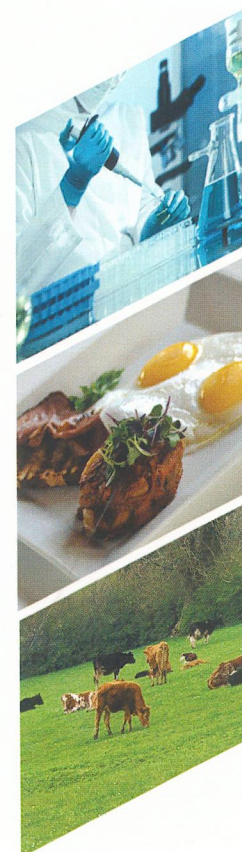


KERALA VETERINARY AND ANIMAL SCIENCES UNIVERSITY
POOKODE, WAYANAD, KERALA

REPORT ON RESEARCH
ACTIVITIES

2015-16

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POOKODE, LAKKIDI (P.O.), WAYANAD - 673576, KERALA STATE

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REPORT ON RESEARCH ACTIVITIES 2015-16

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REPORT ON
**RESEARCH
ACTIVITIES**
2015-16

Vice Chancellor's message



Research denotes the quest of humankind funny over ideas and actions

Research outcome of a University is an indication of quality and glory of that institution. It truly imprints upon the public the excellence and magnitude of the institution. Hence, focused research aiming at advantages for the society, rural upliftment of the farming community through improved farming practices, and enhancement of the national economy is envisioned in the KVASU. It also paves way to unique opportunities for scientists to work with sophisticated equipment and state of the art laboratories.

During 15-16 the university code for cure 1381.33 lakhs with various externally added projects funded by different agencies like DBT, KSCSTE, ICAR, AHD etc. The University has also received grants from the state government under State plan.

I congratulate for Principal Investigators who have secured the externally added projects upon merit. It is high time that the faculty look a keener interest in procuring merit based EAPs which will contribute to taking emergent problems nation-wide and find practical solutions. Let us hope to achieve better highlighting the need of the society and farming community for which the University stands strong.

I congratulate the Director (Academic and Research) and her team in bringing out this document which covers the scientific topics that are being explored by the University, research facilities and innovative achievements.

Best wishes to the University research team.

Pookode,
31-12-2016



Shri. Anil X., IAS
Vice Chancellor

REPORT ON
**RESEARCH
ACTIVITIES**
2015-16



Preface

Like all professional Universities Kerala Veterinary and Animal Sciences University has three major mandates, namely, academics, research and extension. It is indeed a matter of great pride that the University, in its nascence, has been able to invest and to develop its research capabilities. The University has in its rank both the manpower and equipment needed for attaining research excellence.

The presented document is a report of the research and related activities carried out at the University in the year 2015-16. The quantum of external aid research projects and state funded plan projects implemented at the University is a reflection of the hard work and dedication of the faculty.

In the frontiers of research, the University is in state of transition. The success of research in a professional University, which is especially set up to support and improve the animal husbandry and allied sector, is directly related to the field implementable and field viable technologies developed and transferred at the University. The University was fortunate to have got adequate funds for the development of its research capabilities. In the coming years the University would strive to achieve these goals with strict adherence to research ethics.

The time has come for development of application oriented research outcome and its implementation in the sector. The time has come for the university to rise above the rest and surge ahead. The time has come for the university to stake its claim in the annals of veterinary and allied sector research in the country.

Pookode,
31-12-2016

A handwritten signature in black ink, appearing to be 'Devada K'.

Dr. Devada K
DAR, KVASU

Chapter 1

KVASU RESEARCH POLICY

1.0 PURPOSE

This policy sets the framework to spearhead research at the Kerala Veterinary and Animal Sciences University (KVASU) consistent with its policy on research. The research policy shall help to –

- a. Identify core areas of research.
- b. Give direction to research activities carried out in different disciplines of basic science, veterinary science, animal science and dairy science.
- c. Promote multi-disciplinary research.
- d. Instil quality in research through competition among faculty members seeking research funds.
- e. Act as the lead guide with a clear-cut policy on research and extension.

2.0 ORGAISATIOAL SCOPE

This is a University-wide policy and exceptions are to be accepted only with due approval by Research Council.

3.0 VISION

The University aspires to be recognized nationally and internationally as the University of choice, in nurturing meritorious/ renowned Veterinarians, Dairy/ Food Technologists and professionals in related disciplines by entrenching a strong research culture. The research undertaken shall (a) promote sustainable and profitable animal production systems (b) provide quality care and veterinary services (c) assure food safety and quality and security of the State (d) disseminate modern scientific knowledge and skill (e) foster professionalism in animal welfare and ethics and (f) help the government modify/ formulate policies based on scientific information and data.

4.0 MISSION

Equitable development and sustainable animal production through -

- a. Scientific breeding and production of superior quality stock and germplasm.
- b. Model livestock and poultry enterprises and integrated farming systems.
- c. Cost-effective interventions in feeds and feeding.
- d. State-of-the-art hospitals, accredited laboratories, advanced diagnostics and superior vaccines for better diagnosis, treatment and control of animal diseases, food-borne diseases and management of infertility.
- e. Production and evolution of value added formularies.
- f. Internationally competent graduates/ professionals who can foster and promote veterinary, animal science and dairy research.
- g. Control and prevention of zoonotic diseases.
- h. Strategies and technologies for effective animal waste management
- i. Conservation and utilization of domestic and wild animal biodiversity.
- j. Animal welfare measures in veterinary and animal science education and research.

5.0 CORE AREAS OF RESEARCH

5.1 Animal Production and Management

- a. Continued improvement of stock through scientific intervention, and evaluation of various domestic and exotic animal genotypes; breeding for disease resistance. Evolving new strains of animals and poultry adapted to local conditions.
- b. Conservation, characterisation, evaluation and improvement of domestic animal and avian biodiversity.
- c. Model livestock farms for optimum utilization of genetic potential of animals through micro-environmental interventions in different ecological zones; adoption of scientific management practices, user-friendly and less labour intensive technologies in routine farm operations; integration of bio-fuel technologies and value addition of farm wastes for higher net farm income.
- d. Developing of feed and fodders; develop cost-effective feeding schedules based on the availability of feed, fodder, other raw materials and unconventional feeds appropriate for small, medium and large livestock/poultry production units to make animal farming sustainable and economically viable.
- e. Development of reproductive technologies for augmenting fertility and production in livestock.
- f. Impact of climate change in animal production. Mitigation of green house gas emissions and their link to climate change.
- g. Application of biotechnological tools for improvement of animal and poultry production.

5.2 Animal Health

- a. Development of vaccines, vaccination protocols and diagnostics for control and surveillance of diseases of farm and companion animals and disease forecasting.
- b. Better strategies for treatment and control of diseases of livestock and poultry, reproductive disorders and zoonotic and food-borne diseases, to maintain a high standard of animal health and fertility.
- c. Advanced molecular biological techniques for diagnosis of viral, bacterial, rickettsial, fungal, algal, protozoan and metazoan diseases and diseases due to infectious protein particles/prions.
- d. Investigations on diseases of livestock and poultry due to deficiency or toxicity.

5.3 Improvement in Veterinary Care/Support service

- a. Research, development and refinement of medical/ surgical treatment and diagnostic strategies to sustain and improve health of farm and companion animals. Development and use of biomaterials for veterinary use.
- b. Research and development of newer drugs and drug molecules. Ethno veterinary medicine and health care of animals.

5.4 Biotechnology

- a. Molecular characterization of domestic animal biodiversity, marker assisted selection
- b. Bioinformatics

- c. Molecular diagnosis of emerging diseases and development of diagnostic kits.
- d. Gene expression studies- nutrigenomics
- e. Embryo transfer technology, oestrous synchronization.
- f. Manipulation of rumen ecosystems for improving productivity.

5.5 Livestock Products and processing

- a. Processing, packaging, preservation & storage, transport and marketing of meat, milk, egg and their products from the farm to the consumer, with quality management.
- b. Traceability of food of animal origin and development of healthy low fat functional foods.
- c. Value addition of livestock and poultry products
- d. Development of production process through modern innovative technologies for traditional, fermented, functional and ethnic foods.
- e. Energy conservation measures in dairy and food processing.
- f. Low cost farm mechanisation for small scale milk processing.
- g. Physico chemical and microbiological characterisation of milk from different species and their value addition-Starter culture technology.
- h. Adulterants/Contaminants in dairy and meat products.

5.6 Extension and Economics

- a. Technology validation through farmer participatory research/ on-farm research; development of client-based knowledge sharing methods in the practice of Veterinary Science.
- b. Documentation and evaluation of indigenous technology and knowledge.
- c. Economic feasibility of different systems of animal production and nutritional management.
- d. Evolving a mechanism to monitor the cost of production and suggesting periodic variations in the pricing of dairy, meat and egg products.
- e. Utilisation of Information and Communication Technology (ICT) for linkages with other institutions for tele-imaging and diagnosis.

5.7 Other Core Areas

- a. Need-based/ Problem-oriented research and adaptive research.
- b. Animal welfare.
- c. Animal waste management.
- d. Rearing of pet animals, birds and fishes as a livelihood.
- e. Organic farming systems, nutrient cycling, insect and disease control.
- f. Laboratory animal breeding and development of animal models.
- g. Wildlife conservation and welfare.
- h. Veterinary forensics.

6.0 VERIFIABLE INDICATORS

- a. Availability of superior germplasm and adoption of proven new systems of production.
- b. Production based indicators and reproductive management of herd fertility.
- c. Better availability and use of fodder and utilisation of unconventional feeds/ agricultural by-products.
- d. Rapid diagnosis and control of animal diseases and establishment of a disease database.
- e. Demand for farm advisory-cum-modern veterinary services.

- f. Development of entrepreneurship, technological knowledge and skill empowerment of livestock keepers and farm women empowerment.
- g. Enrichment of human nutrition by quality foods of animal origin.
- h. Employment opportunities created and assessment of social impact.
- i. Availability of animal food products to cater the requirement of the state

7.0 OUTPUTS

- a. High producing disease resistant breeds of livestock and poultry.
- b. High net farm income through scientific livestock management practices, better animal waste utilisation.
- c. Organic food products.
- d. Equip livestock entrepreneurs in the process of change from small holder to medium and large production units.
- e. Improved feeds and fodder and scientific feeding schedules based on local fodder varieties and agricultural by-products
- f. Advanced diagnosis of reproductive problems and protocols for optimising fertility, fecundity and reproductive performance.
- g. Protocols for immunization of animals and birds against existing and emerging diseases.
- h. Quality health care, molecular diagnosis, prevalence and surveillance data, control of animal diseases, disease database and an animal disease information system.
- i. Alternative methods for control of parasites.
- j. Meeting the requirements of laboratory animals to the research institutes of the state
- k. Policies, guidelines and strategies for the control of zoonotic and food-borne diseases in Kerala.
- l. Value added animal products and longer shelf life.
- m. Reference hemato-biochemical and hormonal values of domestic and zoo animals.
- n. Patents.
- o. Software and databases/ Presentations/ lectures/ Films/ Videos.
- p. Farm consultancy services for large scale entrepreneurs in livestock and poultry sector.
- q. Models of organic farming systems and user-friendly and labour-conserving technologies in routine farm operations.
- r. Publications such as Authored Books, Edited Books, Edited Journals, Chapter in Book, Research Articles, Doctoral thesis, Post-graduate thesis, Conference Paper in Published Proceedings, Abstracts, Letters, Comments, Notes, pamphlets & leaflets in English and vernacular language.

8.0 OUTCOME

- a. Food security and food safety for the state
- b. Growth and development of the State of Kerala based on animal production systems.
- c. Self-sufficiency in animal germplasm, production inputs and animal products.
- d. Healthy and immune animals.
- e. Employment opportunities to economically weaker sections of people.
- f. Entrepreneurship development and poverty alleviation through animal farming.

9.0 RESEARCH MANAGEMENT

- a. The Research Council is the apex Research Management body of the University. It advises the Faculty Research Committees (FRC) and Project Coordination Committees (PCC) on research strategies to be pursued, develops policy and reviews progress in these areas.
- b. There shall be separate PCCs for different animal species, Animal/ Dairy/ Food Products, Animal Biotechnology, Extension, Statistics & Economics and Wild animals & Fishes.
- c. The Scientists are required to supply complete and accurate details of their research outputs to the Director of Academics and Research.
- d. The Director of Academics and Research shall publish a list of staff and student publications on an annual basis.
- e. Research undertaken shall comply with the Research Policy of the University.

9.1 External Aided Project

- a. External Aided Project shall be submitted to the funding agency through the PCC to the Director of Academics and Research (DAR).
- b. Institutional fee for External Aided Projects shall be 25% of the project outlay, unless
- c. otherwise specified by government agencies.

9.2 Private Sector Funded Research/ Contract Research

- a. The candidates/institutions/agencies from outside university are permitted to undertake research in the university as per the guidelines issued from time to time.
- b. The research undertaken jointly by the University and the private sector should aim at creating new knowledge and solutions maintaining integrity and independence of both parties.
- c. Research findings and innovations shall be guided by the IPR Policy of the University.

9.3 Collaborative research

- a. If a Centre/ Institute/ Department of the University is recognized as a Research Centre by other research Institutions for collaborative research, the DAR shall approve research proposal based on the merit of the topic.
- b. When a research scientist of University is made a Principal Investigator/student major advisor of another university/ Research Centre, the DAR shall approve such research studies to be carried out in the University based on the merit of the topic.
- c. Individuals having in-depth scientific knowledge or proven/ established skill sets shall be encouraged to work with the University by providing them 'bench-space' to carry out research. Research projects shall be routed through the University for receiving external aid/ private funds.
- d. Research findings and innovations shall be guided by the IPR Policy of the University.

9.4 Intellectual Property Rights (IPR)

- a. Benefits derived from commercialisation of IPR resulting from University funded research shall be shared between the creator(s) and the University.
- b. Any type of research activity, making use of the infrastructure or resources of the University shall be guided through a detailed IPR policy of the University.
- c. There shall be an IPR Cell for the University to prepare, process, submit and pursue IPRs applications before relevant statutory authorities.

9.5 Animal Ethics Policy and Data Protection Policy

- a. All the research projects that involve animals/ birds, must secure prior approval of the relevant ethics committee of the University established as per animal welfare Policies and Rules of the Government of India.
- b. The University shall have a Data Protection Policy detailed separately.

9.6 Misconduct in Research

- a. The University aims at creating a strong research culture, embedded in an atmosphere of honesty, integrity, trust and teamwork. This improves the reputation of the University and the acceptance of the researcher.
- b. Misconduct in research is defined as fabrication, falsification or plagiarism. Proved misconduct invites disciplinary action.
- c. If misconduct in research is proved the DAR shall determine appropriate action based on the recommendation of a committee.
- d. The University shall establish a commercial arm through which private sector research contracts, consultancy and other services, and intellectual property management and commercialisation are carried out.
- e. The University Research Policy shall be reviewed triennially with a view to improve quality and accountability in research and to explore new fields of study relevant to the changing socio-economic situations of the State.

10.0 SUMMARY

The Kerala Veterinary and Animal Sciences University research policy is framed with an emphasis on research leading to sustainable development in animal production and their by assuring food safety and security .It focuses on animal welfare and health, the effects of animal production on the environment, and application of new technologies to increase animal production.

Chapter 2

EXTERNALLY AIDED PROJECTS

Implemented At The Kerala Veterinary And Animal Sciences University During The Financial Year 2015-16

	Description of Project	Outlay in Lakhs	Funding Agency	Report/findings in brief
1	All India Co-ordinated Research Project on poultry for eggs	318.61	Indian Council of Agricultural Research	The centre was successful in developing a commercial layer strain (ILM-1990) with average yield of 303 eggs with 55 g weight. Supplied germplasm of 35,873 nos and a revenue of Rs. 38 lakhs was generated during the period.
2	All India Co-ordinated Research Project on Pigs	147.72	Indian Council of Agricultural Research	The centre has produced cross-bred pigs of 50 and 75% exotic inheritance by crossing desi breeds with Large White Yorkshire and Landrace pigs. The centre has successfully fulfilled the demand of the farmers by supplying 368 fattening piglets (crossbreds) and also generated receipt of Rs.11.91/ lakhs during the year 2015-16. Crossbred pigs (75 %) were produced and their production, reproduction and carcass traits were studied. Artificial insemination has been introduced and is being propagated to pig farmers.
3	All India Co-ordinated Research Project on Goat Improvement	75.50	Indian Council of Agricultural Research	A total of 420 farmers have been registered including 271 women. 1894 adult females are provided with free insurance coverage under the project. 24 superior Malabari bucks free of cost to farmers for breeding. 906 kids were born during and the population growth recorded was 68.67%. 585 farmers and 76 vocational students have been trained in goat

				rearing in 25 trainings. Developed an easy to use weight measuring tape to record body weight of goat in the field. A model goat shed to rear 4 goats for high rain fall area has been developed
4	Outreach programme on ethno veterinary medicine	80.00	Indian Council of Agricultural Research	The main objective of the Outreach Programme on Ethno veterinary medicine 2015-2016 was the clinical trial and the activity guided purification of the plant <i>Artemisia japonica</i> . The dogs with positive results (fungal infection) were successfully treated with 4% ointment of <i>Artemisia japonica</i> . GC-MS spectra of essential oil extract of <i>Artemisia japonica</i> , six compounds were identified.
5	Outreach programme on zoonotic Disease	70.63	Indian Council of Agricultural Research	Complete mapping of <i>Listeria</i> species for the state of Kerala carried out. The coating/ brushing of the QAC was found to prevent the <i>Listeria</i> biofilm cells at a lower concentration (100 ppm) from all surfaces. The coating of 1.5 per cent of chitosan prevented the formation of <i>Listeria</i> biofilms on the contact surfaces. Occurrence of <i>Campylobacter jejuni</i> in chicken cloacal swabs was at the rate of 44%. Occurrence of <i>Campylobacter</i> from chicken caecal swabs (retail outlets) was 40% whereas the jejunal swabs had 46.67% positivity
6	ICAR Field Progeny Testing Programme	160.85	Indian Council of Agricultural Research	ICAR Field Progeny Testing Scheme aims at accurately selecting breeding bulls through the evaluation of their female progenies. In this scheme high pedigreed bulls with dams yield above 4500 kg in lactation are used for inseminating the

				<p>cows of farmers in the field. Number of doses of semen used during January to December 2015 is 3960 doses. Pregnancies confirmed were 1703, calves born were 977, out of which 475 were female progenies. Progenies reaching Age at first lactation was 163 and completed first lactation was 67.</p>
7	Mega seed on pigs	11.10	National Research Centre-Pigs, Indian Council of Agricultural Research	<p>In order to fulfill the technical programme of the project 21 Males and 66 Females pigs were maintained as the breeding stock. As per the technical programme foundation stocks of indigenous pigs was established in the Centre and were used for cross breeding with Large White Yorkshire to evolve 75% Cross bred progenies. The centre has successfully fulfilled the demand of 22 farmers by supplying 147 fattening piglets (75% crossbreds) and also generated receipt of Rs 3.67 / lakhs during the year 2015-16. Biogas plant and solar energy systems have been established as alternate energy sources.</p>
8	Chemo-profiling potential phyto - acaricides and their functional characterization for controlling resistant cattle ticks	44.59	National Funds for Basic Strategic and Frontier Application Research in Agriculture, Indian Council of Agricultural Research	<p>Collection of different accessions of the potential antitick plant (patent application no. 124/DEL/2013) the phytoextract [CVP-05 WAY] was identified by activity guided laboratory standardized protocol as potential for the control of chemical acaricide resistant ticks posing serious threat in animal production system.</p>
9	Establishing a Poultry Breeding Farm for Backyard	1493.00	Rashtriya Krishi Vikas Yojna	

	Chicken Production at Thiruvazhamkunnu			
10	Establishment of state of the art large animal surgical teaching facility in the Dept. of Surgery and Radiology, College of Veterinary and Animal Sciences, Mannuthy	50.00	Rashtriya Krishi Vikas Yojna	
11	Improvement on rural livelihood security by establishment of satellite piggery unit in Wayanad District	117.72	Rashtriya Krishi Vikas Yojna	
12	Clinical applications of porcine derived collagen grafts in Veterinary Practice	15.56	Kerala State Council for Science Technology and Environment	The efficacy of porcine cholecyst derived extracellular Matrix scaffold graft in the management of corneal ulcers has been studied. Porcine cholecyst-derived decellularised collagen as an extra-cellular matrix scaffold took a minimum of 14 days to dissolve from the grafted site and produced complete epithelialisation. Porcine cholecyst-derived decellularised collagen as an extra-cellular matrix scaffold was well-tolerated by dogs and could be used as a biomaterial for corneal reconstruction in dogs
13	Development of a multiplex polymerase chain reaction assay for the simultaneous detection of four common food pathogens in meat products.	12.00	Kerala State Council for Science Technology and Environment	The multiplex PCR was standardized for detecting these four pathogens using four different primers like hlyA [456bp] for <i>L. monocytogenes</i> , ail [351bp] for <i>Y. enterocolitica</i> , stm [915bp] for <i>S. enterica</i> Typhimurium and nuc [270bp] for <i>S. aureus</i> .

				The antibiotic sensitivity pattern of the different isolates were also studied against the commonly used antibiotics and found that most of the isolates were resistant to one or more drugs.
14	Molecular detection of ticks and tick-borne pathogens	21.51	Kerala State Council for Science Technology and Environment	PCR assay for the detection of Rickettsia species, Anaplasma / Ehrlichia species from ticks infesting both domestic and wild animals were standardized. Four previously unreported rickettsial species from ticks infesting both domestic and wild animals were identified.
15	Fermented Milk Products for cardiovascular benefits	12.58	Kerala State Council for Science Technology and Environment	The lactic acid bacteria isolated from indigenous sources were evaluated for their cardiovascular health benefits in terms of cholesterol assimilation potential and ability to produce bioactive peptides: ACE inhibitory and antithrombotic peptides. The procedure for preparation of fermented milk product using the probiotic isolate was also standardised
16	Comparison of polymerase chain reaction assay with conventional methods for the diagnosis of leptospirosis in animal hosts and humans in Wayanad.	25.25	Indian Council of Agricultural Research	Kerala State Council for Science Technology and Environment
17	Laboratory and field trials on oil adjuvant inactivated vaccines for the control of New Duck Disease in Kerala	15.38	Animal Husbandry Department, Kerala	

18	Early life care of calves and its implications on future milk production	5.00	Animal Husbandry Department, Kerala	
19	Development of Recombinant vaccine for control of Salmonellosis in poultry	40.42	Department of Biotechnology, Govt. of India	
20	Development of affordable biogradable dermal scaffolds in creating tissue engineered skin	151.73	Defense Research and Development Organization	Sterilized ready-to-apply bovine omental scaffolds having adequate mechanical and biological properties were developed using the cost effective process of decellularization with bovine gall bladder bile. Technique of primary human keratinocyte culture was standardized and the culture was seeded to the developed omental-scaffolds which showed satisfactory cell adhesion. The presence of the omental scaffolds also did not inhibit the proliferation of cultured keratinocytes.
21	Developing an inclusive model for sustainable goat production in Kerala	10.00	National Bank for Agriculture and Rural Development - Farm Sector Promotion Fund	
22	Identification of mechanisms of anthelmintic resistance in Gastro-intestinal nematodes of northern Kerala and effect of phytochemicals in resistant nematodes	31.30	Kerala State Council for Science Technology and Environment	
23	Investigation of therapeutic and bio-preservative lactoferrin of Vechur cow milk	15.29	Animal Husbandry Department, Kerala	

24	Field Level metabolic profile during transition period using glycatedhaemoglobin, serum fructosamine and blood gas analysis in cattle	5.2	Animal Husbandry Department, Kerala	
25	Detection and molecular characterization of emerging viral pathogens of pigs	29.444	Kerala State Council for Science Technology and Environment	
26	Clinical investigation and management of hoof disorders in goat for improved production	5.8	Agricultural Technology Management Agency	
27	Identification of the causative genes & mutation conferring resistance against tick infestation in cattle	31.49	Kerala State Council for Science Technology and Environment	
28	Scheduled Tribes Development Department Project for imparting certificate course on Animal handlers in zoo and forest in KVASU.	44.38	Scheduled Tribes Development Department, Govt. of Kerala	
	Total	1381.33		

Chapter 3

STATE PLAN PROJECTS

IMPLEMENTED AT THE UNIVERSITY IN THE YEAR 2015-16

	Title of the project	Dept./Unit/Station	Amount (in lakhs)	Implementing Officer
A. RESEARCH (RSP/15-16) : 1434 LAKH				
I. Improving Nutritional Base : Rs.108 Lakhs				
1	Strategies for Improving the Fodder Production of Kerala State	Cattle Breeding Farm, Thumburmuzhy (Lead Centre)	20.0	Head, CBF, Thumburmuzhy
2	Strategies for Improving the Fodder Production of Kerala State	Livestock Research Station, Thiruvazhamkunnu (Collaborating Centre)	25.0	Head, LRS, Thiruvazhamkunnu
3	Strategies for Improving the Fodder Production of Kerala State	University Livestock Farm and Fodder Research Station, Mannuthy (Collaborating Centre)	20.0	Head, ULF & FRS, Mannuthy
4	Improving nutritional base through Total Mixed Ration (TMR) technology-	Cattle Breeding Farm, Thumburmuzhy	20.0	Head, CBF, Thumburmuzhy
5	Identification and assessment of nutritive value of herbal by-products for feeding of livestock	Dept. of Animal Nutrition, CVAS, Pookode (Collaborating Centre)	7.0	Head, Dept. of Animal Nutrition, CVAS, Pookode
6	Identification and assessment of nutritive value of herbal by-products for feeding of livestock	Dept. of Animal Nutrition, CVAS, Mannuthy (Collaborating Centre)	6.0	Head, Dept. of Animal Nutrition, CVAS, Mannuthy

7	Identification, nutritional significance and feeding value of indigenous fodder grass	Livestock Production and Management, CVAS, Mannuthy (Collaborating Centre)	5.0	Head, Dept. of LPM, CVAS, Mannuthy
8	Preliminary screening studies on feed, fodder and biological samples from livestock across kerala for possible lead and cadmium contamination	Dept. of Animal Nutrition, CVAS, Pookode (Collaborating Centre)	5.0	Head, Dept. of Animal Nutrition, CVAS, Pookode
2. Management and Improvement of Animal Genetic Resources: 172.0 Lakhs				
9	Establishment of a germplasm repository for domestic animal diversity of Kerala	Centre for Advanced Studies in Animal Genetics and Breeding, Mannuthy	13.0	Head, CASAGB, Mannuthy
10	Phenotypic Characterisation of local cattle	Livestock Research Station, Thiruvazhamkunnu	12.0	Head, LRS Thiruvazhamkunnu
11	Conservation of local cattle of Kerala	Cattle Breeding Farm, Thumburmuzhy	15.0	Head, CBF, Thumburmuzhy
12	Heat tolerance studies of Vechur cattle at different agro-climatic zones of Kerala	Instructional Farm Pookode	10.0	Head, Dept. of AGB, Pookode
13	Project on Buffalo Improvement	Livestock Research Station, Thiruvazhamkunnu	20.0	Head, LRS Thiruvazhamkunnu
14	Assessing performance of Murrah Buffaloes	University Livestock Farm and Fodder Research Station, Mannuthy	15.0	Head, ULFFRS, Mannuthy

15	Conservation and Evaluation of Malabari and Attappady Black goats	University Goat and Sheep Farm, Mannuthy	12.0	Head, UGSF, Mannuthy
16	Sire evaluation and selection for genetic improvement in Malabari goats under farm and field conditions	University Goat and Sheep Farm, Mannuthy	7.0	Head, UGSF, Mannuthy
17	Conservation and Sustenance of Indigenous Goat production under changing Climatic Scenario in Kerala	Livestock Research Station, Thiruvazhamkunnu	15.0	Head, LRS, Thiruvazhamkunnu
18	All India Co-ordinated Research Project for Goat Improvement	Centre for Advanced Studies in Animal Genetics and Breeding, Mannuthy	8.0	Director, CASAGB
19	Establishment of a pure Malabari foundation stock at Pookode	Dept. of Livestock Production and Management, CVAS, Pookode	10.0	Head, Dept. of LPM, CVAS, Pookode
20	Conservation and maintenance of Ankamali pigs of Kerala	Centre for Pig Production and Research, Mannuthy	15.0	Head, CPPR, Mannuthy
21	Conservation, characterization and Popularization of Native Chicken varieties in Kerala	Centre for Advanced Studies in Poultry Science, Mannuthy	20.0	Director, CASPS, Mannuthy

3. Increasing Productivity of Livestock : 97.0 Lakhs

22	Field Progeny Testing of Crossbred bulls (25% of AICRP)	Centre for Advanced Studies in Animal Genetics and Breeding, Mannuthy	15.0	Director, CASAGB
23	Evaluation of lactation performance and establishment of a system of milk recording in crossbred cows of Kerala for sire evaluation	Centre for Advanced Studies in Animal Genetics and Breeding, Mannuthy	10.0	Director, CASAGB
24	Influence of anti-oxidants in alleviating pregnancy stress in transition dairy cattle	Dept. of Veterinary Physiology, CVAS, Mannuthy	6.0	Head, Dept. of Veterinary Physiology, CVAS, Mannuthy
25	Feeding strategies to manipulate rumen Fermentation in crossbred cattle of Kerala	Dept. of Animal Nutrition, CVAS, Mannuthy	5.0	Head, Animal Nutrition, CVAS, Mannuthy.
26	Productivity enhancement of small holder livestock production system by resource integration	Dept of LPM, CVAS, Mannuthy	10.0	Head, Dept of LPM, CVAS, Mannuthy
27	Establishment of integrated farming of livestock, fodder, cash crops and fish at Livestock	Livestock Research Station, Thiruvazhamkunnu	12.0	Head, LRS Thiruvazhamkunnu
28	Research Station, Thiruvazhamkunnu	Centre for Pig Production and Research, Mannuthy	17.0	Head, CPPR, Mannuthy

29	Evaluation of performance of crossbred pigs (25% share of AICRP on pigs)	Centre for Pig Production and Research, Mannuthy	10.0	Head, CPPR, Mannuthy
30	Dietary intervention for early weaning of piglets Establishment of AI facility at CPPR	Centre for Pig Production and Research, Mannuthy	12.0	Head, CPPR, Mannuthy
4. Poultry Production: 172.0 Lakhs				
31	Improving backyard poultry production by supplying cross-bred chicks from improved hens	AICRP on Poultry, Mannuthy	15.0	Director, CASPS
32	Pullet production to support self help groups in back yard poultry Rearing	CAS in Poultry Science, Mannuthy	10.0	Director, CASPS
33	Poultry improvement for Eggs	AICRP on Poultry, Mannuthy	17.0	Director, CASPS
34	Selection for eighth week body weight in kuttanad ducks to produce a broiler duck line	University Poultry and Duck Farm	10.0	Head, UPDF, Mannuthy
35	Establishing a centre for meat type duck production at LRS, Thiruvazhamkunnu	Avian Research Station, Thiruvazhamkunnu	70.0	Head, ARS, Thiruvazhamkunnu
36	Strengthening of Integrated Rural Poultry Production Centre	Avian Research Station, Thiruvazhamkunnu	50.0	Head, ARS, Thiruvazhamkunnu

5.Enhancing Reproductive Efficiency : 38.0 Lakhs				
37	Promotion of milk security in Kerala through better reproductive management techniques	Gynaecology Unit, University Veterinary Hopital, Kokkalai	10.0	Head, ARGO, CVAS, Mannuthy
38	Comparison of different early pregnancy detection techniques in cattle with special reference to ultrasonography	Dept. of Animal Reproduction, Gynaecology and Obstetrics, CVAS, Mannuthy	10.0	Head, ARGO, CVAS, Mannuthy
39	Management of fertility in crossbred cattle by different oestrus induction protocols	Dept. of Animal Reproduction, Gynaecology and Obstetrics, CVAS, Mannuthy	10.0	Head, ARGO, CVAS, Mannuthy
40	Augmenting fertility in Malabari goats by controlled breeding and use of cryopreserved semen	Dept. of Animal Reproduction, Gynaecology and Obstetrics, CVAS, Pookode	8.0	Head, ARGO, CVAS, Pookode
6. Biotechnology in Livestock Research : 166.0 Lakhs				
41	Co-ordinated Project - Augmenting biotechnology and molecular biology research in KVASU			
	Strengthening Biotechnology research	CASAGB, Mannuthy	15.0	Director, CASAGB, Mannuthy
		Dept. of Veterinary Parasitology, CVAS, Mannuthy	5.0	Head, Dept. of Veterinary Parasitology, CVAS, Mannuthy
		Dept. of Veterinary Biochemistry, CVAS, Mannuthy	5.0	Head, Dept. of Veterinary Biochemistry, CVAS, Mannuthy
		Dept. of Animal Reproduction, CVAS, Mannuthy	5.0	Head, ARGO, CVAS, Mannuthy

		Dept. of Veterinary Microbiology, CVAS, Mannuthy	5.0	Head, Dept. of Veterinary Microbiology, CVAS, Mannuthy
		Dept. of Veterinary Pharmacology, CVAS, Mannuthy	5.0	Head, Dept. of Veterinary Pharmacology, CVAS, Mannuthy
		Dept. of Veterinary Public Health, CVAS, Mannuthy	5.0	Head, Dept. of Veterinary Public Health, CVAS, Mannuthy
		Dept. of Clinical Veterinary Medicine, CVAS, Mannuthy	5.0	Head, Dept. of Clinical Veterinary Medicine, CVAS, Mannuthy
		Dept. of Veterinary Epidemiology and Preventive Medicine, CVAS, Mannuthy	5.0	Head, Dept. of Veterinary Epidemiology and Preventive Medicine, CVAS, Mannuthy
		Dept. of Veterinary Physiology, CVAS, Mannuthy	5.0	Head, Dept. of Veterinary Physiology, CVAS, Mannuthy Head, Dept. of Veterinary Microbiology, CVAS, Pookode
		Dept. of Veterinary Microbiology, CVAS, Pookode	5.0	Head, Dept. of Veterinary Microbiology, CVAS, Pookode
	Co-ordinated Projects			
42	Identification of the fertility marker PDC-109 like protein(s) in Vechur bull seminal plasma	Dept. of Animal Reproduction, CVAS, Mannuthy	10.0	Head, Dept. of Animal Reproduction, CVAS, Mannuthy

43	Transcriptome profiling in Malabari Goat exhibiting Feed conversion efficiency at different levels of Protein	Dept. of Animal Nutrition, CVAS, Pookode	10.0	Head, Dept. of Animal Nutrition, CVAS, Pookode
44	Expression pattern of local growth factors controlling ovarian follicle development of Malabari goats	Dept. of Veterinary Physiology, CVAS, Mannuthy	10.0	Head, Dept. of Veterinary Physiology, CVAS, Mannuthy
45	Expression profiling of vascular endothelial growth factor (VEGF) in the ovarian follicles of different stages of growth in Malabari goats	Dept. of Veterinary Physiology, CVAS, Pookode	10.0	Head, Dept. of Veterinary Physiology, CVAS, Pookode
Individual Projects				
46	In vitro challenge studies on the expression profile of Toll-like receptors in native and crossbred cattle of Kerala	Dept. of Veterinary Biochemistry, CVAS, Mannuthy	9.0	Head, Dept. of Veterinary Biochemistry, CVAS, Mannuthy
47	Establishment of a Centre for sexing pet birds by molecular methods	Dept. of Veterinary Biochemistry, CVAS,, Pookode	10.0	Head, Dept. of Veterinary Biochemistry, CVAS,, Pookode
48	Characterization, expression and polymorphism analysis of candidate genes affecting production and reproduction traits	Dept. of Animal Breeding, Genetics and Biostatistics, CVAS, Mannuthy	10.0	Head, Dept. of Animal Breeding, Genetics and Biostatistics, CVAS, Mannuthy

	in Malabari and Attappady Black goats of Kerala			
49	Microsatellite markers for assessing genetic diversity and disease resistance among native goat breeds of Kerala	Dept. of Genetics and Biostatistics, CVAS, Mannuthy	9.0	Head, Dept. of Genetics and Biostatistics, CVAS, Mannuthy
50	Development of multiplex PCR for simultaneous detection of canine haemoparasites	Dept. of Veterinary Parasitology, CVAS Mannuthy	8.0	Head, Dept. of Veterinary Parasitology, CVAS Mannuthy
51	Molecular characterisation of Haemonchus sp. in cattle	Dept. of Veterinary Parasitology, CVAS Mannuthy	5.0	Head, Dept. of Veterinary Parasitology, CVAS Mannuthy
52	Development of multiplex PCR for bovine mastitis and molecular characterization of isolates	Dept. of Veterinary Epidemiology and Preventive Medicine, CVAS, Mannuthy	10.0	Head, Dept. of Veterinary Epidemiology and Preventive Medicine, CVAS, Mannuthy
7. Disease monitoring and surveillance : 180.0 Lakhs				
53	Studies on molecular epidemiology, immunopathology and antimicrobial resistance of infectious organisms associated with clinical mastitis in cattle of Wayanad District	Dept. of Veterinary Epidemiology and Preventive Medicine, CVAS, Pookode	10.0	Head, Dept. of VEPM, CVAS, Pookode
54	Establishment of Veterinary Transfusion Medicine Unit for Field Adoption	Dept. of Clinical Veterinary Medicine, CVAS, Mannuthy	9.0	Head, Dept. of Clinical Veterinary Medicine, CVAS, Mannuthy

55	Screening of bovine repeat breeders for leptospirosis	Dept. of Veterinary Microbiology CVAS, Mannuthy	10.0	Head, Dept. of Veterinary Microbiology CVAS, Mannuthy
56	Development of live vaccine against new duck disease in Kerala	Dept of Veterinary Microbiology, CVAS, Mannuthy	8.0	Head, Dept of Veterinary Microbiology, CVAS, Mannuthy
57	Morphological and molecular identification of haemoproteozoans in ruminants of Kerala	Dept. of Parasitology, CVAS, Pookode	10.0	Head, Dept. of Parasitology, CVAS, Pookode
58	Epidemiological investigations for assessing infection and carrier status of various haemoparasites and therapeutic management for haemoparasitic diseases in goats of Wayanad District.	Dept. of Veterinary Epidemiology and Preventive Medicine, CVAS, Pookode	10.0	Head, Dept. of VEPM, CVAS, Pookode
59	An in-vivo study on efficacy of Antibacterial Teat Dip from Lactic acid bacteria against subclinical mastitis in dairy cows and validation of the product"	Dept. of Dairy science CVAS, Mannuthy	8.0	Head, Dept. of Dairy Science, CVAS, Mannuthy
60	Detection of foot and mouth disease carrier status among vaccinated cattle and goats and evaluation of postvaccinal seroconversion in carrier animals	Dept. of Veterinary Epidemiology and Preventive Medicine, CVAS, Mannuthy	10.0	Head, Dept. of VEPM, CVAS, Mannuthy

61	Evaluation of lipotropic potential of traditional herbs locally available In the district of Wayanad	Dept. of Veterinary Pharmacology and Toxicology, CVAS, Pookode	10.0	Head, Dept. of VPT, CVAS, Pookode
62	Screening and evaluation of medicinal plants for anticancer activity	Dept. of Veterinary Pharmacology and Toxicology, CVAS, Pookode	10.0	Head, Dept. of VPT, CVAS, Pookode
63	Clinical evaluation of inhalation anaesthesia in small ruminants	Dept. of Surgery and Radiology, CVAS, Mannuthy.	8.0	Head, Dept. of Surgery and Radiology, CVAS, Mannuthy.
64	Isolation and adaptation of Classical Swine Fever virus in cell culture	Dept. of Veterinary Microbiology CVAS, Pookode	10.0	Head, Dept. of Veterinary Microbiology
65	Development of an in vitro diagnostic test for detection of anthelmintic resistance	Dept. of Veterinary Parasitology, CVAS, Mannuthy	6.0	CVAS, Pookode
66	Estimation of post vaccinalsero conversion and etiological profile of rabies in domestic animals	Dept. of Veterinary Epidemiology and Preventive Medicine, CVAS Mannuthy.	7.0	Head, Dept. of Veterinary Parasitology, CVAS, Mannuthy
67	Surveillance and Therapeutic management of Blood parasitic infections in dogs and cats	Dept. of Veterinary Epidemiology and Preventive Medicine, CVAS, Mannuthy	10.0	Head, Dept. of VEPM, CVAS, Mannuthy
68	Investigation and management of infectious skin disorders in dogs and cats	Dept. of Veterinary Epidemiology and Preventive Medicine, CVAS, Mannuthy	8.0	Head, Dept. of VEPM, CVAS, Mannuthy

69	Developing a protocol for evaluation and management of veterinary trauma patients and establishment of Veterinary Trauma Care Centre	University Veterinary Hospital, Kokkalai	10.0	Head, UVH, Kokkalai
70	Epidemiological Surveillance of <i>Enterohaemorrhagic E.coli</i> in Kerala	Dept. of Veterinary Public Health, CVAS, Mannuthy	6.0	Head, Dept. of VPH, CVAS, Mannuthy
71	Surveillance of infectious diseases, their management and seromonitoring of vaccination in University farm animals	Dept. of Veterinary Epidemiology and Preventive Medicine, CVAS, Mannuthy	10.0	Head, Dept. of VEPM, CVAS, Mannuthy
72	Study on the management of surgical disorders of dairy cattle in wayanad district	Dept. of Veterinary Surgery & Radiology, CVAS, Pookode	10.0	Head, Dept of Veterinary Surgery and Radiology, CVAS, Pookode

8. Companion Animal : 21.0 Lakhs

73	Investigation and management of companion animal fertility	University Veterinary Hospital, Kokkalai, Thrissur	10.0	Head, UVH, Kokkalai
74	Establishment of a Small Animal Dermatology unit	Dept. of Clinical Veterinary Medicine, CVAS Mannuthy, Thrissur	6.0	Head, CVM, CVAS, Mannuthy
75	Clinicotherapeutic studies on chlamydia among cage and aviary birds of Thrissur District, Kerala	Dept of Clinical medicine, CVAS, Mannuthy	5.0	Head, CVM, CVAS, Mannuthy

9. Wild Life : 20.0Lakhs

76	Disease ecology in the single largest Asia elephant (<i>Elephas maximus indicus</i>) population, Nilgiri biosphere reserve, South India	Centre for Wildlife Studies, CVAS, Pookode	10.0	Head, CWS, CVAS, Pookode
77	Mining mtDNA in wild animals from Wayanad District of Kerala	Centre for Wildlife Studies, CVAS, Pookode	10.0	Head, CWS, CVAS, Pookode

10. Dairy and Meat Processing and Value Addition : 119.0 Lakhs

78	Augmentation of folate content in Goat milk fermented products by employing Lactic acid bacteria	Dept. of Dairy Science, CVAS, Mannuthy.	10.0	Head, Dept. of Dairy science, CVAS, Mannuthy
79	Identification and scaling up of dairy starter bacterial strains suitable for preparing dairy products from natural environment	Dept. of Dairy Science, CVAS, Mannuthy.	7.0	Head, Dept. of Dairy science, CVAS, Mannuthy
80	Setting up of a Centre for Milk Testing and quality awareness for stakeholders	Department of Dairy Chemistry, College of Dairy Science and Technology, Mannuthy	11.0	Head, Department of Dairy Chemistry CDST, Mannuthy
81	Identification CCP for quality improvement of pasteurized milk processed in KVASU dairy plant	Dept. of Dairy Microbiology, College of Dairy Science and Technology, Mannuthy, Thrissur	10.0	Head, Department of Dairy Microbiology CDST, Mannuthy

82	Development of starter culture centre	Dept. of Dairy Microbiology, College of Dairy Science and Technology, Mannuthy	10.0	Head, Department of Dairy Microbiology CDST, Mannuthy
83	Research on Fermented and Functional Dairy Foods	Dept. of Dairy Technology, College of Dairy Science and Technology, Mannuthy	10.0	Head Dairy Technology, CDST, Mannuthy
84	Food Security through augmenting protein availability by effective utilization of male chicks/cockerels	Department of Livestock Products Technology, CVAS, Pookode	10.0	Head, Dept. of LPT, CVAS, Pookode
85	Mapping, standardization and quality evaluation of the traditional value added products from meat, poultry and egg	Department of Livestock Products Technology, CVAS, Pookode	10.0	Head, Dept. of LPT, CVAS, Pookode
86	Infrared Spectroscopy for Identification of Meat of Animal Species and Determination of Adulteration	Department of Veterinary Physiology, CVAS, Mannuthy	4.0	Head, Dept. of Veterinary Physiology, CVAS, Mannuthy
87	Determination of antibiotic residues in chicken meat by multi residue LCMSMS method	Department of Veterinary Pharmacology and Toxicology, CVAS, Pookode	10.0	Head, Dept. of VPT, CVAS, Pookode
88	Technology development for mechanized manufacturing	Meat Technology Unit, Mannuthy	10.0	Head, MTU, Mannuthy

	of Indian meat products for adaptation by micro, small and medium entrepreneurs			
89	Preparation and physico-chemical characterization of acellular bovine omental matrices	Meat Technology Unit, Mannuthy	10.0	Head, MTU, Mannuthy
90	Effects of processing methods on the collagen characteristics of buffalo meat	Meat Technology Unit, Mannuthy	7.0	Head, MTU, Mannuthy
11 Zoonosis : 30.0 Lakhs				
91	Development of infectious and zoonotic disease management software apposite for man and animals	Centre for One health education, advocacy, research & training, Pookode	6.0	Head, Centre for One health education, advocacy, research & training, Pookode
92	Zoonotic importance of <i>Orientia tsutsugamushi</i> and its vector identification	Dept. of Veterinary Parasitology, CVAS, Pookode	9.0	Head, Dept. of Veterinary Parasitology, CVAS, Pookode
93	Developing Veterinary-Medical-Community partnerships for studying diseases of public health importance with special emphasis on Cholera and Leptospirosis	Centre for One health education, advocacy, research & training, Pookode	10.0	Head, Centre for One health education, advocacy, research & training, Pookode
94	Prevalence of <i>Leptospira</i> species in dogs and environment	Dept. of Veterinary Public Health, CVAS, Mannuthy	5.0	Head, Dept. of VPH, CVAS, Mannuthy

12. Extension and Economics (ICT initiatives for capacity building of the rearing folk through effective livestock technology) : 154.0

95	Establishment of ICT oriented Interactive Communication laboratory in College Of Veterinary & Animal Sciences, Mannuthy for facilitating improved Livestock technology Delivery with technology networking and facilitation hubs at various centres of the Kerala Veterinary & AS University and other livestock production and management Institutions	Dept. of Extension, CVAS, Mannuthy	15.0	Head, Dept. of Extension, CVAS, Mannuthy
96	Development of a comprehensive interactive electronic knowledge system in pet animal management (dog and cat) for the benefit of pet owners	Dept. of LPM, CVAS, Mannuthy	3.0	Head, Dept. of LPM, CVAS, Mannuthy
97	Capacity building of the scientists and students of KVASU and selected veterinary officials of the Dept of Animal Husbandry Govt of Kerala on ICT oriented Interactive technology transfer methodologies leading to better livestock production through effective	Dept of Veterinary & AH Extension, CVAS, Mannuthy	10.0	Head Dept of Veterinary & AH Extension, CVAS, Mannuthy

	technology Delivery System			
98	Animal Birth Control In Stray Dogs	Department of Veterinary Surgery & Radiology, CVAS, Pookode	7.0	Head Department of Veterinary Surgery & Radiology, CV&AS, Pookode
99	Doorstep Veterinary Services to the Rural Farmers of Selected Villages through Ambulatory Clinic	University Veterinary Hospital, Mannuthy	8.0	Head University Veterinary Hospital, Mannuthy
100	Improving nutritional and food security through need oriented behavioural modification programmes based on the scientific training curriculum designed and developed for the meat production sector in Kerala	Dept of Veterinary & AH Extension, CVAS, Mannuthy	5.0	Head Dept of Veterinary & AH Extension, CVAS, Mannuthy
101	Universal Veterinary Health Coverage for Optimizing Productivity of Livestock	University Veterinary Hospital, Mannuthy	10.0	Head, University Veterinary Hospital, Mannuthy
102	e Vet connect for providing 24 x 7 Veterinary Services	Teaching Veterinary Clinical Complex, Mannuthy Teaching Veterinary Clinical Complex, Pookode University Veterinary Hospital, Kokkalai Total	36.0	Implementing Officer, E Vetconnect

103	Capacity Building for the Stakeholders of Livestock Sector	Livestock Research Station, Thiruvazhamkunnu	6.0	Head Livestock Research Station, Thiruvazhamkunnu
104	Forecasting the life-time milk production of Cattle	Department of Statistics, CVAS, Mannuthy.	6.0	Head, Department of Statistics, CVAS, Mannuthy.
105	Analysis of the quality of milk of indigenous cattle breeds and varieties of Kerala and it's impact on the milk pricing policy	Department of Animal Breeding and Genetics, CVAS, Pookode	6.0	Head, Department of Animal Breeding and Genetics, CVAS, Pookode
106	Social analysis of smallholder dairy farming systems and strengthening of milk security in Kerala	Department of Veterinary and AH Extension, CVAS, Mannuthy	10.0	Head Dept of Veterinary & AH Extension, CVAS, Mannuthy
107	Analysis of repeated measures data from animal experiments	Department of Statistics CVAS, Mannuthy	5.0	Department of Statistics , CVAS, Mannuthy
108	Investigation and documentation of present status of cage and aviary bird units in Kerala for evolving research and extension strategies	Livestock Production Management, CVAS, Mannuthy	5.0	Head, LPM, CVAS, Mannuthy
109	Capacity building programmes for various stakeholders of livestock sector	Regional Research and Training Centre, Thiruvananthapuram	4.0	Head, Regional Research and Training Centre, Thiruvananthapuram

110	Interface of public health and food industry sector for student, health science graduates and faculties	Centre for One Health Education, Advocacy, Research & Training, Dept of VPH, CVAS, Pookode	5.0	Head, Centre for One Health Education, Advocacy, Research & Training, Dept of VPH, CVAS, Pookode
111	Development of alternate extension model facility as pre-liminary step to undertake training in food safety and public health	Centre for One Health Education, Advocacy, Research & Training, Dept of VPH, CVAS, Pookode	5.0	Head, Centre for One Health Education, Advocacy, Research & Training, Dept of VPH, CVAS, Pookode
112	Centre for the Rehabilitation of Stray Puppies under END programme	Department of Veterinary Surgery and Radiology CVAS, Mannuthy	10.0	Head, Department of Veterinary Surgery and Radiology CVAS, Mannuthy
13. Waste Management: 32.0				
113	Effective waste management system for the small scale dairy entrepreneurs of Kerala state	Livestock Research Station, Thiruvazhamkunnu	10.0	Head, LRS Thiruvazhamkunnu
114	Hatchery waste disposal and its effective utilization	CAS in Poultry Science, Mannuthy	15.0	Head, CASPS, Mannuthy
115	Preparation of model for organic fodder production using cattle and pig slurry	Dept. of Livestock Production and Management, CVAS, Mannuthy	7.0	Head, Dept. of LPM, CVAS, Mannuthy
14. Monitoring & Evaluation Cell : 25 lakhs				
116	Monitoring and Evaluation cell	Camp Office, Office of DAR, Mannuthy	25.0	Director of Academics and Research

15. Strengthening of New Schools and Centers of Research : 100 Lakhs

117	School of Applied Animal production and Biotechnology,	10.0	Director, CASAGB, Mannuthy & Implementing Officer SAAPB
118	School of Zoonosis ,Public health and Pathobiology	10.0	Professor & Head, Dept. Of VPH, CVAS, Mannuthy & Implementing Officer SZPHP
119	School of Animal Nutrition and Feed Technology	10.0	Professor & Head, Dept. of Animal Nutrition, CVAS, Mannuthy & Implementing Officer SANFT
120	Central Instrumentation Laboratory and Central Store	10.0	Professor & Head, Dept. of Physiology, CVAS, Mty. & Implementing Officer CILCS
121	Centre for animal Adaptation to Environment and Climate change studies	10.0	Dean, CDST, Mannuthy & Implementing Officer CAAECCS
122	Centre for Wild life studies and research on captive elephants	10.0	Assistant Professor& Officer i/c, CWS, Pookode& Implementing Officer CWS
123	Centre for Small Laboratory animal production	10.0	Professor & Head, Dept. of Animal Nutrition, CVAS, Mannuthy & Implementing Officer CSLAP
124	Centre for Advanced Studies in Animal Breeding and Genetics	10.0	Director, CASAGB, CVAS, Mannuthy
125	Centre for Advanced Studies in poultry Science	10.0	Director, CASPS, CVAS, Mannuthy
126	Centre for ethnopharmacology	10.0	Assistant Professor & Head, Dept. of Pharmacology & Toxicology, CVAS, Pkd. & Implementing Officer CEP

A. Improving Nutritional Base

EVALUATION OF COMPLETE FEEDS WITH VARYING LEVELS OF NEUTRAL DETERGENT FIBRE FOR LACTATING DAIRY COWS

Lactating dairy cows have to meet its energy requirements mainly from the fibrous and non-fibrous carbohydrate fractions of the diet. The fibrous carbohydrates comprises the useful fibre or the cell wall contents, represented by the neutral detergent fibre (NDF). The major fraction of non-fibrous carbohydrates includes starches and sugars. To achieve maximum production, dairy rations should be balanced in NDF and at the same time not to compromise on the non-fibrous carbohydrate fractions so that optimum energy intake and rumen health are ensured. However, providing even this minimum quantity of fibre, from forage sources alone is very difficult in Kerala as it is not available at affordable rate. In this regard, incorporation of fibre from non-forage sources such as brans like rice bran and oil cakes like coconut cake have to be considered. Moreover, NDF from such non-forage sources have got lesser rumen filling effect, and is also less lignified than NDF from forages. Formulating a ration with the minimum amount of forage NDF is therefore a practical solution.

A feasible cattle feeding practice that can hence be adopted is to provide feed in the form of complete diets, which involves processing the concentrate and roughage ingredients together into a well mixed blend to which the animals are given free access. The optimum level of fibre required to obtain maximum milk production, without causing any harm to the cows was studied. Most of the researches done on complete feeds in the western countries are grass based. In India, not much research has been conducted for formulating a paddy straw based complete feed with the optimum NDF level for lactating dairy cows. Therefore, this investigation was carried out with objectives to assess the effect of different levels of NDF in complete feed for cows in early and mid lactation. So the study focused on the effect of different levels of NDF on rumen fermentation parameters which helps to recommend a complete feed with optimum level of NDF for cross-bred dairy cows of Kerala.

The study planned for six months duration to assess the effect of different levels of neutral detergent fibre (NDF) in complete feeds for lactating dairy cows in early and mid-lactation on the basis of production performance, influence on rumen fermentation parameters and economics. Results obtained in the study experimentally proved that complete rations containing paddy straw as the sole source of roughage, with 25 to 35 per cent NDF can be recommended for use among early and mid lactation dairy cows of Kerala, with 35 per cent being the ideal NDF level.

MANNAN OLIGOSACCHARIDES ARE EFFECTIVE PREBIOTICS IN RABBITS WITH HIGH WEANING STRESS

Mannan oligosaccharides (MOS) are complex substances mainly derived from outer cell wall of the yeast *Saccharomyces cerevisiae*, which are readily fermented by large intestinal micro flora and act as prebiotics. A study was carried out on dietary supplementation of prebiotic mannan oligosaccharides (MOS) on growth performance and carcass characteristics in weaned White Giant broiler rabbits.

The study indicated that though supplementation of MOS had no impact on dietary fortnightly body weight, average daily gain, average daily DM intake, haematological parameters, carcass traits and feed cost per kg body weight gain, its supplementation improved Ca availability ($P < 0.01$), heart and spleen weight. The animals fed diet supplemented with prebiotic showed reduced incidences of diarrhoea and resulted in better intestinal integrity leading to a protective effect against common pathogens. Animals supplemented with 3 g MOS per kg of diet obtained significant reduction of coliform count in caecal content and had longer ileal villi indicating better absorption and better resistance. Thus MOS supplementation at 3g per kg diet had better absorptive power and disease resistance and could be recommended as feed additive in rabbits where high weaning stress and digestive disorders are common.

PROPIONIC ACID AS FEED SUPPLEMENT FOR BROILERS

Feed acidifiers are low molecular weight organic acids having specific antimicrobial activity and they exert their action both in feed and gastrointestinal tract. In gastrointestinal tract the action occurs in the upper part and the lowered gut pH allow most of these organic acids to exist in the undissociated form, which is lipophilic in nature. They diffuses across the cell membranes of bacteria or moulds and causes dissociation of the acid inside the cell, affecting the microbial activity either by acidification of the microbial cytoplasm or by cytoplasmic accumulation of the dissociated acids to the toxic level. In a study conducted at KVASU, it was found that propionic acid at 0.2 per cent level can be recommended as a feed additive in broiler chicken. Propionic acid supplementation in broiler feed improved growth performance and carcass characteristics.

- a. A study on pre – weaning feeding management on the growth performance of Malabari kids revealed that maintaining kids on concentrates like creep ration is profitable in states like Kerala, where roughage availability is less.
- b. A dietary copper level of 200 ppm for broiler birds (Vencobb – 500) resulted in better growth performance than 400, 600 or 800 ppm. The higher levels were found to result in reduced growth performance, gastrointestinal disturbances and hepato-toxicity.
- c. Dietary concentration of 750 ppm betaine hydrochloride in broiler ration resulted in higher body weight gain with better feed conversion ratio and better returns over feed cost. Betaine, also known as lycine, glycine betaine and trimethylglycine, is a naturally occurring amino acid derivative found in microorganisms, plants and animals. Betaine acts primarily as methyl group donor and as an osmolyte that assists in cellular water homeostasis.

B. Management and improvement of animal genetic resources

DIVERSITY ANALYSIS AMONG GOAT GENETIC GROUPS OF KERALA

The increasing demand for goat milk, meat and kids create great opportunities for commercial goat production which can play a major role in poverty alleviation. This necessitates planning breed improvement programmes to meet the ever increasing demands in future. As the genetic variation forms the basis for all livestock improvement programmes for future development, breed improvement programmes must include conservation strategies for sustainable management of autochthonous breeds and/or commercial utilization and development of specific crosses for practical purposes, like alleviation of poverty among rural poor.

In the study the genetic variations existing among the goat population of Kerala was scientifically assessed using morphological, quantitative and molecular markers. Six goat populations namely, Attappady Black (AB), Malabari crossbreds (CB), Malabari populations of Kannur, Calicut, Thrissur and Malappuram (MK, MC, MT and MM respectively) districts formed the material for study. The association of molecular genetic markers assessed with traits of economic importance and the genetic distance between different goat genetic groups was the focus of the investigation.

On genetic diversity analysis using microsatellites as the markers of choice, higher genetic variation obtained may be attributed to intermixing of different populations, whereas heterozygote deficit may be due to inbreeding caused by unplanned mating including lack of sufficient number of good breeding bucks in the population. Phenotypic and genetic diversity analysis using qualitative morphological, quantitative biometric and molecular markers thus established the existence of different goat populations in Kerala. Attappady Black goats differentiated into a distinct population with fewer admixtures and no bottleneck. Malabari Malappuram remained different from other Malabari populations, both phenotypically and genetically.

Malabari populations of Kannur, Calicut and Thrissur districts with many advantageous traits could be clubbed into a single population based on this study and further breed improvement strategies adopted to reduce admixture. Morphobiometric and molecular markers identified Malabari crossbreds as a distinct group of goats with scope for commercial utilization. Such genetic information can provide the foundation for all livestock improvement programmes for future development.

EXPRESSION PROFILE AND GENETIC VARIABILITY OF GENES ENCODING NERVE GROWTH FACTOR AND INSULIN LIKE GROWTH FACTOR-1 IN GOATS

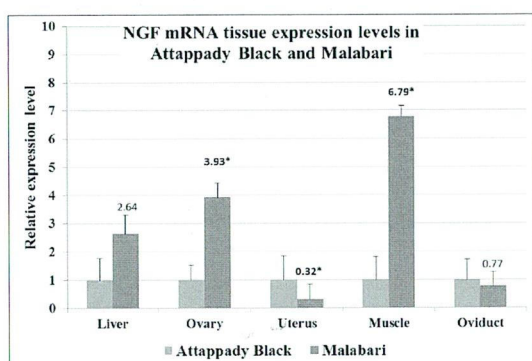
Goat rearing contributes nearly 8.5 per cent of the total Gross Domestic Product from livestock sector to Indian agriculture production through byproducts like milk, meat, skin and manure. To meet the ever increasing requirement of goat meat and milk for growing human population, there is need to augment the number as well as per animal productivity. However, the increase in goats would certainly put stress on depleting natural resources. Therefore, it is necessary to enhance the production efficiency of our goats' thorough review of its different components

such as selection, feeding and management.

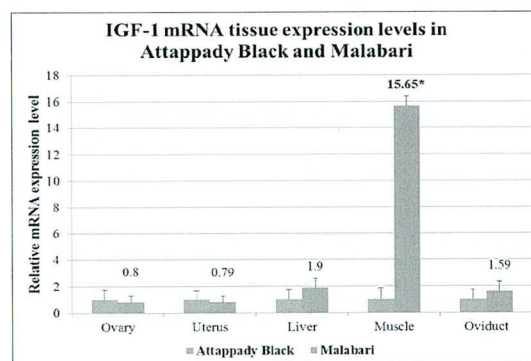
The reproduction and growth are the most important aspects of economically viable livestock production. To augment the selection response, traditional selection methods can be complemented with gene assisted or marker assisted selection (MAS) as an alternative to improve the economically important traits. The candidate genes regulating the growth and reproduction could be targeted for enabling the selection of animals using MAS for these performance traits, which are under the control of multiple genes. Thus understanding the multiple genes regulated complex physiology of growth and reproduction needs the analysis of a large number of candidate genes. Marker assisted selection holds the advantage that it allows selection of individuals at an early stage and independent of sex. In addition, it will yield a faster genetic progress than the conventional methods and also sustainable.

It is imperative to precisely know the genes causing variation within a trait, their molecular architecture, expression profile, sequence variability and association with phenotypes. The genes coding for Nerve Growth Factor (NGF) and Insulin Like Growth Factor -1 (IGF-1) protein of Malabari and Attappady Black goats were investigated in our research. The Nerve Growth Factor (NGF) gene regulates the growth of neurons and development of peripheral organs such as thymus, pancreas and ovary. It promotes the development of preantral follicles, regulate ovarian response to the gonadotropins and vital for folliculogenesis. The Insulin Like Growth Factor -1 (IGF-1) protein plays a crucial role in reproduction, cell proliferation, protein synthesis and growth. It also regulates the secretion of gonadotropin releasing hormone and steroidogenesis. Hence, NGF and IGF-1 genes could be considered as promising candidates for growth and reproduction traits.

On comparative analysis of expression level between high prolific Malabari and low prolific Attappady black goats, it highlighted the decisive role of NGF and IGF-1 in reproduction and growth of goats. In the light of results obtained and functional properties, it was concluded that the NGF and IGF-1 are the potential candidate genes for the reproduction and growth traits of goats.



NGF mRNA levels in different tissues of Attappady Black and Malabari goat (*p-value \leq 0.05)



IGF-1 mRNA levels in different tissues of Attappady Black and Malabari goat (*p-value \leq 0.05)

Porcine beta defensin-1 (PBD-1) gene, which encodes an antimicrobial peptide and has an important role in the innate immunity of pigs, was characterized and its expression profiling and polymorphism study done in Ankamali and Large White Yorkshire (LWY) pigs. Molecular characterisation revealed 100 per cent identity between the sequences of PBD-1 gene in Ankamali and Large White Yorkshire pigs. Quantitative real time PCR for studying expression of PBD-1 mRNA in different tissues (Tongue, Oral epithelia and Intestine) of Ankamali and LWY pigs was revealed that the PBD-1 mRNA was expressed at very high levels in the tongue and at moderately high levels in the oral epithelia compared to the intestine. Expression profiling clearly indicated higher expression of PBD-1 mRNA in the oral cavity of pigs suggesting the involvement of PBD-1 peptide in the co-creation of an antimicrobial barrier in the oral cavity.

C. Poultry

Evaluation of dietary protein level for growth in Kuttanad duck

An experiment was conducted to study the effect of dietary protein level for growth in Kuttanad ducks. The dietary treatment consisted of T1 containing 16 per cent CP (Crude Protein), T2 (18 per cent CP), T3 (20 per cent CP) and T4 (22 per cent CP). The energy level was 2800 kcal/ kg Metabolizable Energy (ME) in all treatments. Parameters of growth performance viz. body weight, feed consumption and feed efficiency were recorded at weekly intervals till 12 weeks of age. The results of the study indicated that the ducklings under dietary treatment containing 20 per cent showed improved growth performance with regards to 8th week body weight, body weight gain, feed consumption, FCR and economy as compared to T1, T2 and T4.

Development of a meat line of Kuttanad ducks (*Anas platyrhynchos domesticus*)

A selection experiment was conducted in Kuttanad ducks at University Poultry Farm, Mannuthy under Kerala Veterinary and Animal Sciences University with the objective of developing a meat line. The results of the selection experiment indicated that selection for body weight at 8 weeks was effective in improving the body weight. The trend observed in body weight gain, frequency distribution, response to selection and correlated responses as well as the high heritability and phenotypic correlation for body weight at 8 weeks established that the criterion for selection (8th week body weight) employed in the present study was appropriate. The carcass characteristics especially the eviscerated yield and yield of cut-up parts over generations indicated that the meat producing potential of Kuttanad ducks has improved as a result of selection. It was concluded that Kuttanad ducks would attain its optimum meat production characteristics at 8 weeks and hence it could be considered as the ideal age for processing.

Identification of SNPs of ovocalyxin-32 gene and its association with production traits in IWN strain of White Leghorns

A study revealed the significant ($P < 0.05$) association of Single Nucleotide Polymorphism 381G>C and 494A>C in exon 3 and 4 of ovocalyxin-32 gene (OCX-32) with traits like body weight, shell thickness, egg number, age at sexual maturity and egg weight at the later stage. Hence these two SNPs of the candidate gene OCX-32 associated with the economic traits of poultry can be utilized as markers in selection and breeding of layers.

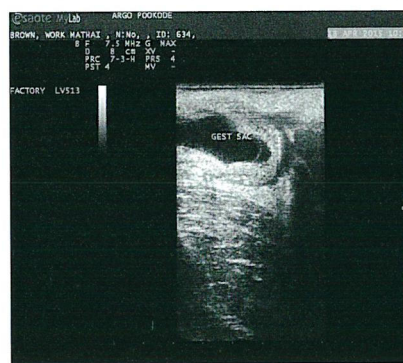
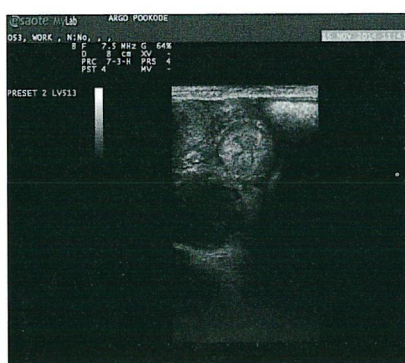
D. Enhancing reproductive efficiency

PROGESTERONE INSERTS HELP IN REDUCING POST PARTUM ANOESTRUS IN DAIRY COWS

Reproductive efficiency is one of the most important factors in determining the productivity and profitability of dairy farming. Peri-parturient health of the dairy cows plays an important role towards achieving these targets. A substantial number of factors such as uterine infections, hormonal and nutritional imbalances associated with calving, production diseases etc. leads to decrease in profitability of dairy farming. In high yielding dairy cows resumption of ovulation after parturition is delayed owing to negative energy balance, retention of foetal membranes, puerperal metritis and other metabolic diseases. To achieve optimum conception rate, cows must have normal uterine involution, resume ovarian cyclicity, should be detected in oestrus and inseminated within 40 to 60 days after calving. Cows bred in tropical conditions present a high incidence of postpartum anoestrus that increases the calving to conception interval and, as a consequence, negatively affect reproductive performance.

Off late, follicular development, regression of corpus luteum and sequentially timed AI are programmed in synchronization of ovulation protocol to improve the fertility of the dairy cows. Research has been conducted in evaluating the effectiveness of synchronization protocols that combine the use of PGF2 α , GnRH, progesterone and oestrogen in dairy cattle.

The present research work evaluated the use of ovulation synchronization protocol with TRIU-B[®] progesterone insert for augmenting fertility in postpartum anoestrous dairy cows. Two synchronization protocols viz., TRIU-B[®] + GnRH + PGF2 α and TRIU-B[®] + oestradiol + PGF2 α were compared for their efficacy. 24 apparently healthy animals were selected and randomly allotted to two experimental and one control group comprising of eight animals each. Experimental animals of group I were inserted with TRIU-B[®] intra vaginal device followed by intra muscular administration of GnRH on day 0. TRIU-B[®] insert was removed and PGF2 α was administered on day 7. FTAI was performed at 56 h after removal of the insert and a second dose of GnRH was given at the time of AI. Animals in group II were administered oestradiol benzoate intramuscular and inserted with TRIU-B[®] on day 0. The insert was removed on day 8 followed by injection of PGF2 α analogue. On day 9, a second dose of oestradiol benzoate was given followed by FTAI,



Ultrasonographic visualization of non-gravid uterus (day 25 post AI) and gestational sac (day 25 post AI)

24 h later. Animals of group III (control group) that showed natural oestrus after 40 days of calving, were inseminated at the detected oestrus. Pregnancy was diagnosed 25th day post AI using real time B-mode ultrasound scanner with multi-frequency transrectal probe (5.0–7.5 MHz). Oestrus was induced in all the animals of both the treatment groups. The TRIU-B® + oestradiol+PGF2α synchronization protocol gave better oestrus response with lesser time taken for the onset of oestrus, more intense oestrus and high first service and overall conception rate than TRIU-B® + GnRH + PGF2α group and control group.

ESTIMATION OF LACTATE AND APGAR SCORING FOR ASSESSING STRESS IN CANINE NEONATE

Estimation of lactate in umbilical vein and Apgar scoring can be considered as easy and reliable techniques for the identification of distress in canine neonates. Such a prompt identification of neonatal distress can help the clinician to undertake immediate medical therapy or resuscitation, thereby reducing neonatal mortality. In 1952, Virginia Apgar developed a simple and reliable scoring system for evaluating the health of human babies just after birth. Later the scoring system was adopted to Veterinary field with slight modifications depending on the physiology of the neonates. The scoring system provided an immediate assessment of the neonatal health status and also helped in identifying the response of the neonates to resuscitation.

- a. Vechur seminal plasma was found to contain 77.3 to 106 mg/ml of proteins. The major fraction of the seminal plasma protein was gelatin binding proteins, which constituted 54.6% of the total seminal plasma proteins.
- b. Malabari goats were found to have significantly higher level of serum oestrogen during pro-oestrus than Attapady goats (41.69 ± 7.5 pg/ml vs 20.2 ± 4.4 pg/ml).

E. Basics and Biotechnology

A COMPREHENSIVE JOURNEY INTO THE DEVELOPMENT OF PANCREAS IN GOATS

The pancreas of mammals is a unique gland since it is composed of both exocrine and endocrine components that are closely related both structurally and functionally. Diseases like diabetes, caused by the dysfunction of endocrine part of pancreas, adversely affect the function of the exocrine component of the gland and conditions like chronic pancreatitis that affects the exocrine part gradually disturbs the function of the islet cell hormones.

Pancreas develops from dorsal and ventral pancreatic primordia that are outgrowths of endodermal lining at the caudal part of foregut. Cells of the pancreatic primordia proliferate and differentiate into ducts and secretory acini. Some cells get detached from the duct system and develop into islets of Langerhans.

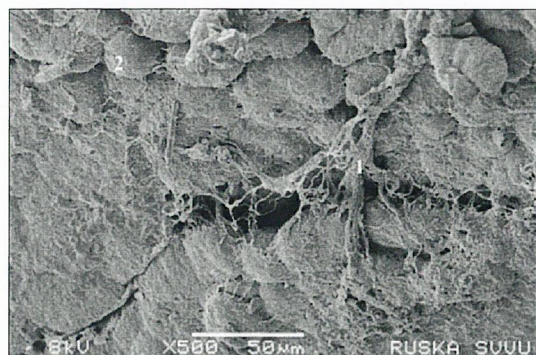
The exocrine pancreas constitutes the larger part of the pancreatic parenchyma and functions as one among the major digestive glands in the body. It is composed of tubulo-acinar glands that secrete various digestive enzymes such as amylase, protease and lipase. The relatively smaller endocrine component is composed of groups of hormone-secreting cells, the islets of Langerhans that are intermingled with capillary loops. The islets are mainly composed of four major types of endocrine cells that produce insulin (B-cell or β -cell), glucagon (A-cell or α - or α 2-cell), somatostatin (D-cell or δ -cell or α 1-cell) and pancreatic polypeptide (PP- or F-cell). Insulin is a polypeptide hormone that increases the uptake of glucose into cells. It is an important determinant of the growth rate in utero and is needed throughout late gestation for the normal growth and development of the sheep foetus. Type-I diabetes with degeneration of beta cells of pancreas has been reported in a four year old goat.

Due to the importance of diseases that occur as a result of pancreatic dysfunction, pancreas has been an organ of interest for research in recent years. Studies about the sequences in normal development of pancreas are beneficial in understanding its normal mode of functioning and thereby help to trace the causes of its dysfunction as in diabetes. This information is also crucial for studies that are undertaken to produce functional insulin-producing cells suitable for transplantation.

The endocrine pancreas of lambs has been reported as a suitable animal model for studying some aspects of normal maturation of the pancreatic islets in man. The mechanisms involved in normal pancreatic organogenesis and structural maturation of the fetal and neonatal pancreas in goats are poorly understood. Knowledge about the normal development of pancreas in goats will add on information to the existing scientific data and thereby contribute to advances in developmental biology. The results can also be compared to human data for furthering the knowledge of human biology and medicine. Hence, a study was structured to generate baseline data on the development of pancreas in goats by tracing the normal developmental pattern during the prenatal and postnatal periods and to study the morphological, topographical and histological development of pancreas from the appearance of primordium till the animals attain six months of age by gross anatomical, light microscopic, ultrastructural and immunohistochemical methods.

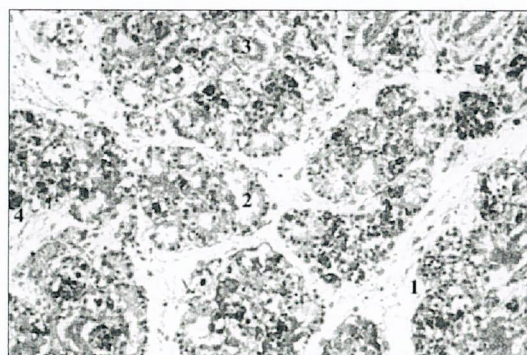
The study was conducted using 30 embryos and 36 male kids. The dorsal pancreatic primordium was identified in 40 days-old embryos in the dorsal mesogastrium and the ventral one near the hepatic diverticulum. The two primordia fused to form a single mass by two months. By three months, it assumed a butterfly shape with right and left lobes connected by a narrow body. Angiogenesis was started by about two months and acini started developing from 70 days of foetal life. Development of the endocrine part started from 52 days onwards as buds from the walls of ductules. During the last month of gestation, most of the lobules contained a well developed duct system and numerous acini. In postnatal animals, the lobules contained several secretory acini, ducts, islets of Langerhans, blood vessels, nerve bundles and ganglia. Histochemistry revealed the presence of glycogen, mucopolysaccharides, lipids and enzymes in different parts of pancreas. Immunohistochemistry with anti-insulin antibody revealed the presence of insulin immuno-reactive cells from 58 days of development and their number increased till the end of study period. It was concluded that the exocrine and endocrine parts

of pancreas developed structural maturity in the prenatal life itself. During prenatal and postnatal periods there was an absolute increase in the endocrine and exocrine components of pancreas even though the relative increase was more with exocrine pancreas.



1. Collagen fibers in interlobular septa 2. Acini

Section of pancreas showing acini and interlobular septa (six months - postnatal).
SEM



1. Lobule 2. Acini 3. Ductule
4. Insulin immuno-reactive cells

Section of pancreas showing insulin immuno-reactive cells (71 days of gestation). Immunohistochemistry x 200

DEVELOPMENTAL STUDIES ON MUCOSA-ASSOCIATED LYMPHOID TISSUE OF DIGESTIVE TRACT IN GOATS

Mucosa-associated lymphoid tissue (MALT) forms an integral part of defense mechanism of the body. Mucosal surfaces are highly susceptible for pathogenic invasions because of their thin and moist nature and most of the mucosal surfaces are in direct contact with the environment. Hence they are protected by a specialized branch of local immune system called mucosa-associated lymphoid tissue. MALT works independently of the systemic immune system and manages antigens from mucosal surfaces. MALT of the digestive tract includes the lymphoid tissue of Waldeyer's ring consisting of large aggregations of lymphoid nodules in the oropharynx, nasopharynx and laryngopharynx, viz. the tonsil of the soft palate, lingual, palatine, pharyngeal, tubal and paraepiglottic tonsils, with species specific variations and gut-associated lymphoid tissue (GALT). Apart from other functions, the gastrointestinal tract is one of the largest lymphoid organs in the body and the lymphoid tissue contained in it is collectively referred to as the gut-associated lymphoid tissue or GALT. It contains up to 70 per cent of the immunocytes of the body and provides the ability to respond appropriately to a large number of dietary and microbial antigenic components.

The goat is a versatile animal and known as the "poor man's cow" in India as it provides a dependable source of income to 40 per cent of the rural population below the poverty line. Since raising a disease free flock of goats depends largely on a strong immune system, a study on their MALT will be highly useful for the breeders and researchers in utilizing this species profitably and commercially.

Though extensive research has been done on the most easily identified palatine tonsils and Peyer's patches, information regarding the age related changes in the histological and histochemical aspects of these organs in goats is scanty. Moreover, basic anatomical data on

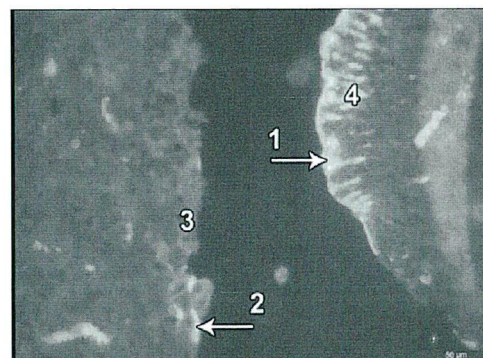
other tonsils and GALT in the large intestine is scarce in the literature. Considering these facts, a study was conducted to elucidate the anatomical organization and developmental pattern of caprine MALT of digestive tract in disease free animals that would form a basis for physiological, pathological and immunological studies in future. In this study, the researcher aimed to trace the histomorphogenesis of MALT of digestive tract during the prenatal period, to study the topography and histology of MALT of digestive tract at different stages of postnatal life and to study the histochemistry of MALT of digestive tract during prenatal and postnatal periods.

The study found that the lymphoid cells were first appeared in lingual tonsil, jejunum, proximal colon and rectum by 60 days of gestation. When compared to tonsils in which only primary nodules were identified at birth, the degree of development was more in GALT with both primary and secondary nodules, suggesting the presence of intrinsic factors that might have stimulated the development in it. Morphometry and micrometry of tonsils and GALT increased as age advanced and showed highly significant correlation with bodyweight and age. The maximum development of lymphoid tissue was noticed in the pharyngeal tonsils and rectal patches, respectively suggesting that they could be exploited as targets for nasal and rectal vaccines for the induction of mucosal immune response in this species.



1. Lymphocytes
2. Rough endoplasmic reticulum

Ultramicroscopy of jejunal Peyer's patches showing lymphocytes (1 month).
TEM x 7720



1. Goblet cell
2. M cell
3. Reticular epithelium
4. Surface epithelium

C.S. of pharyngeal tonsil showing fluorescence of FITC- conjugated Lectin from *Ulex europaeus* (UEA-I)(6 months). FITC-UEA-Ix400



1. M-cell
2. Degenerating cell
3. Lymphocytes

Ultramicroscopy of jejunal Peyer's patches showing M cell in FAE (1 month) TEM x 3860

DIAGNOSIS OF AVIAN ONCOGENIC VIRUSES

The poultry industry is one of the major cogs in the world's agriculture economy. Birds raised under commercial conditions are vulnerable to a number of pathogens. Among these pathogens, avian oncogenic viruses have a major economic impact on poultry industry. The avian oncogenic viruses of chicken include the Marek's disease virus (MDV) and three retroviruses consisting of avian leukosis virus (ALV) (Subgroups A-E), avian leukosis virus subgroup J (ALV-J) and reticuloendotheliosisvirus (REV).

Marek's disease (MD) is a highly contagious lymphoproliferative disease affecting different avian species throughout the world. The infiltration of lymphocytes in nerves and visceral organs results in neuropathy and CD4+ T cell lymphomas. Research on MDV resulted in the development of first ever successful vaccine against a tumor, Herpes Virus of Turkey (HVT). The selection pressure caused the emergence of variant MD viruses with high virulence which resulted in severe outbreaks worldwide. Trials are still progressing on new vaccine development to combat the virulent MDV. Incidences of MD had been reported recently throughout Kerala even in vaccinated flocks which could be due to MD or other oncogenic viruses. This warrants the need for the rapid and confirmatory diagnosis of the causative agent.

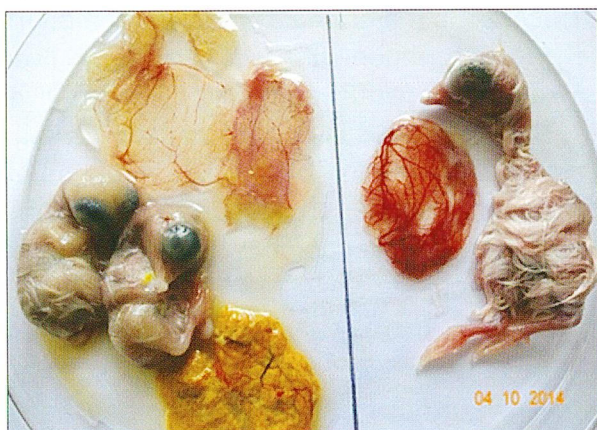
ALV, also called as leukosis/sarcoma virus causes a group of leukosis, sarcomas and related neoplasms. It is a lymphoproliferative disease of chicken affecting primarily the bursa of Fabricius and visceral organs, transforming the B-type lymphocytes. In commercial poultry flocks worldwide, ALVs are prevalent in several breeding flocks causing carcass condemnation, decreased growth rates and egg production leading to serious economic losses which were estimated to be in millions of U.S dollars each year.

The most common REV- induced syndromes are chronic lymphomas and immunosuppressive runting disease causing bursal and T-cell lymphomas in chicken and turkeys. The virus is widespread and often asymptotically infects chicken, turkeys, ducks, geese, pheasants, quails and other avian species, resulting in contamination of biological products. REV produces more or less similar lesions as that of other tumors.

The diagnosis of these diseases is difficult at necropsy level. Serological or molecular tests are required for confirmation. As MD and ALV are ubiquitous in nature, serological tests have only limited value in the diagnosis but are instrumental in control and eradication programmes. Since all three disease conditions produce more or less similar clinical signs and pathological lesions, a differential diagnosis is important.

Among these three diseases, MD possesses most dangerous threat to poultry farming since the vaccination can only prevent formation of tumor but generation of infectious virus is not prevented. The virus is shed in the environment as dander dust after maturation in the feather follicle epithelium. Therefore, a study was undertaken on avian oncogenic viruses with special emphasis on MDV. The study envisaged a comprehensive investigation of seroprevalence of avian oncogenic viruses in chicken of Kerala, development of PCR based diagnostic tool for the diagnosis of avian oncogenic viruses and genetic characterization of field viruses by sequencing.

A total of 1030 sera from chicken above four weeks of age from nine organized farms of Kerala were screened by different serological tests viz. ELISA, agar gel immunodiffusion and indirect fluorescent antibody assay. The overall per cent positivity estimated by ELISA was 15.2 per cent 48 per cent and 14 per cent respectively, for Marek's disease, avian leukosis and reticulo endotheliosis viral antibodies. The study showed that the ELISA is more sensitive than other two tests in detecting the oncogenic viruses and can be recommended for routine screening of antibodies against avian oncogenic viruses as it is simple also. PCR based diagnosis revealed the presence of all the three oncogenic viruses in three organized farms. The study also proved feather follicle as the right clinical material for the diagnosis of MD since maximum number of positivity for MD reported from feather follicle DNA, as well as feathers are easy to collect and transport. In an attempt to isolate these viruses in embryonated chicken eggs, it was found that isolation of ALV and REV was not successful indicating unsuitability of embryonated chicken eggs for the primary isolation of these two viruses. But MDV could be isolated in embryonated chicken eggs. Pathological lesions noticed from birds brought for necropsy were compared histopathologically using three staining techniques viz., H & E, May- Grunwald Giemsa (MGG) and methyl green pyronin (MGP) staining. Compared to the lesion distinctness and ease in preparation of staining, MGG was found to be better stain than H & E and MGP. Hematological parameters viz., VPRC, Hb and WBC count were estimated in 100 number of blood samples. No correlation of hematological values was noticed with serology or molecular detection. Hence, hemogram of live birds had limited value in diagnosis of avian oncogenic viruses.



MDV-Stunted growth of embryos

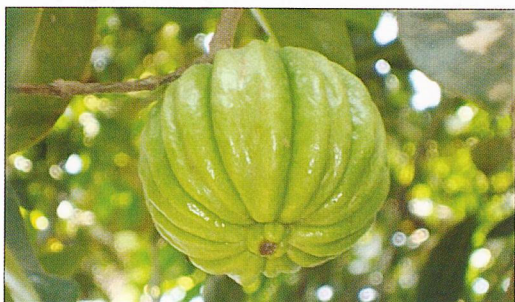


MDV- Congestion and pock lesions on CAM

SEROSURVEILLANCE OF FMD IN CATTLE CARRIED OUT

Post-vaccination sero-monitoring is a vital component of any intensive vaccination strategy. A study was conducted to assess the sero-conversion following FMD vaccination in pre-sensitized adult cattle using Sd-LPB ELISA. Adult animals responded well to FMD booster vaccination and maintained protective immunity up to six months post vaccination. Persistence of subclinical infection within vaccinated herd was also noticed. The maternally derived antibodies were found to persist in the system of colostrum fed calves for up to the age of five months and its interference toward induction of primary immune response to vaccination was further documented. The efficacy of a booster dosage in calf-hood vaccination was evaluated and found to drastically improve the immune response. Carrier status could be detected among FMD convalescent cattle even six months post-outbreak, with higher molecular prevalence of serotype O in their oro-pharyngeal secretion. Presence of previous exposure to infection, subclinical infection or carrier state did not significantly influence the sero-conversion to subsequent vaccination.

Garciniagummi-gutta HAS ANTIOXIDANT AND HEPATOPROTECTIVE EFFECT IN PARACETAMOL INDUCED TOXICITY IN RATS



Liver disease is a major health problem in modern era. The most common diseases are fatty liver, cirrhosis, cancer, hepatitis and drug induced liver damage. The major risk factors of hepatic damage include excess consumption of alcohol, autoimmune diseases, infection, continuous exposure to environmental toxic chemicals, xenobiotics, drugs, food additives and pollutants.

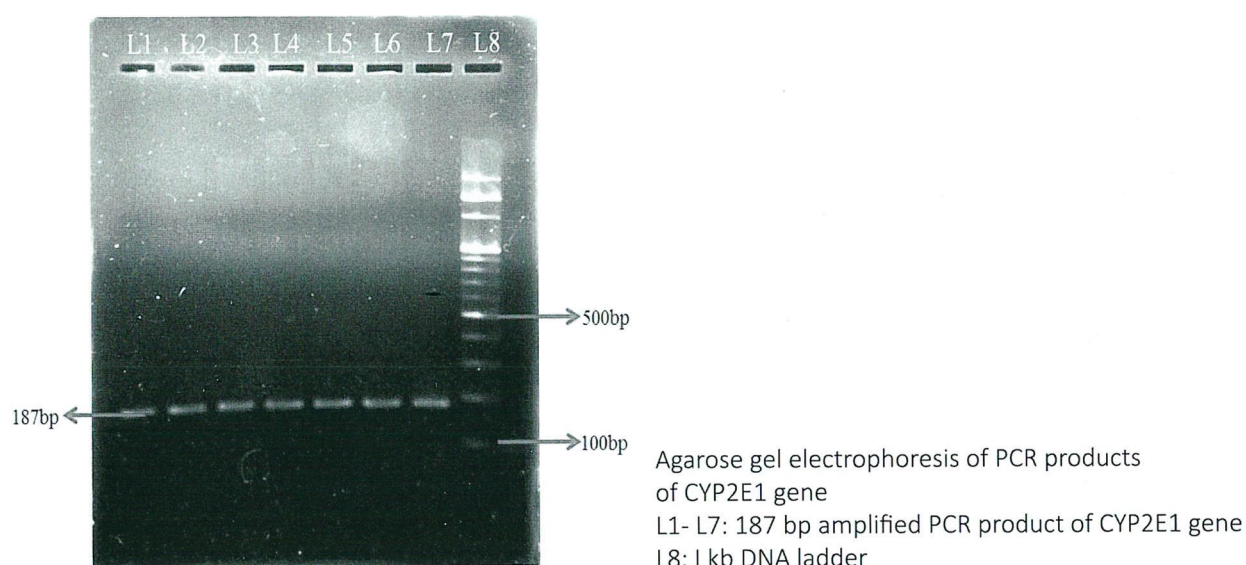
Paracetamol (N-acetyl-p-aminophenol, acetaminophen, APAP) is a widely used antipyretic and analgesic agent that is considered to be safe at therapeutic doses, but can cause fatal liver in human and animals due to over dosage. Drug-induced intrinsic hepatotoxicity produced by paracetamol accounts for more than half of acute liver failure cases in the world. In acetaminophen over dosage, hepatic glutathione is depleted by N-acetyl-p-benzoquinoneimine (NAPQI), followed by covalent binding of NAPQI to cellular proteins resulting in cellular oxidative damage, mitochondrial dysfunction, derangement of calcium homeostasis, and development of acute hepatic necrosis.

Medicinal plants and their formulations that were used in traditional medicine for treatment of liver disease have now become popular due to their safety, efficacy, antioxidant property and cost effectiveness. *Garciniagummi-gutta* (L) Roxb. Syn. *Garcinia cambogia*, popularly known as Malabar tamarind/ Kudampuli belonging to the family Clusiaceae is a dicotyledonous medium sized tree distributed widely in the evergreen forest of southern and eastern India and Andaman Islands. The fruits of this tree have been reported to be used in traditional Ayurvedic medicine for the treatment of ailments like diarrhoea, heart complaints, haemorrhoids and rheumatism.

Experimental studies have shown that *G. gummi-gutta* possesses hypolipidemic, immunomodulatory, antioxidant, anti-ulcer and larvicidal properties.

Even though *G. gummi-gutta* is found to have many medicinal properties, reports on in vivo application of the antioxidant and hepatoprotective potentials of its fruit rind on paracetamol induced hepatotoxicity has been found to be scanty. Considering the high incidence of paracetamol induced acute liver failure cases due to hepatotoxicity and oxidative stress along with the growing demand for novel naturally occurring hepatoprotective agents, a study was designed to assess the antioxidant and hepatoprotective effect of *Garciniagummi-gutta* fruit rind extract on paracetamol induced toxicity in rats and to evaluate the expression level of CYP2E1 gene in rats fed with *Garcinia gummi-gutta* fruit rind extract since Cytochrome P450 pathway is involved in the formation of toxic metabolite of paracetamol.

The experiment consisted of six groups with each group comprising of eight animals. Group I served as the normal control and Group II served as the positive control for paracetamol. Group III, IV and V received ethanolic extract of *G. gummi-gutta* fruit rind at different dose levels orally and group VI received sylimarin at standard dose for 10 days. Hepatotoxicity was induced in Group II, III, IV, V and VI by single oral administration of paracetamol at a dose of 2 g/kg body weight on day 8 of the study. Administration of the extract revealed hepatoprotection by significant reduction in serum levels of liver function enzymes like aspartate amino transferase, alanine amino transferase and alkaline phosphatase and with a significant increase in the antioxidant level. Histopathological studies revealed the presence of regenerating binucleated hepatocytes. Expression studies with RT- qPCR for Cytochrome P450 2E1 gene showed a significant down regulation in the liver of extract-treated group in a dose dependent manner when compared with that of control group. Thus, the study concluded that the ethanolic extract of dried fruit rind of *G. gummi-gutta* has marked antioxidant and hepatoprotective effect in paracetamol induced toxicity in rats.

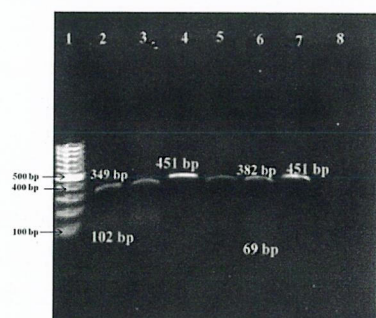


AN INVESTIGATION OF CAT PLAGUE IN KERALA

Cats are considered as one of the world's most popular pets. In this globalization era, as with the other fields, transport of valuable pet birds and animals across the countries is increasing. This stands true in case of cat breeds also. Its positive impact is that, cat breeding has grown as a well flourished sector with huge financial gains. But, with the increasing population of pet cats, there is a high chance of increased incidence of diseases also.

The transport of pet cats from one country to another can result in introduction of exotic cat diseases. Like other animals, cats are also susceptible to several bacterial and viral diseases, which trouble the pet owners, veterinarians and scientists worldwide. Among these, feline panleukopenia (FPL) is an acute viral infection of domestic and wild felids resulting in high mortality rate in unvaccinated population. The disease is characterized by anorexia, fever, leukopenia, vomiting and diarrhea. It is also known as feline infectious enteritis, feline parvoviral enteritis, feline ataxia or cat plague. Kittens up to 12 months of age recorded highest morbidity and mortality rate. In peracute infections, mortality may reach up to 100 per cent and is 25 to 90 per cent in acute cases. The causative agent, feline panleukopenia virus (FPLV) is a host range variant of feline parvovirus subgroup. The virus is closely related to canine parvovirus (CPV), mink enteritis virus and racoon parvovirus. It is transmitted by direct contact of susceptible animals with infected cats and its secretions. During the active stages of the diseases, the virus is excreted from all body secretions. But, it is most consistently recovered from intestine and feces.

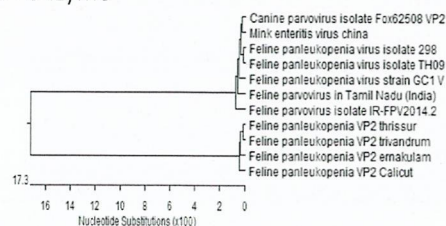
Though, FPLV and CPV share over 98 per cent similarity in DNA sequence, they have specific host range, antigenic and haemagglutination properties which are located on capsid protein gene. Hence, specific identification of FPLV and its rapid differentiation from CPV is highly essential for differential diagnosis. For the antigenic variation, only a few amino acid substitutions in the VP2 capsid protein are responsible. Hence, for the characterization and typing of FPLV, the VP2 amino acid sequence could be used. Therefore, PCR amplification of VP2 gene and subsequent sequencing can demonstrate definite antigenic and genetic characterization of FPLV from cats.



RFLP pattern of FPLV and CPV digested with Rsa I and Hinc II

- Lane 1: DNA Molecular weight marker (100 bp)
- Lane 2: Rsa I digest of FPLV Positive control DNA
- Lane 3: Rsa I digest of positive clinical sample
- Lane 4: Uncleaved PCR product of FPLV positive control DNA with Hinc II enzyme
- Lane 5,6: Hinc II digest of CPV positive control DNA
- Lane 7: Uncleaved PCR product of CPV positive control DNA with Rsa I enzyme

Phylogenetic analysis of the partial FPLV VP2 gene sequence of the samples under study with other FPLV sequences in the GenBank



Continuous epidemiological surveillance and characterization of field isolates of FPLV is a need of the hour since the variation in the major antigenic sites can lead to failure of nucleic acid-based diagnostic assays as well as it can negatively affect vaccine efficacy. It also helps to understand virus mutation, if any occurred, which will provide insights into the mechanisms that drive the FPLV evolution. Monitoring of FPLV field isolates, molecular characterization and sequence analysis will help to elucidate virus evolution and to adopt preventive measures aimed to control the spread of FPLV. Considering the above facts, a study was designed to detect FPLV by haemagglutination (HA) test, commercially available immunochromatographic strips (ICS) and PCR and to determine the genomic differentiation from CPV by PCR based Restriction fragment length polymorphism (PCR-RFLP) and sequencing. The study found that specificity of ICS and HA test versus PCR was excellent (100 per cent), whereas sensitivity was poor. The blast analysis revealed that the local field isolates of FPV showed 99 % homology with other FPV sequences available in the GenBank. The PCR-RFLP analysis with restriction enzymes AfaI and HincII differentiated FPLV from canine parvovirus.

AN INSIGHT INTO THE MOLECULAR EPIDEMIOLOGY OF CLASSICAL SWINE FEVER IN KERALA

Among the various livestock species, piggery is the most promising source of meat production with efficient feed conversion rates capable of transforming food waste of least value into beneficial products. As the demand for meat has augmented worldwide, fast-growing species such as pigs form a major contribution among the meat producing animals.

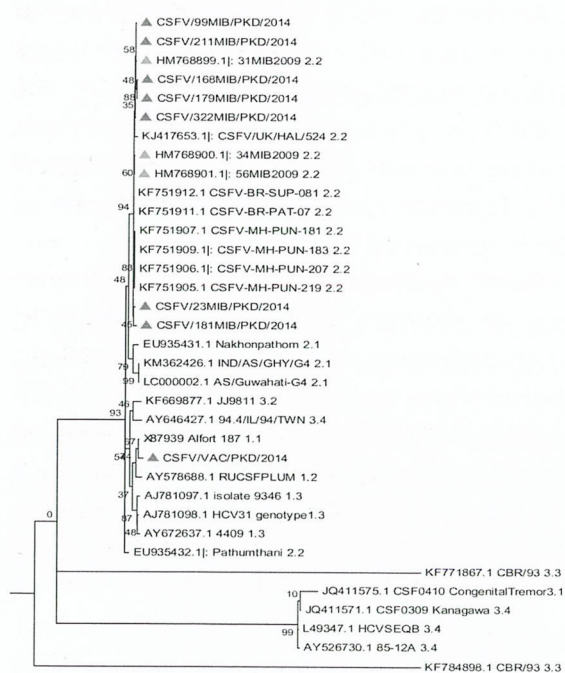
As far as Kerala is concerned there is a reduction in the pig population between 2007 and 2012 livestock census. One of the major reasons for this trend of decline in pig population is the high incidence of infectious diseases in this species. Among the many known viral diseases of pigs, classical swine fever (CSF) is a highly contagious disease causing heavy financial losses primarily due to mortality, diminished growth, reduced reproductive performance of the affected pigs and secondarily due to restrictions on the international trade of meat and meat products. In India, CSF is one among the five important viral diseases affecting livestock. Classical swine fever is found to have a deleterious effect on the domestic economy of a nation as far as eradication of the disease and export of pork products is concerned.

The clinical signs associated with CSF are rise in body temperature, unsteady strides, pinpoint or widespread reddening on surface of skin, lack of co-ordination, depression, conjunctivitis, cyanosis of skin and ears, constipation accompanied by diarrhoea and anorexia. The need of differential diagnosis is at paramount for effective management of a disease. Commonly employed laboratory techniques in the specific detection of CSFV are virus isolation and identification, viral antigen and antibody detection by serology and identification of the virus by amplification of the viral nucleic acid.

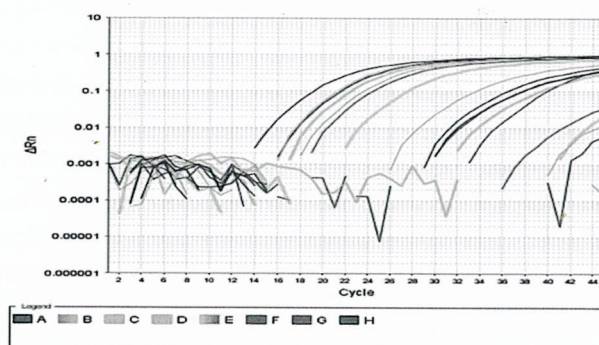
Genetic characterization of the CSFV is essential to realize the pattern of evolution, transmission and distribution of viruses and the source of epidemics. Various regions of viral genome are employed in the distinction and molecular characterization of CSFV, including the Npro gene, NS5B gene, E2 envelope glycoprotein gene and 5'-UTR gene region of CSFV.

Even though the disease is enzootic in Kerala, no systematic study has been carried out to ascertain the genotype and molecular epidemiology of CSF viruses circulating in pigs in Kerala. Also, the current methods of diagnosis are based on tests standardized using foreign isolates of the virus. Hence, an investigation was undertaken to genotypically characterize CSFV isolates obtained from outbreaks in Kerala based on partial sequencing and phylogenetic analysis of envelope glycoprotein gene (E2) and 5' non coding region (NCR) and to develop a SYBR Green/TaqMan based real-time reverse transcriptase polymerase chain reaction (RT-PCR) assay to rapidly detect CSFV from clinical samples.

Of the 21 suspected CSFV suspected outbreak, 42.86 per cent cases were diagnosed as swine fever by molecular methods. Molecular epidemiology of CSFV circulating in pigs in Kerala was established by phylogenetic analysis of the sequenced CSFV isolates and it was observed that all of them belonged to subgroup 2.2. Another significant observation was that the CSFV viruses from Kannur district were distinct from those circulating in the other districts as evidenced by their divergence from other Kerala isolates in the phylogenetic tree. On phylogenetic analysis, the isolate from wild boar was very much similar to other domestic pig CSFV isolates from Kerala indicating that the wild pigs might have picked up the infection from domestic pigs. A TaqMan based real time PCR assay was standardized and the sensitivity of the test in terms of copy number was determined as 3670 copies. The sensitivity of the developed assay when compared with the E2 nested RT PCR was found higher than that of nested RT-PCR.



Phylogenetic tree based on the analysis of 190 nucleotides of E2 gene of CSFV isolates from India and other countries



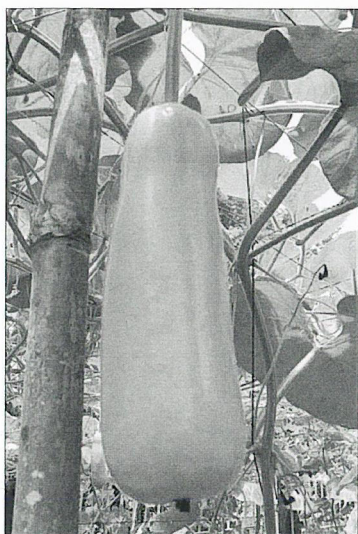
Amplification plot of clinical samples tested by TaqMan Real Time PCR

***Zingiber officinale* EXTRACT AS A SAFE AND EFFECTIVE WAY OF TACKLING OBESITY**

The modern life style has contributed to two of the greatest public health challenges of twenty first century, obesity and overweightness. According to world health organization (WHO), global obesity rates have nearly doubled since 1980, with more than 1.9 billion adults being reported as overweight, among them 600 million are obese. Apart from the genetic factors that contribute to the development of obesity, the consumption of high fat/energy diet, environmental factors and modernization are also implicated in recent upsurge in the global obesity. Obesity has been ranked as the fifth leading risk factor for global deaths, owing to its metabolic comorbidities such as insulin resistance, dyslipidemia, cardiovascular disease etc. It is noteworthy that, among these comorbidities, dyslipidemia prevails as a principal independent risk element for cardiovascular diseases and almost one third of the population in developed countries is detected to be dyslipidemic, even though prevalence varies vide ethnic group. Moreover, almost 23% of cardiovascular disease affliction is attributed to the overweight and obesity related perturbations in the lipid levels.

Increased oxidative stress underlies the pathophysiology of the disorders associated with obesity. The reactive oxygen species (ROS) generated causes dysregulation of adipocytokines, decreased expression of anti-oxidant enzymes and increased incidence of comorbidities allied with obesity. Meanwhile, the augmented lipid peroxidation as observed in dyslipidemia/hyperlipidemia leads to cardiovascular complications, paving way to metabolic syndrome. Therefore, the redox status of adipose tissue can be ascribed as a promising target for the treatment of obesity associated metabolic syndrome.

Unfortunately, the research for anti-obesity therapies, although pursued avidly for more than half a century, and the weight loss medications available in the clinician's armamentarium are very few. The paucity for these therapies has arisen due to the hasty withdrawal of the drugs owing to unacceptable side effects that outweigh benefits of drug. Hence, there is a huge void in the current pharmacologic options available for obesity that causes the prevalence and associated costs of obesity to exacerbate. Orlistat, the only drug approved by United States food and drug administration (USFDA) for long term treatment of obesity is associated with comparatively less side effects as compared to the other anti-obesity therapies, as it acts through pancreatic lipase inhibition and sans a central mechanism of action. Pancreatic lipase inhibition also causes sufficient magnitude of alleviation on cardiovascular morbidities as evident by reduced low density lipoprotein cholesterol, glucose and blood pressure. Consequently, research on pancreatic lipase inhibitors, has emerged momentarily in the recent years as a therapeutic choice for obesity and dyslipidemia. Moreover, natural-based products are fast gaining popularity due to the high cost and hazardous side effects of synthetic anti-obesity drugs and thereby the potential of natural products for treating obesity and associated dyslipidemia is under extensive exploration. Natural agents ascribe to an immense pool of pancreatic lipase inhibitors, which can be further investigated comprehensively to develop into new clinical products for treatment of obesity and associated disorders.



Lagenaria siceraria



Coccinia Indica

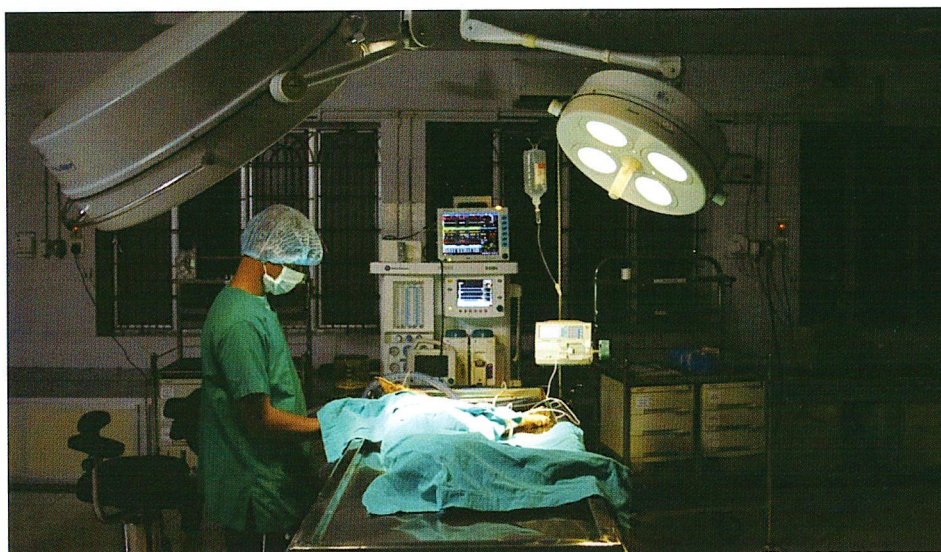
Many remedies have been quoted in the Ayurveda and Shushruthasamhitha for the treatment of 'medroga' (Obesity), offering an unfettered choice for the scientific exploration of anti-obesity effects of traditionally used medicinal plants. Therefore, in the present study, various parts of six plants viz., *Allium cepa* (*A. cepa*, onion), *Coccinia indica* (*C. indica*, ivy-gourd), *Coriandrum sativum* (*C. sativum*, coriander), *Lagenaria siceraria* (*L. siceraria*, bottle gourd), *Trigonella foenum graecum* (*T. foenum*, fenugreek) and *Zingiber officinale* (*Z. officinale*, ginger) having hypolipidemic activity were selected, based on the traditional systems of medicine along with the evidences from published literature, for the preliminary screening so as to identify the lead. The screening and further evaluations to identify an extract which may exhibit significant ameliorative effect on obesity and associated conditions in vivo, and can then be considered for further studies in order to develop as a new therapeutic molecule. Therefore, the study aimed at identifying a safe herbal substance possessing anti-obese and anti-dyslipidemic potentials along with targeting the underlying oxidative stress. Six plant extracts were initially screened for acute oral toxicity and hypotriglyceridemic effect in oral lipid load test. The screening tests indicated aqueous extract of *Zingiber officinale* rhizome as the safe and potent extract, which was further fractionated to improve the solubility. The water soluble fraction of *Zingiber officinale* extract (WFZE) was found to be safe and its triglyceride lowering activity was found to be better than the parent extract. Consequently, WFZE was evaluated for anti-obese and anti-dyslipidemic potentials. The anti-obesity effect of WFZE was established in high fat diet induced obese male rats by the significant reduction in body weight gain, adiposity and triglyceride levels along with the amelioration of metabolic perturbations such as hyperleptinemia, increase in the free fatty acid, glucose and insulin. Moreover, the total hepatic lipids, serum aspartate amino transferase and alanine amino transferase were reduced while atherogenic index and insulin resistance indices such as homeostasis model assessment and quantitative insulin sensitivity check index (QUICKI) were controlled and the severity of histopathological lesions in liver, pancreas and adipose tissue were reduced after treatment with WFZE. In addition, WFZE treatment significantly reduced the oxidative stress induced by high fat feeding. The findings of the present study suggested that the WFZE is a safe, effective therapeutic agent for the management of obesity and dyslipidemia acting via the inhibition of pancreatic lipase and anti-oxidant mechanisms.

F. Companion Animal and Pet Birds

ORAL RISPERIDONE AND TRAMADOL DOSING FOUND EFFECTIVE IN RESTRAINING VICIOUS DOGS

General anaesthesia is an inevitable part of small animal practice. Though many drugs are available as a means of inducing general anaesthesia most of the drugs require intramuscular or intra venous administration requiring handling of the animal. This presents challenges and risks for the animal handler and veterinarian especially when an anxious or vicious dog is presented. It is in this scenario that oral sedatives hold promise. The treatment efficacies of orally dosed sedatives have not been reviewed much in veterinary practice. A research was conducted to validate the clinical efficacy of Risperidone and Tramadol orally, and Midazolam intramuscular as preanaesthetic for propofol anaesthesia in dogs. Twenty apparently healthy, difficult-to-control female dogs presented for spaying were subjected to the study. It was found that oral administration of Risperidone and Tramadol reduced the anxiousness and excitement. Ptosis, nodding, sternal recumbency and sedation were observed from fifteen minutes after administration of Risperidone orally in dogs. Induction dose of propofol in the premedicated group was significantly reduced when compared to the non premedicated group. Anaesthetic induction was smooth and rapid in the premedicated group. The continuous rate infusion dose of propofol for maintenance of anaesthesia in the pre-medicated group was also significantly lower. Recovery though smooth and without any excitement in the pre-medicated group, took longer than the non pre-medicated group. Physiological, haematological and biochemical values did not show any significant alteration in both the groups except for blood glucose which was significantly elevated in non pre-medicated group during the entire period of anaesthesia.

Thus, from the present study it could be concluded that oral administration of risperidone and tramadol could be employed for calming and restraining of difficult-to-control dogs for physical and clinical examination, and also for translocation of dogs.



Maintenance of anaesthesia using Programmable infusion pump.

CLINICO-THERAPEUTIC STUDIES ON DILATED CARDIOMYOPATHY IN DOGS

Indiscriminate breeding and promotion of inbred and imported lines has increased the incidence of cardiac diseases especially myocardial diseases and cardiomyopathies. Acquired damage of myocardium due to the metabolic derangements results in myocardial diseases whereas cardiomyopathy is due to cytoskeletal abnormalities related to genes which progress towards congestive heart failure.

There is no single gold standard test for the diagnosis of dilated cardiomyopathies (DCM) and diagnosis is by combined use of various diagnostic modalities including ECG, thoracic radiography, complete echocardiogram as well as haemato-biochemical studies. Use of potential cardiac biomarkers like brain natriuretic peptide showed significance in the diagnosis and prognostication of clinical DCM. The repeatability and reliability of echocardiographic findings can be improved by adopting advanced echocardiographic techniques and indices.

Staging the heart failure is very significant in determining the appropriate therapy. Likewise, it is significant to differentiate primary heart disease from the pulmonary diseases as they are mimicking each other. Therefore diagnosing the underlying cause of the clinical signs has utmost priority.

A therapeutic protocol combining pimobendan and carvedilol with diuretics was found to improve the clinical parameters and patient response when compared to the usual use of beta blockers and diuretics and is found to be very effective in long term management of clinical cardiomyopathies by assuring good quality of life, rather than the use of these agents separately.

- a. The pre-exposure prophylactic anti rabies intradermal route of vaccination in dogs was found to result in development of equivalent antibody titres as that of subcutaneous route of administration with the added benefit that only one fifth dose of the vaccine was required in the former route.
- b. Rota virus and transmissible gastroenteritis virus (TGEV) are the two most common viral causes of neonatal diarrhea in piglets and their presence causes huge economic losses to the porcine industry. A study carried out on 67 piglets having diarrhea at the University farms, recorded that rota virus infection was most common in two to four week old piglets. All the examined samples were found to be negative for TGEV when probed by RT-PCR.
- c. A study on evaluation and management of long bone fractures in birds found that both intramedullary pin – external fixation, tie-in fixator and type I external skeletal fixator were effective in treatment of long bone fractures in birds, albeit subtle differences were observed with regards to radiographic healing of external skeletal fixator – intramedullary pin, tie-in fixator over type-I external skeletal fixator in birds. Early weight bearing was noted in type I external skeletal fixator birds, although no significant variations were noted.

G. Dairy Processing and Value Addition

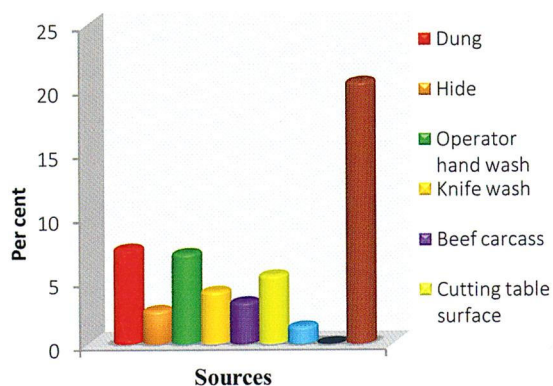
PROCESS OPTIMIZATION FOR DRYING OF DAHI

Dahi also known as Indian yoghurt is a popular fermented milk product and is considered as a food for all seasons. Drying Dahi to develop a powder can extend its shelf life, provide maximum survivability of culture organism and provide pleasing sensory attributes. Freeze drying is the well accepted process for drying products containing viable cells but is costly when compared to vacuum tray drying and spray drying. A study was conducted for process optimization of drying of Dahi. Spray drying at an inlet air temperature of 164.768 °C, outlet air temperature of 70.222°C and a feed temperature of 24.851°C was found to be a cost effective process which provides us with a powder of acceptable moisture content, maximum survival ratio, minimum browning and most favourable sensory attributes.

IDENTIFICATION OF CRITICAL CONTROL POINTS IN BEEF PROCESSING LINE WITH SPECIAL REFERENCE TO ENTEROHAEMORRHAGIC *ESCHERICHIA COLI*

Indian meat industry contributes a major share to the global beef industry. In the year 2015 beef exports from India made a big boom surpassing the previous year. Hygienic meat production becomes secondary when heavy loads coming to the state are slaughtered together with domestic animals. These may further lead to epidemics of food borne infections. So it is necessary to prevent the introduction of pathogenic organisms into beef during its production and processing.

Among the major food borne pathogens, Enterohaemorrhagic *Escherichia coli* (EHEC) is one of the most important bacteria when beef processing line is considered. Ruminants, the main reservoir host for EHEC are capable of shedding these organisms asymptotically in their faeces. Even though EHEC is a widely studied organism there is dearth of information regarding its occurrence and critical control points of this organism in beef processing line. Also there is only limited data available on the occurrence of EHEC in humans at national level. By considering all these factors our research was focused to identify the critical control points (CCPs) in beef processing line with special reference to Enterohaemorrhagic *Escherichia coli*. Virulence genes of the isolates were identified using PCR. Moreover anti-microbial residues and consumer's



Overall occurrence of EHEC in slaughter houses

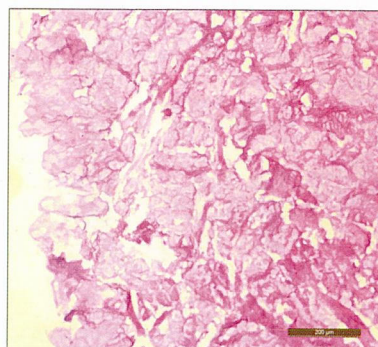
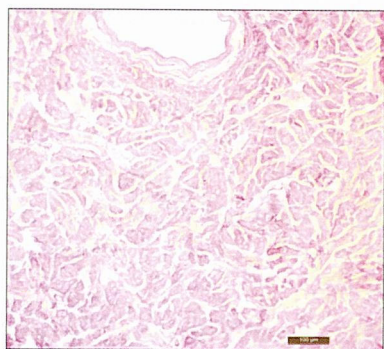
demand for minimally processed foods lead to the search of naturally occurring edible antimicrobials. In this regard, effectiveness of chitosan to produce anti-biofilm against EHEC was investigated. As a biomaterial chitosan is proved to be non-toxic and bio compatible. Before its use in the field chitosan should be investigated further for its anti microbial activity against other commonly occurring organisms in slaughter houses.

STERILIZATION STUDIES ON PORCINE COLLAGEN BASED BIOSCAFFOLDS

Extracellular matrix is the tissue from which the resident cells have been removed with minimum alterations to the other components of the matrix. These bioscaffolds have been used for various human and veterinary clinical applications including soft tissue regeneration, correction of abdominal wall defects and cutaneous wound applications. They are also used for tissue engineering applications where it forms one of the three components of the tissue engineering triad, the other two being cells and signalling factors.

In cases of extensive burn injuries, the practice of autologous split thickness skin grafting has limitations because of limited donor sites in the injured patient. The use of bioscaffolds as dermal substitutes in full thickness cutaneous wounds has emerged as an important application. Therefore, development and analysis of ECM scaffolds for dermal application has become imperative.

Porcine skin is one of the most extensively studied materials because of its similarity to human skin, biocompatibility and immediate availability. Porcine dermis mainly contains collagen which is biodegradable, biocompatible and highly versatile for use as bioscaffolds. Safety is of primary concern as these scaffolds come in contact with open wounds. Gamma irradiation has become the most common and widely used method of sterilization among the different methods because of its ease of application, ability to terminally sterilize material after packing and being free from toxic residues. But at the same time, gamma irradiation is known to cause changes to the physico-chemical and biomechanical parameters of the bone allografts which may affect the ultimate tissue response upon the intended application. The effects of gamma irradiation on porcine dermal bioscaffolds are sparse and hence a study was undertaken to analyze this aspect. Decellularized porcine dermal matrices were gamma irradiated at 25 kGy and its effect on the physico-chemical and biomechanical characteristics of the scaffold were assessed. Unscalded skin samples collected from twelve 6 - 9 months old Large White Yorkshire pigs were sanitized in hot water at 65°C for 15 sec. Dermal layers were harvested and defatted, further sanitized using ethanol/povidone iodine and then decellularized using Trypsin-EDTA/Triton-X-100 protocol. Bioburden was determined at different stages of processing. The dermal scaffolds were subjected to 25 kGy gamma irradiation. The thickness of the scaffold, histological characteristics, collagen content and solubility, primary amino group content, resistance to enzymatic digestion, uniaxial tensile strength and water uptake of the two groups were compared to assess the effect of irradiation.



Cross section of the porcine dermal scaffold: non - irradiated (left) and irradiated (right).

It was found that there was significant reduction in the bioburden by various stages of processing of skin. All the irradiated samples were found to be sterile. The total collagen content, solubility, tensile strength and water uptake were significantly higher for the irradiated scaffolds indicating radiation induced collagen fragmentation. Radiation induced crosslinking was evident in the irradiated scaffolds. Both non-irradiated and irradiated scaffolds were degraded almost completely within 24 h of enzymatic digestion. This has important implications for the tissue response during its intended clinical application. Hence, though gamma irradiation was effective way of sterilization, their exogenous stabilization by effective crosslinking techniques have to be looked into before clinical applications.

NEWER APPROACH IN REGENERATION PATHOLOGY WITH A NOVEL METHOD TO IDENTIFY NEOCOLLAGENIZATION

There are many situations where conventional therapy becomes less effective in correcting the tissue injury. Across the world, research is at its full swing to evolve newer approaches to solve this problem. One such novel initiative is the application of bioscaffolds in tissue regeneration. Bioscaffolds are produced from various animal tissues like bovine pericardium, porcine small intestine submucosa, gall bladder, dermis, omentum etc. These are used for developing body implants or interfaces which can interact with the living tissues and physiological systems of the patient for a significant duration. These bioscaffolds can be used in clinical applications only after qualifying a battery of preclinical in vitro and in vivo tests to assess their tissue responses.

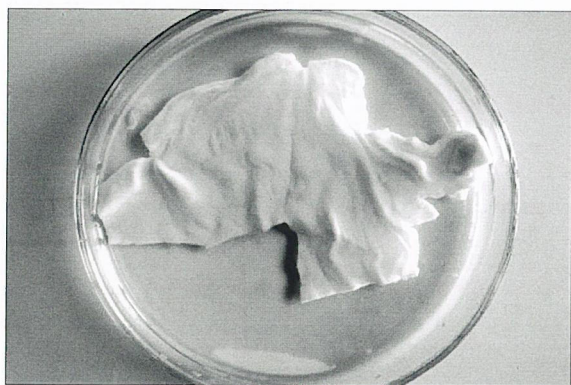
Decellularized bovine pericardium is considered as an excellent scaffold whose biological performance is well understood. A good healing response ranging from scarring to better remodelling response is observed in decellularized bovine pericardium. Since the availability of least immunogenic autologous human pericardium is limited, xenogeneic pericardial substitutes have been developed. Several physical and chemical treatments have been devised to remove cells that carry antigens that are supposed to mediate adverse immunological reaction and attenuation of constructive remodelling response of the scaffolds. Therefore, tissue processing methods such as decellularization are critical determinants of clinical success. One advantage of decellularization is that it removes the antigenic cells with concurrent preservation of extracellular matrix's (ECM) integrity. ECM thus produced by decellularization process can promote chronic inflammatory response that has shown to cause positive remodelling and induce regeneration in animal models.

A number of protocols are available to effect the decellularization that includes physical, chemical and enzymatic processes. Physical methods include agitation, freezing and thawing. Chemicals such as sodium dodecyl sulphate (SDS) and deoxycholic acid (DCA) cause the disruption of cell membranes that finally results in the acellularity of bioscaffolds. Chemicals like glutaraldehyde form strong crosslinking with the ECM of scaffolds thereby improving the mechanical stability and integrity but does not remove the nuclear remnants making it immunogenic. Enzymatic methods include the application of trypsin, chelating agents and

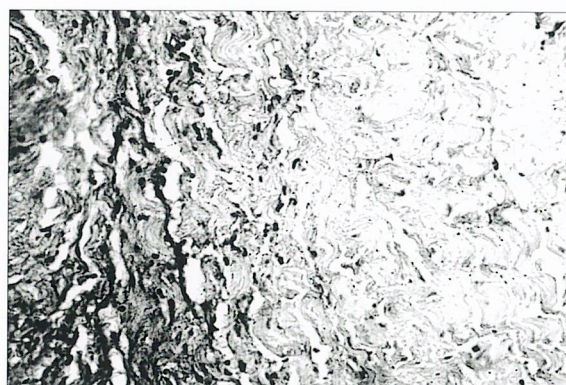
nucleases.

In order to evaluate the *in vivo* remodelling ability of the bioscaffolds, it is necessary to know how much they support the host's constructive repair processes. Neovascularisation, fibroblast proliferation, cellular infiltration and neocollagenisation are the various *in vivo* responses that favour the positive remodelling effect of the scaffolds. Balanced degradation of the scaffold matrix and deposition of host matrix are the essential prerequisites for any surgical application. Improper collagenisation will lead to scarring, reduced tensile strength or healing capacity. Previously no specific protocol was available to identify the newly deposited collagen. Therefore, an experiment was carried out in a rat model to assess the host tissue remodeling response with decellularized bovine pericardium processed under different treatment protocols and to standardize biotinylation and Streptavidin-peroxidase histochemistry technique to differentiate newly laid collagen from the scaffold collagen that will aid in assessing the biomaterial quality and selection of best scaffold.

The different bioscaffolds used in the present study were deoxycholic acid treated decellularized bovine pericardium (DXDCL), enzymatically processed decellularized bovine pericardium (EDCL) and glutaraldehyde crosslinked bovine pericardium (GBP). The *in vivo* remodelling responses were evaluated in a rat sub cutaneous implantation protocol and parameters studied were histopathological evaluation of inflammatory response, Argyrophilic nucleolar organizer region (AgNOR) count test for indexing fibroblast proliferation and Biotinylation Streptavidin- peroxidase staining for evaluation of neocollagenisation response. The study proved that EDCL was better inducers of regeneration response as revealed by extensive neovascularisation, fibroblast proliferation and neocollagenisation. Further, biotinylation and Streptavidin-peroxidase staining was found to be effective in differentiating native collagen of the scaffold from that of the newly laid collagen which help in the selection of the best scaffold in regeneration studies.



Enzymatically processed decellularized Bovine pericardium (EDCL) infiltration of mononuclear cells and fibroblast proliferation (H&E x 400)



Histochemistry of EDCL 60 days post implantation - showing two-third areas of neocollagenisation (pink in colour) and nearly one-third dark brown areas of scaffold collagen (Streptavidin-peroxidase stain x 400).

DEVELOPMENT OF WHEY BASED EDIBLE COATING AND ITS EFFECT ON SHELF-LIFE EXTENSION OF PANEER

Paneer, a traditional value added product prepared by heat acid coagulation of cow or buffalo milk is highly advisable for people suffering from diabetes and tooth decay, growing children and pregnant women. But the availability of paneer in the Indian market is limited as it can be stored only for a day at room temperature and for about six days under refrigerated condition without deteriorating its chemical and microbiological quality. Lipolysis, proteolysis, increased acidity and lowering of pH are the chemical changes, while increase in yeast and mould count is the major microbial change that affects the product quality during its course of storage.

Through the years, scientists and researchers have made several attempts to increase its shelf-life following various physical and chemical means. Use of edible films and coatings is an emerging technique put into use for successful increase in the storage life of various products. The main advantage of edible films over traditional synthetics is that they can be consumed with the packaged products. They help in protecting the fresh produce from attack of pests, insects and also aids in preserving its flavour, aroma and increase its sensory appeal.

As milk protein based edible coatings were proven to be excellent oxygen, lipid, and aroma barriers, whey based edible coating was investigated for its potential to improve the shelf life of paneer. Whey based edible films and coatings are transparent, flavourless, tasteless and flexible materials. In addition whey can improve the nutritional quality of the product. Addition of antimicrobial agents like lactic acid and antifungal agents like potassium sorbate to this coating is expected to further ensure food safety and extension of shelf-life by reducing (or even preventing) growth of pathogenic and spoilage microorganisms.

The study focussed on potential possibilities of employing whey based edible coatings containing glycerol (as plasticizer), lactic acid (as antimicrobial agent) and potassium (as antifungal agent) as an alternative shelf-life extension technique for paneer. Results suggests when paneer samples were coated with the optimized coating the shelf-life of samples increased to four days as against one day (sample without coating) when stored at room temperature.

P. emblica (Nellikai), *L. indica* (Thumba) and *S. rhombifolia* (Kurumthotti) were found to have safe and effective therapeutic effects in the management of carbon tetrachloride induced fatty liver in Wistar rats. Hence they hold promise as therapeutic agents in the management of fatty liver in humans and domestic animals.



H. Zoonosis and Waste Management

ANIMAL WASTES – A POTENTIAL SOURCE OF LISTERIA CONTAMINATION

Listeria monocytogenes is a ubiquitous Gram-positive bacterium associated with potentially serious invasive diseases in humans and in a variety of animal species. The bacterium has the ability to multiply in diverse habitats and survives adverse conditions longer than many other non sporing bacteria. The distribution of organism in nature includes vegetation, water, sediment and soil. Human and animals also act as important reservoir of the organism. Farm environments are potential sources of *L. monocytogenes* and may contribute to the contamination of vegetables at the pre-harvest stage. Recycling animal feces as crop fertilizers or irrigation with contaminated water may increase the risk of soil and vegetable contamination.

A study was conducted to examine the prevalence of *Listeria* spp. in soil, antibiotic sensitivity of the isolates and the survivability of *L. monocytogenes* in three different viz., laterite, saline and loam, soils of Kerala. Soil samples were collected from different districts of Kerala to study the occurrence of *Listeria* spp. The soil samples were subjected to isolation and identification of *Listeria* following two-step enrichment and subsequent selective plating on PALCAM agar. The species level identification was carried out by carbohydrate utilization test and pathogenicity assay and confirmation by PCR assay. For assessing survivability, nine conditions of each soil type were prepared and inoculated with *L. monocytogenes* culture and incubated at suitable conditions for a period of 120 days.

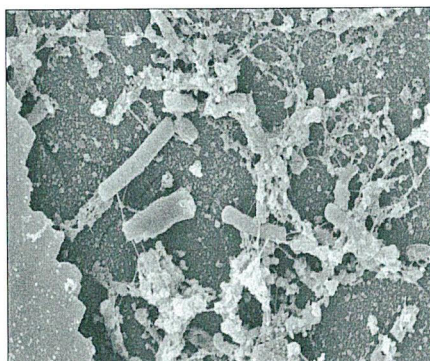
A total of 450 soil samples from highland, midland and lowland were screened for *Listeria* spp. The occurrence of *Listeria* spp. in midland and lowland was found to be 0.56 and 0.61 per cent respectively, while none were found in high land. The overall occurrence was 0.44 per cent. No *L. monocytogenes* could be isolated during the study. The isolates were found sensitive to chloramphenicol, cefotaxime, gentamicin, streptomycin, tetracycline, cotrimoxazole, and vancomycin but resistant to ceftriaxone, cefixime and cefuroxime.

While the organism survived for 105 days in laterite soil at 25°C, at 37°C it survived for only 90 days.

The findings suggest that contamination of soil with *L. monocytogenes* through animal excreta, sewage or manure can cause the organism to survive in soil for considerable period, which can lead to contamination of vegetation and crops posing threat to animals and public health. In order to reduce the risk of food contamination and infections due to *Listeria*, it is important to adopt appropriate farming and husbandry practices that lessen the chances of environmental contamination.

A novel functional meat product viz., chitosan incorporated chicken sausage containing paneer and oats has been developed at the University which has better shelf life, wholesome, new sensory appeal and health benefits than the routine chicken sausages.

Study on the effect of different sanitizers on *Listeria monocytogenes* biofilms



◀ Effect of chitosan coating (1.5 %) on *L. monocytogenes* biofilms on rubber surface

A study on the effect of different sanitizers on *Listeria monocytogenes* biofilms showed that the best temperature-time combination of each sanitiser for treating different surfaces was hot water (75°C for 10 min), bleaching powder (200 ppm for six min), quarternary ammonium compounds (150 ppm for six min) and chitosan (1.5 per cent for five min).

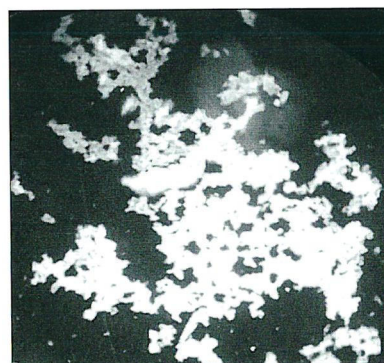
More biofilm forming *L. monocytogenes* cells were recovered from rubber and fibre surfaces as compared to stainless steel and aluminium surfaces which revealed that hydrophobicity and surface roughness along with conditioning of surface plays an important role in the attachment of cell to surfaces and formation of *Listeria* biofilms.

Leptospirosis in Dogs in Central Kerala and its Public Health significance

In a study on the occurrence of Leptospirosis in Dogs in Central Kerala, a total of 810 blood samples (520 humans and 290 dogs) and 308 environmental samples and 45 rodents (kidney, blood and urine) were screened for *Leptospira* spp. The overall seroprevalence based on Microscopic Agglutination test was found to be 8.21% in humans, 12.75% in dogs and 17.77% in rodents. The predominant serovars identified in dogs and humans were Icterohaemorrhagiae, Grippityphosa, Autumnalis and Australis. The pathogenic leptospires were found in 3.92% of sewage and 5.56% of soil samples.



Microscopic
Agglutination Test



Identification of Critical Control Points (CCPs) in beef processing line with special reference to Enterohaemorrhagic *Escherichia coli*

In the study on occurrence of EHEC in various points in beef processing line, a total of 1056 samples including dung, hide, operator's hand wash, knife wash, surface swabs, beef carcass swabs, water, air and beef samples were examined and the overall occurrence of EHEC was found to be 7.39%. The study revealed 2.8% occurrence of EHEC in human stool samples. The CCPs identified in beef processing line were animal, operator's hand, knife, beef carcass, beef contact surfaces and water.

Chapter 5

SEMINARS/CONFERENCES

CONDUCTED BY THE UNIVERSITY OF LESS THAN 3 DAYS DURATION

- a. Induction programme for newly recruited Assistant Professors on Pedagogy, research priorities and administrative management, 19-21st June, 2016
- b. International collaborative workshop on development of veterinary nursing curriculum, 16th to 24th November, 2015 at CVAS, Pookode and CVAS, Mannuthy
- c. Winter School on Application of one health concepts for the control of emerging zoonosis and health threats, 26 November to 16th December, 2015 at COHEART, Pookode
- d. Regional Asian Elephant and Tiger Veterinary workshop, 1st to 4th February 2016 at CVAS, Pookode
- e. KVASU orientation programme on Academic Leadership, 11th February to 9th March 2016 at CVAS, Mannuthy
- f. Interface meet on food safety and Public Health, 28th to 30th March 2016 at COHEART, Pookode
- g. 13th Annual convention of Indian society for the Advancement of Canine Practice and National symposium on Canine Practice, 27th-29th June, 2016

Chapter 6

REPORT ON SCHOOLS AND CENTRES

CONDUCTED BY THE UNIVERSITY OF LESS THAN 3 DAYS DURATION

A. School of Animal Nutrition and Feed Technology

The School of Animal Nutrition and Feed Technology was instituted with the aim of conducting animal nutrition research in the basic and applied areas and helping in coordination of animal nutrition research and physiology researches with other institutes. The School also aims at establishing a feed processing and technology unit to produce nutritionally balanced feed with a quality testing laboratory with all modern techniques and facilities. The school provides specialized training programmes in allied sectors for up gradation of man power in animal nutrition and feed technology for different part of the country.

The School has unveiled a new feed mill and will be made functional once electrical works are completed. Advanced equipment needed for a feed analytical laboratory have been purchased and the analysis using these equipment is being carried out currently. The new mill with a quality testing laboratory and all modern techniques and facilities will help to produce nutritionally balanced feed and to keep pace with the growing livestock feed market.

A mineral mixture plant, established under SANFT is being utilized for preparation and supply of mineral mixture for cattle and feed supplement for pigs under revolving fund scheme

B. School of Applied Animal Production and Biotechnology

The School of Applied Animal Production and Biotechnology was established in 2013 with the objectives of establishing cutting edge facilities to take up research in the frontier areas of biotechnology, strengthen post-graduate education, research and training programmes and to generate specific expertise and human resource in Animal production and Biotechnology. The School has got well-equipped laboratories with all modern facilities for carrying out biological research. A multi-disciplinary core group consisting of 20 scientists is entrusted with the duties of teaching, research and training activities of the School.

The School offers two Post graduate programmes, M.Sc (Animal Biotechnology) and M.V.Sc (Animal Biotechnology). Seven students have completed Masters degree under the school. Currently the SAAPBT has seven students pursuing Masters Degree.

Masters Research projects

A. Completed projects

- a. Single nucleotide polymorphisms analysis of Thyroid hormone Responsive and Insuline like growth factor binding protein -3 genes in goat.
- b. Single nucleotide polymorphism analysis of fecundity genes (BMPR1B, GDF9 & BMP15) in

Malabari and Attappady black goat breeds of Kerala.

- c. Isolation and characterization of PDC-109 like proteins from Vechur bull seminal plasma.
- d. Isolation of theca cells from goat ovarian follicles and expression of CYP19 gene in the isolated cells.
- e. Characterization of solute carrier family 11 member 1 (SLC11A1) gene in native breeds of goat.
- f. Assessment of carrier status of canine haemoparasites in common ixodid ticks of Thrissur.
- g. Exon wide DNA capture and nextgeneration sequencing in Vechur cattle of Kerala.

B. Ongoing projects

- a. Evaluation of E74-like factor 5 (Elf5) gene polymorphism and its association with milk production traits in crossbred and Vechur cattle of Kerala.
- b. Polymorphism study on candidate genes affecting height in Vechur and crossbred cattle of Kerala.
- c. Comparative evaluation of conventional and realtime PCR detection of haemoparasites in dogs and ixodid ticks.

Trainings organised

The School conducted a series of Hands on Training Programmes on Introduction to Bioinformatics Tools and Basic molecular biology techniques during 2015-16.

C. School of Zoonoses Public Health and Pathobiology

Mandate

To generate, transfer and apply knowledge in the concerned disciplines for the protection and promotion of animal and human health and their well-being in consonance with the theme of 'Health for all in 21st century' and the mission will be routed through:

- a. Education - Professional, Undergraduate, Post Graduate
- b. Research - Strategically focused "Signature Programs" for animal and Community health
- c. Industry support
- d. Public and Institutional Services

Activities of SZPHPB

- a. The School was involved in the conduct of various zoonoses awareness programme entitled 'KNOW ZOONOSSES TO NO ZOONOSSES' for school children in association with NSS units of College of Veterinary and Animal Sciences, Mannuthy. The programmes included: Exhibition on zoonoses, Seminar on zoonoses for high school students and Quiz programme on zoonoses.
- b. A three day camp was organized at Gopal Memorial High School, Thiruvallur, Kodunbu, Palakkad from 12.2.16 to 14.2.16. Animal Health camps and farmers interface were conducted at Palayamkode Veterinary Centre and Kodumbu Veterinary Dispensary with scientists from CVAS, Mannuthy.
- c. Workshop on 'Culture of Responsibility' was organized on March 18th, 2016 in association with the American Society of Microbiology for the first year MVSc and residency students of College of Veterinary and Animal Sciences, Mannuthy on March 18th 2016 at CVAS, Mannuthy. The workshop included sessions on biological safety and biosecurity in the laboratory and need for responsible research.

D. CENTRE FOR ADVANCED STUDIES IN ANIMAL GENETICS AND BREEDING

Diversity analysis of native and cross bred goat genetic groups of Kerala using microsatellite markers

Six goat populations namely, Attappady Black (AB), Malabari crossbreds (CB), Malabari populations of Kannur, Calicut, Thrissur and Malappuram districts (MK, MC, MT and MM) were analysed for genetic diversity using microsatellite markers. Low F_{ST} values (0.02 ± 0.004) indicated that only two per cent of total genetic variability was attributed to between population variations, whereas 98 per cent was due to within population differences. Structure analysis revealed the presence of three underlying clusters, with Attapady Black and Malabari crossbred showing fewer admixture whereas Malabari goats showed greater admixture with less differentiation between subpopulations. Bottleneck analysis revealed typical L-shaped mode shift curve, which confirmed the absence of bottleneck in all populations under study.

Novel Polymorphism detected in the Toll like receptor 3 (TLR3) of Vechur cattle

A Study using advanced PCR technology-PCR-RFLP revealed a novel polymorphism in the Toll like Receptor (TLR3) in Vechur cattle. Toll like receptor 3 (TLR3) is an innate immune gene involved in viral disease resistance. Whole blood samples of 50 Vechur cattle was used for the purpose. Vechur is the one indigenous breeds of cattle in Kerala which is unique for a number of economically important traits. These traits like adaptability to hot and humid environmental conditions and resistance to various diseases were especially important to survive well in the local environmental conditions of Kerala

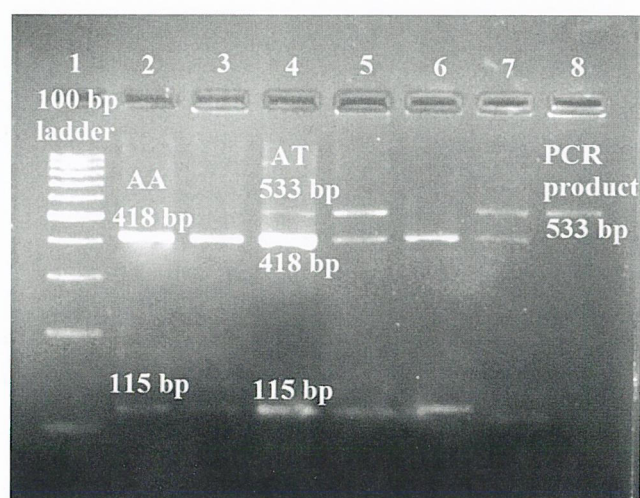


Fig1: PCR product and RFLP alleles of TLR3 gene fragment resolved in 3 per cent agarose gel.
Lane 1 - 100bp ladder, Lane 2, 3, 6 - AA genotype, Lane 4, 5, 7 - AT genotype,
Lane 8 - PCR product

E. Centre for Advanced Studies in Poultry Science

Centre for Advanced Studies in Poultry Science (CASPS) was established in 1985 as recognition for its contribution in various fields of activities. The centre has successfully completed 12 External Aided Projects, 9 PhD projects and 80 MVSc. Projects. Establishment of AICRP on Poultry improvement, Release of crossbred chicken for backyard - Gramasree and Gramalakshmi, release of high yielding ILM-90, ICAR Revolving Fund poultry project, NATP project on Ducks and successful conduct of IV World Water Fowl conference, RKVY project, IPSACON 2015 etc. are the significant milestones of the Centre.

Mandate

- Academic programmes of the Poultry Science and Veterinary faculty
- Research on advanced areas in Poultry Science
- Implementation of Externally aided projects
- Transfer of Technology (TOT) programmes

Research activities

- Conservation of poultry germplasm
- Selection and breeding for egg production
- Evolving of birds for backyard rearing
- Nutritional requirement studies of poultry species
- Management studies on chicken, duck, quails and turkeys

Projects undertaken during 2015-16

Revolving Fund Poultry Project

This is a successful model of Revolving Fund Project operating in the Animal Husbandry Sector in the country which is under the administrative control of CAS in Poultry Science. The project is engaged in the scaling up of hatching operation of ILM 90, Gramalakshmi and Gramasree birds developed by the University and propagates this among the farming community. After repaying the corpus fund (25 lakhs to ICAR) the project has remitted Rs. 30 lakhs to KAU and 185 lakhs to KVASU since inception. In 2015-16, 2677 MT of good quality balanced feed was produced and supplied from this project. Apart from this, poultry feed in 5 kg packets are also being supplied to farmers to promote backyard poultry production.

State plan projects implemented during 2015-16 (Continuing projects)

- a. Conservation, characterisation and popularization of native chicken varieties in Kerala
The main objectives of the project include evaluation of the phenotypic and production characteristics of native chicken, Popularization of indigenous varieties of native chicken germplasm in rural homesteads and molecular characterization of native chicken and their comparison with White Leghorn. A population of 1000 females and 250 male birds are conserved and evaluated for breeding purposes. Germplasm supply of native birds to the farmers was also carried out through this project.
- b. Pullet production to support self-help groups in backyard poultry rearing
Day-old chicks, suitable for backyard rearing were purchased from AICRP on Poultry, Mannuthy. Brooding of chicks up to 2 months of age was done and pullets were distributed to Self-help Groups of Thrissur and neighboring districts at a subsidized rate along with necessary technical support for rearing of pullets.
- c. Hatchery waste disposal and its effective utilization
A collaborative project with Kerala Agricultural University with the aim of converting hatchery waste into a fertilizer by incorporating organic elements has been started in the centre during 2015-16. The project not only aims at solving the waste issue but also benefits the agricultural industries which are relying more on chemical fertilizers.
- d. Advanced mycotoxin testing facility for poultry feed
A rapid and accurate mycotoxin testing facility has been established in the centre by purchasing ELISA reader and standard kits for estimation of aflatoxin B1 and total aflatoxins of feed and feed ingredients.

F. Centre for One Health Education, Advocacy, Research and Training (COHEART), POOKODE, KVASU

COHEART established in the year 2013 with the mandate of

- a. Establishment of suitable facility for academic, research and training on One Health and developing liaison to facilitate One Health concept and its practice
- b. Empowering the human resources to face the challenging needs of Health sector with special reference to zoonoses control
- c. Develop One Health competency among various stake holders and graduates through dedicated courses and training
- d. Develop, implement and sustain strategies for One health practices by 'thinking globally while acting locally

Activity list (in summary) undertaken by the COHEART during 2015-16

- a. Offered Courses: PG Diploma in One Health, PG Cert. in One Health, PG Cert. in Community Based Disaster Management.
- b. Organized interface meets: COHEART organized series of Interface meets for veterinarians, students, faculty, scientists, hotel owners etc.
- c. Commemorated important days: COHEART commemorated important days such as World Milk Day- June 1st, World Rabies Day 2015, World Health day- 2015, World Zoonoses Day 2015-16, World Veterinary Day- 2016 etc. by Organizing/ Co-organizing various events and programmes
- d. Conducted awareness programme: COHEART organized series of Awareness programme on food safety and zoonoses and other issues addressing One Health
- e. Information technology developed/ associated: COHEART act as knowledge partner of Curofy which is a unique Veterinary Doctors mobile app. COHEART also launched various online portals such as Vets Info- An online newsletter for Veterinary doctors published monthly basis with a short mission "Be the most Informed Veterinary Doctor". This is available at <http://vetsinfo.coheart.ac.in/> . WISDOM- Worldwide information sharing domain for One Health movements, Vet Sign Pro Symptom analyser, Food Safety Knowledge Connect etc
- f. Publications: The centre published around 15 articles as chapters in compendium, research articles, popular articles etc. Apart from this there are various publication in form of leaflets, brochures, guideline book, online newsletters etc

- g. Awards and recognitions: Dr. Prejit, Officer-In-Charge, received travel grant by World Veterinary Association and the World Medical Association to attend the Global conference on One Health Concept on 21st and 22nd of May, 2015 in Madrid, Spain. Dr. Prejit also received travel grant to attend the 2015- Annual Conference of International Society for Disease Surveillance (ISDS) held at Marriott City Center, Colorado, USA from December 8-10, 2015. Also received Outstanding One Health Surveillance case study Award during the 2015- Annual Conference of ISDS held at Colorado, USA from December 8-10, 2015. Dr. Prejit was also nominated as Asian Region Spokesperson by Executive Director, One Health Commission, USA in order to commemorate the first official One Health day to be held on November 3
- h. Research: COHEART conducted various researches on broad topics such as zoonoses, food safety and public health some of which are published in national journals.

G. Centre for Animal Adaptation to Environment and Climate Change Studies (CAADECCS)

CAADECCS was established to excel in climate change education, research and extension in the field of Animal Agricultural. CAADECCS offers P.G. Diploma in Climate Services and Ph.D. in Climate Change and Animal Agriculture.

Activity list (in summary) undertaken by the COHEART during 15-16 Education

Education: Four students of B.Sc.-M.Sc. (Integrated) Climate Change Adaptation of Academy of Climate Change Education and Research (ACCER), KAU have joined in CAADECCS for their further last three semesters of academic programme (8, 9 and 10 semesters). CAADECCS is co-coordinating the multidisciplinary programme with Dept. of Veterinary physiology, Livestock production and management, Poultry science and Animal nutrition. As a part of Industrial Training in the eighth semester, all the four students were deputed to NIANP, Bangalore for a period of one month, commencing from 08-06-2015 to 28-06-2015.

An Automatic Weather Station (AWS) is functioning at the CAADECCS Campus, Mannuthy. The hourly weather data for the year 2015 were compiled and Temperature humidity index is worked out.

Extension: MoU between NIANP and KVASU was signed for the benefit of students and faculty of KVASU.

World Environment Day: The World Environment Day- 2015 was observed at College of Dairy Science & Technology (CDST) in collaboration with Centre for Animal Adaptation to Environment and Climate Change Studies (CAADECCS), Kerala Veterinary & Animal Sciences University, Mannuthy. The financial support was extended by Kerala State Council for Science, Technology and Environment (KSCSTE), Government of Kerala.

Farmer interface at College of Avian Sciences Thiruvizhamkunnu: A farmer interface with poultry farmers of Palakkad district was organised on 17th June 2016 in collaboration with College of Avian Sciences, Thiruvizhamkunnu on Climatic Impacts on Poultry farming. Nearly 60 farmers participated and they were given classes on climatic stress management

H. Central Instruments laboratory (CIL), CVAS, Mannuthy

Central Instruments laboratory (CIL) of CVAS, Mannuthy is the central facility with state-of-the-art analytical instruments to fulfil the needs of the faculty and research scholars and is well equipped with high end sophisticated instruments. The facilities are extensively used by post graduate students as well as doctoral research scholars. This facility is also extended to external organizations, mainly academic institutions in and around of the region at nominal rates.

An area of 3,500 sqft made ready to use as six laboratory spaces (CIL I to VI) to house 58 sophisticated high end equipment with air-conditioning facility. Equipment worth Rs. 8.2 crore have been installed in CIL. Catalogues with standard operating procedure for the major sophisticated equipment have been made available for the staff and students. National Accreditation Board for Testing and Calibration of Laboratories (NABL) has already approved and certified certain scopes of CIL.

During April 2015 to June 2016, a total of 16 batches comprising 238 trainees have undergone short term hands-on training on Modern Analytical Research Techniques Used in Veterinary and Allied Sciences. The trainees include faculty, PG and PhD students from KVASU and faculty from Kerala Agricultural University, Government Medical College and Jubilee Mission Medical College Thrissur.

A revolving fund project operating at Central Instruments Laboratory generated Rs. 1,50,000.00 as profit, which was credited to the University account during the above mentioned period. A nominal usage fee has been levied at concessional rate from research students for 12 out of 58 equipments, in order to meet the operational expenses and the rest are used by students at free of cost. Usage/ Service/ Testing fee are being levied for all equipment from principle investigators of funded projects (KVASU and outsiders).

I. Centre for Small Laboratory Animal Production

The use of laboratory animals in scientific research is inevitable as it is essential in the advancement of medicine, development of drugs, diagnostics and production of biologicals for alleviating sufferings of both human and animals. There is a great demand for laboratory animals from the different medical and paramedical colleges as well as biotechnology institutes of our state and also of neighbouring states.

The new centre is functioning in the small animal breeding station at Mannuthy campus. The Centre is having a stock of the following laboratory animals

J. All India Co-ordinated Research Project on Goat Improvement (AICRP)

AICRP on Goat Improvement (Malabari field unit) started functioning since April, 2001 with central assistance of 75% through Indian Council of Agricultural Research. Total outlay for five years, XII plan is 193.60 lakhs (2012-17). The field centres includes Thalassery and Thaliparambu in Kannur district, Vatakara and Perambra in Kozhikode district, Kottakal and Tanur in Malapuram districts and Tirur in Thrissur district. The objectives are to bring the improvement in the farmer's flock of Malabari goat in their habitat, validate and implement breeding, feeding, health control technologies and capacity building of stakeholders/goat keepers for sustainable goat production.

A total of 420 farmers have been registered including 271 women and 1894 adult females have been provided with insurance coverage under the project. Since April, 2012, 63 superior Malabari bucks including 24 numbers in 2015-16 were distributed free of cost to farmers. Number of kids born were 4152 including 906 during 2015-16. Average litter size was 1.66 and percentage of singles, twins and triplets were 45.71%, 48.74%, 5.23% and 0.34% respectively. The mortality reduced from 7.20% to 4.20% in the current year. Enteritis and Pneumonia was the major cause of mortality. Around 2146 goats vaccinated against ET and PPR, deworming was done for around 3052 goats. Majority of goat keepers (92.50%) in the project area had school education with land holding of below 25 cents. Average flock size was 4.10 adult female goats. The participation of women goat farmers was around 62.50%. As capacity building, 25 trainings were organized to 420 farmers and 90 vocational students. A body weight measuring tape was developed for field use to record body weight directly by measuring height and girth of animal. A mini model goat shed for 4 goats for high rain fall area has been developed and supplied to tribal families of Wayanad.

Chapter 7

POST GRADUATE RESEARCH AT THE UNIVERSITY DURING THE YEAR 2015-16

	Student Name	Admission No	Year of Thesis Submission	Title of Thesis	Department
DOCTORAL RESEARCH					
1	Biju Chacko	12-DVM-03	27-03-2015	Evaluation of complete feeds with varying levels of neutral detergent fibre for lactating dairy cows	Animal Nutrition
2	Joshua Alllan J.	12-DVM-06	30-06-2015	Screening and evaluation of selected herbal extract for management of obesity and associated metabolic disorders	Veterinary Pharmacology and Toxicology
3	Naicy Thomas	12-DVM-001	19-03-2015	Expression profile and genetic variability of genes encoding nerve growth factor and insulin like growth factor-1 in Goats	Animal Breeding, Genetics and Biostatistics
4	Thanuja Kumari G. M.	12-DVM-008	30-04-2015	Rapid detection of certain pathogens from beef by multiplex PCR	Veterinary Public Health
5	K. Vrinda Menon	12-DVM-007	28-03-2015	Critical control points of listeria SPP. In seafoods and control of biofilm formation	Veterinary Public Health
6	Binoj Chacko	12-DVM-004	22-09-2015	Influence of energy level and particle size of feed on production performance of Athulya layer chicken	Poultry Science
MASTERS RESEARCH (VETERINARY SCIENCE AND DAIRY SCIENCE)					
1	Vishnu S.	13-MVM-10	07-08-2015	Effect of Differently processed decellularized Bovine Pericardium on tissue remodelling in Rat subcutaneous Model	Veterinary Pathology

2	Sithara M. S.	13-MVM-11	02-12-2015	Bacterial gastroenteritis in piglets and pathogenicity studies in mice with special reference to <i>E-Coli</i>	Veterinary Pathology
3	Rony Sunny	13-MVM-31	19-06-2015	Effect of Gamma irradiation on the Characteristics of collagen based bio-scaffolds	Livestock Products Technology
4	Sunitha R.	13-MVP-003	18-06-2015	Characterisation and Anti-biogram profile of <i>Escherichia coli</i> and <i>Staphylococcus aureus</i> isolated from bovine mastitic milk.	Veterinary Public Health
5	Mathew Jacob	13-MVP-006	16-07-2015	Comparative Evaluation of Different Herbs for Lipotropic Potential in Rats	Veterinary Pharmacology and Toxicology
6	Bernard Joy K.	13-MVP-009	18-08-2015	Comparative study on ameliorative effects of dietary vitamin C and DL-Methionine against lead toxicity in guinea pigs	Animal Nutrition
7	Sindhu k.	13-MVP-007	30-11-2015	Anti-diabetic potential of <i>Flacourtia Montana</i> (Lavalolikka) in streptozotocin induced diabetic rats	Veterinary Pharmacology and Toxicology
8	Jinu John	13-MVM-004	06-08-2015	Evaluation and management of long bone fractures in birds	Veterinary Surgery and Radiology
9	Anoop Kumar T.	13-MVP-012	29-06-2015	Pheromone based detection of oestrus in cross-bred dairy cattle of high range zone.	Livestock Production Management
10	Rincy M Ali	13-MVM-13	27-11-2015	Loop mediated isothermal amplification based detection of canine parvoviral DNA in faecal samples of diarrhoeic dogs	Veterinary Microbiology

11	Seemanthini r.	13-MVM-02	19-06-2015	Comparative evaluation of intradermal and subcutaneous prophylactic Rabies vaccination in dogs	Veterinary Epidemiology and Preventive Medicine
12	Abhina M.	13-MVM-38	19-06-2015	Differential follicular morphology and BMPRII Gene expression in Malabari and Attappady black breeds of goats	Veterinary Physiology
13	Rehna A.	13-MVM-18	19-06-2015	Antioxidant and hepatoprotective of Malabar tamarind (<i>Garcinia gummi-gutta</i>) fruit rind extract in paracetamol induced toxicity in rats	Veterinary Pharmacology and Toxicology
14	Satish Patil K H	13-MVM-41	19-06-2015	Occurrence of <i>Listeria</i> spp. in vegetables, milk and meat products and its public health significance	Veterinary Public Health
15	Vishak C. R.	13-MVM-15	19-06-2015	Comparison of the diagnostic efficacies of recombinant LIPL21 and LIPL32 proteins in canine leptospirosis	Veterinary Microbiology
16	Rishi Kumar Puri	13-MDM-04	03-10-2015	Development of pedia incorporating <i>Caesalpinia sappan</i> Linn. As natural colourant	Dairy Technology
17	Parvathy S.	13-MVM-23	16-10-2015	Effect of prostaglandin administration on progesterone levels during oestrous cycle in crossbred cattle showing prolonged oestrus	Animal Reproduction, Gynaecology and Obstetrics
18	Naveen Kumar T. J.	13-MVP-011	27-11-2015	Quality of Novel chicken sausage incorporated with paneer and oats	Livestock Products Technology

19	Axsa P. Thomas	13-MVM-27	23-07-2015	Dietary supplementation of feed acidifiers on growth performance and CARCASS characteristics in broiler chicken	Animal Nutrition
20	Jasitha Jaafar	13-MVM-25	06-11-2015	Effect of nutrient supplementation on litter size of Malabari does and growth rate of kids	Animal Nutrition
21	Nijin Jos B. M.	13-MVM-03	28-07-2015	De-cellularised Bovine Pericardium for Hernioplasty in Dogs	Veterinary Surgery and Radiology
22	Shuhaib P.	13-MVP-008	21-10-2015	Comparative efficacy of two synchronization protocols using progesterone insert in postpartum anoestrus dairy cows	Animal Reproduction , Gynaecology and Obstetrics
23	Kelkar Pallavi Suhas	13-MVM-05	06-07-2015	Evaluation of porcine chole cyst derived collagen scaffold for the treatment of corneal injuries in dogs	Veterinary Surgery and Radiology
24	Ghag Rupalee S.	13-MVM-040	20-02-2016	Screening of geriatric dogs for chronic kidney disease and its management	Clinical Veterinary Medicine
25	Pragathi K. S.	13-MVM-34	19-06-2015	Characterisation of superoxide dismutase 2 (SOD2) gene in cattle and buffaloes	Animal Breeding Genetics and Biostatistics
26	Marial Lukose	13-MVM-17	19-06-2015	Evaluation of thrombocytotic and antioxidant effects of papaya (<i>Carica papaya</i>) leaves in mice	Veterinary Pharmacology and Toxicology
27	Neetha Narayanan	12-MDM-02	23-04-2015	Development of low calorie dietetic Palada	Dairy Technology
28	Ankitha Anto C.	13-MDM-01	05-10-2015	Development of whey based edible coating and its effect on shelf-life extension of paneer	M.Tech-Dairy Technology

29	Divya G. N.	13-MDM-02	27-10-2015	Process optimization for drying of DAHI	M.Tech-Dairy Technology
30	Sheba Sugathan	13-MDM-03	05-10-2015	Development of A Ready-to Reconstitute probiotic drink using indigenous lactic acid Bacteria	M.Tech-Dairy Technology
31	Pruthviraj D. R.	13-MVM-32	19-06-2015	Expression profile and Genetic variability of Porcine beta-defensin -1 gene	Animal Breeding Genetics and Biostatistics
32	Shivakumara P. N.	12-MVM-16	20-02-2016	Characterization and expression profiling of Toll like receptor 2 (TLR2) and bovine peptidoglycan recognition protein-1 (PGLYRP1) Genes in Vechur and Crossbred cattle of Kerala	Animal Breeding Genetics and Biostatistics
33	Neethu C. K.	13-MVP-004	18-06-2015	Toxicopathological evaluation of copper in broiler chicken	Veterinary Pathology
34	Ebin Baby M.	13-MVP-002	18-06-2015	Epidemiology of cholera among tribes in Muttill Panchayath of Wayanad District	Veterinary Public Health
35	Grace A Thachil	12-MDM-01	23-04-2015	Development of functional spiced paneer by incorporating indulin as a flat mimetic	Dairy Technology
36	Raheena Koulath P.	13-MVM-14	19-06-2015	Detection and Genotyping of feline pan-leukopenia virus from domestic cats	Veterinary Microbiology
37	Manvir Singh Nahal	13-MVM-20	18-06-2015	Optimum age for introduction of finisher ration in Gramasree cockerels	Veterinary Poultry Science
38	Iyyappan R.	13-MVM-16	19-06-2015	Reverse transcriptase-polymerase chain reaction based detection of	Veterinary Microbiology

				rotavirus and coronavirus in the faeces of diarrhoeic piglets	
39	Karthikeyan A.	13-MVM-35	19-06-2015	Evaluation and expression profiling of L-selectin and osteopontin genes in relation to mastitis in cattle	Animal Breeding Genetics and Biostatistics
40	Neethu K. P.	13-MVM-07	19-06-2015	Leptospirosis in dogs in central Kerala and its public Health significance	Veterinary Public Health
41	Anu P. Joseph	13-MVM-08	19-06-2015	Identification of critical control points in Beef processing line with special reference to enterohaemorrhagic Escherichia coli	Veterinary Public Health
42	Nimisha Bhaskar	13-MVP-005	19-06-2015	Molecular characterization and nucleic acid based detection of classical swine fever virus from Kerala	Veterinary Microbiology
43	Chinju Bose	13-MVM-12	19-06-2015	Bacterial etiopathology of pulmonary infection in piglets	Veterinary Pathology
44	MINI K. V.	13-MVM-01	19-06-2015	Sero-surveillance of foot and mouth disease in cattle based on structural and non-structural protein ELISA	Veterinary Epidemiology and Preventive Medicine
45	Janipalli Nikhil Kuar Tej	13-MVM-37	19-06-2015	Assessment of stress response and supportive role of vitamin E in cross-bred female calves	Veterinary Physiology
46	Muhammed Afzal A.	13-MVM-19	19-06-2015	Performance of crossbred layers of Australorp and Rhode island red with genetically improved strains of white leghorn under back yard system	Poultry Science

MASTER OF SCIENCE

1	Vishnu O.	13-MSVP-06	31-10-2015	Assessing genetic diversity of tiger (<i>Panthera tigris tigris</i>) in Wayanad Wildlife sanctuary by using non-invasive technologies	Wild life studies
2	Karuvalliyil Dipika Valsarajan	13-MSVP-05	31-10-2015	Epidemiological study on Kyasanur forest disease (KFD) in the monkey population of Wayanad District, Kerala	Wild life studies
3	Nithin Divakar	13-MSVP-03	31-10-2015	Diversity, Habitat preference and feeding habits of chiropterans in Wayanad Wildlife sanctuary	Wild life studies
4	Karthika Chandran	13-MSVP-02	31-10-2015	A comparative study of mixed-species bird flocks in a forest and coffee habitat in Wayanad, Kerala	Wild life studies
5	Ajisha S.	13-MSVP-08	31-10-2015	Influence of different habitats on occurrence of Asian small-clawed otter (<i>Aonyx cinera</i> , illiger, 1815) in Wayanad, Kerala	Wild life studies
6	Dencin Rons Thampy	13-MSVP-01	31-10-2015	The leverage of Riparians vegetation and Physical habitat on fish assemblage structure	Wild life studies
7	Arjun M. S.	13-MSVP-10	31-10-2015	Prevalence of endoparasite and prey preference of tiger (<i>Pathera tigris tigris</i>) in Wayanad wildlife sanctuary	Wild life studies
8	Anuraj R. Kaimal	13-MSVP-04	31-10-2015	Comparison of community structure of reptiles between a forest fragment and an intact forest	Wild life studies

MASTER OF SCIENCE

9	Kavyanajali Karthikeyan	13-MSVM-01	08-02-2016	Isolation and characterization of PDC-109 like protein(s) from Vechur bull seminal plasma	Animal Biotechnology
10	Adharsh R.	13-MSVM-13	31-10-2015	Application of microbial proteases for washing of crushed bones for gelatin preparation	Biochemistry and Molecular Biology
11	Syama M. S.	13-MSVM-05	04-09-2015	Effect of gamma irradiation on the characteristics of decellularized Human amniotic membrane	Biochemistry and Molecular Biology
12	Fathima Jasmin A. T.	13-MSVM-17	04-09-2015	Molecular characterization of exon 1 of RIPK2 gene in Vechur cattle	Biochemistry and Molecular Biology
13	Linu Eldho	13-MSVM-14	04-09-2015	Probiotic characterization of A Lactobacillus species isolated from raw cow milk	Biochemistry and Molecular Biology
14	Anjan Behera	13-MSVM-03	04-09-2015	Single nucleotide polymorphism analysis of thyroid hormone responsive and insulin like growth factor binding protein-3 genes in goat	Animal Biotechnology
15	Reshmi Sasi	13-MSVM-02	06-09-2015	Single Nucleotide polymorphism analysis of fecundity genes (BMPRII, GDF9 & BMP 15) in Malabari and Attappady Black goat breeds of Kerala	Animal Biotechnology
16	Neethu Bala Krishnan	13-MSVM-09	31-10-2015	Assessing the genetic variability in the free ranging Asian elephant (<i>Elephas maximus</i>) population of Wayanad Wild life sanctuary	Wild life studies

MASTER OF SCIENCE

17	Anusha Kishore	13-MSVM-21	04-09-2015	Development of a protocol for the detection of added neutralizers in Milk	Quality system in dairy processing
18	Shancy C	13-MSVM-07	06-08-2015	Standardisation of outer membrane protein based ELISA to detect antibodies against new duck disease	Applied Microbiology
19	Lamya T. V.	13-MSVM-09	26-08-2015	Radiation resistance of bacteria associated with bio-burden in human amniotic membrane used as bio-scaffold	Applied Microbiology
20	Subhachandran M. P.	13-MSVM-08	06-08-2015	Evaluation of Recombinant LIPL21 protein based lateral flow assay for the diagnosis of canine leptospirosis	Applied Microbiology
21	Sabnan V. S.	13-MSVM-10	06-08-2015	Serotyping and molecular characterisation of <i>Reimerella anatipestifer</i>	Applied Microbiology
22	Renuka K. K.	13-MSVM-15	06-08-2015	Comparative assessment of certain biochemical parameters in native cattle breeds of Kerala	Biochemistry and Molecular Biology
23	Aiswarya Jose	13-MSVM-18	04-09-2015	Molecular characterization of exon 11 of RIPK2 gene in Vechur cattle	Biochemistry and Molecular Biology
24	Veenamol E. M.	13-MSVM-12	04-09-2015	Application of microbial Lipases in degreasing of crushed bones used for gelatin preparation	Biochemistry and Molecular Biology
25	Simi Prakash	13-MSVM-19	06-08-2015	Analysis of repeated measures data from animal experiments	Biostatistics

MASTER OF SCIENCE					
26	Suma T. B.	13-MSVM-20	06-08-2015	Morbidity and mortality of livestock in Kerala	Biostatistics
27	Shabana K. C.	13-MSVM-26	04-09-2015	Tracking of Bacillus spp. In production supply chain of milk	Quality system in dairy processing
28	Afaf Mohammed Ali	13-MSVM-22	04-09-2015	Production of Biomass from paneer whey using yeast Spp.	Quality system in dairy processing
29	Jinitha V.	13-MSVM-23	04-09-2015	A study on the prevalence of Salmonella Spp in ice cream marketed in Thrissur City	Quality system in dairy processing

Chapter 8

REPORT ON WINTER SCHOOLS AND WORKSHOPS HELD

TWENTY ONE DAY ICAR SPONSORED WINTER SCHOOL

Kerala Veterinary and Animal Sciences University (KVASU) and Department of Veterinary Public Health, College of Veterinary and Animal Sciences, Pookode, Wayanad organized 21 days ICAR sponsored Winter school on "Application of One Health Concepts for Control of Emerging Zoonoses and Health Threats" from 26th November 2015 to 16th December 2015 at College of Veterinary and Animal Sciences (CVAS), Pookode. Dr. Prejith, Assistant Professor and Head, Department of Veterinary Public Health, CVAS, Pookode was the course director and Dr. B. Sunil, Professor, Department of Veterinary Public Health, CVAS, Mannuthy and Dr. Vinod, V. K, Assistant Professor, Department of Veterinary Public Health, CVAS, Pookode served as course coordinators. The training was designed to give the participants an in depth and specific exposure on the role of One Health approach in the control of emerging zoonoses and health threats. Apart from the experienced University faculties, eminent resource persons working in ICAR institutes and State Agricultural Universities having vast knowledge and experience in the proposed area of training handled the sessions. Twenty participants from eight states attended the winter school. Dr. Joseph Mathew, Registrar, KVASU inaugurated the winter school and gave a brief account on the institute with its mandate, activities and technologies developed. Director of Academics and Research, Dr. K. Devada and Dean, CVAS, Pookode, Dr. K.Vijayakumar welcomed the participants.

43 theory and 16 practical classes covering various aspects of One Health concept were handled by experts in these fields. There were also two field trips arranged as a part of the training. On 15.12.15, participants visited Brahmagiri Meat Factory, a unique multispecies abattoir of Wayanad district. The participants were exposed to most modern methods of slaughter. Another trip conducted was to Wayanad Institute of Medical Sciences to know latest updates in medical field. In the visit, participants were explained on laboratory facilities and surveillance activities carried out in human subjects in detail. A post evaluation test was conducted to evaluate the effectiveness of training. Lots of improvement in the subject knowledge was observed among all participants after Winter school training. All the participants graded the winter school as good to outstanding.

Valedictory function was held on 16.12.15. Shri. Kesevendra Kumar, IAS, Honourable District Collector of Wayanad gave the valedictory address. He endorsed the One Health concept for the successful control of KFD outbreak in the district by collaborative efforts of multiple departments.

First Regional Asian Elephant and Tiger Veterinary Workshop held at Pookode

The first Regional Asian Elephant and Tiger Veterinary Workshop was held at College of Veterinary and Animal Sciences, Kerala Veterinary and Animal Science University Pookode, Kerala, from February 1 through February 4, 2016.

This Workshop was hosted by the Centre for Wildlife Studies, Kerala Veterinary and Animal Science University, in collaboration with the Department of Forest and Wildlife, Government of

Kerala. The Workshop was supported by the U.S. Fish and Wildlife Service Asian Elephant Conservation Fund in collaboration with Asian Elephant Support.

The first Regional Asian Elephant and Tiger Veterinary Workshop continued the efforts of two earlier regional veterinary workshops hosted in Aceh Sumatra-Indonesia in March 2012, and in Nay Pyi Taw, Myanmar in March 2014, by providing practical training and enabling veterinarians in Asia to share experiences regionally. These Workshops helped to build local and regional capacity in elephant and tiger veterinary care, enhancing veterinary expertise needed for effective elephant and tiger conservation in Asia. The Regional Workshop hosted representatives from several Asian elephant and Tiger range countries including Bangladesh, India, Indonesia, Malaysia, Myanmar, Nepal, Thailand, as well as veterinarians from the United Kingdom and the United States.

The workshop was formally inaugurated by honorable MLA and Member, Board of Management, Shri. M. V. Shreyamskumar, on 01.02.2016 at Kabani Auditorium, KVASU. Linda Reifschneider, President, Asian Elephant Support also addressed the gathering.

The Regional Asian Elephant and Tiger Veterinary Workshop addressed veterinary topics such as general elephant and tiger health, diagnosis, medical and surgical management, epidemiology etc. During the Workshop, presentations from each participating range country discussed regional and local elephant and tiger health issues, scientific studies, and elephant and tiger management plans. Discussions were also made on wildlife health from the ecosystem perspective and topics such as disease spill over from humans and/or livestock to wildlife, emerging diseases and/or disease prevalence, as well as reducing stressors in the environment. By focusing on a broader view of wildlife health, veterinarians recognized how their contributions assist elephant and tiger conservation issues, such as improving habitat to reduce stressors and therefore reduce disease risk.

Special emphasis were given for human tiger and human elephant conflict. Methods of Chemical immobilization and translocation of tigers and elephants were presented by leading experts from the field.

Additionally, part of the Workshop spent in hands-on practical sessions on the topics of wildlife diagnostics and immobilization. A site visit to a Forest Department elephant camp will include elephant health and management discussions.

While handling a session on 3rd February, 2016, John Lewis, scientist, Wildlife Vets International, U.K., highlighted the need to expand research into the canine distemper virus as it is more prone to mutation and results in high mortality. "Minimal tiger surveillance data owing to the declining wild tiger population makes the task daunting. Currently, there is no tiger-specific vaccine available to prevent the same," Dr. Lewis said adding that understanding the disease better and proposing a plan to prevent its occurrence in the wild is the need of the hour to save the tiger population. Dr. Nadya Sulikhan, a veterinary scientist from Vladivostok, Russia, spoke on sampling, data acquisition and data analysis techniques and methodology required to study the prevalence of a disease in a particular area. Arun Zachariah, Assistant Professor, Centre for

Wildlife Studies, KVASU, spoke on the pathology and progression of elephant endothelial herpes virus. Over 30 such cases of the disease had been recorded from Kerala in the past few years, he said. He also explained the incidences of other infectious diseases in the wild. Sanjay Gubbi, wildlife biologist, Nature Conservation Foundation, Mysore, elucidated the conceptual framework by which the populations of tigers and other large carnivores is estimated. Dennis Schmitt and Christopher Stremme, scientists, South West Missouri State University, US, and Centre for wildlife Studies, Sumatra, Indonesia, respectively, demonstrated ultrasonography in an Asian elephant.

Chapter 9

RESEARCH AWARDS RECEIVED FROM PRESTIGIOUS PROFESSIONAL /SCHOLARLY SOCIETIES NATIONAL /INTERNATIONAL ACADEMICS

Sl No.	Award Recipient	Name of award/honour	Awarding body
1.	KVASU	National award for excellence in education among the category of best performing educational institutions in the country	National educational conclave- Educon-2015' held at Kochi on 10th June 2015
2.	Dr. S. Maya	Fellow of Indian Association of Veterinary Anatomists	Indian Association of Veterinary Anatomists
3.	Dr. Rajani C. V.	Best paper Award-Dr. A.K. Srivastava Award for Biotechnology including Stem Cell Technology"	Indian Association of Veterinary Anatomists
4.	Dr. Harshad Patki Sudhir	Dr. Md. Hafeezuddin Silver Jubilee Medal and Award for Best Paper in Anatomy of Wild and Zoo Animals'	Indian Association of Veterinary Anatomists
5.	Dr. John Abraham	Vaithilingam Rathnasabhapathi innovation Award	TANUVAS
6.	Dr. S. Senthil Murugan	Best Poster award	28th Kerala Science Congress-KSCSTE
7.	Dr. Anju Varghese	Best paper award	28th Kerala Science Congress-KSCSTE
8.	Dr. Anju Varghese	Dr. J. P Dubey Young Scientist award for best presentation of research paper	25th National congress of Veterinary Parasitology-IAAVP
9.	Dr. Rajesh Kumar	Best paper Award	SVBBI (Society of Veterinary Biochemistry and Biotechnology of India)
10.	Dr. Abdul Azeez C. P.	Young Scientist Award	ISSAR
11.	Dr. Prejit	Outstanding One Health Surveillance Case study Award	International Society for Disease Surveillance (ISDS), USA

12	Dr. Ranjith D.	<p>Recipient of Best Young Scientist oral presentation Award in the year 2015</p> <p>Recipient of Dr. J.V. Anjaria Award for the year 2015, for the best oral presentation and research paper in the area of Ethnopharmacology</p> <p>Recipient of Award for the year 2015, for the best poster presentation and research paper in the area of Ethnopharmacology</p> <p>Prof .R Natrajan Award (Co authored) for best paper</p>	<p>Annual Conference of Indian Society for Veterinary Pharmacology and Toxicology held at NDRI, Karnal, 14-16 Jan 2016.</p>
13	Dr. S. Anoop	Young Scientist award-2015	<p>12th Convention of ISACP and National congress on Canine Practice and symposium on Challenges in Diagnosis and Management of Emerging Diseases of Canine held at Allahabad from 17th to 19 June 2015</p>
14	Dr. Varuna P. Panicker	Young Scientist award-2015	VIFRA
15	Dr. Dhanush Krishna B.	Best thesis award	XXXII IAVP conference at Gannavaram, AP
16	Dr. Amritha Aravind	Best poster award	<p>XXXI Annual convention and National symposium of Indian society for study of Animal Reproduction, organized by Department of Veterinary Gynaecology and Obstetrics, Veterinary college Bangalore, 3-5th Dec, ,2015</p>
17	Dr. Sudheesh S. Nair	Best Oral Presentation	VII Kerala Veterinary Science Congress 14, 15 November 2015 CV&AS, Pookode
18	Dr. P. V. Tresamol	Best Teacher award -2014	College of Veterinary and Animal Sciences, Mannuthy
19	Dr. S. Maya	Best Teacher award 2014	College of Veterinary and

			Animal Sciences, Mannuthy
20	Dr. K. A. Mercey	Best Teacher award -2014	College of Dairy Science and Technology, Mannuthy
21	Dr. C. Jayakumar	Best paper award	XXXI annual convention of the ISSAR and national symposium on Current challenges and opportunities in Animal Reproduction held at Bangalore from 3rd to 5th December 2015.
22	Dr.R.S.Abhilash	Best Research Paper Presentation award	XXXI Annual Convention of the Indian Society for the Study of Animal Reproduction (ISSAR) and National Symposium on Current Challenges and Opportunities in Animal Reproduction from 3rd to 5th December 2015 conducted at Veterinary College, Hebbal, Bengaluru
23	Dr. Priya P. M	First prize in Oral presentation	XXXII Annual Conference and National Symposium of Indian Poultry Science Association (IPSACON 2015).
24	Dr. K. Vrinda Menon	Best Oral Presentation	Kerala Veterinary Sciences congress, Kottayam -2015
25	Dr. A.R. Sreeranjini	Dr. V. Ramkrishna Silver Jubilee Medal & Award	XXX Annual Convention and National Symposium of Indian Association of Veterinary Anatomists, held from 16th -18th December, 2015 at West Bengal University of Animal & Fishery Science University, Kolkata
26	Dr.Indu V. Raj	Best Poster Presentation Award	7th Kerala Veterinary Science Congress

27	Dr. Indu V. Raj	Dr. Mohan Bhattacharya Silver Jubilee Medal and Award for Best Paper in Histology, Histochemistry and Electron Microscopy'	the XXXAnnual Convention and National Symposium of Indian Association of Veterinary Anatomists held at Veterinary College, Kolkata from 16th to 18th December 2015
28	Dr. Indu V. Raj	Dr. K.S. Roy Award for Best Paper in Histo enzymology and Immunohistochemistry'	XXXth Annual Convention and National Symposium of Indian Association of Veterinary Anatomists held at Veterinary College, Kolkata from 16th to 18th December 2015.
29	Dr. Sumena K.B	First Prize for the Best Poster Presentation	National seminar on Food, health & Agro-biodiversity changing paradigms, 2015.
30	Dr. Sumena K.B.	Second Prize for the Best Oral Presentation Award	7th Kerala Veterinary Science Congress, from 14th -15th November, 2015.
31	Dr. Bindu Lakshmanan	II prize in session V for oral presentation	IAAVP
32	Dr. John Abraham	Millennium Alliance Award' for his innovation entitled "Low cost Manual Milking Machine"	USAID, Technology Development Board, Federation of Indian Chamber of Commerce, ICICI Foundation, UKaid, WISH, World bank group
33	Dr. C. Sethulakshmi	Second best Poster presentation-Vector borne zoonoses and public health	7th Kerala Veterinary Science Congress-IVA
34	Dr. Soumya Ramankutty	Second best poster presentation, Animal Health Science	7th Kerala Veterinary Science Congress-IVA
35	Dr. S. Sujith	Second best poster presentation	ISVM-2015
36	Dr. John Abraham	Best Teacher Award-2013	College of Veterinary and Animal Sciences, Pookode
37	Dr. Tresamol P. V.	Best poster presentation	ISVM -2015
38	Dr. Krithiga K	Best oral presentation	APRICON 2016

39	Dr. Krithiga K.	First prize in poster presentation	IPSACON 2015
40	Dr. Senthil Murugan .S	Best Teacher award 2014	College of Veterinary and Animal Sciences, Pookode
41	Dr. Dhanush Krishna	Dr. Patri Rama rao award -Best Ph.D thesis	Indian Association of Veterinary Pathologists
42	Dr. Biya Ann Joseph	Second prize- Poster presentation	National food and agro bio-diversity
43	Dr. M. Shynu	Best teacher award-2014	College of Veterinary and Animal Sciences, Mannuthy
44	Dr. Rajesh Kumar	Best Paper award in the Annual Convention and National Symposium 2016	Society of Veterinary Biochemists and Biotechnologists of India (SVBBI)
45	Dr. Sajitha .I.S	Prof. S. Ramachandran memorial award 2015 for best research paper presentation	Indian Association for Veterinary Pathologists
46	Dr. Deepa Ananth	Best poster award (third place) at ANISCON 2016	Animal Nutrition Society of India

Chapter 10

RESEARCH PAPERS PUBLISHED IN PEER REVIEWED JOURNALS WITH IMPACT FACTOR

- 1 Amod K., Manjit P., Bharat B., Sourabh S., Muhasin A. V. N, Prakash. J. G., B.C.Saravanan, Ghosh, S. and Gyanendra K. G. 2015. Expression profile of CXCL3 Gene in Peripheral Blood Mononuclear Cells Challenged in Vitro with Theileria annulata in corsbred cattle. J. Anim. Res., 5: 373. Impact factor 2.466
- 2 Amritha. A, Aswathy, Gangaraj. K.P, Rajesh, M. K., Reghu, R. and Grace, T. 2015. Computational study of interaction between CYP319A1 and organophosphates in the Cattle Tick, Rhipicephalus Microplus. Int. J. Multidisci., Curr. Res. 3: 1056.Global Impact factor 2.021
- 3 Amritha. A, Deepa. A. V, Shalini. K, Thashi B, Reghu R, Joby P, Shamjanad U, Karthi. N. R., Grace, T. 2015. Nuances of Transcriptomics in understanding acaricide resistance in ticks. IOSR J. Agri. Vet. Sci., 8: 15. Impact factor. 1.739
- 4 Amritha. A, Rajesh. M. K., Gangaraj, K. P., Reghu R. and Grace, T.. 2015. Homology modelling and Docking analysis of CYP41 protein in response to pyrethroids in Rhipicephalus microplus. Int. J. Innov. Res. Comp. Commun. Engin. 3:85. Impact factor 6.577
- 5 Anahita Anil Kumar, Usha Narayana Pillai, S.Ajithkumar, P.C. Alex and T.S Rajeev, 2015, A visual health assessment of captive Asian elephants under different managerial conditions in Kerala. J. Vet. Anim. Sci., Vol- 46(2), Page 46-48.NAAS Rating 2.92.
- 6 Anoop, S., Devanand, C. B., Syam, K. V., John Martin,K. D., Ajithkumar, S., Gleeja, L and Aravinda Ghosh, K. N. 2015. Pigmentary keratitis in dogs. Ind.. J. Vet. Res. 24(1): 31-33 NAAS Rating 3.6
- 7 Anoop. S., Devanand, C. B., Syam K. V., John Martin, K. D., Ajithkumar S., Aravinda Ghosh, K. N. and Gleeja, L. 2015. Pigmentary keratitis in dogs – A study on incidence in 83 corneas. Malaysian. J. Vet. Res. 7(1): 9-14. (IF-0.04). NAAS RATING 0.034
- 8 Anoop.S., C.B. Devanand., Syam K.Venugopal., K.D.John Martin., L. Gleeja and Aravinda Ghosh, 2015. Assessment of grading and isolation of organism in pigmentary keratitis in dogs. Int. J. Adv. Res. Impact factor 0.454
- 9 Anoop.S., Devavand, C.B., Syam,K.V., John Martin, K.D., Ajithkumar,S., AravindaGhosh,K.N and Gleeja,L., 2016, Pigmentary keratitis in dogs- A study on incidence in 83 corneas. Malaysian J. Vet. Research. 7(1): Impact factor 0.034
- 10 Anoop.S., Laiju M P,Gayathri, Pallavi., Karthika.,Devanand,C.B, 2015, Congenital Cystic eye ball and its surgical management in a Rottweiler pup- a case report. Int. J. of Adv. Res. 3(7) 1127-1129. Impact factor 0.454

- 11 Anoopkumar, T., Balusami, C., Sanis J., John A. and Kannan, A. 2015. Identification of Oestrus Specific Pheromones in Crossbred Dairy Cattle of High Range Zone. Ind. J. Nat. Sci., June, 2015 Vol.5 / Issue 30. Pp. 7228- 7234. Impact Factor: 2.51
- 12 Anoopraj, R., Hemalatha, S. and Balachandran, C. 2015. A study on the effect of E. alba on liver lipid peroxidation and antioxidant status in diethylnitrosamine induced experimental hepatocarcinogenesis in Wistar rats. Ind. Vet. J. 92:76-77. NAAS Rating 4.33; Impact Factor (2008): 0.056
- 13 Anumol Joseph, P.V. Tresamol, Stella Cyria and Ammu Ramakrishnan, 2015, Evaluation of the Anaemia scoring famacha © chart in goats of Kerala. J. Vet. Anim. Sci., Vol- 46(2), Page- 57-60. NAAS Rating 2.92.
- 14 Arjun, C.P., R. Ravindran and T. Anoopkumar. 2015. A study of Gastrointestinal parasites in Bonnes Masaque (macacaradlata) of Pookode, Wayanad, Kerala. Zoo's print, 30: 7. Impact factor 0.40
- 15 Asha, A. Maya, S. and Chungath, J.J. 2015. Prenatal development of thoracic and tracheal lymph nodes in goats. J. Vet. Anim. Sci., 46 (2): 61-64. NAAS Rating 2.92.
- 16 Asha, A., Maya, S., Chungath, J.J. 2015. Development of Lymph sacs in Prenatal Goat. Ind. J. Vet. Anat. 27 (1): 4-6. NAAS RATING 4.19
- 17 B. Abeena, A.J. George, N.D. Nair, M.S. Sreelakshmi, M. Shejir R.1, S. Pramod and K.B. Dhanush, 2015, Gastric impaction in an Indian Rock Python (Python molurus molurus). Ind. J. Vet. Pathol., 39(1) : 104-105 NAAS RATING 5.03
- 18 B. Abeena, A.J. George, N.D. Nair, M.S. Sreelakshmi, M. Shejir R.1, S. Pramod and K.B. Dhanush. 2015. Gastric impaction in an Indian Rock Python (Python molurus molurus). Ind. J. Vet. Pathol., 39(1) : 104-105 NAAS Rating 5.03
- 19 Becha, B.B. and Devi, S.S, 2015, Effect of addition of Hydrated Sodium Calcium Aluminosilicates (HSCAS) on the total aflatoxin levels in poultry feeds. Ind. Vet. J., 92 (5): 41 – 42. NAAS Rating 4.33; Impact Factor (2008): 0.056
- 20 Beena A.K. Anupa A., 2015, A study on probiotic aspects of Lactobacillus isolated from raw milk of Vechur cow. Int. J. Sci. Res. 4(12): 192- 193. IC Value: 69.48
- 21 Beena.A.K, Anupa.A, Twinkle.J.K. 2015. Hypocholesteremic potential of a Lactobacillus species isolated from house hold Curd. Ind. J. Appli. Res., 4: 48. Global Impact factor 0.565
- 22 Beena.A.K. 2015. Purification of an Alkaline Protease Suited for Eco-friendly sanitation in Milk processing units. Ind. J. Appli. Res., 4:12. Global Impact factor 0.565

- 23 Behra, S., Harshan, H.M., Lekshmi Bhai, K., Ghosh, K.N.A., Joseph, M, and Mini, M., 2015, Effect of methyl β Cyclodextrin and cholesterol loaded cyclodextrinomalabari buck spermatozoa thermoresistance, J. of Cell and tissue Res. 15 (1) 4805-4810. NAAS Rating 4.38
- 24 Bharat B., Manjit P., Amod K., Prashant D., G.K. Gaur and Deepak S., 2015, Lack of association of allelic variants of BRCA1 gene with mastitis susceptibility in Vrindavani cattle. Ind. J. Anim. Sci., Vol-85 (1), Page- 81.NAAS Rating 6.16.
- 25 Bhaskar N., Ravishankar, C., Rajasekhar R., Sumod, K., Sumithra, T. G., John, K., Mini, M., Ravindran, R. Shaji, S., Aishwarya J. (2015). Molecular typing and phylogenetic analysis of classical swine fever virus isolates from Kerala, India. Virus Disease 26:260-266 DOI:10.1007/s13337-015-0271-y .NAAS rating 5.00
- 26 Bibu J.K. and Usha P.T.A., 2015, Acute oral toxicity study of Curculigoorchioides in female albino rats. Int. J. Curr. Res. 7 (12) 24408-24410. Impact factor 0.765
- 27 Bibu John Kariyil, 2015, In vivo models in cancer research. Int. J. Curr. Res. 7 (12) 24399-24404. Impact factor 0.765
- 28 Bindu L., K. Devada, Siju J. and R Radhika, 2015. Immunoblot Analysis of Schistosoma spindale excretory-secretory antigens with sera from naturally infected bovines. J. Appl. Anim. Res. NAAS Rating 6.44
- 29 Bindu L., K. Devada, Siju J., T.V Aravindakshan and Lucy S., 2015,Copro-PCR based detection of bovine schistosome infection in India. J. Helminthology. NAAS Rating 7.42
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- 32 C. V. Rajani, R. V. Prasad, K. V. Jamuna, K. and V. Ramakrishna. 2016. Morphogenesis of umbilical cord in porcine (Sus domesticus). Ind. Vet. J. 93 (06): 45-48.NAAS : 4.33
- 33 C. Jayakumar, A.Krishna S., G.Sudha and T.G.Honnappa, 2016, Blood glucose and total calcium concentration in obstetrical emergencies in dogs. Ind. J. Canin. Pract., 8(1): 25-27 NASS Rating 2.76

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- 39 Chinchu J., S. Anoop., Syam, K.V and Sarada, A. T. 2015, Collagen sheet as an extracelluar matrix scaffold for the management of corneal ulcers in dogs. Ind. J. Canine Pract. 5: 171-174. NAAS Rating 2.76
- 40 Chinnu, M V., Varuna P. Panicker and Sisilamma George, 2016, Promoter sequence analysis of ATP citrate lyase gene in buffalo and Vechur cattle. Buffalo Bulletin, 35 (2) NAAS Rating 6.06
- 41 Chithrima, S.C.R, Jasmine R. K and Panakar, P.S, Effect of bypass fat supplementation during early lactation on milk composition of cross bred dairy cows of Kerala. Sci. J. Impact Factor: 3.762.Impact Factor.
- 42 Chithrima S.C.R, Jasmine R. K, Surej J. B. and Ally, K. 2016, Effect of dietary incorporation of Ksheerabala Residue on dry matter intake and nutrient digestibility in crossbred calves. Int. J. Agri. Food Sci. Tech. ISSN 2249-3050, 7 (1): 7- 11.NAAS Rating 7.38
- 43 Deepa C., Alex P.C. and Usha N. P. , 2015, Microscopic characteristics of canine filariasis in Thrissur district of Kerala. Ind. Vet. J., 2015, 92: 81-82 NAAS Rating 4.33
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Chapter 11

PAPERS PRESENTED IN NATIONAL/STATE/INTERNATIONAL CONFERENCES 2015-16

Sl No.	Conference/ seminar	Papers/posters presented
1	XXV National Congress OF Veterinary Parasitology and National symposium, 17 th to 19 th Feb, 2016, Chennai	5
2	XXXII Annual Conference of Indian Poultry Society Association and National symposium , 19-21 Nov, 2015, Kerala	49
3	7 th Kerala Veterinary Science Congress-2015, 14-15 Nov, 2015, Pookode	93
4	XXX Annual Convention of Indian Association of Veterinary Anatomists and National symposium	24
5	National congress of Canine Practice , 27-19 April, 2016, Pookode	109
6	XXXI Annual Convention of Indian Society for Study of Animal Reproduction and National symposium , 3-5, Dec, 2015, Bangalore	30
7	28 th Kerala Science Congress, 2016, Calicut	31
8	Veterinary Pathology Congress 2015, 3-5 Dec, 2015	13
9	34 th Annual Convention of ISVMand Annual Symposium, Ludhiana 17-19, Feb, 2016	15
10	XV Annual Convention of ISVPT, NDRI ,Karnal , Feb -2016	10
11	8 th Annual International symposium on Agriculture, 13-16 July, 2015, Athens , Greece	2
12	Global Innovation Initiatives , International workshop on sustainable farming systems , 19-20 August, 2015, Kochi	16
13	International conference-steps to sustainable livestock, Bristol, UK 12-15 Jan, 2016	2
14	4 th Molecular Virology meeting, Thiruvananthapuram 16-17 April, 2015	2
15	Bio-conference 2015, EMEA College of Arts and Science, Kondotti, Kerala	4
16	Swadeshi science congress 2015, 16-18 Dec, 2015	5

17	102 nd Indian Science Congress	2
18	National congress on canine practice 17-19, June 2015, Allahabad	1
19	25 th Annual general meeting, Malaysian Small animal association	1
20	National food and agro diversity, 10-14 Dec, 2015	1
21	International symposium on ecology and Health Management of Asiatic elephants	1
22	Kerala Environmental Congress, 2015 6-8 May, 2015	1
	Total	417