

# Vision 2030



Indian Veterinary Research Institute  
Izatnagar-243 122 (UP) India



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कृषि अनुसंधान और शिक्षा विभाग एवं  
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## Foreword

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The diverse challenges and constraints as growing population, increasing food, feed and fodder needs, natural resource degradation, climate change, new parasites, slow growth in farm income and new global trade regulations demand a paradigm shift in formulating and implementing the agricultural research programmes. The emerging scenario necessitates the institutions of ICAR to have perspective vision which could be translated through proactive, novel and innovative research approach based on cutting edge science. In this endeavour, all of the institutions of ICAR, have revised and prepared respective Vision-2030 documents highlighting the issues and strategies relevant for the next twenty years.

Livestock sector is an integrated component of agricultural activities in the country. Due to rising demand for animal products and changing food preferences of the next generation consumers, the Indian livestock sector has to improve its performance. Therefore, to make it profitable, the Indian Veterinary Research Institute needs to develop innovative alternate livestock research system. Indian Veterinary Research Institute, Izatnagar, is a premier Institute in veterinary science and the technologies developed by the scientists so far to improve animal health and production are commendable.

It is expected that the analytical approach and forward looking concepts presented in the “Vision 2030” document will prove useful for the researchers, policymakers, and stakeholders to address the future challenges for growth and development of the agricultural sector and ensure food and income security with a human touch.



**(S. Ayyappan)**

*Secretary, Department of Agricultural Research and Education  
and  
Director General, Indian Council of Agricultural Research*

## Preface

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The Indian Veterinary Research Institute, Izatnagar is the premier and one of the oldest institutions in the field of veterinary and animal sciences. The institute, through its significant contributions, has created a niche in R&D on animal health and production, generation of technology, patents and their commercialization. The institute's valuable and significant contributions in the areas of livestock health protection, productivity enhancement, and products technology has played a pivotal role in ushering white revolution, which led the country to attain number one position in milk production in the world. The institute has made remarkable progress in the new IPR regime with patentable research and commercial technology transfers. The institute has also attained acknowledged excellence in post-graduate veterinary education.

The livestock population in India has increased from 292.8 million in 1951 to 529.7 million in 2007, which includes 199.1 million cattle, 105.3 million buffaloes, 71.5 million sheep, 140.5 million goats, 11.3 million pigs, 0.6 million horses and ponies, 0.6 million mules and donkeys, 0.5 million camels, 0.1 million yaks, 0.26 million mithun besides 489.0 million poultry. Presently the country is producing 112.5 million tonnes of milk, 59.8 billion eggs and 6.3 million tonnes of meat. Therefore, the livestock sector has emerged as one of the key components of agricultural growth in India. Role of livestock sector is crucial to fulfill growing food demand which is expected to increase by 40% by 2030 and shall almost be doubled by 2050. The increased demand of livestock products can be met by enhancing the numbers of animals, improving feed utilization efficiency, adopting better reproductive strategies and improving health coverage based on newer generation biotechnological vaccines and drugs. With increase in economic development of the country and social obligations of nuclear families, the need for companion animals is certainly going to increase in the coming decades.

Climate change is likely to affect animal health and hence productivity directly, by altering the homeostasis and other thermo-regulatory responses to maintain the thermal balance and indirectly by

affecting supply of feed and fodder, increasing vulnerability to diseases and pests. In the changing scenario of increasing global trade, food demand, manpower requirement, adverse impact of climate change on productivity of livestock and threat from emerging livestock and zoonotic diseases, livestock sector is going to face numerous challenges which need to be addressed for composite livestock development.

The present document, **IVRI Vision 2030** after revisiting the priorities identified earlier for research, extension, education and development in the veterinary and animal sciences articulates the strategies to overcome the challenges and tap opportunities pertaining to livestock development in harmony with agriculture and allied sectors.

I am grateful to the chairman and members of the committee for **IVRI Vision-2030** for discharging the responsibility of preparation of this important document. The document adequately reflects the vision of a vibrant institution committed to the task of nation building in our mandated areas of research, extension, education, technology development and transfer in livestock sector.



**[M.C. Sharma]**

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## Preamble

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In India, the livestock production and agriculture are intrinsically linked, each one being dependent on the other and both are crucial for the overall food security of the people. Livestock sector plays an important and vital role in providing nutritive food rich in animal protein, in supplementing family income and generating gainful employment in the rural sector, particularly among the landless, small, marginal farmers and women, and thus is a dependable “bank on hooves” in times of need. With the galloping growth in human population, the demand for crop and livestock production is ever increasing. With the concept of 'Food Secure India', the significance of livestock and poultry products becomes enormous.

The contribution of livestock sector to National GDP varied from 4.8-6.5% during the last two decades (Working Group Report 2006). Accelerating the GDP growth in livestock sector to 6-7%, which is equitable, benefiting mainly the small and marginal farmers and landless labourers would be a major source of income and provide additional employment opportunities to people in the rural areas. A sustainable and financially viable livestock farming, which will generate wealth and self employment through entrepreneurship, is the need of the day.

The institute played an important role as an apex centre of animal health research in the country by providing technologies, interventions and package of practices for prevention and control of highly infectious animal diseases. The incremental benefits accrued at national level on account of specific research inputs made available by IVRI include, freedom from rinderpest since 1995; achieving zero status of CBPP; rapid response, timely control and strict vigil on avian influenza; development of indigenous live modified vaccine against PPR and a C-ELISA kit for PPR antibody detection and sandwich ELISA kit for PPR antigen for control programme and sero-epidemiology; a safe potent low volume saponified HS vaccine to minimize losses on account of morbidity and mortality. In the changing scenario of increasing global trade, ever increasing food demand due to population pressure, adverse impact of climate change on productivity and reproduction of livestock and threat from emerging, re-emerging and trans-boundary livestock and zoonotic diseases, livestock sector is going to face numerous challenges.

Vision 2030 document of the IVRI is a blue print for future programmes of science, education, technology and services, which have been formulated after revisiting the priorities identified earlier for research, education and development in the veterinary and animal sciences under National Agricultural Research System.

## **Livestock Scenario**

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Global food demand is ever increasing and expected to be doubled by the year 2050 due to exponential increase in population while the agricultural productivity is declining, largely due to shrinking of resources particularly cultivable land. Under such a situation, role of livestock sector to fulfill growing food demand is of paramount importance in terms of nutritional security and employment generation. The livestock sector has emerged as one of the key components of agricultural growth in developing countries. It plays a critical role in the socio-economic development and welfare of India's rural population not only as a source of food (milk, meat and egg) but also draught power, manure, hides etc. Distribution of livestock wealth is more egalitarian compared to land. Hence from the equity and livelihood perspective, it is considered an important component in poverty alleviation programmes. The Indian livestock sector is the endeavor of small holders and is a centuries old tradition and over 70% of rural households depend upon livestock farming for supplementary income. This sector is highly gender sensitive and about 90% of the activities related to care and management of livestock are carried by family's women folk. As a result of gradual transition from subsistence to market system, the economic dimensions of livestock keeping have gained significance. The value of output from livestock and fisheries sectors together at current prices is about ₹4,08,386 crore during 2009-10, which is about 29.7 per cent of the value of output of ₹13,76,561 crore from agriculture and allied sectors. Livestock in total contributes 3.93% (₹2,41,177 crore) of national GDP and 22.14% of the agricultural GDP. The contribution of milk in national economy is higher (₹ 2,28,809 crore) than paddy (₹1,35,307 crore), wheat (₹1,03,226 crore) and sugar cane (₹37,366 crore). Animal husbandry sector provides large self employment opportunities and about 6.7% of work force in rural areas is engaged in this sector.

### **Livestock resources**

India possess 530 million livestock, which includes 199.08 million cattle, 105.34 million buffaloes, 71.5 million sheep, 140.5 million goats, 11.34 million pigs, 0.61 million horses and ponies, 0.57 million mules and donkeys, 0.52 million camels, 0.08 million yaks, 0.26 million mithun besides 489 million poultry (18<sup>th</sup> Livestock Census, 2007). India ranks first with respect to buffalo, second in cattle and goats, third in sheep and fifth in poultry population in comparison to the world livestock and poultry population. Total Livestock population in India has increased from 292.8 million in 1951 to 530 million in 2007 at the rate of 1.06%. In contrast, population of horses and ponies, camels, pigs, mules and donkeys has shown a trend of negative growth.

### **Contribution of livestock**

Livestock sector not only provides essential protein and nutrition to human diet through milk, eggs, meat, raw material/ by products such as hides and skin, blood, bone and fat etc. but also plays an important role in utilization of non-edible agricultural by-products. India continues to be the largest producer of milk in the world (15.70% of total milk) having 112.5 million tonnes production with 263 g/day/capita availability (2009-10). The milk production followed quadratic trend during 1979-80 to 2009-10. If the same trend continues the milk production will reach to a level of 135 million tonnes by 2015-16. Crossbred cattle, indigenous cattle, buffaloes and goats contribute about 22.86, 20.25, 53.37 and 3.52%, respectively to total milk production. The average daily milk yield of indigenous cattle is quite low (2.1 kg) as compared to crossbred cattle (6.9 kg) and buffalo (4.6 kg). So far the fullest production potential of our livestock could not be tapped and there is an urgent need to enhance the levels through genetic improvement along with modern husbandry and health practices.

Poultry development in the country has shown steady progress over the years by producing 59,844 million eggs in 2009-10 as against 1,832 million eggs in 1950-51 with the availability of 51 eggs per head per year in 2009-10 in contrast to 5 eggs in 1950-51. The egg production in India has witnessed an exponential growth during 1979-80 to 2009-10 and is expected to touch the level of 83,200 million eggs by the year 2015-16.

India produced about 63 lakh tonnes of meat in the year 2009 against 16.96 lakh tonnes in 1961 with an annual growth rate of 2.01%. Buffalo contributes maximum (33.66%) followed by cattle (20.90%) and poultry (17.13%) in the total meat production of the country. The total meat production has shown logistic trend with an annual growth rate of 5.4%.

During the year 2009-10, the total wool production was 43.2 million kg as compared to 27.5 million kg in 1950-51. India contributed 2.2% of total world's wool production and Rajasthan is the highest contributor (29%) to the wool production of the country.

Among the animal by-products, 9.17 lakh tonnes of hides and 1.89 lakh tonnes skins were produced during the year 2008-09, which is 10.53 and 6.36%, respectively, of the total world production.

### **Livestock production**

Indian cattle and buffalo milch breeds have inherent capability of heat tolerance, resistance to diseases and ability to thrive under extreme nutritional and environmental stress. Considering the importance of these indigenous breeds in the national economy, Government is undertaking serious steps for their development and conservation. The cattle and buffalo genetic resources

of India are represented by 30 indigenous breeds of cattle including Rathi, Gir, Kankrej, Tharparkar, Sahiwal, Deoni, Halliker and Haryana and 10 breeds of buffaloes including Murrah, Jaffarabadi, Mehsana and Surti. Conservation and propagation of these indigenous breeds using modern biotechnological tools including artificial insemination (AI) needs to be focused in order to gradually replace our huge non-descript population to augment productivity. This would require bringing maximum breedable bovine population under the umbrella of artificial insemination. The essential pre-requisites would be owner's awareness programmes and strengthening the AI infrastructure. The statistics related to progress of AI gives satisfaction that semen production in the country has increased from 22 million straws (1999-2000) to 50.52 million straws (2009-10) and the number of inseminations has increased from 20 million to 44 million. The overall conception rate has also increased from 20 to 35%, however, infertility needs to be kept at bare minimum as it continues to be a major bottleneck in the rapid genetic improvement besides causing huge economic losses.

Adequate availability of feed and fodder to livestock is vital for increasing the productivity and also for sustaining the initiatives taken for genetic improvement. Optimum and efficient utilization of feed and fodder resources holds a key for successful commercial livestock production. A large gap exists between demand and supply of feed and fodder in the country.

### **Livestock health**

Besides management, animal health plays a major role in the progress of livestock industry. Occurrence of diseases causes heavy economic losses in terms of livestock health and production. Introduction of exotic breeds have increased the incidence of diseases especially Foot and Mouth Disease (FMD), Haemorrhagic Septicaemia (HS), *peste-des-petits* ruminants (PPR), Brucellosis, Mastitis, Blood protozoon diseases etc. Unless we make sincere efforts to control and manage common diseases like FMD, HS, mastitis and Brucellosis, we will be far away from achieving the targeted milk production of 160-170 million tonnes by 2030.

The economic loss due to FMD is tremendous as it causes death of young animals, reduction in milk yield and quality and quantity of meat, abortion, infertility and poor quality of semen. FMD also restricts the possible export of livestock and livestock products. In India alone 902 outbreaks of FMD occurred during 2009-10 affecting more than 26,500 animals. HS in cattle, buffaloes, sheep, goats and pigs accounted for 296 outbreaks. Mastitis is a multi factorial problem of dairy animals affecting milk production adversely. The loss caused by mastitis is due to reduced milk production, cost of treatment and culling of animals. As per annual report of the Department of

Animal Husbandry, Dairying and Fisheries, more than 26,300 animals mostly cattle were affected by mastitis in the year 2009-10.

The small ruminants like sheep and goats play critical role in socio-economic development of the rural poor. These animals also suffer with many diseases of different origin, most importantly PPR and bluetongue. The economic loss due to PPR is mainly through mortality of adult population and poor carcass quality. During the year 2009-10, 184 outbreaks of PPR and 73 outbreaks of bluetongue have occurred causing heavy economic losses.

Pig is an important livestock species, which plays crucial role in the livelihood in north-eastern states of the country. There are several diseases like FMD, swine fever and HS, which cause severe economic loss to the pig industry. During the year 2009-10, 136 outbreaks of swine fever have occurred causing heavy mortality.

Poultry industry is growing exponentially but it is under constant threat from various diseases like avian influenza, infectious bursal disease, Newcastle disease (ND), chronic respiratory disease (CRD), salmonellosis, fowl pox and coccidiosis etc. ND has been the most dangerous with respect to incidence and death occurrence. During the year 2009-10 alone, 412 outbreaks of ND, 122 outbreaks of fowl pox, 222 outbreaks of CRD and 348 outbreaks of coccidiosis have occurred causing heavy economic loss due to mortality, poor production and cost involved in their control.

### **Climate change and livestock**

One of the environmental threats which our planet faces today is the global climate change. These changes are harmful to both human beings and animals. Inter-Governmental Panel on Climate Change has projected that by the end of this century global earth temperature is likely to increase by 1.8-4.0°C. This global climate change could potentially lead to scarcity of water and food resources and may also cause spread of infectious diseases and heat-related deaths. Further, projected climatic changes are expected to increase the risks of vector-borne and other diseases leading to change in pattern of disease transmission. Due to increase in temperature and change in rainfall pattern, the vector populations will be expanding to unforeseen areas (higher altitude or temperate zones). Bluetongue in Europe and Rift Valley Fever in goats in East Africa are two documented examples of increased vector-borne disease risk in goats associated with climate change. Further, microbial agents and their vectors may be sensitive to factors such as temperature, humidity, precipitation, surface water, wind and changes in vegetation and bound to have an impact on heat-related mortality and morbidity. It has been hypothesized that under climatic variability and change, our livestock population is bound to be affected by emerging and re-emerging infections.

The animal biodiversity available in our country is a virtual goldmine of germplasm. Some of the indigenous animals have unique characteristics of adaptability to adverse agro-climatic conditions, better feed conversion efficiency, ability to survive under zero management and input conditions, and tolerance to locally prevalent diseases. Therefore, challenging task is to make our livestock population sustainable in changing climatic scenario, which would require change in breeding policy, perpetuating disease resistant and climate adaptable traits, capacity building and regional and global cooperation.

### **Technological advancement**

Recent advancement in molecular biology, biotechnology and nanotechnology has revolutionized the field of animal disease diagnosis and prophylaxis. Now pen-side and sensitive sero-diagnostics using synthetic and recombinant antigens are available for many diseases, which are very useful in sero-surveillance. Further, nucleic acid based diagnostics like PCR, Real time PCR, probe based diagnostics for detection of important diseases like IBR, FMD, HS, swine fever etc are now being used routinely. Many laboratories are working towards developing high throughput chip based diagnostics for important diseases of livestock. Biotechnology/nanotechnology developments have also revolutionized the field of vaccinology including vaccine delivery system. Recombinant vaccines are being developed that have the advantages of better immunity and long shelf life. Biotechnology tools are also being used to improve our indigenous breeds using transgenic and stem cell technology.

### **Future perspectives**

Although animal sector is growing at satisfactory level, but to meet the national demand of animal products, concerted efforts in terms of better health, feed and fodder availability, and proper breeding management are required to exploit this sector maximally. Efforts are to be made to conserve and perpetuate our valuable germplasm, which are adaptable to adverse climatic conditions and resistant to various endemic diseases. Livestock sector holds key to overcome the future unemployment problems in rural youth.

## Indian Veterinary Research Institute

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The Indian Veterinary Research Institute (IVRI), Izatnagar established on 9<sup>th</sup> December 1889 as Imperial Bacteriological Laboratory, Pune is the premier Institution for veterinary research and education. IVRI is the oldest institution governed by Indian Council of Agricultural Research, which is an autonomous organization under the Department of Agricultural Research and Education, Ministry of Agriculture, Government of India, New Delhi. The institute, through its significant contributions, has created a niche for itself in R&D on animal health and production, technology generation, patents and technology commercialization. The institute presently has 4 campuses, 3 regional stations and functions through 20 research divisions, beside Centres for Animal Disease Research and Diagnosis and Wildlife Conservation, Management and Disease Surveillance and other supporting central facilities. The institute acquired Deemed University status in 1983 and today the university offers Master's programme in 22 disciplines, PhD programme in 20 disciplines and National diploma courses in 9 disciplines as a part of continuing education for field veterinarians, besides several short-term specialized training courses to the professionals and vocational trainings to the farmers.

In its 122 years of eventful journey, the institute has been the torch bearer for pioneering research and quality post-graduate education in veterinary and animal sciences. The institute's valuable and significant contributions in the areas of livestock and poultry health protection, productivity enhancement, and products technology have been highly rewarding to the nation. The creditable work carried out at the institute on the promotion of integrated programmes of health care, genetic improvement and nutrition has played a pivotal role in ushering white revolution, which led the country to attain number one position in milk production, fourth in egg production and fifth in broiler production in the world. The technologies developed by the Institute in the area of animal health have helped to protect our livestock and poultry against scourge of dreaded diseases and infections.

Keeping in view the present and future needs, the institute is embarking upon extensive programmes of research in frontier areas to improve animal health and productivity. In the scenario that is going to unfold, the institute will have the following mandate.

### **Mandate**

1. To conduct research, provide post-graduate education and transfer of technologies in all areas of veterinary and animal sciences with emphasis on animal health and production.
2. To act as National Referral Centre for veterinary type cultures, disease diagnosis, biologicals, immunodiagnosics, etc.

## **IVRI 2030**

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Indian Veterinary Research Institute with the excellence in frontier areas in veterinary and animal science is ready and geared up to play pivotal role in addressing the national goals of improved productivity, profitability, stability and sustainability in livestock sector. The institute will strive hard with the concerted efforts to be global leader in veterinary science for the animal and human welfare.

### **Vision**

Striving for excellence in innovative research, human resource development, technology generation and transfer for improved animal owners and lovers with acknowledged leadership among the world nations.

### **Mission**

Undertaking pioneering research in veterinary and animal sciences with holistic approach, promoting high quality education and training, developing systems and technologies for better animal health care and production and their transfer to end-users, functioning as an effective instrument for nutritional security, poverty alleviation and rural construction.

### **Focus**

In order to keep pace with the society's needs and scientific advances in the area of livestock and poultry health and production, and for realization of the envisioned goals and to accomplish the mission of the IVRI, the major thrust areas will be:

- Improving animal health by development of diagnostic kits, vaccines, biologicals, natural and synthetic drugs, methodologies for surgical disorders, biosafety measures for handling pathogens and recombinant organisms, strategies for effective control of zoonotic, exotic and emerging diseases, vectors and measures for combating toxicity and residue problems.
- Creating excellence in clinical sciences with capacity building for super specialities in medicine, surgery, gynaecology and obstetrics.
- Development of modern diagnostic methods and therapeutic management of non-infectious diseases like metabolic and deficiency diseases.
- Gainful utilization of potential of frontier areas like stem cells, pharmacokinetics and nutri-genomics, transgenic animals, proteome analysis, bio-sensor applications, targeted nano-delivery of drugs, sports-space medicine, IVF-ETT, etc.

- Enhancing animal production through genetic improvement of cattle, buffalo and other livestock species for better disease resistance/ resilience, development and use of genetic markers for fertility improvement, expanding feed resources and improving bioavailability of nutrients, clinical nutrition studies, abiotic stress management, development of diagnostic markers and therapeutic strategies for infertility
- Focused attention on other research areas namely residue analysis in livestock products, development of alternate systems of medicine like herbal and ethno veterinary formulations, organic animal husbandry and livestock waste management,
- Strengthening animal products technology by developing strategies on production, consumption and marketing of meat and meat products and optimizing technologies for meat processing, preservation, etc.
- Strengthening market intelligence, entrepreneurship development, commercialization and transfer of technologies.
- Major thrust on human resource development, especially, preparing specialists in frontier areas of research and sharpening the skills in newer techniques/ technologies through continuing education.

## Harnessing Science

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Indian Veterinary Research Institute continues to play a major role in harnessing veterinary and animal science research, education and extension for the all-round development of livestock sector, thus making the country self-reliant in immuno-biologicals, other products and services. Changing nature of livestock service delivery, growing economy, manpower requirements and opportunities in the private sector provide both push and pull dynamics for composite livestock development. Amidst these global changes and challenges, it is time that we reassess strengths, weakness and opportunities to fully harness the power of science to accomplish the set goals.

### **Development and improvement of diagnostics and precise methodologies including diagnostic kits for existing, emerging, exotic disease conditions of livestock, poultry and wildlife**

The changing global climatic, demographic, ecological, socio-economic conditions, global tourism, etc. are mainly responsible for the changing epidemiology of infectious animal diseases. Therefore, the use of precision and easy to use laboratory and field diagnostics using the cutting-edge technologies and high throughput assays is of paramount importance today. The improvement of existing techniques through use of precision reagents/molecules *viz.*, purified antigen and tailor-made antibodies including monoclonal/targeted antibodies, molecular recognition units, etc. employing newer generation technologies, namely bio-sensors/ bio-chips, high throughput assays like microarray-based diagnostic kits would facilitate accurate and sensitive identification. It will improve herd health through identification of disease problems and ensure better planning for development of control/containment strategies, thereby improving productivity and preventing economic losses.

### **Development and improvement of immuno-prophylactics for effective control of existing, emerging and exotic diseases of animals and poultry**

The disease control scenario in the country is becoming complex with the intensification of the livestock and poultry production, import of germplasm, unrestricted



Goat affected with peste des petits ruminants

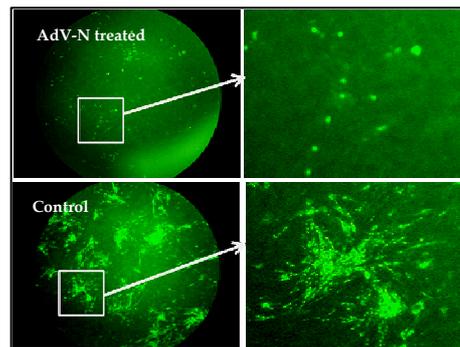
movement of livestock, changes in ecosystem due to climate change, selection pressure on the pathogens and emergence of new variants. This warrants improvement of the existing vaccines and/or vaccination schedule and development of new generation vaccines including subunit, genetically engineered, edible, synthetic and combination vaccines with concurrent development and improvement in vaccine delivery systems through use of nano-particle, adjuvants, liposomes, escheriosomes and immunomodulators. The availability of improved, potent and efficacious vaccines meeting international standards against major prevalent diseases will enable better management, containment and control of the diseases. This will ensure better preparedness to meet the SPS requirements for the international trade and rapid development of sustainable livestock industry.

### Epidemiological studies and estimation of economic losses due to important diseases of livestock and poultry

The specialized and reliable epidemiological information on the diseases is a prerequisite for developing a meaningful and successful control/preventive programme. Establishment of comprehensive and reliable laboratory based databank to facilitate formulating strategies for preventive and control measures in respect of important livestock and poultry diseases would help estimation of economic losses and cost-benefit analysis, which in turn would give proper direction to animal health programmes. Further, studies in different agro-climatic regions would yield information to help forecast disease outbreaks and early-warning systems.

### Protecting and promoting human health

The world today is plagued with many infectious diseases, of which the zoonotic diseases contribute to the pool of emerging diseases inter transmissible between animals and human beings. There have been serious outbreaks of zoonotic diseases like avian and swine influenza, Crimean Congo haemorrhagic fever, Japanese encephalitis, Nipha virus disease and food borne infections and intoxications whose endemicity, reservoir and seasonal patterns, etc. are a matter of growing concern. Further, toxicological aspects of residues of drugs, pesticides, environmental pollutants and other xenobiotics are of great concern to both livestock wealth and human life, as well as, for providing wholesome food for human beings and animals.

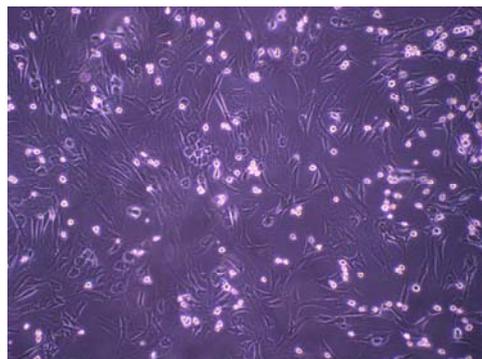


Fluorescent foci reduction in BHK-21 cells transduced with adenovirus encoding siRNA against RV-N gene of rabies virus

The potential of risk analysis-based approach encompassing risk assessment, risk management and risk communication would be utilized for safeguarding the human health.

### **Harnessing the power of cutting-edge technology research**

The biological research is flooded with continuous flow of data emanating from the confluence of technological advances in protein and nucleic acid analyses, as well as imaging advances of cell biology. Information at the level of genome, transcriptome, proteome and metabolome which provide distant data sets for understanding biological function of all living organisms including animals and



Bone marrow stem cells

the biological agents acting as pathogens. The research in the frontier areas like stem cells, pharmacokinetics and nutri-genomics, transgenic animals, proteome analysis, siRNA technology, bio-sensor applications, targeted nano-delivery of drugs, IVF-ETT, etc. will be gainfully utilized for strengthening research efficiency.

### **Excellence in clinical services with capacity building for super speciality**

Early and precise clinical intervention for alleviating the animal suffering is a foremost and prime duty of veterinarians. Veterinary clinical service is a facade of the veterinary institute. As a hub of veterinary science, the institute would like achieve excellence in clinical services by developing competence in speciality/ super speciality and



Interferential therapy in a Spitz dog with hind quarter weakness

building infrastructure of an ultra-modern clinical facility. The focus in the clinical subjects would be on strengthening diagnostic imaging (ultrasound, CT and MRI), anaesthesia and surgical techniques; development of facilities and expertise in speciality areas like ophthalmology, neurology, cardiovascular diseases, dentistry, geriatrics, sports and space medicine; search for newer healing promoters, biomaterials and implants for managing surgical disorders; modern therapeutics like stem cell therapy, modern diagnostic biomarkers and

expertise for early detection of structural and functional disorders in sick animals; search for newer therapeutics like alternative medicine, research on production, deficiency, toxicological and non infectious diseases of animal and developing strategy for their mitigation.

### **Development and strengthening bio-safety capabilities**

A number of animal pathogens if not handled properly in the laboratories, are likely to escape into the environment and may cause outbreaks. Some of the animal pathogens, which are zoonotic in nature, may adversely affect human health. The guidelines from concerned departments of Govt. of India stipulate appropriate bio-safety precautions to be taken while handling animal pathogens and rDNA products. It is therefore, necessary to develop and strengthen the bio-safety measures (laboratories handling risk group III and IV pathogens) at the institute and modernize the laboratories engaged in production of veterinary biologicals, quality testing and diagnostic services with appropriate GMP/GLP/bio-safety compliant facilities under the new SPS regime.



Biosafety laboratory

### **Strategies for climate change**

Climate change is likely to aggravate the stress condition in livestock, thereby adversely affecting productivity and reproductive efficiency. It will also have direct or indirect influence on the susceptibility of animals to diseases as well as changing pattern of disease occurrence, especially vector borne diseases. With the support from policy framework, the institute would like to take lead role in mitigating the adverse effect of climate change by strengthening research on allele mining for abiotic stress management, geographic information system (GIS) based pathogen-specific bio-climatographs for reliable disease forecasting and monitoring and physiological, nutritional and managemental strategies.

### **Genetic studies on disease resistance in domestic species of livestock**

Many diseases of domestic animals cannot be prevented/ eradicated by conventional measures of hygiene and prophylaxis. Better solution to these problems lie in identification and propagation of genetically resistant animals against bacterial, viral, parasitic, metabolic and reproductive diseases/disorders. Many of these diseases can be genetically controlled.

DNA markers for disease resistant genes and the ability to diagnose specific genotypic markers that correlate with susceptible and resistant

phenotypes shall facilitate identification of resistant genotypes to diseases across a range of breeds available in the country. The approach used will be determining economic trait loci (ETL) including polymorphic DNA markers positioned throughout the genome, performing high-throughput genetic analysis, ETL detection algorithms for analysis of correlations between genotypes and phenotypes. These techniques offer the potential for identification of the susceptible and resistant phenotypes and development of the resistant breeds of animals.

### **Production of laboratory animals**

Production of laboratory animals has been one of the important programmes in any biological research institution. There is a need to intensify the production facilities for conventional laboratory animals and create infrastructure, expertise, training needed for production of SPF rodents, rabbits, chicks, and chicken embryos. Designated ABSL-4 facilities and infrastructure-biosecurity, isolators and quarantine facilities are also to be established. Studies on inheritance pattern of fiber in mutant stock of Angora rabbits and selection for genetic improvement in New Zealand White rabbits need to be carried out.

### **Livestock production management**

Livestock managemental issues, specifically related to feeding, housing, behaviour, adaptation etc. are of utmost importance for improvement of the health, productivity and welfare of animals. Therefore, development of managemental norms with respect to feeding, breeding, housing and health care need to be undertaken in cattle, buffaloes, sheep, goats, pigs and other livestock species for enhancing growth, reproduction and production performance. Understanding animal behaviour and development of appropriate modules are also required to enhance production and to promote animal welfare. In modern intensive method of animal production, modernization of livestock production units through electronic identification, automation of various livestock farm activities including livestock shelters and fodder production will have to be undertaken for efficient utilization of available resources.

### **Livestock production and health in North West Humid Himalayan Region**

The Regional Station of IVRI at Palampur has the mandate to look after animal feeding problems, disease investigation and diagnosis in the region, which is now classified as North West Humid Himalayan Region (NWHHR). To achieve the objectives, it is important to study animal feeding problems of the region and develop feeding systems using local feed resources, detoxification of anti-nutritional factors present if any, to

make them usable for the feeding of animals, monitoring and surveillance of livestock diseases specific to the region.

### **Optimized nutrition for healthy and improved livestock production**

Animal nutrition plays a vital role in livestock production as it accounts for more than 70% of total recurring cost of production. In addition to meeting the nutrient requirements of animals, there is a need for precision feeding to avoid wastage of nutrients and making the livestock production more economic and eco-friendly. Considerable amount of methane is produced by the large animal population of the country. India being a signatory to Kyoto Protocol, is bound to check release of green house gases to avoid further increase in global warming. Therefore, efforts will be focused to reduce methane emission by the ruminants using improved feeding practices and technologies.

To make the livestock production self sustaining, economic and eco-friendly nutritional strategies *viz.*, the search for newer unconventional feeds including herbal and microbial feed additives, organic mineral supplements for better bio-availability and improved health and production of designer livestock products by modifying the rumen microbes using conventional and advanced biotechniques would be taken up. Newer feed supplements for pet and domesticated animals ensuring their health, immunity and productivity will be addressed. Specific diet for different disease conditions of livestock and pet animals will also be developed.

### **Basic and strategic research for physiological capacity building**

The production efficiency of meat, milk, eggs and wool, the end products of physiological processes in the body, are greatly dictated by the integrated cell structure, function and gene expression. Environment and climate as external components impinge these physiological functions, and change in climate is likely to affect the animal health and production directly (homeostasis and thermo regulatory responses) or indirectly (supply of feed and fodder and increasing vulnerability to diseases and pests).

To achieve superior and healthy livestock productivity, physiological responses, genes and allele mining associated with abiotic stress tolerance and immune competence under natural and controlled climatic stress conditions in livestock adaptation, facilitation and amelioration of stress via newer generation biotechnological approaches are important areas which need research attention. Application of gene based physiological strategies in augmenting animal production and performance in farm animals, modulation of physiological functions through nutrients, impact of dietary energy level and body condition score on physiological resilience, identification of novel growth promoters, exploration of applied molecular

endocrinology for understanding functional regulation of animal body, generation of stem cell lines from different sources and development of the nano-molecules for propagation and delivery of stem cell might be helpful in improving livestock productivity, therefore, need special attention.

### **Augmentation of fertility and quality semen production in farm animals**

Reproduction is the backbone of animal production and forms a vital component of livestock development programme. Advances in the diagnosis and therapeutic management of reproductive disorders are central to sustainable and rapid growth of livestock sector. Alternate animal model systems, cryobanking of germ cells and mammalian cells, development of diagnostic markers and therapeutic strategies for augmentation of fertility will be the major focused activities. Adoption of new technologies like spermatogonial stem cell research to salvage poor fertility in breeding sires, sexing of semen, fertility markers for bull selection and improving freezability of spermatozoa are likely to have far-reaching consequences on the improvement of livestock fertility and productivity.

### **Development of quality and safe livestock products**

The rapid urbanization and change in human life style demands consumer friendly livestock products such as low calorie, low cholesterol, low-salt, high dietary fibre and fortified or fermented products suiting to their health requirements. In the WTO era, wholesomeness parameters related to microbiological standards, handling, processing practices, temperature abuse indicators and residual analysis need to be addressed. This can be achieved by assessment of risks and development of rapid screening methods including biosensors, development of simple technologies for quality enhancement of meat from spent animals, field kits for meat speciation, sex identification, protocols for food safety assurance and quality control with special emphasis on TQM, HACCP and 'production-to-consumption' approach. Newer technologies for value-addition, bio-preservation, eco-friendly packaging and quality control are required for effective utilization and improvement in quality as well as shelf life of meat and meat products.

### **Strengthening extension linkages, technology management and transfer and feedback in animal science**

It is increasingly realised that the technologies generated at the research institutions are not readily adaptable in field conditions, especially in livestock sector. The envisaged programme will foster close linkages between research systems and clientele. Technology feed banks (ATICs and KVKs) will ensure that technologies developed find immediate users. Regular feedback would help in technology refinement so that a continuous process is established for

improved performance under field conditions. Flow of information between technology feed bank and utilization points would provide strong basis for development of only need based technologies. It is also envisaged to develop cyber extension network modules in the form of species specific interactive livestock information modules in local languages to be disseminated through local information kiosks.

Another core domain which will have top priority is IPR and technology management, facilitation of transfer to the industries and end-users and entrepreneurship development.

### **Human resource development**

The institute has immensely contributed to higher veterinary education and training in the country for over eleven decades. The excellence in research and higher education achieved by the institute, received accolades nationally and internationally. A vibrant academic atmosphere in IVRI would be maintained by a) strengthening niche areas towards global competitiveness, b) introducing new specialized courses in the emerging areas like biosecurity and biosafety, bioengineering and bioinformatics, sanitary phytosanitary measures, business and trade management, forensic sciences, biodiversity conservation, information and communication technology, IPR management, etc. and c) reorienting academic programmes, teaching methodologies (Multi-media modules and ICT tools) and course curricula to meet emerging challenges. Apart from the HRD services to the nation, the scientists are frequently deputed to other institutes within and outside the country for improving their knowledge and scientific skills.

## **Strategic Framework**

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The following 5-point strategy would be adopted to accomplish the vision and the goals of the Indian Veterinary Research Institute, and hence to enhance efficiency and effectiveness of veterinary research towards achieving better health and production of livestock (Annexure-I).

### **1. Impetus on research on animal health**

- Develop specific and sensitive serological, molecular, chip- and bio-sensor based diagnostics for important bacterial, viral, fungal and parasitic diseases.
- Develop new vaccines specially nuclear vaccines with appropriate adjuvant and better delivery system.
- Apply molecular tools for epidemiological studies on animal pathogens, zoonotic diseases and drug resistance organisms/ anthelmintic resistant parasites.
- Strengthen basic research on host pathogen interaction, functional genomics of pathogens and mucosal immunity.
- Surveillance and diagnosis of diseases and develop methodologies for forecasting the incidence, mortality, production and economic losses.
- Emphasis on developing excellence and speciality in clinical services.
- Pathology, pathogenesis and management of toxic, deficiency and metabolic diseases of domestic and pet animals.
- Studies on the effects of environmental pollutants and other xenobiotics on animal health and production and development of strategies to counter them.
- Genetic studies on disease resistance in livestock.
- Optimized nutrition for healthy and improved livestock production.
- Food safety assurance and quality control with special emphasis on TQM, HACCP and emerging pathogens.
- Newer technologies for value-addition, bio-preservation and improvement in quality as well as shelf life of meat and meat products.

### **2. Emphasis on quality education for competent human resource**

- Reorient academic programmes, teaching methodologies and course curricula to meet emerging challenges, giving more emphasis on business oriented approach, utilizing multimedia modules for instructions, on-line examinations and network based instructions and use of distance learning teaching methodology.
- Manpower planning and improving HRD competence.
- Introduce new courses in the emerging areas like bio-security and bio-safety, bio-engineering and bio-informatics, livestock business

management, forensic sciences, information and communication technology, herbal medicines/ pharmaceuticals etc.

- Establishment of Centres of Excellence/Advance Studies in all the teaching disciplines.
- Organization of industry-academia interface workshops to reorient education and research contributing to the economic growth.

### **3. Strengthening of livestock extension services through digitalization, e-connectivity and cyber extension**

- Strengthening of digitalization of information for prompt and effective exchange and dissemination of information amongst the end users.
- Develop and implement strategy of e-connectivity and cyber extension to drive full advantage of the available human and material sources for their best utilization within a short time.
- Test and popularize organic livestock husbandry based farming system.
- Develop softwares in different languages for the use of farmers and livestock owners.
- Regular training programmes for field veterinarians and livestock owners on latest technical know-how to augment livestock production through better health.
- Develop mass media programmes for better health and production.
- Refresher courses for field veterinarians.

### **4. Technology management, entrepreneurship development and business incubation**

- Business incubation for commercialization of veterinary and animal science technologies through organized intellectual property rights and benefits sharing system.
- Creating self-employment through livestock entrepreneurship development.
- Development of human resource in R&D and marketing of drugs.

### **5. Infrastructure development**

- Development of modern veterinary polyclinic with clinical super specialities.
- Biosafety and biosecurity facilities.
- GMP/GLP compliant laboratories.
- State of art common instrumentation facility.
- Establishment of multimedia with audio visual facilities for disease forecasting through radio, T.V. etc.

## Epilogue

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Indian Veterinary Research Institute is marching ahead with renewed zeal and is committed to make concerted efforts in veterinary and animal science research, education and extension for sustained development of livestock sector.

The envisaged reinforcement of research on quality livestock health care is expected to have a direct and decisive impact on animal health and production which influences human health favourably. The balanced diet to all human population, with the minimum requirement for animal protein per person per day will be provided to realize the concept of "Food Security".

For effective implementation of the identified programmes, linkages will be fostered with national and international R&D institutions on one hand and with the beneficiaries/farmers/industries through collaborative research, consultancy, contract research and contract service, training, extension activities, etc. on the other.

## Annexure 1: Strategic framework

Goal	Approach	Performance measures
Early and accurate diagnosis of diseases of livestock.	<ul style="list-style-type: none"> <li>▪ Develop specific and sensitive serological, molecular, chip- and bio-sensor based diagnostics for important bacterial, viral, fungal and parasitic diseases.</li> <li>▪ Apply molecular tools for epidemiological studies on animal pathogens, zoonotic diseases and drug resistant organisms/ anthelmintic resistant parasites</li> </ul>	<ul style="list-style-type: none"> <li>▪ Reduced morbidity and mortality of animals.</li> <li>▪ Reduced economic loss to the farming community.</li> </ul>
Prevention and control of bacterial, viral, fungal and parasitic diseases.	<ul style="list-style-type: none"> <li>▪ Surveillance and diagnosis of animal and poultry diseases.</li> <li>▪ Develop methodologies for forecasting the incidence, mortality and morbidity pattern of disease conditions.</li> <li>▪ Strengthen basic research on host pathogen interaction, functional genomics of pathogens and mucosal immunity.</li> <li>▪ Conducting basic and applied research to understand the genetic basis of host's resistance/ susceptibility against infectious &amp; parasitic diseases and reproductive disorders in different livestock species.</li> <li>▪ Develop vaccines with markers, appropriate adjuvant and better delivery system like nano-delivery against animal diseases.</li> </ul>	<ul style="list-style-type: none"> <li>▪ Reduction in the incidence of diseases, hence reduced morbidity, mortality and better animal health.</li> </ul>
Achieving excellence in clinical services.	<ul style="list-style-type: none"> <li>▪ Development of nano-particle based drug delivery system and safety of nano-particle to overcome the difficulties in chemotherapy.</li> <li>▪ Development of safe and effective modern therapeutics like nano-medicine and stem cell therapy.</li> <li>▪ Development of diagnostic and therapeutic modalities for production, deficiency, toxicological and non-infectious diseases.</li> <li>▪ Development of facility and expertise in the areas of dental, ophthalmic, neurosurgery and cardiovascular surgery.</li> </ul>	<ul style="list-style-type: none"> <li>▪ Early recovery from diseases, leading to reduced convalescent, less cost of treatment and less economic loss to the farmers.</li> </ul>

	<ul style="list-style-type: none"> <li>▪ Developing healing promoters, biomaterials, and implants for management of surgical disorders.</li> <li>▪ Development of facilities and expertise for digital radiography, diagnostic ultrasound, CT and MRI.</li> <li>▪ Application of stem cell therapy in various clinical situations like healing of wounds, cartilage and bone defects, tendon and spinal injuries etc.</li> </ul>	
Development of alternate and unconventional methods of treatment for animal diseases	<ul style="list-style-type: none"> <li>▪ Pharmacological evaluation of indigenous medicinal plants and development of drugs against infectious and parasitic diseases.</li> <li>▪ Scientific validation of ethno veterinary medicine.</li> </ul>	<ul style="list-style-type: none"> <li>▪ Cheaper, effective and non-toxic therapy for animal diseases.</li> </ul>
Augmentation of fertility in domestic animals	<ul style="list-style-type: none"> <li>▪ Develop technique for ultra low preservation of spermatozoa without affecting their fertilizing potential and the delivery system.</li> <li>▪ Improvement in diagnosis and therapeutic management of reproductive disorders.</li> <li>▪ Development of alternate animal model systems, cryobanking of germ cells and mammalian cells, diagnostic markers and therapeutic strategies for augmenting fertility.</li> <li>▪ Spermatogonial stem cell research to salvage poor fertility in breeding sires, sexing of semen, fertility markers for bull selection and improving freezability of spermatozoa for quality semen production.</li> </ul>	<ul style="list-style-type: none"> <li>▪ Improved fertility leading to better production and profit.</li> </ul>
Improvement of livestock nutrition, health and production.	<ul style="list-style-type: none"> <li>▪ Reducing methane emission and improving feed utilization by the ruminants.</li> <li>▪ Developing newer unconventional feeds including herbal and microbial feed additives, area specific mineral mixture for all states, organic mineral supplements and to produce designer livestock products by modifying the rumen microbes using conventional and advanced biotechniques.</li> <li>▪ Developing newer feed supplements, nutraceuticals, prebiotic, probiotic for pet</li> </ul>	<ul style="list-style-type: none"> <li>▪ Improve feed conversion efficiency and protection of the environment against global warming.</li> <li>▪ Better bio-availability and improved health of</li> </ul>

	and domesticated animals ensuring their health, immunity and productivity.	livestock.
Development and improvement in quality and safety of livestock products.	<ul style="list-style-type: none"> <li>▪ Develop technologies for quality enhancement of meat from spent animals.</li> <li>▪ Development of field kits for meat speciation and sex identification.</li> <li>▪ Development of protocols for food safety assurance and quality control with special emphasis on TQM, HACCP and emerging pathogens.</li> <li>▪ Use of newer technologies for value addition, bio-preservation, eco-friendly packaging and quality control of innovative meat products.</li> <li>▪ Develop advanced methods for residue analysis of pesticides, antibiotics, xenobiotics and chemicals in livestock products.</li> </ul>	<ul style="list-style-type: none"> <li>▪ Effective utilization of spent animals' meat.</li> <li>▪ Improvement in quality as well as shelf life of meat and meat products.</li> </ul>
Strengthening of veterinary extension programmes.	<ul style="list-style-type: none"> <li>▪ Dissemination of information and technologies through digitization.</li> <li>▪ Develop and implement strategy of e-connectivity and cyber extension to drive full advantage of the available human and material sources for their best utilization within a short time.</li> <li>▪ Test and popularize organic livestock husbandry based farming system.</li> </ul>	<ul style="list-style-type: none"> <li>▪ Prompt and effective exchange and dissemination of information regarding the animal diseases and available technologies amongst the end users.</li> </ul>
Human resource development and entrepreneurship development	<ul style="list-style-type: none"> <li>▪ Reorient academic programmes, teaching methodologies and course curricula to meet emerging challenges, giving more emphasis on business oriented approach, utilizing multimedia modules for instructions, on-line examinations and network based instructions and use of distance learning teaching technology.</li> <li>▪ Manpower planning and improving HRD competence.</li> <li>▪ Introduction of new courses in the emerging areas like biosecurity and biosafety, bioengineering and bioinformatics, livestock business</li> </ul>	<ul style="list-style-type: none"> <li>▪ Improved quality of postgraduate teaching and research.</li> <li>▪ High standard of postgraduate students.</li> <li>▪ More number of self</li> </ul>

	<p>management, forensic sciences, information and communication technology, herbal medicines/ pharmaceuticals etc.</p> <ul style="list-style-type: none"><li>▪ Establishment of Centres of Excellence/ Advance Studies in all the teaching disciplines.</li><li>▪ Organization of industry-academia interface workshops to reorient education and research contributing to the economic growth.</li><li>▪ Creating self-employment through livestock entrepreneurship development.</li></ul>	<p>employed graduates.</p>
<p>Commercialization of technologies</p>	<ul style="list-style-type: none"><li>▪ Business incubation for commercialization of veterinary and animal science technologies through organized intellectual property rights and benefits sharing system.</li></ul>	<ul style="list-style-type: none"><li>▪ More and more technologies will reach the end users to benefit both the scientific and farming community.</li></ul>