitive (73.08%) for detection of rabies from urine. It was concluded that in comparison of detection of rabies from urine and saliva, saliva renders more sensitive and accurate secretion for attempting diagnosis of rabies. Rapid detection kit based on chromatographic assay was employed to detect rabies ante-mortem from saliva of 26 clinically suspected animals [dogs (12), cows (8), buffaloes (8) and mongoose (one)] and 17 (65.38%) were positive for rabies by the rapid detection kit. The sensitivity, specificity and accuracy of rapid detection kit for diagnosis of rabies from saliva was 65.38%, 100% and 81.63%, respectively.

#### *Canine mammary tumour*

The study was conducted on 45 cases of canine mammary tumour and on screening by histopathology, 40 cases, including 22 of carcinoma, 13 of carcinosarcoma and 5 of sarcoma, were further subjected to immunohistochemistry by lymphangiogenesis markers viz. podoplanin, LYVE-1, PROX 1 VEGFR-3, and their mediators viz. VEGF-C and VEGF-D. The lymphangiogenesis was compared with angiogenesis by employing laminin and VEGFR-2. In addition, Q-PCR was also done for podoplanin, LYVE-1, PROX 1 and VEGF-C. Highest lymphatic vessel density in intratumoural area was recorded with VEGFR-3 ( $35.94 \pm 3.45$ ), followed by podoplanin ( $31.95 \pm 2.77$ ), LYVE-1 ( $11.11 \pm 2.20$ ) and PROX 1 ( $7.62 \pm 1.11$ ). In peritumoural area lymphatic vessel density was highest with podoplanin

(11.48±1.32) followed by VEGFR-3 (7.69±0.51), LYVE-1 (5.19±0.96) and PROX 1 (3.48±0.48). VEGF-D expression showed a significant correlation with PROX 1. Blood vessel density with VEGFR-2 and laminin was (31.32±2.88) and (28.31±2.49) in intratumoral fields and (6.59±0.43) and (10.33±0.96) in peritumoral fields, respectively. Dual immuno-staining led to higher blood vessels to lymphatic density in both peri-tumoural and intratumoral areas due to good contrast between the two. Out of 23 cases subjected to Q-PCR, podoplanin mRNA expression was observed in 21, PROX 1 in 20 and VEGF-C in 19 cases. Kaplan Meier Analysis showed an overall poor survival with the increase in peritumoral lymphatic and blood vessel densities. It was concluded that the peri-tumoral lymphatics played a role in tumour spread and prognosis mainly versus intra-tumoral lymphatics

### **Veterinary Pharmacology and Toxicology**

#### *Antimicrobial efficacy of commonly used antibacterials in veterinary practice*

Pharmacodynamic characteristics (MIC) of ciprofloxacin, enrofloxacin, levofloxacin, moxifloxacin, norfloxacin, cefquinome and ceftiofur against *E. coli* isolates from diarrheic buffalo calves revealed full susceptible to fluoroquinolones and cephalosporins. The MIC (0.022 µg/ml) of enrofloxacin was lowest compared to MICs of other tested fluoroquinolones viz., levofloxacin (0.024 µg/ml), moxifloxacin (0.028 µg/ml) and norfloxacin (0.036 µg/ml). Enrofloxacin exhibited low MIC compared to ceftiofur (0.194µg/ml) and cefquinome (0.038µg/ml). But the MIC of ciprofloxacin (0.009µg/ml) was two times less than enrofloxacin. The MIC values obtained for reference strain of *E. coli* were almost similar to values obtained from natural isolates of *E. coli* from diarrheic buffalo calves.

#### *Therapeutic potential of some indigenous plants of Punjab*

Aqueous and ethanolic extracts of leaves *Cymbopogon winterianus*, *Vitex negundo* and *Withania somnifera* and roots of *Vitex negundo* were tested for acaricidal activity against synthetic pyrethroid resistant *Rhipicephalus (Boophilus) microplus* and against deltamethrin resistant *Hyalomma anatolicum*. The results of the study showed that various plant extracts are toxic to R. (B.) microplus adults. Also, there was a significant reduction in the egg production in ticks treated with both aqueous and ethanolic extracts. Ethanolic extract of the leaves of *Vitex negundo* and aqueous extract of *Withania somnifera* leaves were highly effective in controlling hatching of eggs laid by the treated ticks. Various ethanolic extracts produced a concentration dependent increase in tick mortality of *Hyalomma anatolicum* larvae, whereas the aqueous extracts exhibited a much lower mortality. The highest mortality

(93.7±0.66 %) was observed at the 5.0% concentration of ethanolic extract of leaves of *C. winterianus* and the lowest LC50 value (0.011%) was recorded for ethanolic extracts of leaves of *V. negundo*.

#### *Toxicological studies of quinalphos in buffalo calves*

Based on the recommended concentrations of quinalphos used for crop protection, a suitable non-lethal dose of quinalphos (1 mg/kg) was administered in buffalo calves for 90 days by oral route. There were mild clinical signs exhibited by the animals upon quinalphos treatment. The biochemical parameters studied showed alterations like inhibition of cholinesterase activity in RBC and plasma. There was significant increase in creatinine, gamma-glutamyl transferase, AST, ALT and AKP.

#### *Nitrite toxicity*

Oral subacute exposure of buffalo calves to fenvalerate produced significant decline in Hb (27.2%), TLC (23.3%), TEC (24.5%) and MCHC (27.7%) and a corresponding elevation in MCV (35.7%). Following oral exposure to sodium nitrate, significant depreciation of blood Hb (21.9%), TLC (17.0%), TEC (20.7%), MCH (16.4%) and MCHC (27.6%) and a significant elevation in MCV (35.4%) was observed. Combined exposure to fenvalerate and sodium nitrate produced severe effects with an appreciably more prominent decline in Hb, TLC, TEC and MCHC and a significant elevation in MCV. Methaemoglobin percentage was observed to follow an elevating trend in animals exposed to sodium nitrate alone (0.69%-13.8%) and in combination with fenvalerate (0.75%-13.7%). The biochemical alterations after oral subacute coexposure to fenvalerate (1.0 mg/kg/day) and sodium nitrate (20 mg/kg/day) for 21 days were investigated in buffalo calves. Fenvalerate and sodium nitrate co-administration for 21 days produced significant increase in plasma AST (42.8%), AKP (45.5%), gamma-GTP (75.0%), LDH (62.5%), CK (31.4%), glucose (60.6%), BUN (90.0%), cholesterol (30.1%) and creatinine (37.7%), but a significant decrease in total plasma proteins (29.2%) in buffalo calves.

#### *Toxicity of Pyrethroids*

Subacute fenvalerate toxicity in buffalo calves was induced by daily oral administration of fenvalerate @ 1.0 mg.kg<sup>-1</sup>day<sup>-1</sup> for 21 consecutive days which failed to elicit any effect on TSH levels, but it produced declined T<sub>3</sub> (13.1%) and T<sub>4</sub> (19.3%) levels. The plasma level rose from 0.5 h value of 1.79±0.06 µg.ml<sup>-1</sup> to 4.22±0.13 µg.ml<sup>-1</sup> by 16 h and thereafter started declining and reached 0.77 ± 0.04 µg.ml<sup>-1</sup> by the 48 h. The C<sub>max</sub> was 6.04±0.07 µg.ml<sup>-1</sup>, AUC measured was 141.9±3.11 µg.ml<sup>-1</sup>.h; AUMC was 2398.0±53.8 µg.ml<sup>-1</sup>.h<sup>2</sup>; MRT recorded was 16.9±0.15 h; Kel 0.06±0.001 h<sup>-1</sup>; t<sub>1/2</sub> elm 11.7±0.10 h; Volume of distribution was 0.10±0.004

$L.kg^{-1}$ ;  $Vd(SS)$   $0.12 \pm 0.003 L.kg^{-1}$  and the clearance was  $0.007 \pm 0.0002 ml.kg^{-1}.h^{-1}$ . Oral subchronic fenvalerate toxicity was induced in buffalo calves by daily oral administration of fenvalerate at the dose of  $0.5 mg/kg/day$  for 90 consecutive days. This produced mild degree of toxic signs including salivation, lachrymal discharge, dullness, depression, reduced feed intake, emaciation, alopecia and sunken eyes in buffalo calves. Sub-chronic exposure of fenvalerate produced significant increase in the extent of lipid peroxidation (28.1%) and enzymatic activity of glutathione peroxidase (18.3%), but a significant decrease in blood glutathione (20.1%), superoxide dismutase (25.1%) and catalase (12.8%) in buffalo calves. Repeated oral administration of fenvalerate produced significant increase in the plasma AAT (22.0%), AKP (15.1%), gamma-GTP (49.4%), LDH (22.0%), CK (15.1%), glucose (55.1%), BUN (73.5%) and creatinine (24.4%) in male buffalo calves. A significant decrease was observed in the plasma total proteins (13.6%) and in  $T_4$  (7.04%).

#### *Pesticide-induced adverse effects*

Subacute toxicity of CBZ causes significant decline in circulatory levels of LH, FSH, testosterone, estradiol and insulin, and an increase in plasma cortisol. Administration of Se (supra-nutritional) partially restores circulatory levels of some hormone. Thyroid hormones showed age related response to CBZ. In immature rats, TSH was increased, however, there was no significant effect in mature rats. There was corresponding decrease in  $T_3$  levels in immature and increase in mature in CBZ treated rats.

#### *Influence of exposure to new generation insecticides on the disposition of antimicrobial agents*

*Pharmacokinetic profile of cloxacillin in buffalo calves:* Cloxacillin was injected as single iv injection of  $10 mg.kg^{-1}$  body weight in buffalo calves. The peak plasma level of cloxacillin was  $48.1 \mu g.ml^{-1}$  which was approximately 96 times higher than the minimum therapeutic level ( $0.5 \mu g.ml^{-1}$ ) of the drug and the was detected above MIC level up to 4 hours of administration. Plasma disposition of cloxacillin followed two-compartment open model. Cloxacillin was rapidly transferred from central to peripheral compartment in buffalo calves as is evident from high value of distribution rate constant  $\alpha$  ( $7.74 \pm 0.25 h^{-1}$ ) and further confirmed by the high value of  $K_{12}$  ( $3.99 \pm 0.19 h^{-1}$ ) and the high ratio of  $K_{12}/K_{21}$  ( $2.60 \pm 0.15$ ). High value of AUC ( $19.3 \pm 0.67 \mu g.ml^{-1}.h$ ) and AUMC ( $25.2 \pm 1.02 \mu g.ml^{-1}.h^2$ ) in buffalo calves indicated vast area covered under drug concentration. The large  $Vd_{area}$  ( $0.96 \pm 0.07 L.kg^{-1}$ ) in buffalo calves indicated extensive distribution of cloxacillin in various body fluids and tissues. The elimination half-life of cloxacillin was very short ( $1.28 \pm 0.06 h$ ) which correlates well with the detection of drug in plasma up to a short interval of 4 h. An

intravenous dosage regimen of cloxacillin at 10 mg/kg body weight at 12 h interval against the bacterial pathogens with MIC values 0.25 µg/ml and at 8 h for bacteria with MIC values 0.25-1.0 µg/ml in healthy buffalo calves would be sufficient to maintain the plasma levels required for effective clinical outcome.

*Effect of oral subchronic fenvalerate exposure on the disposition of cloxacillin:* The drug was injected as single iv injection of 10 mg.kg<sup>-1</sup> body weight in buffalo calves on day 90 of daily oral administration of 0.5 mg. kg<sup>-1</sup> dose of fenvalerate. The plasma drug levels in insecticide-exposed animals were lesser than those of healthy buffalo calves throughout the observation period and were detected above MIC level up to 4 h similar to that in healthy animals. The plasma disposition of cloxacillin, the absorption rate constant  $\alpha$ ,  $K_{12}/K_{21}$  ratio was similar in exposed and healthy animals. Larger  $V_{darea}$  (1.08 ±0.03 L.kg<sup>-1</sup>) in exposed as compared to corresponding value in healthy buffalo calves revealed that the drug is more extensively distributed to various body fluids and tissues of fenvalerate-exposed buffalo calves than in healthy buffalo calves. An intravenous dosage regimen of cloxacillin at 10 mg/kg body weight at 12 h interval against the bacterial pathogens with MIC values 0.25 µg/ml and at 8 h for bacteria with MIC values 0.25-1.0 µg/ml in healthy as well as fenvalerate-exposed buffalo calves would be sufficient to maintain the plasma levels required for effective clinical outcome.

### **Veterinary Physiology and Biochemistry**

*Role of fibronectin binding outer membrane proteins of Pasteurella multocida in extracellular matrix (ECM) adhesion and pathogenesis in Bubalus bubalis*

Fibronectin from buffalo plasma were isolated utilizing gel filtration, gelatin and heparin affinity chromatography. Fibronectin was characterized using polyacrylamide gel electrophoresis (PAGE). Outer membrane proteins of Pasteurella isolates from few isolates were isolated and characterized in PAGE.

*Amla as an antioxidant in summer stressed buffalo*

Treatment group animals were supplemented with amla powder @ 200 mg/Kg body wt. /day and it was concluded that supplementation of amla powder may ameliorate the adverse effects caused due to oxidative stress and improve the reproductive performance of summer stressed buffaloes.

### **Veterinary Surgery and Radiology**

*Long bone fracture repair equipments*

Ten bovine patients were operated for long bone fractures by intramedullary interlocking nailing. The other fractures were treated with conventional internal and external fixation

techniques. After comparison of different techniques of internal and external fixation, interlocking nailing was found better for healing of long bone fractures. T-Plate and low contact dynamic compression plate were suitable internal fixation techniques for the repair of radius ulna fractures in dogs. Use of C-Arm for minimally invasive fracture repair in small animals was standardized and is being used routinely.

#### *Ultrasonography for equine abdominal affections*

Ultrasonography was standardized for pre- and post-operative evaluation of colic and other abdominal affections in equine and was found useful for the diagnosis of abdominal affections in equine and for evaluating the post-operative recovery period.



*Large animal intelocking nailing*

*Large animal surgery*

#### *General anesthesia in bovine*

Xylazine-Ketamine–Midazolam-isoflurane was standardized for the induction of general anesthesia in bovine. This combination was satisfactory for induction and maintenance of general anesthesia in cattle and buffalo. Studies on the use of dexmedetomidine in pre-anesthetic regimen and propofol as induction agent have been initiated. Epinephrine and dobutamine were useful for the maintenance of arterial blood pressure in large animal patients.

#### *Equine colic*

In equine colic, ventral midline celiotomy provided proper visualization of intestinal lesion and helped in removal and drainage of the obstruction. Pre-operative levels of blood lactate, PCV, TLC were established as good prognostic indicators for equine colic patients. Elevated lactate levels were indicative of poor prognosis. Assessment of peritoneal fluid protein and its lactate levels along with cytology were reliable in post-operative assessment in abdominal surgery. Abdominal support bandage was helpful in preventing wound dehiscence, edema

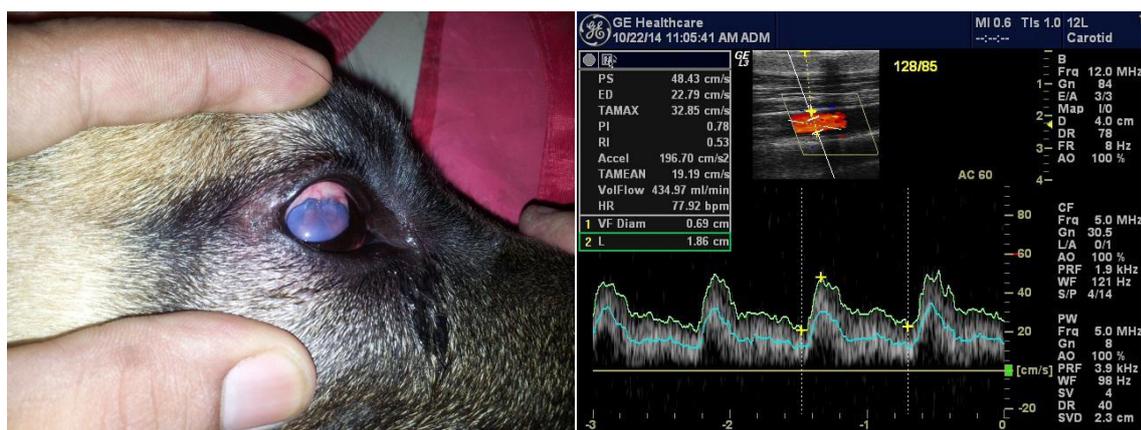
formation and abdominal hernias. Lignocaine as a prokinetic drug helped in preventing the paralytic ileus post-operatively.

#### *Doppler database for major blood vessels*

B-mode and Doppler database for major blood vessels common carotid artery, external jugular vein, cranial epigastric vein, caudal vena cava and portal vein were established in non-gravid cattle and buffalo. Advanced pregnancy had no effect on the Doppler values of Common Carotid Artery (CCA), External Jugular Vein (EJV) and Cranial Epigastric Vein (CEV) in cattle and buffalo. Doppler ultrasonography in CCA, EJV, Caudal Vena Cava (CdVC), Portal Vein (PV) and CEV was used to establish pathophysiological changes in the blood flow of these vessels in reticular diaphragmatic hernia, pericarditis, traumatic reticulitis and intestinal obstruction in cattle and buffalo.

#### *Treatment of cataract*

Extracapsular lens extraction using phacoemulsification and intraocular lens transplantation has been standardized and is being performed successfully for the treatment of cataract in small animals.



*Cataract treatment in canines*

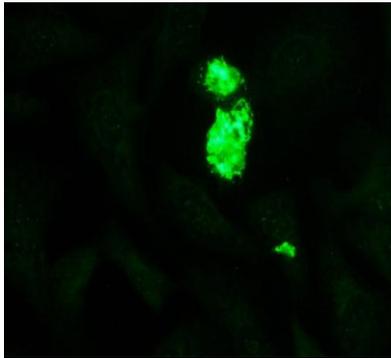
*Doppler ultrasonography*

### **School of Animal Biotechnology**

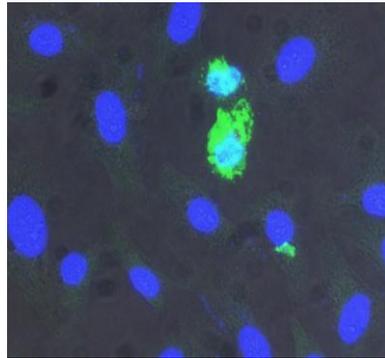
#### *Development of a Vero-dSLAM and MDCK-dSLAM cell lines constitutively expressing canine signaling lymphocyte activation molecule (SLAM) or CD150 on the cell surface*

Canine distemper virus infects its host with the help of signaling lymphocyte activation molecule (SLAM) or CD150 present on the surface of susceptible cells. For *in vitro* studies of CDV, such as viral isolation and propagation, Madin-Darby canine kidney (MDCK) cells or African green monkey (Vero) cells have traditionally been used but these cells do not express canine SLAM, which is a major receptor in CDV infection thus making the virus isolation a difficult task. Canine SLAM gene (dSLAM) was amplified from activated PBMC by RT-PCR, cloned in between the hRAGE signal sequence and FLAG tag, constitutively expressed

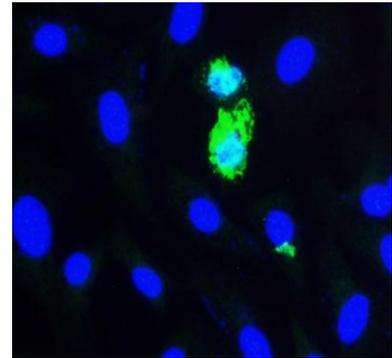
on the surface of the MDCK and Vero cells and then the expression was detected by anti-FLAG antibody.



*40X, FITC filter*

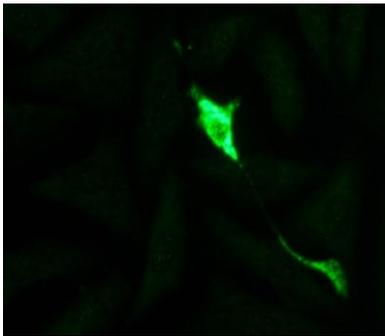


*40X, Merged DAPI+FITC*

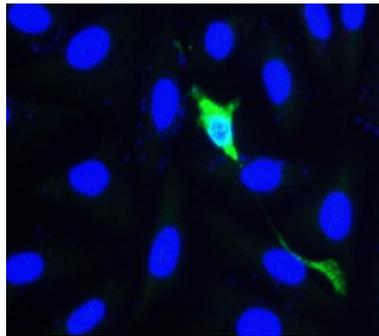


*40X Merged DAPI+FITC+ Bright Field*

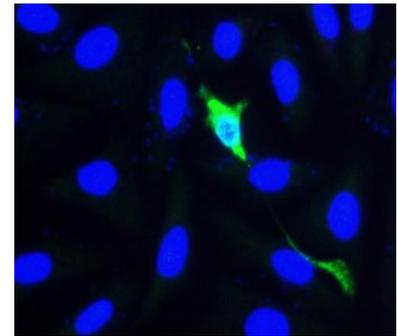
*Detection of dSLAM expression on MDCK-dSLAM cells by using anti-FLAG Antibody and Alexafluor-488 secondary antibody*



*40X, FITC filter*



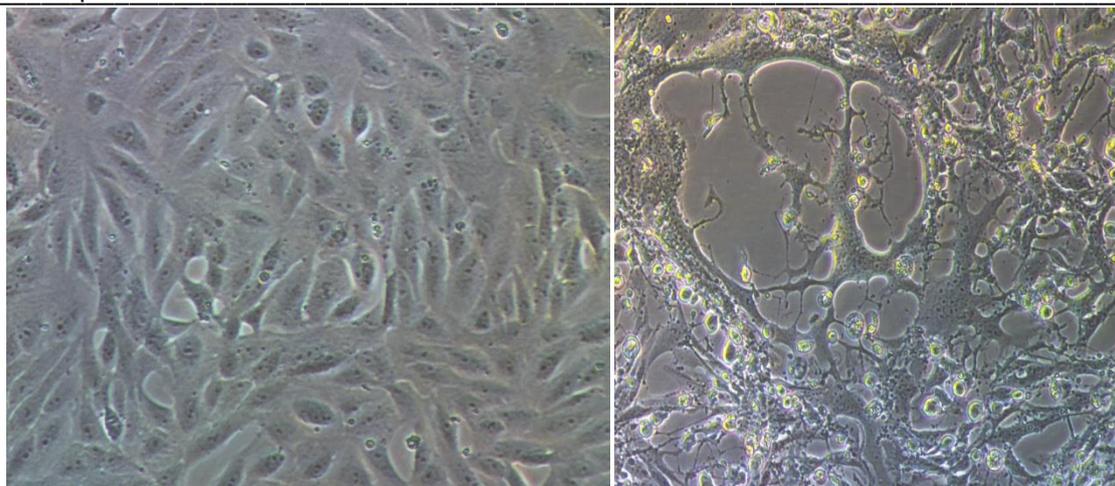
*40X, Merged DAPI+FITC*



*40X Merged DAPI+FITC+ Bright Field*

*Detection of dSLAM expression on Vero-dSLAM cells by using anti-FLAG Antibody and Alexafluor-488 secondary antibody*

The hRAGE signal sequence could successfully express canine SLAM gene (dSLAM) on the cell surface of MDCK and Vero cells. The newly developed, stably transfected MDCK and Vero cell lines constitutively expressing dSLAM will serve as permissive cell lines for isolation and culture of canine distemper virus (CDV).



*Non-infected cell control*

*Syncytia formation – Multinucleated cell that results from the fusions of multiple cells*

*Cytopathic effect (CPE) of Canine Distemper Virus (CDV) Snyder Hill strain in newly developed Vero-dSLAM cell line indicating growth of CDV, confirmed by RT-PCR*

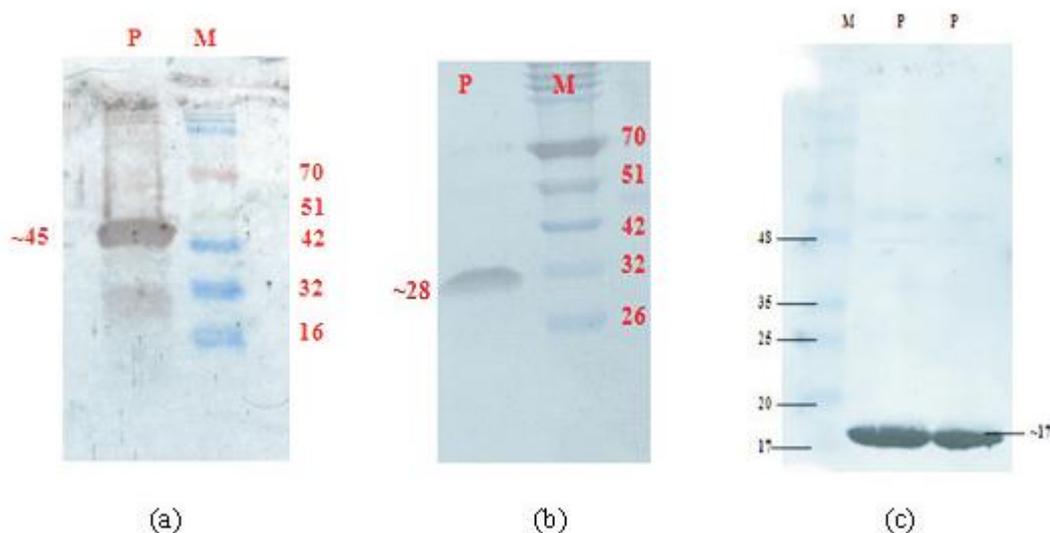
#### *Expression of TNF $\alpha$ following single and multiple exposures to poultry barn air*

Real time PCR analysis for the expression profile of Tumor necrosis factor-alpha (TNF $\alpha$ ) mRNA showed that multiple exposures of 24-day resulted almost two-fold increased expression of TNF $\alpha$ . There was decreased expression of TNF $\alpha$  following multiple exposures of 6-day. Also, 6-day exposure followed by LPS challenge almost showed similar findings.

#### *Cloning, phylogenetic analysis and expression of recombinant LipL41, Loa22 and LipL21 Proteins from Leptospira interrogans*

Three genes *lipL41* (1088 bp), *loa22* (608bp) and *lipL21* (581bp) of *L. interrogans* were cloned and sequenced. Multiple sequence alignment and phylogenetic analysis revealed that *loa22* and *lipL21* gene sequences of *L. interrogans* serovars Grippotyphosa and Canicola respectively were conserved in nature but *lipL41* gene sequence of *L. interrogans* serovars Grippotyphosa showed variation in nucleotide sequence which contributes to serovar evolution within species. For protein expression truncated *lipL41* (1028 bp), *loa22* (548bp) and *lipL21* (472bp) genes were amplified, cloned and expressed in prokaryotic expression system and His-tagged ~45kDa (*lipL41* gene), ~28kDa (*loa22* gene) and ~17kDa (*lipL21* gene) proteins were purified by nickle-nitriloacetic acid (Ni-NTA) affinity chromatography. Antiserum raised in mice against recombinant immuno-dominant proteins LipL41, Loa22 and LipL21 successfully reacted with proteins in immuno-blot tests revealed that recombinant proteins mimic the role of natural surface exposed antigens of Leptospira. These recombinant

proteins can be used for various downstream applications like as vaccine candidates and for development of ELISA for sero-diagnosis of leptospirosis.



*Immunological characterization of recombinant proteins using mice hyperimmune serum. (a) LipL41 protein, (b) Loa22 protein, (c) LipL21 protein. Lane P. Protein in kDa, Lane M. Multicolour broad range protein ladder in fig a & b; Broad range protein ladder in fig c.*

#### *Cloning, expression and characterization of recombinant outer membrane protein 16 from *Brucella* spp*

Medical defense against the bio-terror threat posed by *Brucella* would be strengthened by development of a vaccine and improved diagnostic tests. Recombinant outer membrane protein 16 was expressed from *Brucella abortus* using prokaryotic expression vector. The recombinant protein was purified and characterized immunologically by western blotting for development of ELISA or can be evaluated as vaccine candidate.

#### *Sequence analysis of e2 glycoprotein from Indian isolate of classical swine fever virus (CSFV)*

Currently, this is the most epizootically dangerous disease to the species. Numerous CSFV isolates with various degrees of virulence have already been isolated worldwide, ranging from low virulent strains that do not result in any apparent clinical signs to highly virulent strains that cause a severe per acute hemorrhagic fever with very high mortality. Aligning the nucleotide (1119bp) and amino acid (373) sequences with 29 reference strains revealed nucleotide and amino acid sequence identities of 82.60-97.80% and 88.70-98.70%, respectively, indicating a higher mutation rate of the field CSFV strains. The phylogenetic analysis based on the complete E2 amino acid sequences also revealed a reliable



differentiation of all the analyzed strains into specific genetic groups and subgroups, plus the local isolate (CSFV-E2) was found to cluster with the CSFV subgroup 2.2.

### School of Public Health and Zoonoses

#### *Community awareness project for prevention and control of zoonoses*

The pre- and post-training knowledge assessment performed to assess knowledge, attitude, risks and perceptions related to zoonotic diseases for different target groups (school children, dairy farmers, poultry handlers, pet owners, animal husbandry workers and consumers) and the posters to be displayed depicting prevention and control measures of important zoonotic diseases have been developed. A book entitled '*Zoonoses – the diseases transmissible between animals and man*' and the pamphlets on important zoonotic diseases have been published. These are freely distributed to the target groups especially in school libraries for better awareness on prevention and control measures on zoonotic diseases. The school children and dairy farmers in 110 villages and 25 urban/peri-urban population areas are imparted knowledge on prevention and control of important zoonotic diseases. About 60 field programmes/awareness meetings, 14 exhibitions and 15 trainings have been imparted.

<b>Profession-wise distribution of Brucellosis in humans</b>						
<b>Occupation</b>	<b>Total sample</b>	<b>RBPT +ve</b>	<b>% +ve</b>	<b>STAT +ve</b>	<b>ELISA IgG +ve</b>	<b>ELISA IgM +ve</b>
<b>Dairy Farmers</b>	725	129	17.8	117	131	8
<b>Veterinarians</b>	576	90	15.3	91	122	16
<b>Pharmacists</b>	260	76	29.2	73	89	6
<b>PUO</b>	101	49	-	48	28	0
<b>General population</b>	246	15	6.1	16	5	1
<b>Total</b>	<b>2022</b>	<b>360</b>	<b>17.8</b>	<b>345</b>	<b>376</b>	<b>32</b>

<b>Distribution of Brucellosis in animals (cow, buffalo, sheep, goat) from different districts of Punjab having reports of human or animal brucellosis</b>			
<b>District</b>	<b>Total samples</b>	<b>RBPT</b>	<b>ELISA</b>
<b>Amritsar</b>	58	7	8
<b>Barnala</b>	22	8	8
<b>Fatehgarh</b>	28	16	18
<b>Gurdaspur</b>	46	2	2
<b>Khanna*</b>	60	18	26
<b>Ludhiana</b>	367	86	65
<b>Mohali</b>	17	4	4
<b>Morinda*</b>	97	55	54
<b>Patiala</b>	208	50	51
<b>Ropar *</b>	100	65	35
<b>Sangrur*</b>	30	10	11
<b>Jalandhar</b>	60	4	5
<b>Bathinda</b>	97	52	10
<b>Mansa</b>	7	0	*
<b>Ferozepur</b>	3	0	*
<b>Muktsar</b>	5	0	*
<b>Moga</b>	36	8	*
	<b>1241</b>	<b>385</b>	<b>297</b>

*Molecular epidemiology and diagnostics of pig transmitted human parasitic diseases*

Three species of *Sarcocystis* viz. *S. miescheriana*, *S. suihominis* and *S. porcifelis* were recorded from pigs. Among these, *S. suihominis* is of paramount zoonotic importance and an important food safety issue. Pig cardiac tissues from 250 stray and farm pigs (*Sus scrofa*) were collected from slaughter shops located in urban slums of Punjab state of North India. Using intact cyst isolation, pepsin HCl digestion method, conventional PCR and Real time PCR–melt curve analysis, the *Sarcocystis* cysts/zoites were recorded in 58.4%, 58.4%, 72.8% and 76.4% samples, respectively. One and six isolates belonged to *S. miescheriana* and the zoonotic species *S. suihominis*, respectively. This is the first study providing molecular identification for the presence of zoonotic species *S. suihomonis* in the country, but transmission studies in non-human primates must be carried out to assess the pathogenic

potential of *S. suis* among definitive hosts. The high prevalence of *S. suis* in Indian pork is worrisome and warrants intervention policies to stop the practice of rearing pigs under unhygienic conditions.

#### *Validation of a new ELISA for the detection of Toxoplasma gondii infection*

The scientists at CFAP, CFIA, Canada are in the process of preparing antigens from cultured tachyzoites. Anti-*T. gondii* antibodies produced experimentally in pigs, cats, mice and seals were used to develop and assess the performance of ELISA-A/G. Toxoplasma antigen is being prepared for MAT or WB tests. The method of standardization for ELISA, MAT and WB tests is in progress at GADVASU.

#### *Major foodborne pathogens and molecular epidemiological studies on viral food borne pathogens*

Analysis of 242 meat samples, 73 swab samples for *S. aureus* and Methicillin Resistant *S. aureus* revealed 21.1% meat samples and 37.0% swab samples contaminated with *S. aureus*, respectively, and 1.2% meat samples contaminated with MRSA. Majority *S. aureus* isolates were resistant to penicillin (90%), followed by ciprofloxacin (66.9%) and tetracycline (41.3%). The prevalence rate of group A rotavirus in children was detected as 6.17% by RNA-PAGE, 8.02% by RT-PCR and 9.25% by ELISA.

#### *Persistent organic pollutants (POPs) in fish, fishpond sediments and water*

Fish (n=195) samples collected from fish farms (n=39) representing three different agroclimatic zones of Punjab indicated the presence of lindane,  $\alpha$ -chlordane, p,p'-DDE, p,p'-DDD, endosulfan sulfate, methoxychlor, PCB-28, PCB-138 and PCB-180 with mean level of 22.6, 16.4, 15.3, 22.7, 23.7, 20.2, 26.9, 27.3 and 25.7 ng/g, respectively. The detection frequency of lindane,  $\alpha$ -chlordane, p,p'-DDE, p,p'-DDD, endosulfansulfate, methoxychlor, PCB-28, PCB-138 and PCB-180 was 2.5, 7.6, 42.0, 14.8, 0.5, 2.5, 1.5, 1.5 and 1.5% of fish samples, respectively. Based on overall mean residue levels, p,p'-DDE contributed 48% of the total POPs residues detected in fish followed by p,p'-DDD, chlordane, lindane, methoxychlor, PCB-28, PCB-138, PCB-180, endosulfan with comprising of 25, 9, 4, 4, 3,3,3, and 1%, respectively. While the analysis of pond sediments samples collected from fish farms revealed the presence of only lindane and p,p'-DDE residues with mean level of 17.7 and 9.4 ng/g, respectively. Mean POP levels detected were below the MRLs described by EU-MRLs, Italian-MRLs, FDA-2001 and FAO-1983.

#### *Pesticides residues in food of animal origin*

Mapping of Punjab for presence of pesticide residues in milk and meat revealed cancer and non-cancer risks were within prescribed range values.

### *Antibiotic residues in food of animal origin*

Antibiotic residues were estimated in 400 chicken samples and human health hazard risks were calculated based on residue levels in chicken. The methodology was standardized for the extraction of residues in bovine milk and eggs.

### *Prevalence of major zoonotic disease*

Brucellosis and echinococcosis are endemic in Punjab. About 15.43% humans were seropositive for hydatidosis. The seroprevalence of *T. canis*, *T. spiralis* and *T. solium* was 22.13, 5.73 and 11.47%, respectively.

## **Animal Disease Research Centre**

### *Disease outbreak*

Outbreaks (n=23) of bacterial (Hemorrhagic septicemia-4, Listeriosis 1, Posterior Paralysis 2), viral (Classical swine fever-4, IBH - 1, PPR-1) and parasitic diseases (Anaplasma-3, Babesiosis 1, Coccidiosis -1) as well as toxicities (Nitrate-4, Weedicide-1) were attended and successfully controlled by using conventional and molecular laboratory techniques for their diagnosis.

### *Brucellosis and tuberculosis testing*

Out of cattle (n=121) tested for brucellosis, 3.30% were positive by Rose Bengal Plate Test (RBPT) and 0.82% were positive by competitive ELISA. All goats (n=68) were negative for brucellosis by using RBPT and cELISA.

Out of cattle (n=121) tested for tuberculosis, 14.87% were positive by comparative intradermal test, 0.82% by Gamma Interferon assay, 14.87% by PCR for mycobacterium complex and 3.30% by PCR for *Mycobacterium bovis*.

### *Nitrate toxicity outbreaks*

Nitrate toxicity outbreaks are common in hot and humid weather and agronomical factors had an important role in accumulation of nitrate and oxalate in fodder crops. About 25-30% fodder samples contained nitrate >2000 ppm and higher nitrate in fodder was found in Ludhiana, Kapurthala and Bathinda districts. Healthy bovine and goat blood had nitrate as 9-44 ppm and 7.5-18 ppm, respectively.

## **College of Dairy Science and Technology**

### *Dairy product technologies*

Technology for Low Fat Yoghurt Ice Cream developed, and is pack ready for its transfer to interested entrepreneur and/or industry. Technology for the manufacture of sugar free milk

cake has been standardized. Dairy prototype for hygienic and hand free operation for preparing traditional dairy product 'pinni' has been designed and fabricated.

#### *Nanoemulsion and encapsulation*

Nanoemulsion-based herbal formulation developed and its antimicrobial/ preservative effect established and demonstrated against selected food pathogenic bacteria. Another innovative technology on emulsion-based delivery system developed for the safe and efficient delivery of bioactive ingredients into food matrix and their targeted delivery into human gut. Technology for particle coating and encapsulation using food grade materials has been standardized and would be useful for the encapsulation of bioactive ingredients/minerals. These technologies are significant step forward in development of specialized functional foods for a specific group of people.

#### *Food safety at dairy farm level*

Survey on existing status of food safety at dairy farm level in Punjab suggested that compliance with requirements of food safety measures involves cost and may be unbearable especially for marginal and small farmers.

### **College of Fisheries**

#### **Inland saline water aquaculture**

##### *Improved carp culture technology for higher productivity*

Productivity of fresh water carps (3 species combination-catla, rohu and common carp) further enhanced from 3.5 to 4.69 t/ha/yr (salinity 4-6 ppt) through stocking density enhancement from 15,000 to 20,000 fingerlings/ha. Maximum average weight gain recorded in rohu (405g and 395g) followed by common carp (332 and 311g) and catla (287 and 275g) at stocking densities of 15,000 and 20,000 fingerlings/ha, respectively. As net weight gain of fresh water carps declines with increase in salinity of water, hence to utilize the full available water space in the pond, it was found that stocking density of fresh water carps can be enhanced to 15,000 and 20,000 fingerlings/ha in ponds with salinity range 4-8 and 4-6 ppt, respectively.

##### *Integrated fish cum duck farming in inland saline water*

Productivity of fresh water carps (3 species combination-catla, rohu and common carp) further enhanced from 3.5 to 4.75 t/ha/yr (salinity 4-6 ppt) through stocking density enhancement from 15,000 to 20,000 fingerlings/ha and integration with duck (layer variety – Khaki Campbell @ 300/ha), with an anticipated annual net profit of 2.27 lakhs. Maximum average weight gain recorded in rohu (412g) followed by common carp (367g) and catla (291g) at stocking densities 20,000 fingerlings/ha.

### *Brackish water shrimp farming in inland saline water*

After developing protocols for rearing fresh water carps in inland salt affected waterlogged waste lands of south west districts of the State, another break through was achieved in rearing brackish water shrimp, ‘Vannamei’ (*Litopenaeus vannamei*) in inland saline water. First commercial trial of ‘Vannamei’ shrimp culture conducted successfully in inland saline water (salinity 2-4 ppt) at stocking density of 50PL/m<sup>2</sup>, with an average productivity of 3.12 t/ha in single crop of 96 day and a net profit of 2.43 lakhs.



*Brackish water shrimp ‘Vannamei’ (Litopenaeus vannamei) harvested from inland saline water pond in Fazilka*

### *Fish biodiversity in inland saline water*

Ecological mapping of inland saline resources w.r.t fish biodiversity was carried out. *Tilapia mossambicus* was the major species found breeding and surviving well, at wide range of salinity (5 to 30 ppt), in all the saline water drains and salt affected water logged waste lands in district Fazilka throughout the year. Other species included murrels, minor craps and weed wishes, dominated by *Puntius spp.*

### **Fresh water aquaculture**



*Haul of P. pangasius from 1<sup>st</sup> commercial trial carried out at Fazilka*

*Rearing of Pangas catfish in cages erected in earthen pond*

### *Culture of high value species - Pangas catfish, Pangasius pangasius*

First Commercial trial of ‘Pangas’ culture conducted successfully with an average productivity of 17.5 t/ha (average fish weight 500g) and net profit of 1.25 lakhs in 6 months

of culture period. The profitability could have been higher if the stock could be sold at a higher price. The fish fetched low market price due to flooding of local markets with 'Pangas' from Andhra Pradesh and further due to climatic constraints to sell the stock before onset of winters to prevent mortality. To work out optimum density for rearing Pangas catfish in cages, erected in carp poly culture earthen pond, Pangas fry (5cm) was reared at 4 stocking densities (25, 30, 35 & 40 fry/m<sup>3</sup>) for 120 days fed on floating feed. Although, maximum average weight gain of fish was recorded at stocking density of 25/m<sup>3</sup> (188.8g) but maximum biomass was harvested at stocking density of 35/m<sup>3</sup> (average weight gain 175.4g). 35 fry/m<sup>2</sup> stocking density was found to be optimum w.r.t. fish survival (100%), fish growth (30% higher net weight gain) and FCR (1.46). 'Pangas' is a cold sensitive species, which does not survive during winter. In spite of overwintering challenges, 'Pangas' catfish has been overwintered with 100% survival under polyhouse conditions. Further, Pangas catfish brood stock production is under progress. Already overwintered yearlings (stock procured in 2013) undergoing overwintering for the second year for developing 2 yr+ brood stock for conducting breeding trials under local climatic conditions, in 2016. In view of local demand for Pangas fish, climatic conditions of the State and sensitivity of Pangas catfish to temperatures below 20°C, farmers have come with an interest to take up small scale processing units to develop value added Pangas products, which will not only add substantially to their profitability but also extend the shelf life and availability of Pangas fish during winters.



*First year overwintered Pangas catfish undergoing overwintering for the 2<sup>nd</sup> year for 2 year + brood stock production under poly house conditions*

#### *Culture of high value species - Singhi catfish, *Heteropneustes fossilis**

Vitamin C and E supplemented brood stock diets developed for *H. fossilis* for improved breeding performance. Diet supplemented with Vitamin-C @ 100 mg/kg diet resulted in highest Av. weight gain (53.25%), gonado-somatic index (14.2%), Av. fecundity (125 No./g FBW), Av. fertilization rate (77%) and Av. hatching rate (82%). Diet supplemented with

Vitamin-E @ 200 mg/kg diet resulted in highest Av. weight gain (59.48%), gonado-somatic index (13.8%), Av. fecundity (119 No./g FBW), Av. fertilization rate (78%) and Av. hatching rate (84%). Improved protocol developed for induced breeding of *H. fossilis* (without sacrificing male) with synthetic inducing agent Wova – FH (@ 0.6 – 0.8 ml/kg FBW). Improved reproductive performance in terms of breeding success (90%), Av. fecundity (288 No./g FBW), Av. fertilization rate (90.7%) and Av. hatching rate (93%) was recorded with WOVA-FH as compared to inducing agent ‘Ovatide’.



*Mature brooders of Singhi developed at GADVASU*

*Brooders with spawned eggs in indoor flow through trough*

*Stocking of larvae in outdoor flow through troughs*

*Harvesting of fry*

### *Larval diets*

Mixed zooplankton + egg yolk, egg yolk + *Artemia* nauplii and egg yolk + vitamin C diets developed for higher larval survival under indoor flow through rearing conditions. However, highest larval survival (82.5%) achieved with diet containing egg yolk + *Artemia* nauplii.

### *Fry diets*

Vitamin-C incorporation @ 1200 mg/kg diet resulted in 100% survival of fry with highest weight gain and SGR. No significant differences were observed for protease activity ( $\mu\text{mole/g/min}$ ) whereas, amylase activity ( $\mu\text{mole/g/min}$ ) was found to be maximum in thyroxine enriched diet (0.144) followed by Vitamin-C enriched (0.093), amino acid enriched (0.083) and control (0.048) diets. Papain incorporation in fry diet @ 1.5% resulted in maximum survival (100%) and growth (% net weight gain - 61.02). Although, maximum survival (92%) of *H. fossilis* fry was recorded with 2% yeast incorporated diet, but significantly higher growth (% net weight gain - 74.5%) was observed with 4% yeast incorporated diet.

### *Fingerlings diet*

For fingerlings of *H. fossilis*, formulated dry diet (rice bran: mustard cake: soybean meal 1:1:2) developed for both higher survival (95 %) and growth (% net weight gain - 95.68 %)

### *Overwintering of Singhi*

Successful overwintering (December – February) of fingerlings (6.2g) and brood stock (95g) achieved in outdoor earthen ponds with 85% and 77% survival by feeding supplementary diet (rice bran – 24 %, mustard meal– 24 %, soybean meal – 50 %, vitamin – mineral mixture – 1.5 % and salt – 0.5 %) @ 10% and 5 % FBW daily, respectively.



*Outdoor earthen pond for overwintering of Singhi*

*Overwintered fingerlings and brood stock of Singhi*

### *Murrel, Channa striatus (Saul)*

Brood stock of Murrel, *Channa. striatus* (Saul) reared successfully for second year in outdoor earthen pond under simulate natural habitat conditions. Surface floating and submerged aquatic plants (*Eichhornia*, *Hydrilla*) were provided in the pond to simulate natural conditions. Fish was intensively fed on forage fish and slaughter house waste @ 10-15% of fish BW daily. Fish bred naturally in the month of July, 2014. 30-day-old fry (0.5 g) reared successfully in outdoor flow through FRP pools for one month and fed (*ad-libitum*) on live food (carp spawn and insect larvae) and wet diet (slaughter house waste), with 72% survival and 400% net weight gain. Fry (2.5 g) reared successfully in outdoor cemented ponds on wet diet (slaughter house waste) fed @ 10% FBW daily for 4 months, with 30% survival and net weight gain of 47.5g. Fingerlings (47.5 g) overwintered successfully in outdoor earthen pond for 3 months with survival of 65% and 78.9% of net weight gain by feeding with slaughter house waste @ 10% FBW.



*Earthen pond for overwintering of saul*



*Overwintered fingerlings of saul*

***Fresh water Prawn, Macrobrachium rosenbergii (Scampi)***

Developed with different carbon sources like dextrose, sucrose and starch (C:N ratio of 15) for rearing fresh water prawn. Biofloc is a macro-aggregate consisting of bacteria, diatoms, algae, invertebrates, fecal matter, dead organic matter etc. and it acts as natural feed as well as water quality enhancer. The results indicate that addition of sucrose as carbon source for biofloc production, resulted in better growth, survival and innate immunity in freshwater prawns.



*Manuring of biofloc rearing tanks*

*Inoculation of bacteria*

*Biofloc development*

*Estimation of biofloc sediment*



*Biofloc*



*Harvest of prawn from biofloc tank*

With an improved grow out technology, fresh water prawn, *M. rosenbergii* (Scampi) reared at a stocking density of 50,000/ha with an average productivity of 2.7t/ha in 5 months from June to October (survival about 40% and an average individual weight of 32g). Graded starter, grower and booster pelleted diets (30% crude protein) developed for fresh water prawn.

An indigenous bio-filtration system has been developed to maintain water quality during larval rearing of freshwater prawn, with special reference to ionic composition & hardness. With this system inland saline water can be utilized for breeding & seed production of fresh water prawn.

Successful mass production of live feed such as *Artemia nauplii* and pure rotifer (*Brachionus calyciflorus*) culture was undertaken successfully for larval rearing of high value species

#### *New species introduced*

For diversification of traditional carp farming practices in the State, two new species were introduced to work out the possibilities of rearing these species under monoculture and polyculture conditions. Monosex stock (all male) of genetically improved farm tilapia (GIFT tilapia) and an important carp species, Calbasu (*Labeo calbasu*) was procured from Kolkatta, West Bengal and Central Institute of Freshwater Aquaculture (CIFA), ICAR, Bhubaneswar (Odhisha), respectively. Both the species have been acclimatized and reared successfully under local climatic conditions.



*GIFT Tilapia*



*Labeo calbasu*

#### *Utilization of non-conventional resources in aquaculture nutrition*

*Azolla*: *Azolla* culture experiments, with different doses of manure/fertilizer (cow dung @ 0.5-2.0 kg/m<sup>2</sup>/week and DAP @ 1-4 gm/m<sup>2</sup>/week) and different harvesting rates (125-250 gm/m<sup>2</sup> daily), were carried out to work out *Azolla* culture protocols for producing high quality (w.r.t protein and fiber content) *Azolla* biomass with enhanced productivity under local climatic conditions. *Azolla* dry biomass (kg) production per unit area increased with increase in dose of manure and daily harvesting rate. The results reveal that daily fresh *Azolla* harvest of 250g/m<sup>2</sup> of culture pit is sustainable at all the doses. Over 50%, 16%, 18%, 7% and 6% increase in % dry matter content was recorded with increase in manuring dose from 1kg cow dung + 1g DAP to 2kg cow dung + 4g DAP/m<sup>2</sup> /week in the month of August, September, November, December and January, respectively, which reveals that the effect of manure dose on % dry matter of *Azolla* decreases with decrease in temperature after the month of September. Percent crude protein (CP) content of *Azolla* increased with increase in manuring dose. Over 17- 39% increase in *Azolla* protein content (on dry matter basis) was recorded during different months with increase in manuring dose from 1 kg cow dung + 1g DAP to 2 kg cow dung + 4 g DAP/m<sup>2</sup> /week. However, seasonal variations revealed significantly higher CP content during winter months (Dec to Jan) as compared to summer

months (Aug - Sept). The results can be used to manipulate manuring doses and harvesting rates for producing protein rich *Azolla* biomass with higher productivity during different months of the year.

**Duckweeds:** To standardize duckweed culture technology under local climatic conditions, two duckweed species (*L. minor* and *L. gibba*) were cultured with different organic manures (cow dung and poultry droppings) and inorganic fertilizers (urea and TSP) at different doses and combinations, for one year. With respect to growth, total biomass production, winter season tolerance and nutritive value, *L. minor*, was found suitable for the region, whereas stock of *L. gibba* vanished during the winter months (October to January). Nutritive value of both the varied with species as well as type and dose of manure/fertilizer. *L. minor*: maximum average crude protein (26.27%) and crude fat (2.28%), on dry matter (DM) basis, was recorded with cow dung + poultry droppings (1:1) mixture at manuring doses of 600 kg/ha/yr and @ 700 kg/ha/yr, respectively. *L. gibba*: maximum average crude protein (28.30%) and crude fat (3.49%), on DM basis was observed with cow dung+ poultry droppings (1:1) mixture at manuring doses of 700 kg/ha/yr and @ 600 kg/ha/yr, respectively. Low cost duckweed (*L. minor*) incorporated diets developed by incorporating sundried *Lemna* @ 10-20% in the traditionally used fish diet (rice bran + mustard meal 1:1) for common carp (*Cyprinus carpio*) and rohu (*Labeo rohita*), without affecting water quality and fish growth.



*Mother stock of L. minor and L. gibba maintained in pits*

*Experiment culture of L. minor L. gibba with different manures for one year*

**Pressmud:** To assess efficacy of pressmud in carp diet, press mud was incorporated in the traditionally used diet (rice bran + mustard meal 1:1) by 15-30% replacement of rice bran (RB) and fed to carp fishes (catla, rohu, mrigal and common carp) in a poly culture system. The results revealed that press mud supported higher or comparable growth in rohu (20% RB replacement), mrigal (20-30% RB replacement) and common carp (30% RB replacement), whereas growth of catla declined with pressmud incorporation in carp diet. Since, differential and positive growth response of different carp species to press mud incorporation has been observed; fish biomass production and profitability can be enhanced through rearing selected species with pressmud based diets.

### *Periphyton based aquaculture technology*

Efficacy of three substrates viz., bamboo poles, rice straw and sugarcane bagasse, was evaluated in a periphyton based semi-intensive carp poly-culture (catla, rohu, mrigal and common carp) system. None of the substrate appeared to have any undesirable effect on water quality and survival of fish. Differences among treatments with respect to plankton (phytoplankton and zooplankton) productivity were also insignificant. Periphyton biomass per unit area varied with type of substrate. Although higher periphyton dry matter was recorded in rice straw substrate, but periphyton ash and ash free dry matter content did not differ significantly among substrates. Efficacy of periphytic substrates, with respect to growth and flesh quality of fish, varied with species. As compared to control, 12.09, 54.51, 28.77 and 8.41% higher growth was recorded in catla, rohu, mrigal and common carp, respectively with bamboo substrate, while with sugarcane bagasse substrate, 20.63, 16.92 and 22.24% higher growth was recorded in catla, rohu and common carp, respectively, which resulted in 24.18 and 17.21 % higher fish biomass production in the respective treatments. In rice straw substrate, only common carp registered 21.04% higher growth. Among all the species, significantly higher protein content was recorded in rohu with all the periphytic substrates, while in catla, mrigal and common carp, it was higher only with bamboo substrate, which indicates more periphyton grazing by rohu as compared to other species. Survival and growth of fresh water carp, rohu increased linearly in a periphyton based aquaculture system (mono culture) with increase in periphyton substrate (bamboo) density from 50% to 100% of culture tank surface, which resulted in 100% survival & over 32% higher fish harvest. Although, best results in terms of fish growth and flesh quality were observed with bamboo substrate as compared to sugarcane bagasse and rice straw, but in view of high cost of bamboo involved, both sugarcane bagasse and rice straw is expected to have more relevance, especially in rice and sugar cane growing states like Punjab, with respect to aquaculture productivity enhancement through periphyton based aquaculture technology. Efficacy of both sugarcane bagasse and rice straw in periphyton based aquaculture can be further enhanced through scientific interventions with respect to method of substrate application and fish species combinations.



*Different periphyton substrates*

*Periphyton substrate  
(bamboo) fixed in fish pond*

*Periphyton growth on bamboo*

## Fish health management

Prebiotics are defined as non-digestible food ingredients that induce growth and activity of commensal micro organisms (bacteria, fungi etc.) and contributes to the well being of their host. Application of probiotic, *Paenibacillus polymyxa* as water additive in aquaculture was tested with respect to survival, feed utilization, innate immune responses and disease resistance in fish. For this purpose, the said probiotic was used as water additive ( $@10^3$  to  $10^5$  cfu ml<sup>-1</sup>) for rearing common carp for 8 weeks. The results revealed that *P. polymyxa* inoculation, in the range of  $10^3$  to  $10^4$  cfu ml<sup>-1</sup>, can be used as water additive in aquaculture, to improve survival, growth performance and innate immune responses in freshwater carps. Synbiotic effect of probiotic *Paenibacillus polymyxa* ( $@10^6$ cfu/ml) and a short-chain fructo-oligosaccharide prebiotic (Inulin) was evaluated in fresh water carp, rohu, for eight weeks. Inulin ( $@ 0.2\%$ ) and *P. polymyxa* ( $@10^6$ cfu/ml) as synbiotics, resulted in improved growth performance and enhanced immune responses in rohu, which was confirmed through challenge test against *Aeromonas hydrophilla*.

## Non- food aquaculture

*Ornamental fish culture:* Value added Koi carp, *Cyprinus carpio*, with enhanced colour pattern/intensity, was developed by incorporating sundried *Spirodela* in farm made feed (rice bran 49%, mustard cake 49% along with vitamin – mineral mixture 1.5% and salt 0.5%) fed @ 20-40%. Although *Spirodela* enhanced colour in Koi carp at all incorporation levels (10-40%) but highest carotenoid concentration ( $\mu\text{g/g}$  wet weight) was recorded in fish fed with 20% *Spirodela* incorporated diet (1.20) followed by 30% (1.08), 40% (1.08) & 10% (0.88) *Spirodela* incorporated diets. Lowest carotenoid concentration (0.760) was recorded in fish fed with control diet.



*Designer true pearls produced at College of Fisheries*

*Fresh water pearl culture:* Round and designer pearl nuclei implanted in freshwater pearl mussel, *Lamellidens marginalis*. Implanted mussels reared in grow out crap culture ponds and true pearls produced successfully in both mantle cavity & the gonad of the mussel.

## Value added products

New fish meat and mince based products like fish wafers, fish papad, fish samosa, fish Muruku, fish fingers and fish sausages developed with good acceptability. Carp and pangas catfish cutlets (in 8 different combinations) developed with good textural qualities and improved acceptability. Instrumental texture analysis and sensory analysis was carried out to assess the texture and acceptability of cutlets and it was found that texture profile analysis can be used as an alternative to sensory analysis, which can be used for rapid determination of sensorial acceptability with least possible errors. Products like steaks, fillets, whole marinated fish, cutlets and pickle developed from Pangas catfish, which has very high potential with respect to value addition, due to high demand in the market and very less intra muscular spine as compared to carps. Value added products including breaded/battered products and pickle developed from brackish water shrimp ('Vannamei' shrimp, *Litopenaeus vannamei*) harvested from the 1<sup>st</sup> commercial culture trials conducted in Fazilka. Meat recovery and nutritional value of *Litopenaeus vannamei*, cultured in salt affected area of Punjab were estimated. Average 63.18% meat yield was recorded in the form of fantail butterfly. It gained 29.17% average weight due to coating of batter and bread crumb. Average cooking yield for coated and fried shrimp was recorded 95.51% and 69.58%, respectively. Proximate composition and biochemical analysis of raw, coated and fried shrimp was also assessed. In raw, coated and fried shrimp, average moisture content was 72.62, 47.87, 51.32%, crude protein 18.68, 24.89, 25.86%, crude fat 5.40, 19.51, 20.12% and ash content 2.46, 2.97, 1.98%, respectively. pH, peroxide value, free fatty acids and titratable acidity in coated shrimp was recorded 5.52, 1.06 meq/kg, 0.13% and 0.30%, while in fried shrimp values were 5.48, 1.53 meq/kg, 0.15% and 0.32% , respectively.



*Fish wafer*

*Vannamei shrimp  
pickle*

*Breaded and battered shrimp*



## EXTENSION

The Directorate of Extension Education geared up extension activities through its wings like Farm Advisory Service, Training and Visit to villages. In order to transfer the new technologies evolved by the University, training courses were organized for the farmers, field veterinarians and scientists from other universities. Faculty published about 160 extension articles in various magazines, journals, news papers etc. in order to disseminate information important to farmers. The faculty members also delivered 51 TV and 50 radio talks on the topics assigned by the Directorate of Extension Education.

### I. Training programmes organized for farmers –

Name of the training programme	Duration (days)	No. of trainings held	No. of Beneficiaries	Collaboration
Specialized dairy farming training course	10 days	6	275	-
Specialized pig farming training course	5 days	1	170	-
Specialized poultry farming training course	10 days	4	126	-
Specialized training course on Goat farming for farmers of Punjab	5 days	2	101	-
Training on balanced and quality feed manufacturing	3 days	4	213	PDDDB
Training on Progressive dairy farming	3 days	1	18	Lakshaya Instt. of Development, Action and Studies, Katni, M. P.
Knowledge up gradation programmes for farmers	5 days	2	50	Indian Immunologicals, Hyderabad
Specialized training on dairy	5 days	1	18	NABARD, Chandigarh
Entrepreneurs Training Programme on “Hands-on product development and Technical know-how, of various value added products”	3-5 days	6	2-3 in each training	-
Training on goat farming for the farmers from Bihar	5 days	1	20	Sponsored by ATMA, Bihar
Knowledge up gradation programmes for farmers	5 days	3	74	Indian Immunological, Hyderabad



## II. Training programmes organized for Veterinary Officers of Animal Husbandry Department, Punjab –

The University has liaison with Animal Husbandry Department, Punjab. University provides latest technical know-how to Veterinarians of the State to refresh their knowledge and enhance professional skill. Animal Husbandry Officers' Workshop was organized at GADVASU Ludhiana in collaboration with Department of Animal Husbandry, Punjab on August 29, 2014. The trainings coordinated/organized by the Department of Veterinary and Animal Husbandry Extension Education for the Veterinary Officers of Punjab state during 2014-15 were:

Name of the training programme	Duration (days)	No. of trainings held	No. of Beneficiaries	Collaborative Department
Hands on training on Radiology for surgical specialists for Animal Husbandry department of Punjab	5 days	3	47	Veterinary Surgery and Radiology
Training on Equine diseases management, diagnosis and treatment for Vets of Animal Husbandry department of Punjab	5 days	1	9	Veterinary Surgery and Radiology
Refresher course to update the knowledge of Vets of Animal Husbandry department of Punjab	5 day	7	82	-
Training on Management and disease problem of commercial dairy farming for Vets of Animal Husbandry department of Punjab	5 day	3	32	Veterinary Medicine
Training on Canine diseases: Diagnosis, prevention and treatment for Vets of Animal Husbandry department of Punjab	5 day	3	45	Veterinary Medicine
Training on diagnosis of animal diseases for Vets of Animal Husbandry department of Punjab	5 days	1	13	Veterinary Medicine
Training on management of infertility in bovines for Vets of Animal Husbandry department of Punjab	5 days	2	22	Veterinary Gynaecology
Hands on training on latest microbiological techniques for Vets of Animal Husbandry department of Punjab	5 days	1	11	Veterinary Microbiology
Hands on training for gynaecology specialists of Animal Husbandry department of Punjab	5 days	1	16	Veterinary Gynaecology
Hands on training for pathology specialists of Animal Husbandry department of Punjab	5 days	1	17	Veterinary Pathology
Hands on training for microbiology specialists of Animal Husbandry department of Punjab	5 day	1	18	Veterinary Microbiology

**III. Partnership Excellence Award from the NABARD** – GADVASU was conferred with Partnership Excellence Award from the NABARD for its performance in 2013-2014 for technology dissemination by Directorate of Extension Education to the farmers in livestock field. Hon'ble Chief Minister Punjab, S. Parkash Singh Badal has given the award to Dr V.K. Taneja, Worthy Vice Chancellor of GADVASU.

**IV. Animal Welfare Camps** – The department organized 16 animal welfare camps in the rural areas of Punjab for the treatment of sick animals. In these camps the farmers and the field functionaries were advised/made aware of the recommended animal health practices. The technical support in the form of animal welfare camps and Pashu Palan Melas has been regularly provided to Regional Research and Training Centres i.e. Booh (Tarnataran), Kaljharani (Bathinda) and Talwara (Hoshiarpur).

**V. Expert Lectures/Technical guidance** – The faculty members delivered extension lectures to the farmers in collaboration with the other animal welfare agencies of the state like Dairy Development Department, Department of Animal Husbandry, Punjab, Nestle, Smith kline Beecham, Punjab & Sind Bank and in the trainings organized by the Krishi Vigyan Kendras (KVKs) and Department of Extension Education, PAU, Ludhiana. On these occasions, demonstrations regarding the collection, dispatch and transport of clinical material like blood, mucous discharge and faeces from the animals, correct method of milking, teat dip, computation of ration, silage making, acaricide drug application and heat detection were carried out in the field for livestock farmers.

**VI. Pashu Palan Melas** – The faculty actively participated in organizing the Pashu Palan Mela of the Guru Angad Dev Veterinary & Animal Sciences University (GADVASU) held in the months of March and September every year. In these melas the Departments of constituent Colleges of the University arranged exhibition stalls to show the new technologies/innovations developed for the farmers. On this occasion the other Govt. and private agencies involved in animal welfare work also displayed their exhibits much of the importance to the farmer community. A large number of farmers visited the melas and discussed their problems with the experts of the University. On this occasion the GADVASU mela highlights depicting the services and facilities available at University and other informational materials were distributed to the farmers. The GADVASU also participated as knowledge partner in the Kisan Melas at Balawal Saunkhadi, Gurdaspur, Bathinda, Rauni, Tarnataran/Amritsar, Faridkot Regional Research Stations/KVKs of PAU for the benefit of the Livestock farmers.



**VII. Farmers Associations** – Various farmers associations are working under the aegis of Guru Angad Dev Veterinary and Animal Sciences University, Ludhiana. The Directorate of Extension Education is involved in regulating the activities of different livestock farmer associations. The regular monthly meetings/seminars of members of these associations are being held at GADVASU, Ludhiana. Besides giving lectures on technical information, the queries/ problems of farmers are solved by University experts. These meetings provide a common platform for both scientists and farmers to solve problems at field level expressed by the farmers.

**VIII. Chief Minister Awards conferred to progressive farmers** – To give a push to the livestock farming, Guru Angad Dev Veterinary and Animal Sciences University, Ludhiana has conferred Chief Minister Award to progressive farmers of the state. Many livestock farmers applied for the CM award in different categories and the University team visited the Livestock farms of the farmers. The Chief Minister's Awards for 2014 were given to S. Harpreet Singh S/o S. Balwinder Singh, VPO Noorpur Hakima, Distt. Moga for Dairy farming, S. Dalwinder Singh S/o S. Sahib Singh, Village Kishanpura, Distt. Roop Nagar for pig farming and S. Gurjatinder Singh Virk S/o S. Atmainder Singh, Village Kandola, Distt. Roop Nagar for fish farming. Dr. V.K. Taneja, Vice-Chancellor, GADVASU, Ludhiana bestowed the C.M. Award to the farmers and farmers were presented with a citation, cash award and a *loi*.

**IX. Farmers Advisory Helpline** – The telephonic helpline in the department of Veterinary and Animal Husbandry Extension Education attends to the queries of livestock owners regarding the animal health and management problems. Telephone helpline was started with the motto “You ask, we reply”. The University has also been receiving calls from distant areas like Haryana, U.P, Bihar, Rajasthan, H.P and M.P. The farmer queries attended on helpline for on the spot solution and the queries are also answered through postal letters as well.

**X. Farmers Information Centre** – The department runs a Farmers Information Centre as a single window system to cater the needs of the farmer at one place. The farmers have been given technical advice during their visit to the University. The various University publications/extension literatures are available in the farmer information centre for the use and purchase by the farmers. The faculty of the department attends to the farmer queries on various subject matters in this centre.

**XI. Linkage with other departments** – The University has liaison with various departments of Punjab State *viz.* Animal Husbandry, Dairy Development and Fisheries for undertaking

animal welfare activities. The University participates as knowledge partner in various livestock promoting activities *viz.* Zonal Livestock Shows, North Zone Livestock Championship, Dairy Training Programmes, Animal Welfare Camps/Field Days etc. organized by the state departments every year and the exhibitions were arranged at various places of events. Directorate of Extension Education, GADVASU provides the technical assistance in establishing the modern dairy farm at Gurudwara Karnsar Sahib, Rarra Sahib. Honble Vice chancellor, GADVASU inaugurated the same.

**XII. Guided Visits/ Farmers Exposure Visits** – To provide the latest technical know-how existing at farms of progressive farmers, the trainees are taken to these model farms to get exposure about the practices being followed so that they can practically judge the pros and cons of the practices for adoption at their farm and the trainees of different associations like ATMA, Punjab Dairy Development Board have been provided with facilities to visits the farms.

**XIII. Progressive Punjab Agriculture Summit-2014** – GADVASU participated in Progressive Punjab Agriculture Summit organized by the Punjab Government in association with PHD Chamber of Commerce & Industry from February 16-19, 2014 at Fateh Burj, Baba Banda Singh Bahadur War Memorial, Chapar Chiri, SAS Nagar (Mohali), Punjab. About 50 thousand farmers from Punjab, West Bengal, Chattisgarh, Madhya Pradesh, Rajasthan, Haryana, Himachal Pradesh, Jammu and Kashmir, Uttar Pradesh, Uttarakhand etc. participated in this mega event. The University established an exhibition stall at this expo and displayed the latest innovative technologies developed at GADVASU. The University participated as knowledge partner and facilitated various livestock development sessions *viz.* Commercial Dairy Farming, Rearing of Small Ruminants, Fisheries, Country Session- Canada, Punjab Agriculture- Challenges and Way Forward etc. The worthy Vice Chancellor Dr. V. K. Taneja acted as Co-Chairman in ‘Country session- Canada’ and participated in concluded panel discussion on Punjab Farmers’ Economy with focus on role of Punjab in Indian Economy. The University faculty from various departments participated in Agriculture Summit-2014 and educated the farmers about various aspects of livestock farming.

**XIV. National livestock championship-2015** – GADVASU participated in National livestock championship-2015, organized by the Punjab Government in association with PHD Chamber of Commerce & Industry from Jan 8-12, 2015 at Sri Muktsar Sahib, Punjab. Thousands of farmers from Punjab, Madhya Pradesh, Rajasthan, Haryana, Himachal Pradesh, Jammu and Kashmir, Uttar Pradesh, Uttarakhand etc. participated in this mega event. The University established an exhibition stall at this expo and displayed the latest innovative

technologies developed at GADVASU. The University faculty from various departments participated in technical sessions held in parallel and educated the farmers about various aspects of livestock farming.

**XV. Utility services** – The University is providing the following utility services at very nominal rates for the livestock farmers:

- I. Information Services** – For up gradation of knowledge of the farmers, extension functionaries, scientists and subject matter specialist the Directorate of Extension Education has been bringing out following publications.
  - a. Publications** –
    - A book on Package of Practices for Veterinary and Animal Husbandry
    - Vigyanak Pashu Palan (Monthly Punjabi Magazine)
    - Hand Book on Infectious Animal Diseases
    - Veterinary Punjabi Shabad Kosh
    - Dairy Farming
    - Goat Farming in Punjab (English & Punjabi)
    - Pashuan Da Parjanan Parbandh
    - Santulit Ate Miyari Pashu Khurak
    - GADVASU Hand-Book
    - Poultry Farming
    - Indigenous Practices of Farmers
    - Vet Alumnus
    - Vigyanik Soor Palan
    - Paltuu Kuttian Di Samb Sambhal
    - GADVASU News Letter
  - b. TV/ Radio talk**
  - c. Telephone helpline:** 0161-2414005, 2414026
- II. Technical services** –
  - a. O.P.D. /Indoor services for sick animals.
  - b. Surgical treatment of animals
  - c. Blood/faeces/urine/mucous/milk testing
  - d. Feed and fodder evaluation
  - e. Testing of water sample of farmer's ponds
- III. Input services** –
  - a. Mineral mixture.
  - b. Uromin lick
  - c. Semen
  - d. Breeding bulls/calves
  - e. Mastitis Kit
  - f. Disease outbreaks
  - g. Sale of carp fish seed and ornamental fish seed/table size fish
  - h. Maintenance of Aquaria
- IV. Chartered services** –
  - a. Animal Welfare Camps/Days
  - b. Expert Lectures (on campus/field)
  - c. Training Programmes for farmers, field functionaries (on campus/field)
  - d. Tailor made courses (on campus/field)

**Krishi Vigyan Kendra (KVK), Booh, Taran Taran**

**Training courses:** A total of 37 trainings (28 of short duration and 09 of vocational) have been organized by KVK, both on and off campus modes. Trainings have been organized in the disciplines of Animal Science, Crop Science, Soil Science and Home Science. The details of trainings conducted are as follows:

<b>Vocational trainings (5 days)</b>					
<b>Village</b>	<b>Name of course</b>	<b>No of trainings</b>	<b>Block</b>	<b>Held during</b>	<b>No. of beneficiaries</b>
Sito Mahi Jhugian	Goat Farming	01	Patti	Sept. 2014	40
Harike Pattan	Home Science	01	Patti	Sept. 2014	20
Mari Kamboke	Dairy Farming	01	Bhikhiwind	Oct. 2014	53
Mari Kamboke	Dairy Farming	01	Bhikhiwind	Oct-Nov. 2014	66
Dhunda (Goindwal)	Pig Farming	01	Chola Sahib		42
Nathuchak	Integrated Goat and Fish Farming	01	Naushera Pannua	Jan. 2015	40
Madar Mathra Bhagi	Integrated Dairy-Vermicomposting-Kitchen gardening training course	01	Bhikhiwind	Feb. 2015	40
Booh Havelian	Home Science	01	Patti	Feb. 2015	20
<b>Vocational trainings (3 days)</b>					
Dhunda, Goindwal	Rabi crops (Crop and Soil Sciences)	01	Chola Sahib	-	29
<b>Short duration trainings (1 day)</b>					
Booh Havelian	Home Science	03	-	-	-
Booh Havelian	Crop, Soil, Animal and Home Science	03	Patti	-	85
Jindawala	Crop Science	01	Patti	-	13
Thatian Khurd	Crop and Animal Science	01	Patti	-	12
KVK campus	Animal, Crop and Soil Science	03	KVK Campus	-	79
Mari Kamboke	Crop, Soil, Animal and Home Science	04	Bikhiwind	-	99
Sito Mahi Jhugian	Crop, Soil, Animal and Home Science	03	Patti	-	78
Dhunda	Crop and Soil Science	02	Chola Sahib	-	37
Kirtowal	Crop and Soil Science	01	Patti	-	11
Chamba Khurd	Crop Science	01	Naushera Pannua	-	21
Booh	Integrated crop and animal science	01	Patti	-	13
Others	Miscellaneous	04		-	48

**Frontline demonstrations (FLD):** A total of 12 FLDs on Gobhi Sarson, Gram, Kitchen Gardening, MP Chari, Tensiometer, Direct Seeded Rice, Fodder Maize, New Paddy Variety (PR 123), Wheat Varieties, Mineral Mixture, and others have been conducted involving around 300 farmers at various locations in the district. Details of FLDs carried out are as follows:

Crops	No. of demonstrations	Area (ha)
<b>FLDs (completed)</b>		
Leaf Colour Chart	20	-
New Rice Variety (PR 123)	10	-
Insecticide + Pesticides in pear	6	10
Direct Seeded Rice	8	4
Maize J-1006	20	10
Kitchen Gardening	70	4
MP Chari	2	0.4
Tensiometer	10	-
<b>FLDs (in progress)</b>		
Oilseeds (Gobhi Sarson)	48	4
Pulses (Gram)	11	1.33
Wheat	15	15
Leaf Colour Chart	54	-
Kitchen Gardening	56	-
Use of Mineral Mixture in Dairy Animals	25	-

**On Farm Trials (OFTs):** OFTs are in progress in the fields of Agriculture and allied sciences. Total beneficiaries under OFT so far are eleven (11) farmers. OFTs are conducted to evaluate the performance of three herbicides viz. Topik, Algrip and Sencor. Herbicides are being tested on wheat crop at three locations of the district with an aim to evaluate the quality and production of pear fruit through proper fertilizer management at eight (8) orchard farms. To evaluate the parasitic load in animals at the farms along with rational antihelminthic treatment at five (5) dairy farms is under the process and to evaluate the nutritional security of school going children at household level and safe storage of pulses with indigenous methods in around thirty (30) subjects per OFT in the field of Home Sciences is also being carried on.

**Operational villages:** In a cluster approach, activities of KVK in five (5) villages have been initiated. Village Booh (cluster 1), village Jindawala (cluster 2) and 3 new cluster of villages

namely Mari Kamboke, Sito Mahi Jughian and Dhunda have been taken up as operational villages for KVK activities. KVK activities of Animal Welfare Camps, Soil and Water Testing Services, Agricultural Camps, Vocational Trainings, FLDs, OFTs and others have been initiated in these villages. Operational villages are regularly being visited by KVK scientific staff rendering facilities on various aspects of Agriculture and allied fields along with backstopping from GADVASU and PAU Ludhiana and other NARS Institutes.

### Other Extension Activities

Name of Training Programme	No. of Programme	Beneficiaries
Exposure Visits of Farmers	2	80
Animal Camps	6	36
Group Meeting	10	95
Other Result/Method Demonstrations	7	135
Extension Literature Distributed	-	350
Kisan Goshthi (other than FLDs)	15	304
Field Days (other than FLDs)	10	190
Lecture delivered		
Exhibitions	5	131
Publications	2	-
Papers/Articles	7	-
Mobile Advisory Services	66	66
Soil and Water Testing Services		85
Seed Distribution Camps	3	200
Scientists Visits to Farmers' Fields	155	190
Farmers Visit to KVK	557	557
Scientists-Farmers Meet	5	10
Plant Samples	15	3
<b>Total</b>	<b>865</b>	<b>2432</b>

### Krishi Vigyan Kendra (KVK), Barnala

Training programmes were conducted by KVK, Barnala to create awareness, improve their knowledge and change in attitude of the farmers to improve the productivity of different agricultural crops and livestock to uplift their livelihood. A total of 38 training programmes were conducted benefiting to 761 farmers/ farm women.



S. No	Name of the Training Programme	Duration (days)	No. of Trainings held	No. of Participants
1.	Importance of soil and water testing	1	1	10
2	Scientific cultivation of fodder crop during Kharif	1	1	25
3	To combat the problem of fluorosis	1	1	21
4	Value addition of tomatoes	1	1	25
5	Use of LCC for proficient and management in rice	1	1	21
6	Efficient use of fertilizers in crop production	1	1	20
7	Pasu Palan seminar	1	1	67
8	Management strategies for the control of foot rot in basmati rice	1	1	21
9	Importance and use of mineral mixture and UMMB	1	1	31
10	Value addition of milk	1	1	30
11	Importance of deworming in dairy animals	1	1	21
12	Foliar fertilization in crops	1	1	20
13	Weed management (Spray techniques)	1	1	17
14	Value addition of papaya	1	1	19
15	Integrated pest management in paddy crop	1	1	19
16	Integrated pest management in cotton crop	1	1	19
17	Method of fertilizer application for efficient use especially for balanced use of fertilizer	1	1	18
18	Promotion of micro entrepreneur through skill development among farm woman	1	1	20
19	Soil and water management	3	1	53
20	Care and management of new born calf	1	1	19
21	Celebration of swachh Bharat conpon	1	1	31
22	Seed treatment a preventive measure to control seed born disease in rabbi crops	1	1	21
23	Conservation agriculture practices	1	1	26
24	Importance of diversification of rice wheat cropping system for enhancing productivity and employment	1	1	14
25	Knowledge and awareness regarding scientific dairy farm practices	1	1	15
27	Soil testing and its importance	1	1	22
29	Supplementary feeding for infants and young children	1	1	20
30	Insect pest and disease management in potato crop	1	1	17
31	Insects pest and disease management of wheat and mustard crop	1	1	20
32	Candle making	1	1	17



34	Insects pest and disease management of honey bees	1	1	22
35	Nutrient and weed management techniques in rabbi crops	1	1	13
36	Importance of feeding of mineral mixture in dairy animals	1	1	15
37	Importance of feeding of mineral mixture to combat production and reproduction problems	1	1	21
38	Feeding of mineral mixture their importance in dairy animals	1	1	21

#### Long Duration Training Programmes

S. No	Name of the Training Programme	Duration (days)	No. of Trainings held	No. of Participants
1	EDP through candle making and painting among farm women and school dropouts	5	1	22
2	Bee Keeping	5	2	31
3	Poultry Farming	5	1	29
4	Scientific Goat Farming	5	2	112
5	Bee Keeping	5	1	27

A total 7 long duration training programmes were conducted to create the self employment in the rural youth as well as in farmers and farm women benefiting 221 Rural youth/ farmers and significant impact was observed.

#### Front Line Demonstrations (FLDs)

A total of 211 Front Line Demonstrations were laid out during 2014-15 at farmer's field/ livestock on learning by seeing principle.

S. No	Title of FLD	Area (Acre)	Total Area (Acre)	No. of Participants
1.	Cultivation of Maize Fodder	0.5	14.50	29
2.	Foot Rot in Basmati seed treatment in Basmati Rice to Control Foot Rot	0.5	5.0	10
3.	LCC for proficient and management in transplanted rice	-	-	22
4.	Ameliorating Zinc deficiency in Basmati rice	0.75	9.75	13
5.	Impact of Urea Molasses Mineral Block (UMMB) on Milk Production	-	-	20 Animals
6.	Effect of crocodile insecticide on plant hoppers in rice	2	20.0	10
7.	FLD on wheat production technologies under conservation agriculture practices	1	10.0	10
8.	FLD on Oats fodder production technologies	0.5	10.0	20
9.	FLD on chickpea production technologies	0.5	5	10
10.	Effect of Mineral mixture on milk production and reproduction.	-	-	66 Animals
11.	Direct Seeded Rice (DSR)	0.5	0.5	1

### On Farm Testing (OFT):

To assess the technologies under micro climatic situation of Barnala district, a total 3 on farm trials were conducted on 40.0 acre area at farmer's field situation and benefiting 30 farmers.

S. No.	Title of OFT	Area (Acres)	No. of Participants
1	Effect of crocodile insecticide on plant hoppers in rice	20	10
2	Nutrient management through foliar fertilization in cotton	10	10
3	Foliar calcium nitrate and potassium nitrate application on paddy rice for more field and increase in farmers net income	10	10

### Other Extension activities

S. No.	Name of activity	No. of activities	Beneficiaries
1	Exposure visits of farmers	4	105
2	Animal Camps (ETV Vaccination Camps for Goats)	3	600 goats
3	Other Result/Method Demonstrations	2	30
4	Extension Literature Distributed	1	1000 copies
5	Kisan Goshthi (other than FLDs)	3	73
6	Invited Lecture Delivered	7	305
7	Exhibitions	3	NF
8	Popular Articles	3	NF
9	Farmer Visit to KVK	254	254
10	Scientist Visit to Farmers Field	191	267
11	Press Release	21	NF
12	Faecal Samples Analyzed	62	1162 goats
13	Deworming to Goats	902	907
14	Soil Samples Analysed	15	15
15	Telephone Help Line	79	79
16	Text Message Sent to Farmer's Mobile	15	8721 farmers
17	Research Papers Published	11	NF

### RRTC, Kaljharani, Bathinda

#### Training Programmes:

Name of the Training Programme	Duration (days)	No. of Trainings held	No. of Participants
Goat Farming Training	5 days	24 <sup>th</sup> to 28 <sup>th</sup> February, 2014	25
Goat Farming Training	5 days	5 <sup>th</sup> to 9 <sup>th</sup> March, 2014	50
Goat Farming Training	5 days	27 <sup>th</sup> to 31 <sup>st</sup> May, 2014	40
Dairy Farming Training under RKVY Scheme	5 days	15 <sup>th</sup> to 19 <sup>th</sup> December, 2014	43 (Free of cost-SC)
Goat Farming Training under RKVY Scheme	5 days	30 <sup>th</sup> December to 3 <sup>rd</sup> January, 2015	42 (Free of cost-SC) +5 (Paid-General)

## Library and Networking

The GADVASU library is central to the academic and research activities of the University. The Library has upgraded Libsys Software which is used for automation of library's operations.

University Library's website i. e. Cyberary (<http://www.gadvasu.in/>) has been upgraded to provide single window access to various e-resources and other important information. The library provides access to about 3500 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 through the Consortium for electronic Resources in Agriculture (CeRA). Access has been provided to KrishiPrabha, a database of doctoral dissertations and theses submitted to Agricultural Universities in India. In addition links have been given to various open access electronic information resources to access the scientific literature. To keep the users informed of the incoming documents, list of latest arrivals is regularly updated on Cyberary website.

The university library has subscribed to 8 foreign journals, 3 Indian journals and a database Indiastat.com during the year 2014-15. Library has strengthened e-books collection for the academic community of GADVASU. The library has added Book Bank facility for the benefit of the SC UG/PG students of GADVASU where books are issued for a period of one semester.

### Networking

Library has purchased 11 Online UPS of 1 KVA for providing the power supply backup to the network switches. This will help to reduce the breakdown of Local Area Network in GADVASU. Library has also purchased networking materials for extending the network like Fiber Patch Cords to connect the network switches on LAN, UTP CAT 6 cable and Input/Output Units.

In order to cover the risk of any hardware failure, support for the HP Blade Servers and its accessories was purchased. Renewed AMC of SPSS Statistics 22.0 software on network based version for 20 users for statistical analysis for getting the latest updates and technical support. In order to provide uninterrupted power supply to Servers placed in the GADVASU Library, AMC of 6 KVA UPS and 5 KVA UPS was renewed. The proposal to establish Wi-Fi network in Hostels of GADVASU has been initiated.

## Sports and Co-curricular Activities

### Sports Wing

During the period under report, GADVASU has created enough facilities to promote the sports activities among the students. Large number of students (both boys and girls) from our various constituent colleges have shown keen interest in sports activities. GADVASU successfully conducted its 9<sup>th</sup> Annual Athletic Meet on March 12, 2015. In this meet, Ramanjot Kaur was adjudged as Best Athlete and Gulgul Singh as 2<sup>nd</sup> Best Athlete in Women Section. Similarly, Arshdeep Singh Kailey was adjusted as Best Athlete and Jaskarandeep Singh Chahal as 2<sup>nd</sup> Best in Men Section. GADVASU teams also participated in North Zone Inter Varsity Tournaments for various games i.e. Table Tennis (M), Badminton (M&W), Cricket (M), Volleyball (M), Handwall (M&W), Basketball (W) and Power Lifting (M).

### Cultural Activities Wing

The Cultural Activities Wing of the Directorate has been entrusted the responsibility of promoting the cultural and co-curricular activities among the students, sharpening of their skills 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.

During the period under report, GADVASU cultural contingent participated in 19<sup>th</sup> All India Inter University Youth Festival (REVERIE '14) held at NDRI, Karnal from April 24-26, 2014 and won 22 first prizes and 6 second prizes.

GADVASU conducted its 5<sup>th</sup> Inter College Youth Festival – 2014 successfully from Nov. 04-09, 2014. The Cultural Activities Wing of the University also organized functions to celebrate Independence Day (15 Aug., 2014), *Parkash Utsav* of Shri Guru Angad Dev Ji on April 23-25, 2014 and Republic Day (26 Jan., 2015).

### NSS Unit

During the period under report, the NSS Unit organized 7 Days NSS Special Summer Camp in September, 2014 and 7days NSS Special Winter Camp from January, 2015.

The NSS Unit also observed various important days such as National Youth Day, Wetland Day, World Health Day, Anti-Terrorism Day, World No Tobacco Day, World Red Cross Day, World Environment Day, World Population Day, Sadbhawana Divas, Teachers Day, International Literacy Day, International Peace Day, NSS Day, Social Justice Day, National Blood Donation Day, Communal Harmony Day, National Integration Day, World AIDS Day, World Human Rights Day, Road Safety Week, Van Mahotsav Week, International Literacy Week, *Parthenium* Awareness Week and Qaumi Ekta Week. The volunteers also provided their services in creating awareness on various social issues in rural areas as well as in urban slum areas.



## Estate Organization

### **Construction Wing**

The **Construction Wing** continued its efforts for the construction of new buildings and renovation of existing ones. During 2014-15, the construction of building for Regional Research & Training Centre, Bhatoli (Talwara) was completed. The construction work of building for College of Dairy Science & Technology and new Girls Hostel continued on full scale and now is almost near completion. The construction work of four new buildings viz. College of Fisheries, School of Animal Biotechnology, Veterinary Referral Hospital and Milk Plant (Demonstration Unit) at Ludhiana campus and construction of one building for new College of Vety. Science at Rampura Phul (Bathinda) was started. The initial formalities for other two new buildings namely Directorate of Extension Education and Equine Hospital have been completed and the work is going to start shortly.

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.

### **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.

### **Landscape Section**

During the period under report, the Landscape Section of this directorate continued its efforts to aesthetically beautify the campus by plantation of seasonal flowers and ornamental plants of various varieties. Maintained lawns of various buildings viz. Admn. Block, library, Silver Jubilee Block, LPM Lab, Poultry Shed No. 4 and New Nursery area. The role of the Landscape Section, which is it plays in the decoration of various venues of important functions/programmes conducted by the University, deserves a special mention as it adds colour to the programmes. Plantation and maintenance of evergreen trees were also undertaken with a view that the Campus remains evergreen throughout the year.



## Conferences and Trainings Organized

S. No.	Name	Organizing Department	Dates	Sponsoring/ Collaborating Agency, if any
1	Training programme “Canine Diseases: diagnosis, prevention and treatment”	Deptt of Vety Medicine	Jan 20-24, 2014	Deptt. of Animal Husbandry, Chandigarh, Punjab
2	Trainings on “Diagnosis of Animal Diseases” for Veterinary Officers of Punjab State	Deptt of Vety Medicine	Jan 27-31, 2014	Deptt. of Animal Husbandry, Chandigarh, Punjab
3	Training programme “Canine Diseases: diagnosis, prevention and treatment”	Deptt of Vety Medicine	Feb 3-7, 2014	Deptt. of Animal Husbandry, Chandigarh, Punjab
4	Training program “Equine Diseases: diagnosis, prevention and treatment”	Deptt of Vety Medicine	Feb 17-21, 2014	Deptt. of Animal Husbandry, Chandigarh, Punjab
5	Practical Training Course in ‘Techniques in Veterinary Microbiology and Molecular Biology’ for B.Sc./B.Tech. and M.Sc. Biotechnology/ Microbiology students.	Deptt of Vety Microbiology	June 2 to July 1, 2014	-
6	27 <sup>th</sup> advanced training course on “Current trends in Veterinary Surgery and Imaging Techniques”	Centre of Advanced faculty Training, Department of veterinary Surgery and Radiology	Sep 3-23, 2014	ICAR
7	Hands-on-Training on Value Added Pork Products	Department of LPT	April 21-22, 2014	-
8	Entrepreneurship Development Programme (EDP) on “Hygienic processing and Value Addition of Meat and Meat products for Employment Generation and Women Empowerment”	Department of LPT,	Dec 29,. 2014 to Jan 24, 2015	Ministry of Food Processing Industries, GoI
9	World Vet Day	Deptt of TVCC	April 28, 2014	Pharmaceutical companies
10	Oath taking ceremony of veterinary interns.	Deptt of TVCC	Jan 31, 2015	Intas pharmaceuticals
11	Training course on <i>Adoption of newer reproductive techniques in</i>	Dept of Veterinary	Sept 10-30, 2014	CAFT-ICAR



	<i>education, diagnostics and research</i> held at ICAR Center of Advanced Faculty Training in Gynaecology and Reproduction,	Gynaecology and Obstetrics		
12	Training course on 'Management of Gynaecological Complications in Large Animals' for the Veterinary Officers of Andhra Pradesh, Telangana, West Bengal, Gujarat, Maharashtra and Rajasthan.	Dept of Veterinary Gynaecology and Obstetrics	Aug 20-22, 2014	Indian Immunologicals Limited
13	International Symposium on One Health: An Integrated View on Infectious Diseases, Food Safety and Zoonoses	School of Public Health	Nov 3-7, 2014	University of Saskatchewan Canada
14	International Workshop on Dynamic Modeling in Support of Infectious Disease Issues	School of Public Health	Nov 10-12, 2014	University Of Saskatchewan, Canada
15	Goat Farming Training	Veterinary Polytechnique Kaljharani	24-28, 2014,	-
16	Goat Farming Training	Veterinary Polytechnique Kaljharani	March 5-9, 2014,	-
17	Goat Farming Training	Veterinary Polytechnique Kaljharani	May 27-31, 2014,	-
18	Dairy Farming Training under RKVY Scheme	Veterinary Polytechnique Kaljharani	Dec15-19, 2014	Under RKVY Scheme for SC farmers
19	Goat Farming Training under RKVY Scheme	Veterinary Polytechnique Kaljharani	Dec 30 to Jan 3, 2015	Under RKVY Scheme for SC farmers
20	Training for field VO on Pathology and Pathological techniques for diagnosis	Deptt of Vety Pathology	Dec 1-5, 2014	Department of Animal Husbandry, Punjab.
21	Two days training programme on "Ornamental Fish Culture"	College of Fisheries	July 2-3, 2014	-
22	Five days training programme on "Carp Fish Farming"	College of Fisheries	July 14-18, 2014	-
23	Value addition of fish and shellfish	College of Fisheries	Feb 23-27, 2015	-



## Awards and Honours

Name of the Faculty/ Student	Award/Honour
<b>COLLEGE OF VETERINARY SCIENCE</b>	
Animal Genetics and Breeding	
Dr. Balwinder Kumar / Dr. S.T. Singh	Young scientist award by society for scientific development in Agriculture and Technology, CCS Uni. Meerut
Dr. S. T. Singh	Best Poster Presentation on one health theme in the International school of one Health
Dr. Simarjeet Kaur	Best Oral Presentation Award for Livestock and Poultry-Futuristic energy alternative for rural India from Society for conservation of Domestic Animal Biodiversty Executive Member of Society of Conservation of Domestic Animal Biodiversity ( SOCDAB)
Livestock Production Management	
Dr. A.L. Saini	Best oral presentation award ISAPM 2014. Effect of probiotics on performance, Health and Welfare of beetal kids under stall fed conditions. Chandrahas and Saini A.L. Navsari, Gujarat, 9-11 october, 2014
Dr. Daljeet Kaur	Best oral presentation award ISAPM 2015 Compositing as a suitable alternative for efficient poultry waste disposal. at Aizawl Mizorum. Anil Kumar Sharma, APS Sethi, Mudit Chandra and Amit Sharma
Veterinary Microbiology	
Dr N S Sharma	Fellow of National Academy of Dairy Science
Livestock Products Technology	
Dr Om Prakash Malav	2 <sup>nd</sup> prize for oral research paper presentation entitled “Development of meat <i>papad</i> from spent hen meat” at IMSACON 2014
Dr Akhilesh Kumar Verma, PhD Scholar	Best poster presentation at IMSACON 2014
Dr. Dinesh Krofa, PhD Scholar	1 <sup>st</sup> prize for oral research paper presentation entitled “Quality of Omega 3 fatty acid enriched chevon patties incorporated with micro-encapsulated algal oil” at IMSACON, 2014
Dr Manish Kumar Chatli	Best poster presentation at IMSACON 2014
Veterinary Pharmacology & Toxicology	
Kamalpreet Kaur Gill, Daundkar Prashant S. and Rajdeep Kaur	Best Poster Award at the 18th Punjab Science Congress on ‘Innovation trends of science & Technology in Current Scenario’ organised by Desh Bhagat University, Mandi Gobindgarh from 7-9 February, 2015.
Dr H S Sandhu	Editor-in-Chief, Toxicology International
Dr. V. K. Dumka	Managing Editor, Toxicology International
Veterinary Medicine	
Dr. B.K. Bansal	Best oral paper presentation award at ISVM conference, College of Veterinary & Animal Sciences, Pookode, Kerala, 22-24 Jan, 2015
Dr. Swaran Singh	Second Award in poster presentation at ISVM conference, College of Veterinary & Animal Sciences, Pookode, Kerala, 22-24 Jan, 2015



Dr. Raj Sukhbir Singh	Best oral presentation award at ISVM conference, College of Veterinary & Animal Sciences, Pookode, Kerala 22-24 Jan, 2015
Dr. Shukriti Sharma	Appointed "Australian Awards Ambassador" by Australian High Commission, New Delhi
Veterinary Anatomy	
Dr. Neelam Bansal	Best reviewer of Indian Journal of Veterinary Anatomy First in Veterinary among India's Best Researchers by Careers 360, March, 2014 Dr. V. R. Bhamburkar IAVA silver jubilee award and medal for veterinary anatomists of the year 2014 at XXIX Annual Convention of Indian Association of Veterinary Anatomists and National Symposium at Department of Veterinary Anatomy, Anjora Durg (C.G.) during 11-13, February, 2015.
Dr Varinder Uppal	Dr K L Suri Award and Medal for Best Poster presentation at XXIX Annual Convention of Indian Association of Veterinary Anatomists and National Symposium at Department of Veterinary Anatomy, Anjora Durg (C.G.) during 11-13, February, 2015.
Veterinary Gynaecology & Obstetrics	
Karanpreet Kaur	Best Poster Presentation' Award in International School on 'One Health held at School of Public Health and Zoonoses, GADVASU, Ludhiana, 2014
Veterinary Pathology	
Dr. N.D. Singh	Conferred the Rank of Lieutenant in Army as Associate NCC Officer of the College. Got "A" grading in Army Refresher course at RVC centre and College, Meerut Cantt.
Teaching Veterinary Clinical Complex	
Dr. Raj Sukhbir Singh	Best Oral Presentation Award in the 33rd Annual Convention of Indian Society for Veterinary Medicine (ISVM), Organized by Department of Veterinary Medicine, Pookode Veterinary college, Wayanad, Kerala from 22 <sup>nd</sup> -24 <sup>th</sup> January, 2015
Veterinary Surgery & Radiology	
Arun Anand, S.S.Singh, A. Kaur, J. Mohindroo, S.K.Mahajan and N.S. Saini	Gold medal in Equine Surgery Session of XXXVII annual congress of ISVS held at COVAS, RUVAS, Bikaner
Prachi Taksande, N.S. Saini, J. Mohindroo, T. Singh and A. Kumar	Gold medal in Ruminant Surgery Session of XXXVII annual congress of ISVS held at COVAS, RUVAS, Bikaner
Veterinary Parasitology	
Dr. L.D. singla	Editorial Excellence Award as the Editor of "Indian Journal of Animal Research" for significant and outstanding contribution to the journal as Editor. Editorial Board member The Journal of Advances in Parasitology Editorial Advisory Board of International Science Journal Member senior Editorial Board Veterinaria Member Senior Editorial Board Science Letters Editorial board Journal of Vaccines and Immunology Editorial board International Journal of Veterinary Science and Research Editorial Board member of Modern Research Journal of Agriculture Editorial Board member Animal and Veterinary Sciences Editorial Advisory Board: International Journal of Current Research and



	Academic Review Editorial Board member Science Journal of Public Health Received international travel grant from Pakistan higher education Commission and selected member of Scientific Committee from India to attend 1 <sup>st</sup> International Conference on Zoonoses-2014.
Dr. Aman Dev Moudgil Ph.D.Scholar	Granted with International Society of Zoological Sciences scholarship by the organizers to cover the local cost including registration fee, hotel accommodation and per diem during the symposium and training program in Beijing
<b>School of Animal Biotechnology</b>	
Dr R S Sethi	Short term Visiting Fellowship
Pallvi, RS Sethi, Nidhi, Shanti Choudhary, CS Mukhopadhyay, Daljit Kaur, Ramneek	Best Poster Awards during CREATE/ITrap Summer School at University of Saskatchewan, Saskatoon Canada
<b>School of Public Health &amp; Zoonoses</b>	
Dr. JPS Gill	Dr. A T Sherikar outstanding Public Health Veterinarian Award by IAVPHS
Dr. JPS Gill, JS Bedi, SPS Ghuman	Best Poster Presentation Award in International School on 'One Health held at School of Public Health and Zoonoses, GADVASU, Ludhiana, 2014
Dr. JPS Gill, JS Bedi, Simranpreet Kaur and DS Pooni	3 <sup>rd</sup> best poster prize in Second Annual Review Meet of DBT Network Project on Brucellosis held on 21-22 Nov, 2014 at JNU, New Delhi
Dr. Simranpreet Kaur	Dr. S.P. Singh Best Paper Award conferred by Indian Association of Veterinary Public Health Specialists
<b>COLLEGE OF FISHERIES</b>	
Dr. Asha Dhawan, Dean, College of Fisheries	Co-chairman for the 5 <sup>th</sup> Dean's Committee, ICAR



## Participation of Faculty in Conferences/ Symposia/ Workshop/ Trainings International

### International

S. No.	Name of the Conference/ Symposia/ Workshop/ Training
1	4 <sup>th</sup> FAO-APHCA/OIE Regional Workshop on Brucellosis Diagnosis and Control with an Emphasis on <i>B. Melitensis</i> , Veterinary Research and Development Center, FAO-APHCA/OIE, Mar 19-22, 2014
2	ISAPP.SFA Confernce, ISAPP-SFA/Aberdeen, Scotland, U.K., June 18-20, 2014,
3	Host-Pathogen Interactions, National Institute of Animal Biotechnology, Hyderabad and DBT, New Delhi, July 12-15, 2014,
4	2 <sup>nd</sup> International Conference on Animal & Dairy Sciences, OMICS Group, Hyderabad, Sept 15-17, 2014
5	XXXVII Annual Congress of ISVS and International symposium on New Horizons Of Camel Surgery And Large Ruminant Surgery, Department of Veterinary Surgery and Radiolgy, College of Veterinary and Animal Science, RUVAS, Bikaner, Rajasthan, Oct 15-17, 2014
6	1 <sup>st</sup> International Conference on Zoonoses, Bahauddin Zakariya University, at Multan, Pakistan, Oct 16-17, 2014
7	International School on One Health: An Integrated View on Infectious Diseases, Food Safety and Zoonoses, In Collaboration with University of Saskatchewan, Canada, School of Public Health and Zoonoses GADVASU, Ludhiana, Nov 3-7. 2014
8	6 <sup>th</sup> International Symposium of Integrative Zoology and International Training Course on Frontiers in Animal Ecology and Conservation Biology, Institute of Zoology, Chinese Academy of Sciences at Beijing, China, Nov 22-30, 2014
9	XXXIInd conference of the International Society for Fluoride Research, Chiang Mai, Thailand, Nov 25-28, 2014
10	Blue Paper Forum- Indian Aquaculture Pathfinder, United States Soybean Export Council and PFGF, Feb 5-6, 2015
11	International Conference on Redefining Literacy in the Emerging Digital Society, Bhutta College of Education, Ludhiana, Feb 5-6, 2015
12	XII Annual Convention and International Symposium on Sustainable Management of Animal Genetic Resources for livelihood security in developing countries, SOCDAB, TANUVAS, Chennai, Feb13-14, 2015

### National

S. No.	Name of the Conference/ Symposia/ Workshop/ Training
1	OFT on AH workshop, GADVASU, Ludhiana, April 11, 2014
2	Hands on training on Quantitative Real Time PCR for Diagnosis of Brucellosis DBT Network Project on Brucellosis, National Institute of Veterinary Epidemiology & Disease Informatics, June 2-4, 2014
3	Summer school on Modern techniques and approaches in storage of harvested and processed plant and animal food products, CIPHET, Ludhiana, June 11 to July 1, 2014
4	Advances in Freshwater Aquaculture for Progressive Fish Farmers of Punjab at Central Institute of Freshwater Aquaculture, ICAR, Bhubaneswar, June 17-19, 2014
5	107 <sup>th</sup> Orientation Programme of UGC-Academic Staff College, University of Allahabad, June 25 to July 22, 2014
6	96 <sup>th</sup> Orientation Programme of UGC -Academic Staff College, The University of Burdwan, West Bengal. July4-31, 2014
7	ICAR-NAVS Expert consultation meet on Strategies for Breeding Buffaloes Round-the-



	Year, NASC, New Delhi, July 4, 2014
8	One day workshop on “Innovation for Inclusive Growth and Entrepreneurship Generation, Punjab State Council for Science and Technology (PSCST) Chandigarh, July 23, 2014
9	Mushroom production technology, Directorate of Mushroom Research, Chambaghat, Solon, July 24, 2014
10	ICAR sponsored Summer School on Food quality and Safety: Recent Advances In Evaluation Techniques, Central Institute of Post Harvest & Engineering Technology, Ludhiana, Aug 5-25, 2014
11	Research and Extension Specialists Workshop for Rabi Crops, PAU, Ludhiana, Aug 12-13, 2014
12	Animal Husbandry Officers’ Workshop, GADVASU and State Animal Husbandry Department, Punjab, Ludhiana, Aug 29, 2014
13	Annual Review Meeting of AICRP on Cattle, GBPUAT, Pantnagar. Utrakhnad, Aug 29, 2014
14	9 <sup>th</sup> IDEA convention on Engineering interventions for global competitive advantage of Indian Dairy Industry, NDRI, Karnal, Sept 8-9, 2015
15	National seminar on “Augmenting processing and shelf life of perishable food products, National Productivity Council, New Delhi at PAU, Ludhiana, Sept 26, 2014
16	Training-cum-Awareness workshop on J-gate@CeRA, NASC Complex, New Delhi, Sept 29, 2014
17	2 <sup>nd</sup> Workshop on Brucella Genomics, Madurai Kamaraj University, Madurai, Oct 13-17, 2014
18	Seminar on Enhancing Access to Library Resources: A Critical Discussion, Examination and Evaluation of Web-Scale Discovery Services, A. C. Joshi Library, Panjab University, Chandigarh, Oct 16, 2014
19	Whole Genomic Analysis and Functional Omics Technologies for Future Designer Milk, National Dairy Research Institute, Karnal, Haryana, Oct 28 to Nov 17, 2014
20	IAVMI-2014 - XXVII Annual Convention of Indian Association of Veterinary Microbiologists, Immunologists and Specialists in Infectious Diseases & International Conference on “Challenges and Opportunities in Animal health at the Face of Globalization and Climate Change, DUVASU, Mathura, Oct 30 to Nov 1, 2014
21	Winter School on Recent Advances in Diagnosis and Management of Emerging Diseases of Livestock with Special Reference to Pigs, Deptt of Vety Pathology, College of Vety Sci and Animal Husbandry, Central Agricultural University, Selesih, Aizawl, Mizoram, Nov 4-24, 2014
22	46 <sup>th</sup> Annual Conference of the Nutritional Society of India, Dayanand Medical College, Ludhiana, Nov 6-8, 2014
23	First MDP for Newly Recruitment PCs, NAARM, Hyderabad, Nov 10 to Dec 13, 2014
24	XXXI Annual Conference of Indian Association of Veterinary Pathologists, Department of Veterinary Pathology, COVS, AAU, Anand, Gujarat, Nov 11-13, 2014
25	10 <sup>th</sup> Indian Fisheries and Aquaculture Forum (IFAF): Towards Responsible Aquaculture and Sustainable Fisheries, Indian Fisheries and Aquaculture Forum & National Bureau of Fish Genetic Resources (NBFGR), Lucknow, Nov 12-15, 2014
26	31st Annual Conference of IAVP and 5 <sup>th</sup> Annual meeting of ICVP National Symposium and CL Davis Satellite Seminar, Department of Veterinary Pathology, College of Veterinary Science and Animal Husbandry, AAU, Anand, Nov 13-15, 2014
27	Exploring Basic and Applied Sciences for Next Generation Frontiers (EBAS), Lovely Professional University, Jalandhar, Nov 14-15, 2014
28	Symposia on Agricultural Diversification for sustainable livelihood and environmental security, PAU, Ludhiana, Nov 18-20, 2014
29	XXX Annual Convention of the Indian society for study of Animal Reproduction and National Symposium on Research and innovation to improve animal fertility and fecundity, Deptt Of Obstetrics and Gynaecology, DUVASU, Mahtura, Nov 20-22, 2014
30	Annual Brucella Review Meet, J. N. U., New Delhi, Nov 21-22, 2014



31	11 <sup>th</sup> Conference of Association of Public Health Veterinarians & National Congress on Veterinary Public Health, AVPH, , NAAS complex, New Delhi, Nov 24-25, 2014
32	XXIII Annual conference of SAPI (Society of Animal Physiologists of India) and National Symposium on Physiological Determinants of Climate Resilient and Sustainable Animal Production, Central Institute for Research on Buffaloes (CIRB), Hisar, Nov 27-28, 2014
33	XXX IATLIS National Conference, on Re-inventing LIS Education Programmes in India: Challenges and Opportunities in the Digital Era, Central University of Himachal Pradesh, Dharamshala, Shahpur, Kangra, Nov 27-29, 2014
34	6th Indian Meat Science association Conference and National symposium, DUVASU, Mathura, Nov 28-30, 2014
35	XIV Annual conference of Indian Society of Veterinary Pharmacology and Toxicology, College of Veterinary Science, Assam Agricultural University, Khanapara, Guwahati, Dec 2-4, 2014
36	Winter school on Stem Cell Technology in Farm Animals, Karnal, Dec, 9-29, 2014
37	XXXIVth Annual Conference of Society of Toxicology (India), Madras Veterinary College, Chennai, Dec 10-12, 2014
38	India Innovation Growth Programme, Federation of Indian Chambers of Commerce and Industry (FICCI), Ludhiana, Dec 11, 2014
39	National Workshop on NISAGENET for Appraisal cum Validation of Data, Rajasthan University of Veterinary & Animal Sciences, Bikaner, Dec 16-17, 2014
40	Silver jubilee seminar on Present scenario and future strategies for processing and value additional of agricultural commodities, CIPHET, Ludhiana, Dec 19-20, 2014
41	Conclave on Nanobiotechnology (NanoBio2014), INST, Mohali, Dec 22, 2014
42	118 <sup>th</sup> Orientation Programme of UGC-Academic Staff College, University of Lucknow, Lucknow, Jan 1-28, 2015
43	XXVIII annual convention of IAVA and National Symposium on Veterinary Anatomy Vision 2050, Department of Anatomy, College of Veterinary Science, Bikaner, Rajasthan, Jan 8-10, 2014
44	33 <sup>rd</sup> Annual Convention and the National Symposium of ISVM on New dimensions in Veterinary Medicine: Technological Advances, One Health Concept and Animal Welfare Concerns, Dept of Veterinary Medicine, Pookode Veterinary College, Wayanad, Kerela, Jan 22-24, 2015
45	XXII Annual Convention of Indian Society of Animal Production and Management and National Symposium, COVS & AH, CAU, Selesih, Aizawl, Mizoram, Jan 28-30, 2015
46	Basic Epidemiology Training Programme in collaboration with Centre for Disease Control and Prevention (CDC), USA, National Institute of Veterinary Epidemiology and Disease Informatics at Yelahanka, Bengaluru, Feb 2-6, 2015
47	XII Agricultural Science Congress on Sustainable Livelihood Security for Smallholder Farmers, NDRI, Karnal, Feb 3-6, 2015
48	Sensitization workshop on societal fellowship scheme of DST, GOI for women empowerment, Punjab State Council for Science and Technology in collaboration with Research Promotion Cell, PU and NASI, India, Panjab University, Chandigarh, Feb 4, 2015
49	18 <sup>th</sup> Punjab Science Congress, Desh Bhagat University, Mandi Gobindgarh, Feb 7-9, 2015
50	National Seminar on Promoting the Use of Libraries in the Internet Era, Punjabi University, Patiala, Feb 10, 2015
51	13 <sup>th</sup> Annual meeting of IAVPHS, Veterinary College, Bangalore, Feb 10-12, 2015
52	XXIX Annual Convention of Indian Association of Veterinary Anatomists and National Symposium, Department of Veterinary Anatomy, Anjora, Durg, Feb 11-13, 2015



### Distinguished Visitors

S. No.	Name and other details about the visitor	Date of Visit
1	Australian Awards Team comprising of Mr. Michael Sadlon and Colin Reylonds	May 2014
2	Dr. V. L. Chopra, Former Director General ICAR along with Vice Chancellor and Registrar	May 12, 2014
3	Dr. Daljit Singh, Principal DMCH Hospital	May 14, 2014
4	Dr KML Pathak, Deputy Director General (Animal Sciences), Indian Council of Agricultural Research (ICAR); New Delhi	June 5, 2014
5	Dr. S Prabhu Kumar, ZPD Zone -1	June 14, 2014
6	Dr K.M.L.Pathak, DDG Animal Sciences, ICAR	June 5, 2014
7	Students from Jawahar Lal Nehru Govt. Sr. Sec. School, Jawahar Nagar, Ludhiana	July 8, 2014
8	Dr. Sriranganathan Nammalwar, Director, Centre for Molecular Medicine and Infectious Diseases (CMMID), VA-MD Regional College of Veterinary Medicine, Virginia Tech University, USA	July 20-21, 2014.
9	38 Veterinarian from Indian Immunological Ltd.	Aug 20-22, 2014
10	Farmers under training from PAMETI	Aug 29, 2014
11	Mr Suresh Kumar (Principal Secretary), Financial Commissioner Development, Punjab	Sept 4, 2014
12	Dr. Braham Parkesh, Director, Central Institute of Research on Cattle, Meerut (U.P.)	Sept 17, 2014
13	54 female farmers under ATMA	Sept 18.09.2014
14	Dr B. Prakash, Director Central Institute for Research on Cattle-ICAR, Meerut UP- Under Field Progeny testing project	Sept 18.09.2014
15	50 Farmers from Chhatisgarh through PAMETI	Sept 19, 2014
16	Dr. RK Singh, Director IVRI, Izat Nagar (UP)	Sept 24, 2014
17	Dr. Douglas Freeman, Dean, Dr. Baljit Singh, Associate Dean (Research), Dr. Vikram Misra, Dr. Emily Jenkins, Dr. H. Townsend, WCVM, University of Saskatchewan, Canada	Nov 3-7, 2014
18	Dr. Kurt Kreuger, University of Saskatchewan, Canada	Nov8, 2014
19	Team of NABARD	Nov 14, 2014
20	Dr Ayyappan DG, ICAR	Nov 15, 2014
21	Dr N T Carvalho, Buffalo Reproduction Scientist from Brazil	Dec 9, 2014.
22	Production team from ICAR on to film the developments in infrastructure development	Dec 10, 2014
23	Dr V.K.Modi, Head, CFTRI, Mysore	Dec 13, 2014
24	Mr. HR Singla, Director (Gen), Lovely Professional University, Jalandhar	Dec 15, 2014
25	Prof. Harjinder Singh, Director, Massey Institute of Food Science and Technology, Massey University, New Zealand.	Dec 17, 2014
26	Ashok K. Mittal (Chancellor) and Rashmi Mittal (Pro-Chancellor) from Lovely Professional University, Jalandhar	Dec 17, 2014
27	Dr A K Das, Principal scientist, and Dr Ravinder Kumar Sangwan Senior Scientist, ICAR-Central Institute for Research on Cattle, Meerut UP- Under Field Progeny testing project	Dec 18-19, 2014
28	S. Parkash Singh Badal, Hon'ble Chief Minister of Punjab.	Jan19, 2015
29	Dr. H.S.Sanda, Director, Animal Husbandry, Punjab. Dr P.K. Uppal, Advisor to Govt. of Punjab, Deptt. of Animal Husbandry. Dr. S.N.S. Randhawa, Director Extension Education, GADVASU.	Jan 31, 2015



30	Dr. S. M. Shivaprakasha, DEE, Karnataka Veterinary Animal & Fisheries Sciences University	Feb 2, 2015
31	Mr. Dibagh Singh, Member, Board of Management, GADVASU	Feb18, 2015
32	Trainees from GADVASU-KVK Booh, Tarantaran	Feb 22, 2015
33	14 masters of social work from Roda Mistry College of Social work and Research centre	March 5, 2015

### National and International Linkages

- Net work program on Brucellosis
- All India Network program on HS
- Network project on Diagnostic imaging and Surgical management in collaboration with Department of Surgery and Radiology, IVRI, Chennai, Bikaner and Mathura
- The Dept of Pharmacology and Toxicology, GADVASU has become the Headquarter of the Journal Toxicology International from 2015 onwards.
- “International School on One Health: An Integrated View on Infectious Diseases, Food Safety and Zoonoses” organized in collaboration with University of Saskatchewan, Canada.
- MOU signed between CFAP, CFIA, Canada and GADVASU, Ludhiana.
- University of Sydney, Australia
- Dr. A.K. Mishra, PI- Characterization of Kajali Sheep in its native tract, NBAGR, Karnal
- Dr Umesh Kumar, PI-Indigenous Breeds Project Central institute for Research on Cattle, Merrut Cantt, UP
- KVK Barnala has linkage with state departments of Agriculture, Horticulture, Soil and water conservation and Dairy development for organizing training programmes
- Linkages established with CIBA (ICAR), Chennai, CIFA (ICAR), Odisha and CIFE centre, Rohtak, Haryana for supply of brackish water finfish/shellfish, catfish seed, freshwater prawn/brackish water shrimp seed and technical support



## List of Research Schemes Operational during 2014-15

### State Government

1	Strengthening of Fisheries Research in GADVASU
2	Fisheries Research Scheme
3	Sustainable aquaculture technology for salt-affected/water logged areas of Punjab
4	Studies on viral, bacterial & mycotic infections of cattle and buffaloes with a view to develop diagnostics and suitable vaccine
5	Diagnosis and control of Brucellosis a dreadful zoonotic disease in domestic livestock for enhancing productivity in Punjab state
6	Development of a Molecular test to detect etiological agents involved in Neonatal Calf Diarrhoea with a view to quicken its diagnosis
7	Evaluation of different diagnostic tests for the development of suitable strategy in diagnosis of Mycobacterial infections (Bovine Tuberculosis and Johne's disease) in cattle and buffaloes in different agro climatic zones of Punjab.
8	Anatomical, histological, histochemical, electron microscopic studies as related to hormonal and biochemical profile in female reproductive organs in buffalo.
9	Strengthening of diagnostic facilities and experimentation
10	Anatomical, histological, histochemical, electron microscopic studies as related to hormonal and biochemical profile in female reproductive organs in buffalo
11	Pesticide-induced adverse effects: implication on livestock production
12	Toxicity Studies on Insecticides in Live Stock
13	CIntegrated Management and Control of Parasitic Diseases in Domestic Animals for Enhancing Livestock Productivity in Different agro-climatic zones of Punjab State
14	Immunological Studies on the Helminthic Diseases of Livestock
15	Immunological Control of Cattle Tick ( <i>Boophilus microplus</i> )
16	Control of Mastitis in Punjab State- A pilot project
17	Internal Diseases of Dairy Animals- Their clinico-pathological diagnostic and therapeutic aspects
18	Nutritional Deficiency Diseases of Dairy Animals- Their clinico-pathological diagnostic and therapeutic aspects
19	Epidemiology, diagnosis & management of gastrointestinal disorders in dairy animals in Punjab
20	Studies on metabolic profile, risk factors and treatment of production diseases in dairy animals in Punjab
21	Reproductive disorders in dairy animals
22	Reproductive biology, ecology and management of birds and mammals
23	Genetic improvement of dairy cattle through ETT in Punjab
24	Augmenting fertility in dairy cattle through ARTs
25	Studies on the utilization and popularization of processed meat products prepared from buffaloes and other species
26	Strengthening of Department of Livestock Products Technology
27	Creation of Facilities for Rearing of meat animals i.e. goat, pig and rabbit
28	Establishment of Small Animal Colony at GADVASU
29	Intensification of Research in Animal Nutrition
30	Improvement of buffalo and crossbred cattle through nutrition effect of plans of nutrition on their growth rate age at puberty, pregnancy and lactation
31	Seed production in Forage Crops.
32	Research Lab. For feed evaluation and processing.
33	Improvement of Forages and Estt. of Forage.
34	Estt. of Research-cum-Quality Control Lab. for Livestock/Poultry farmers and feed manufacturers
35	Research Facilities for Dairy Cattle & Buffalo Breeding
36	Recovery, Cryopreservation and Embryo Transfer in Buffaloes& Crossbred Cattle



37	Additional Facilities for the modernization of dairy operations
38	Advanced Research Centre for Buffalo Reproduction
39	Rearing of buffalo male calves for meat
40	General Dairy Farm
41	Establishment of Regional Research Centre for Nili Ravi Buffalo
42	Improvement of Dairy Animals through Embryo Transfer Technology at the Institutional Farm and Field Conditions
43	Genetic Improvement of egg type stocks
44	Germplasm Multiplication of Egg type poultry stocks
45	Physical Facilities to breed quails for Meat& Egg
46	Introduction and Breeding of Naked Neck Rhode Island Red and other miscellaneous stocks of Poultry

#### Indian Council of Agriculture Research (ICAR)

1	Niche Area of Excellence (NAE) - Inland Aquaculture in Punjab
2	Outreach Programme on Zoonotic Disease. ICAR Network project
3	ICAR Niche Area of excellence - Animal disease registry and tissue bank
4	All India Network Program on Haemorrhagic Septicemia
5	Project Directorate on Animal disease monitoring & surveillance (PD_ADMAS)
6	Network Program on Diagnostic Imaging and Management of Surgical Affections in Animals
7	Strengthening of an Animal Disease Registry and Tissue Bank
8	AICRP project - Nutritional and Physiological Approaches for Enhancing Reproductive Performance in Cattle and Buffalo
9	Rumen microbial diversity in domesticated and wild ruminants and impact of additives on methanogenesis and utilization of poor quality fibrous feeds
10	Outreach programme on "Estimation of methane emission under different feeding systems and development of mitigation strategies
11	Open Necelus Breeding System to improve Sahiwal Cattle and Nili Ravi Buffaloes in the state of Punjab
12	Network Project on Buffalo Improvement (Main Unit)
13	Network Project on Buffalo Improvement (Field Unit)
14	Project Directorate on Cattle Field Progeny Testing
15	AICRP on Cattle-Sahiwal (Data Recording Unit)
16	AICRP on Poultry Improvement

#### University Grants Commission (UGC)

1	Development of bacteriophage therapy as an alternate strategy for treatment of multiple drug resistant bacteria causing pyogenic/suppurative infections
2	Characterization and ultrastructural details of endotoxin induced laminitis in buffalo calf model
3	Studies on the evaluation of outer membrane protein (OMP) genes of <i>Leptospira interrogans</i> for development of PCR based diagnostics as well as production of recombinant OMPs and their immunological characterization
4	Polymorphism screening and association studies of CXCR genes with udder health and milk production in Buffalo breeds of Northern India
5	Studies on cloning and expression of heat shock proteins (Hsps) of <i>Brucella</i> spp. and their immunological characterization in experimental animals.
6	Development of user-friendly diagnostic kit for Marek's disease.
7	Development of probiotics for fish and shellfish
8	Studies on the freshwater pearl mussel culture under agro-climatic conditions of Punjab
9	Standardization of culture technology of duckweed ( <i>Lemna spp.</i> ) and its utilization as feed in carp polyculture system
10	Molecular epidemiological characterization and diagnostics of human brucellosis, a major zoonotic disease
11	Molecular epidemiology & diagnostics of pig transmitted (Zoonoses) human parasitic diseases
12	Persistent Organic Pollutants in Fish, Fish pond Sediments and Water: Health Risk Assessment through Dietary Exposure



13	Comparison of Canine Parvovirus vaccine strain with field isolates by gene sequencing
14	Development of a DIVA strategy for Haemorrhagic Septicaemia in cattle and buffaloes
15	Immunohistochemical localization of estrogen and progesterone receptors in female genitalia of buffalo
16	Colour doppler studies on major blood vessels in dairy animals
17	Heavy metal exposure vis-à-vis reproductive performance in buffaloes
18	Toxicokinetics of Pyrethroids
19	Influence of Exposure to New Generation Insecticides on the Disposition of Antimicrobial Agents
20	Ameliorative measures for enrofloxacin-induced testicular toxicity in rats
21	Studies on lymph-angiogenesis in canine model of human breast cancer.
22	Studies on intravital diagnostic approaches of rabies in animals
23	Development of control strategies based on molecular epidemiology and drug efficacy for equine piroplasmiasis in Punjab.
24	Development of biochemical assay as diagnostic tool for synthetic pyrethroid resistance in cattle tick <i>Hyalomma anatolicum anatolicum</i>
25	Epidemiological study on goat mastitis in north western states of India
26	Uterine immunomodulation: A swap of antibiotic therapy in endometritic cattle
27	Role of antisperm antibodies in infertility/ repeat breeding of cattle
<b>Department of Biotechnology (DBT)</b>	
1	DBT Network on Brucellosis (Network project on Brucellosis for molecular epidemiology and characterization of species and biotypes for sustainable management of brucellosis)
2	Development and Evaluation of Sero-diagnostic Assay for Timely Diagnosis and Prognosis of Mammary Tumors
3	Aetio-pathology and molecular epidemiology of bacterial and viral diseases associated with the respiratory problems of yak in the north eastern regions of India.
4	Development of virus-like particle (VLP) of Japanese encephalitis virus as a potential vaccine candidate
5	Development of sub-viral particles of IBD as a potential vaccine and diagnostic candidate
6	Xanthosine treatment: A novel strategy to increase milk production and mammary stem cells
7	Combined use of novel diagnostic tools and strategic vaccination to control bovine brucellosis in endemic areas (DBT-BBSRC UK)
8	Improvement in fertilizability of cryopreserved buffalo bull semen by minimizing cryocapacitation and apoptosis like changes
9	Melatonin: A Potential Candidate for Alleviating Seasonal Suppression of Fertility in Buffaloes
<b>Department of Science and Technology (DST)</b>	
1	Funds for Improvement of Science and Technology Infrastructure in Higher Educational Institutions-School of Animal Biotechnology
2	Funds for Improvement of Science and Technology Infrastructure in Higher Educational Institutions-Veterinary Microbiology
3	Funds for Improvement of Science and Technology Infrastructure in Higher Educational Institutions-Veterinary Medicine
4	Funds for Improvement of Science and Technology Infrastructure in Higher Educational Institutions-Veterinary Gynaecology and Obstetrics
5	Development of prototype for mechanized manufacturing of dairy composite product-pinni
6	Community awareness project for prevention and control of zoonoses
7	Studies on fibronectin binding outer membrane proteins of <i>Pasteurella multocida</i> : Role in extracellular matrix (ECM) adhesion and pathogenesis in <i>Bubalus bubalis</i>



8	Biochemical and molecular detection of malathion resistance in cattle tick <i>Rhipicephalus (Boophilus) microplus</i>
<b>Indian Council of Medical Research (ICMR)</b>	
1	Effect of Single and Multiple Exposures to Poultry Farm Air on Pulmonary Defense of poultry workers-A Murine Model
2	Production and evaluation of hyperimmune sera and monoclonal antibodies (mAbs) against immunodominant antigens of opportunistic Gram –ve pathogen <i>Pseudomonas aeruginosa</i>
<b>Ministry of Food Processing of India (MoFPI)</b>	
1	Novel bioactive edible films for extending shelf life of meat based products
2	Encapsulation of natural bioactive compounds and micronutrients for the enhancement of nutritive, preservative and processing functionality of meat products
3	Development of Fortification Technology for Milk to increase Bioavailability of Mineral
<b>Rashtriya Krishi Vikas Yojna (RKVY)</b>	
1	Enhancing Production Reproduction and health of Livestock in Punjab through intensive Research Activities
2	Strengthening of Research in Veterinary, Animal Husbandry, Dairy Technology and Fisheries Sciences for Sustainable Development of Livestock and Aquaculture in Punjab
3	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
4	Sustainable livestock, dairy and fishery farming for food security and economic prosperity through need-based and problem-oriented research
<b>Miscellaneous</b>	
1	Solar energy based Prototype of Vapour Absorption Refrigeration system for Milk Chilling (NABARD)
2	Economics of Milk Production and its regular monitoring in Punjab (PDDDB)
3	Confirmation of lactation performance and animal safety of dairy animals of the <i>Bos sp.</i> and <i>Bubalus sp.</i> treated with recombinant bovine somatotropin (ELANCO Animal Health)
4	Improvement of udder health and milk quality through application of mastitis control programme under field conditions (PFC)
5	Evaluation of treatment by cephapirin (Metricef) - A study on clinical efficacy & bacterial cure for endometritis in buffaloes (Intervet India Pvt. Ltd. Pune)
6	Evaluation of free choice mineral and salt licks in lactating dairy cows (Valk Dairy Nutrition, Netherlands)
7	Collaborative Research and Training Experience (CREATE): Integrated Training Program in Infectious Disease, Food Safety and Public Policy. Collaborative Project with University of Saskatchewan and Free University, Berlin; (Natural Sciences and Engineering Research Council of Canada, NSERC)
8	The Geographical Emergence of Carbapenemases and ESBLs: The Development of Antimicrobial Resistance (Princeton University, USA)
9	The Impact of Farm Operational and Managerial Practices in the Poultry Industry on the Development of Antimicrobial Resistance in Punjab (GARP)
10	Combined use of novel diagnostic tools and strategic vaccination to control bovine brucellosis in endemic areas (INDO UK BBSRC-DBT project with Royal Veterinary College London)
11	One health reinvented: Can we predict brucellosis prevalence in bovines from that in humans? (University of Sydney, Australia)
12	Environmental pollutant and zoonotic pathogens in Punjab and their impact on animal and human health (University of Saskatchewan, Canada and RKVY)

## Research Publications

1. Anand A and Singh S S. 2015. Inside out continuous suturing technique for the repair of 3<sup>rd</sup> degree perineal laceration in mares. *J. Equine Vet. Science*. doi:10.1016 /j.jevs. 2014.12.012.
2. Anand A, Singh S S and Saini N S. 2014). Successful surgical management of enterocutaneous fistula in a horse. *Ind. J. Vet. Surg.* 35: 83.
3. Anand A, Singh S S, Mohindroo J and Kumar A. 2015. Presurgical ultrasonographic evaluation of abdominal hernias in equine patients. *Indian Vet. J.* 92: 69-71.
4. Atwal K S, Prabhakar S, Ghuman S P S and Brar P S. 2013. Mineral profile in anestrus buffaloes having selenium toxicity. *Veterinary Practitioner*. 14 (2): 486-87.
5. Baba I A, Singh Y and Thirumurugan P. 2014. Performance of Vanaraja Birds under different climatic parameters. *Journal of World's Poultry Research*. 4 (1): 01-04.
6. Bal M S, Singla L D, Deka D, Ashuma, Filia G and Verma R. 2014. Evaluation of sensitivity of different *Trypanosoma evansi* specific primers, polymerase chain reaction and parasitological techniques for diagnosis of trypanosomosis. *International Journal of Advanced Research*. 2 (11): 1051-62.
7. Bal M S, Singla L D, Deka Deepak, Ashuma, Filia G and Verma Ramneek. 2014. Comparative sensitivity of different primers in detection of *Trypanosoma evansi* infection in experimentally infected mice by polymerase chain reaction vis-a-vis conventional parasitological techniques. *International Journal of Advanced Research*. 2 (11): 1051-62.
8. Bansal A K and Cheema R S. 2014. Analysis of sperm and relationship between conventional sperm parameters and hypo-osmotic swelling test/acrylamide penetration assay -crossbred cattle bulls. *Adv. Appl. Res.* 6: 39-44.
9. Bansal A K, Cheema R S, Kaur M, Gupta P. 2014. Effect of Mn<sup>2+</sup> on cryocapacitation, *in vitro* acrosome reaction, hypo osmotic swelling test, lipid peroxidation, superoxide dismutase and glutathione enzymes activity during cryopreservation of buffalo bull semen. *Chem. Sci. Rev. Lett.* 3 (12), 896-907.
10. Bansal K, Singh C K, Sandhu B S, Sood N K and Dandale M. 2014. Ante mortem diagnosis of rabies from skin by TaqMan real time PCR. *Indian Journal of Animal Research*. 48 (6): 597-600.
11. Bansal K, Singh Y and Singh P. 2014. Constraints of apiculture in India. *International Journal of Life Sciences Research*. 1 (1): 1-4.
12. Bansal N and Uppal V. 2014. Ovarian folliculogenesis in mammals: A qualitative and quantitative analysis. *Indian Journal of Veterinary Anatomy*. 26: 1-6. (Review Article).
13. Bansal N, Pathak D, Uppal V and Anuradha. 2014. Fate of ovigerous cords in buffalo foetii: A light and electron microscopic studies. *Indian Journal of Veterinary Anatomy*. 26 (2): 69-71.
14. Bedi J S, Gill J P S, Kaur P, Sharma A and Aulakh R S. 2015. Evaluation of pesticide residues in human blood samples from Punjab (India). *Veterinary World*. 8 (1): 66-71.
15. Beri S, Sidhu P K, Gurpreet Kaur, Mudit Chandra, Satyavan Rampal. 2014. Comparative mutant prevention concentration and antibacterial activity of fluoroquinolones against *Escherichia coli* in diarrheic buffalo calves. *Journal of Chemotherapy*. DOI: <http://dx.doi.org/10.1179/1973947814Y.0000000173>.
16. Bhat G R, Dhaliwal G S, Ghuman S P S and Honparkhe M. 2014. Size of dominant follicle, plasma progesterone and estradiol levels on the day of ovulation and subsequent conception rate in buffalo (*Bubalus bubalus*) following modified ocsynch + CIDR protocol. *Journal of Applied Animal Research*. DOI: 10.1080/09712119.2014.964249 (Oct 29, 2014).
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18. Bhat G R, Dhaliwal G S, Ghuman S S, Honparkhe M. 2014. Effect of human chorionic gonadotropin on post-ovulatory mid-luteal profile and subsequent pregnancy rate in anestrus buffalo using two synchronization regimes. *Applied Biological Research*. 16 (2): 1-4.

19. Brar R S, Kumar R, Leishangthem G D, Banga H S, Singh N D and Singh H. 2014. *Ascaridia galli* induced ulcerative proventriculitis in a poultry bird. *J. Parasit. Dis.:* DOI 10.1007/s12639-014-0509-4.
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21. Challana A, Anuradha, Bansal N and Uppal V. 2014. Morphogenesis of mammary glands in buffalo (*Bubalus bubalis*). *Anatomy Research International.* Doi.org/10.1155/2014/687936.
22. Challana A, Gupta, A, Bansal N, Uppal V and Srinath R D. 2014. Histomorphological and histochemical studies on umbilical cord of buffalo. *Indian Journal of Veterinary Anatomy.* 26: 58-59.
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